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PREVENTABLE DISEASES

BY

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PREVENTABLE DISEASES

CHAPTER I

THE BODY-REPUBLIC AND ITS DEFENSE

The human body as a mechanism is far from perfect. It can be beaten or surpassed at almost every point by some product of the machine-shop or some animal. It does almost nothing perfectly or with absolute precision. As Huxley most unexpectedly remarked a score of years ago, "If a manufacturer of optical instruments were to hand us for laboratory use an instrument so full of defects and imperfections as the human eye, we should promptly decline to accept it and return it to him. But," as he went on to say, "while the eye is inaccurate as a microscope, imperfect as a telescope, crude as a photographic camera, it is all of these in one." In other words, like the body, while it does nothing accurately and perfectly, it does a dozen different things well enough for practical purposes. It has the crowning merit, which overbalances all these minor defects, of being able to adapt itself to almost every conceivable change of circumstances.

This is the keynote of the surviving power of the human species. It is not enough that the body should be prepared to do good work under ordinary conditions, but it must be capable, if needs be, of meeting extraordinary ones. It is not enough for the body to be able to take care of itself, [Pg 2]

and preserve a fair degree of efficiency in health, under what might be termed favorable or average circumstances, but it must also be prepared to protect itself and regain its balance in disease.

The human automobile in its million-year endurance-run has had to learn to become self-repairing; and well has it learned its lesson. Not only, in the language of the old saw, is there "a remedy for every evil under the sun," but in at least eight cases out of ten that remedy will be found within the body itself. Generations ago this self-balancing, self-repairing power was recognized by the more thoughtful fathers in medicine and even dignified by a name in their pompous Latinity—the *vis medicatrix naturæ*, the healing power of nature.

In the new conception of disease, our drugs, our tonics, our prescriptions and treatments, are simply means of rousing this force into activity, assisting its operations, or removing obstacles in its way. This remedial power does not imply any gift of prophecy on nature's part, nor is it proof of design, or beneficent intention. It is rather one of those blind reactions to certain stimuli, tending to restore the balance of the organism, much as that interesting, new scientific toy, the gyroscope car, will respond to pressure exerted or weight placed upon one side by rising on that side, instead of tipping over. Let the onslaught of disease be sufficiently violent and unexpected, and nature will fail to respond in any way.

Moreover, we and our intelligences are a product of nature and a part of her remedial powers. So there is nothing in the slightest degree irrational or inconsistent in our attempting to assist in the process. [Pg 3]

However, a great, broad, consoling and fundamental fact remains: that in a vast majority of diseases which attack humanity, under ninety per cent of the unfavorable influences which affect us, nature will effect a cure if not too much interfered with. As the old proverb has it, "A man at forty is either a fool or a physician"; and nature is a good deal over forty and has never been accused of lacking intelligence.

In the first place, nature must have acquired a fair knowledge of practical medicine, or at least a good working basis for it, from the fact that the body, in the natural processes of growth and activity, is perpetually manufacturing poisons for its own tissues.

In this age of sanitary reform, we are painfully aware that the most frequent causes of human disease are the accumulations about us of the waste products of our own kitchens, barns, and factories. The "bad air" which we hear so frequently and justly denounced as a cause of disease, is air which we have ourselves polluted. This same process has been going on within the body for millions of years. No sooner did three or four cells begin to cling together, to form an organism, a body, than the waste products of the cells in the interior of the group began to form a source of danger for the others. If some means of getting rid of these could not be devised, the group would destroy itself, and the experiment of coöperation, of colony-formation, of organization in fact, would be a failure. [Pg 4]

Hence, at a very early period we find the development of the rudiments of systems of body-sewerage, providing for the escape of waste poisons through the food-tube, through the kidneys, through the gills and lungs, through the sweat glands of the skin. So that when the body is confronted by actual disease, it has all ready to its hand a remarkably effective and resourceful system of sanitary appliances—sewer-flushing, garbage-burning, filtration. In fact, this is precisely what it does when attacked by poisons from without: it neutralizes and eliminates them by the same methods which it has been practicing for millions of years against poisons from within.

Take, for instance, such a painfully familiar and unheroic episode as an attack of colic. It makes little difference whether the attack is due to the swallowing of some mineral poison, like lead or arsenic, or the irritating juice of some poisonous plant or herb, or to the every-day accident of including in the menu some article of diet which was beginning to spoil or decay, and which contained the bacteria of putrefaction or their poisonous products. The reaction of defense is practically the same, varying only with the violence and the character of the poison. If the dose of poisonous substances be unusually large or virulent, nature may short-circuit the whole attack by causing the outraged stomach to reject its contents. The power of "playing Jonah" is a wonderful safety-valve.

If the poison be not sufficiently irritating thus to short-circuit its own career, it may get on into the intestines before the body thoroughly wakes up to its presence. This part of the food-tube being naturally geared to discharge its contents downward, the simplest and easiest thing is to turn in a hurry call and cut down the normal schedule from hours to minutes, with the familiar result of an acute diarrhœa. [Pg 5]

Both vomiting and purging are defensive actions on nature's part, remedies instead of diseases. Yet we are continually regarding and treating them as if they were diseases in themselves. Nothing could be more irrational than to stop a diarrhœa before it has accomplished its purpose. Intelligent physicians now assist it instead of trying to check it in its early stages; and paradoxical as it may sound, laxatives are often the best means of stopping it. It is only the excess of this form of nature's house-cleaning which needs to be checked. Many of the popular Colic Cures, Pain-Relievers, and "Summer Cordials" contain opium which, while it relieves the pain and stops the discharge, simply locks up in the system the very poisons which it was trying to get rid of. Laxatives, intestinal antiseptics, and bowel irrigations have almost taken the place

of opiates in the treatment of these conditions in modern medicine. We try to help nature instead of thwarting her.

Supposing that the poison be of more insidious form, a germ or a ptomaine, for instance, which slips past these outer "firing-out" defenses of the food-tube and arouses no suspicion of its presence until it has been partially digested and absorbed into the blood. Again, resourceful nature is ready with another line of defense. It was for a long time a puzzle why every drop of the [Pg 6] blood containing food and its products absorbed from the alimentary food-canal had to be carried, often by a most roundabout course, to and through the liver, before it could reach any part of the general system. Here was the largest and most striking organ in the body, and it was as puzzling as it was large. We knew in some crude way that it "made blood," that it prepared the food-products for use by the body-cells, and that it secreted the bile; but this latter secretion had little real digestive value, and the other changes seemed hardly important enough to demand that every drop of the blood coming from the food-tube should pass through this custom-house. Now, however, we know that in addition to its other actions, the liver is a great poison-sponge or toxin-filter, for straining out of the blood poisonous or injurious materials absorbed from the food, and converting them into harmless substances. It is astonishing what a quantity of these poisons, whether from the food or from germs swallowed with it, the liver is capable of dealing with—destroying them, converting them, and acting as an absolute barrier to their passage into the general system. But sometimes it is overwhelmed by appalling odds; some of the invaders slip through its lines into the general circulation, producing headache, backache, fever, and a "dark-brown taste in the mouth"; and, behold, we are bilious, and proceed to blame the poor liver. We used to pour in remedies to "stir it up," to "work on it"—which was about as rational as whipping a horse when he is down, instead of cutting his harness or taking his load off. Nowadays we stop the supply of further food-poisons by stopping eating, assist nature in sweeping out or [Pg 7] neutralizing the enemies that are still in the alimentary canal, flush the body with pure water, put it at rest—and trust the liver. Biliousness is a sign of an overworked liver. If it wasn't working at all, we shouldn't be bilious: we should be dead, or in a state of collapse.

Moral: Don't rush for some remedy with which to club into insensibility every symptom of disease as soon as it puts in an appearance. Give nature a little chance to show what she intends to do before attempting to stop her by dosing yourself with some pain-reliever or colic cure. Don't trust her too blindly, for the best of things may become bad in extremes, and the body may become so panic-stricken as to keep on throwing overboard, not merely the poisons, but its necessary daily food, if the process be allowed to continue too long.

This is where the doctor comes in. This is the point at which it takes brains to succeed in the treatment of disease—to decide just how far nature knows what she is doing, even in her most violent expulsive methods, and is to be helped; and just when she has lost her head, or got into a bad habit, and must be thwarted. This much we feel sure of, and it is one of the keynotes of the attitude of modern medicine, that a large majority of the symptoms of disease are really nature's attempts to cure it.

This is admirably shown in our modern treatment of fevers. These we now know to be due to the infection of the body by more or less definitely recognized disease-germs or organisms. Fever is a complicated process, and we are still in the dark upon many points in regard to it, but we are [Pg 8] coming more and more firmly to the conclusion that most of its symptoms are a part of, or at least incidents in, the fight of the body against the invading army. The flushed and reddened skin is due to the pumping of large quantities of blood through its mesh, in order that the poisons may be got rid of through the perspiration. The rapid pulse shows the vigor with which the heart is driving the blood around the body, to have its poisons neutralized in the liver, burned up in the lungs, poured out by the kidneys and the skin. The quickened breathing is the putting on of more blast in the lung poison-crematory. It is possible that even the rise of temperature has an injurious effect upon the invading germs or assists the body in their destruction.

In the past we have blindly fought all of these symptoms. We shut our patients up in stove-heated rooms with windows absolutely closed, for fear that they would "catch cold." We took off the sheets and piled blankets upon the bed, setting a special watch to see that the wretched sufferer did not kick them off. We discouraged the drinking of water and insisted on all drinks that were taken being hot or lukewarm. Nowadays all this is changed. We throw all the windows wide-open, and even put our patients out of doors to sleep in the open air, whether it be typhoid, tuberculosis, or pneumonia; knowing that not only they will not "catch cold," but that, as their hurried breathing indicates, they need all the oxygen they can possibly get, to burn up the poison poured out in the lungs and from the skin. We encourage the patient to drink all the cool, pure [Pg 9] water he will take, sometimes gallons in a day, knowing that his thirst is an indication for flushing and flooding all the great systems of the body sewers. Instead of smothering him in blankets, we put him into cold packs, or put him to soak in cool water.

In short, we trust nature instead of defying her, coöperate with her in place of fighting her,—and we have cut down the death-rate of most fevers fifty to seventy-five per cent already. Plenty of pure, cool water internally, externally, and eternally, rest, fresh air, and careful feeding, are the best febrifuges and antipyretics known to modern medicine. All others are frauds and simply smother a symptom without relieving its cause, with the exception of quinine in malaria, mercury, and the various antitoxins in their appropriate diseases, which act directly upon the invading organism.

Underneath all this storm and stress of the fever paroxysm, nature is quietly at work elaborating

her antidote. In some marvelous fashion, which we do not even yet fully understand, the cells of the body are producing in ever-increasing quantities an *anti-body*, or *antitoxin*, which will unite with the toxin or poison produced by the hostile germs and render it entirely harmless. By a curious paradox of the process, it does not kill the germs themselves. It may not even stop their further multiplication. Indeed, it utilizes part of their products in the formation of the antitoxin; but it domesticates them, as it were—turns them from dangerous enemies into harmless guests. [Pg 10]

The treaty between these germs and the body, however, is only of the "most-favored-nation" class; for let these tamed and harmless friends of the family escape and enter the body of another human being, and they will attack it as virulently as ever.

Now, where and how did nature ever succeed in getting the rehearsal and the practice necessary to build up such an extraordinary and complicated system of defense as this? Take your microscope and look at a drop of fluid from the mouth, the gums, the throat, the stomach, the bowels, and you will find it simply swarming with bacteria, bacilli, and cocci, each species of which numbers its billions. There are thirty-three species which inhabit the mouth and gums alone! We are literally alive with them; but most of them are absolutely harmless, and some of them probably slightly helpful in the processes of digestion. In fevers and infections the body merely applies to disease-germs the tricks which it has learned in domesticating these millions of harmless vegetable inhabitants.

Still more curious—there is a distinct parallel between the method in which food-materials are split up and prepared for assimilation by the body, and the method adopted in breaking up and neutralizing the toxins of disease-germs. It is now known that poisons are formed in the process of digesting and absorbing the simplest and most wholesome foods; and the liver uses the skill which it has gained in dealing with these "natural poisons" in disposing of the toxins of germs.

When a fever has run its course, as we now know nearly all infections do, within periods ranging from three or four days to as many weeks, it simply means that it has taken the liver and the [Pg 11] other police-cells this length of time to handle the rioters and turn them into peaceable and law-abiding, even though not well-disposed citizens. In this process the forces of law and order can be materially helped by skillful and intelligent coöperation. But it takes brains to do it and avoid doing more harm than good. It requires far more intelligence on the part of the doctor, the nurse, or the mother, skillfully to help nature than it did blindly to fight her.

This is what doctors and nurses are trained for nowadays, and they are of use in the sick-room simply because they have devoted more time and money to the study of these complicated processes than you have. Don't imagine that calling in the doctor is going to interfere with the natural course of the disease, or rob the patient of some chance he might have had of recovering by himself. On the contrary, it will simply give nature and the constitution of the patient a better chance in the struggle, probably shorten it, and certainly make it less painful and distressing.

If these symptoms of the summer fevers and fluxes are indicative of nature's attempts to cure, those of the winter's coughs and colds are no less clearly so. As we walk down the streets, we see staring at us in large letters from a billboard, "*Stop that Cough! It is Killing you!*" Yet few things could be more obvious to even the feeblest intelligence, than that this "killing" cough is simply an attempt on the part of the body to expel and get rid of irritating materials in the upper air-passages. As long as your larynx and windpipe are inflamed or tickled by disease-germs or [Pg 12] other poisons, your body will do its best to get rid of them by coughing, or, if they swarm on the mucous membrane of the nose, by sneezing. To attempt to stop either coughing or sneezing without removing the cause is as irrational as putting out a switch-light without closing the switch. Though this, like other remedial processes, may go to extremes and interfere with sleep, or upset the stomach, within reasonable limits one of the best things to do when you have a cold is to cough. When patients with severe inflammations of the lungs become too weak or too deeply narcotized to cough, then attacks of suffocation from the accumulation of mucus in the air-tubes are likely to occur at any time. Young children who cannot cough properly, not having got the mechanism properly organized as yet, have much greater difficulty in keeping their bronchial tubes clear in bronchitis or pneumonia than have grown-ups. Most colds are infectious, like the fevers, and like them run their course, after which the cough will subside along with the rest of the symptoms. But simply stopping the cough won't hasten the recovery. Most popular "Cough-Cures" benumb the upper throat and stop the tickling; smother the symptoms without touching the cause. Many contain opium and thus load the system with two poisons instead of one.

Lastly, in the realm of the nervous system, take that commonest of all ills that afflict humanity—headache. Surely, this is not a curative symptom or a blessing in disguise, or, if so, it is exceedingly well disguised. And yet it unquestionably has a preventive purpose and meaning. [Pg 13] Pain, wherever found, is nature's abrupt command, "Halt!" her imperative order to stop. When you have obeyed that command, you have taken the most important single step towards the cure. *A headache always means something*—overwork, under-ventilation, eye-strain, underfeeding, infection. Some error is being committed, some bad physical habit is being dropped into. There are a dozen different remedies that will stop the pain, from opium and chloroform down to the coal-tar remedies (phenacetin, acetanilid, etc.) and the bromides. But not one of them "cures," in the sense of doing anything toward removing the cause. In fact, on the contrary they make the situation worse by enabling the sufferer to keep right on repeating the bad habit, deprived of nature's warning of the harm that he is doing to himself. As the penalties of this continued law-breaking pile up, he requires larger and larger doses of the deadening drug, until finally he collapses, poisoned either by his own fatigue-products or by the drugs which he has been taking

to deaden him against their effect.

In fine, follow nature's hints whenever she gives them: treat pain by rest, infections by fresh air and cleanliness, the digestive disturbances by avoiding their cause and helping the food-tube to flush itself clean; keep the skin clean, the muscles hard, and the stomach well filled—and you will avoid nine-tenths of the evils which threaten the race.

The essence of disease consists, not in either the kind or the degree of the process concerned, but only in its relations to the general balance of activities of the organism, to its "resulting in discomfort, inefficiency, or danger," as one of our best-known definitions has it. Disease, then, is not absolute, but purely relative; there is no single tissue-change, no group even of changes or of symptoms, of which we can say, "This is essentially morbid, this is everywhere and at all times disease." [Pg 14]

Our attainment of any clear view of the essential nature of disease was for a long time hindered, and is even still to some degree clogged, by the standpoint from which we necessarily approached and still approach it, not for the study of the disease itself, but for the relief of its urgent symptoms. Disease presents itself as an enemy to attack, in the concrete form of a patient to be cured; and our best efforts were for centuries almost wasted in blind, and often irrational, attempts to remove symptoms in the shortest possible time, with the most powerful remedies at our disposal, often without any adequate knowledge whatever of the nature of the underlying condition whose symptoms we were combating, or any suspicion that these might be nature's means of relief, or that "haply we should be found to fight against God." There was sadly too much truth in Voltaire's bitter sneer, "Doctors pour drugs of which they know little, into bodies of which they know less"; and I fear the sting has not entirely gone out of it even in this day of grace.

And yet, relative and non-essential as all our definitions now recognize disease to be, it is far enough (God knows) from being a mere negative abstraction, a colorless "error by defect." It has a ghastly individuality and deadly concreteness,—nay, even a vindictive aggressiveness, which have both fascinated and terrorized the imagination of the race in all ages. From the days of "the angel of the pestilence" to the coming of the famine and the fever as unbidden guests into the tent of Minnehaha; from "the pestilence that walketh in darkness" to the plague that still "stalks abroad" in even the prosaic columns of our daily press, there has been an irresistible impression, not merely of the positiveness, but even of the personality of disease. And no clear appreciation can possibly be had of our modern and rational conceptions of disease without at least a statement of the earlier conceptions growing out of this personifying tendency. Absurd as it may seem now, it was the legitimate ancestor of modern pathogeny, and still holds well-nigh undisputed sway over the popular mind, and much more than could be desired over that of the profession. [Pg 15]

The earliest conception of disease of which we have any record is, of course, the familiar Demon Theory. This is simply a mental magnification of the painfully personal, and even vindictive, impression produced upon the mind of the savage by the ravages of disease. And certainly we of the profession would be the last to blame him for jumping to such a conclusion. Who that has seen a fellow being quivering and chattering in the chill-stage of a pernicious malarial seizure, or tossing and raving in the delirium of fever, or threatening to rupture his muscles and burst his eyes from their sockets in the convulsions of tetanus or uræmia, can wonder for a moment that the impression instinctively arose in the untutored mind of the Ojibwa that the sufferer was actually in the grasp, and trying to escape from the clutch, of some malicious but invisible power? And from this conception the treatment logically followed. The spirits which possessed the patient, although invisible, were supposed to be of like passions with ourselves, and to be affected by very similar influences; hence dances, terrific noises, beatings and shakings of the unfortunate victim, and the administration of bitter and nauseous messes, with the hope of disgusting the demon with his quarters, were the chief remedies resorted to. And while to-day such conceptions and their resultant methods are simply grounds for laughter, and we should probably resent the very suggestion that there was any connection whatever between the Demon Theory and our present practice, yet, unfortunately for our pride, the latter is not only the direct lineal, historic descendant of the former, but bears still abundant traces of its lowly origin. It will, of course, be admitted at once that the ancestors of our profession, historically, the earliest physicians, were the priest, the Shaman, and the conjurer, who even to this day in certain tribes bear the suggestive name of "medicine men." Indeed, this grotesque individual was neither priest nor physician, but the common ancestor of both, and of the scientist as well. And, even if the history of this actual ancestry were unknown, there are scores of curious survivals in the medical practice of this century, even of to-day, which testify to the powerful influence of this conception. The extraordinary and disgraceful prevalence of bleeding scarcely fifty years ago, for instance; the murderous doses of calomel and other violent purges; the indiscriminate use of powerful emetics like tartar emetic and ipecac; the universal practice of starving or "reducing" fevers by a diet of slops, were all obvious survivals of the expulsion-of-the-demon theory of treatment. Their chief virtue lay in their violence and repulsiveness. Even to-day the tendency to regard mere bitterness or distastefulness as a medicinal property in itself has not entirely died out. This is the chief claim of quassia, gentian, calumbo, and the "simple bitters" generally, to a place in our official lists of remedies. Even the great mineral-water fad, which continues to flourish so vigorously, owed its origin to the superstition that springs which bubbled or seethed were inhabited by spirits (of which the "troubling of the waters" in the Pool of Bethesda is a familiar illustration). The bubble and (in both senses) "infernal" taste gave them their reputation, the [Pg 16] [Pg 17]

abundant use of pure spring water both internally and externally works the cure, assisted by the mountain air of the "*Bad*," and we sapiently ascribe the credit to the salts. Nine-tenths of our cells are still submarine organisms, and water is our greatest panacea.

Then came the great "humoral" or "vital fluid" theory of disease which ruled during the Middle Ages. According to this, all disease was due to the undue predominance in the body of one of the four great vital fluids,—the bile, the blood, the nervous "fluid," and the lymph,—and must be treated by administering the remedy which will get rid of or counteract the excess of the [Pg 18] particular vital fluid in the system. The principal traces of this belief are the superstition of the four "temperaments," the *bilious*, the *sanguine*, the *nervous*, and the *lymphatic*, and our pet term "biliousness," so useful in explaining any obscure condition.

Last of all, in the fullness of time,—and an incredibly late fullness it was,—under the great pioneer Virchow, who died less than a decade ago, was developed the great cellular theory, a theory which has done more to put disease upon a rational basis, to substitute logic for fancy, and accurate reasoning for wild speculation, than almost any discovery since the dawn of history. Its keynote simply is, that every disturbance to which the body is liable can be ultimately traced to some disturbance or disease of the vital activities of the individual cells of which it is made up. The body is conceived of as a cell-state or cell-republic, composed of innumerable plastid citizens, and its government, both in health and disease, is emphatically a government "of the cells, by the cells, for the cells." At first these cell-units were regarded simply as geographic sections, as it were, sub-divisions of the tissues, bearing much the same relation to the whole body as the bricks of the wall do to the building, or, from a little broader view, as the Hessians of a given regiment to the entire army. They were merely the creatures of the organism as a whole, its servants who lived but to obey its commands and carry out its purposes, directed in purely arbitrary and despotic fashion by the lordly brain and nerve-ganglia, which again are directed by the mind, and that again by a still higher power. In fact, they were regarded as, so to speak, individuals without [Pg 19] personality, mere slaves and helots under the ganglion-oligarchy which was controlled by the tyrant mind, and he but the mouthpiece of one of the Olympians. But time has changed all that, and already the triumphs of democracy have been as signal in biology as they have been in politics, and far more rapid. The sturdy little citizen-cells have steadily but surely fought their way to recognition as the controlling power of the entire body-politic, have forced the ganglion-oligarchy to admit that they are but delegates, and even the tyrant mind to concede that he rules by their sufferance alone. His power is mainly a veto, and even that may be overruled by the usual two-thirds vote.

In fact, if we dared to presume to criticise this magnificent theory of disease, we would simply say that it is not "cellular" enough, that it hardly as yet sufficiently recognizes the individuality, the independence, the power of initiative, of the single constituent cell. It is still a little too apt to assume, because a cell has donned a uniform and fallen into line with thousands of its fellows to form a tissue in most respects of somewhat lower rank than that originally possessed by it in its free condition, that it has therefore surrendered all of its rights and become a mere thing, a lever or a cog in the great machine. Nothing could be further from the truth, and I firmly believe that our clearest insight into and firmest grasp upon the problems of pathology will come from a recognition of the fact that, no matter how stereotyped, or toil-worn, or even degraded, the individual cells of any tissue may have become, they still retain most of the rights and privileges [Pg 20] which they originally possessed in their free and untrammeled amœboid stage, just as in the industrial community of the world about us. And, although their industry in behalf of and devotion to the welfare of the entire organism is ever to be relied upon, and almost pathetic in its intensity, yet it has its limits, and when these have been transgressed they are as ready to "fight for their own hand," regardless of previous conventional allegiance, as ever were any of their ancestors on seashore or rivulet-marge. And such rebellions are our most terrible disease-processes, cancer and sarcoma. More than this: while, perhaps, in the majority of cases the cell does yeoman service for the benefit of the body, in consideration of the rations and fuel issued to it by the latter, yet in many cases we have the curious, and at first sight almost humiliating, position of the cell absorbing and digesting whatever is brought to it, and only turning over the surplus or waste to the body. It would almost seem as if our lordly *Ego* was living upon the waste-products, or leavings, of the cells lining its food-tube.

Let us take a brief glance at the various specializations and trade developments, which have taken place in the different groups of cells, and see to what extent the profound modifications which many of them have undergone are consistent with their individuality and independence, and also whether such specialization can be paralleled by actually separate and independent organisms existing in animal communities outside of the body. First of all, because furthest from [Pg 21] the type and degraded to the lowest level, we find the great masses of tissue welded together by lime-salts, which form the foundation masses, leverage-bars, and protection plates for the higher tissues of the body. Here the cells, in consideration of food, warmth, and protection guaranteed to themselves and their heirs for ever by the body-state, have, as it were, deliberately surrendered their rights of volition, of movement, and higher liberties generally, and transformed themselves into masses of inorganic material by soaking every thread of their tissues in lime-salts and burying themselves in a marble tomb. Like Esau, they have sold their birthright for a mess of "potash," or rather lime; and if such a class or caste could be invented in the external industrial community, the labor problem and the ever-occurring puzzle of the unemployed would be much simplified. And yet, petrified and mummified as they have become, they are still emphatically alive, and upon the preservation of a fair degree of vigor in them depends entirely the strength and resisting power of the mass in which they are embedded, and of which they form scarcely a

third. Destroy the vitality of its cells, and the rock-like bone will waste away before the attack of the body-fluids like soft sandstone under the elements. Shatter it, or twist it out of place, and it will promptly repair itself, and to a remarkable degree resume its original directions and proportions.

So little is this form of change inconsistent with the preservation of individualism, that we actually find outside of the body an exactly similar process, occurring in individual and independent animals, in the familiar drama of coral-building. The coral polyp saturates itself with [Pg 22] the lime-salts of the sea-water, much as the bone-corpuscles with those of the blood and lymph, and thus protects itself in life and becomes the flying buttress of a continent in death.

In the familiar connective-tissue, or "binding-stuff," we find a process similar in kind but differing in the degree, so to speak, of its degradation.

The quivering responsiveness of the protoplasm of the amœboid ancestral cell has transformed itself into tough, stringy bands and webs for the purpose of binding together the more delicate tissues of the body. It has retained more of its rights and privileges, and consequently possesses a greater amount of both biological and pathological initiative. In many respects purely mechanical in its function, fastening the muscles to the bones, the bones to each other, giving toughness to the great skin-sheet, and swinging in hammock-like mesh the precious brain-cell or potent liver-lobule, it still possesses and exercises for the benefit of the body considerable powers of discretion and aggressive vital action. Through its activity chiefly is carried out that miracle of human physiology, the process of repair. By the transformation of its protoplasm the surplus food-materials of the times of plenty are stored away within its cell-wall against the time of stress.

Whatever emergency may arise, nature, whatever other forces she may be unable to send to the rescue, can always depend upon the connective-tissues to meet it; and, of course, as everywhere the medal of honor has its reverse side, their power for evil is as distinguished as their power for [Pg 23] good. From their ranks are recruited a whole army of those secessions from and rebellions against the body at large—the tumors, from the treacherous and deadly sarcoma, or "soft cancer," to the harmless fatty tumor, as well as the tubercle, the gumma of syphilis, the interstitial fibrosis of Bright's disease. They are the sturdy farmers and ever ready "minute-men" of the cell-republic, and we find their prototype and parallel in the external world, both in material structure and degree of vitality, in the well-known sponge and its colonies.

Next in order, and, in fact, really forming a branch of the last, we find the great group of storage-tissues, the granaries or bankers of the body-politic, distinguished primarily, like the capitalist class elsewhere, by an inordinate appetite, not to say greed. They sweep into their interior all the food-materials which are not absolutely necessary for the performance of the vital function of the other cells. These they form first into protoplasm, and then by a simple degenerative process it is transformed, "boiled down" as it were, into a yellow hydrocarbon which is capable of storage for practically an indefinite period. Not a very exalted function, and yet one of great importance to the welfare of the entire body, for, like the Jews of the Middle Ages, the fat-cells, possessing an extraordinary appetite for and faculty of acquiring surplus wealth in times of plenty, can easily be robbed of it and literally sucked dry in times of scarcity by any other body-cell which happens to need it, especially by the belligerent military class of muscle-cells. In fever or famine, fat is the first element of our body-mass to disappear; so that Proudhon would seem to have some [Pg 24] biological basis for his demand for the *per capita* division of the fortunes of millionaires. And yet, rid the fat-cell of the weight of his sordid gains, gaunt him down, as it were, like a hound for the wolf-trail, and he becomes at once an active and aggressive member of the binding-stuff group, ready for the repair of a wound or the barring out of a tubercle-bacillus.

And this form of specialization has also its parallel outside of the body in one of the classes in a community of Mexican ants, whose most distinguishing feature is an enormously distended œsophagus, capable of containing nearly double the weight of the entire remainder of the body. They are neither soldiers nor laborers, but accompany the latter in their honey-gathering excursions, and as the spoils are collected they are literally packed full of the sweets by the workers. When distended to their utmost capacity they fall apparently into a semi-comatose condition, are carried into the ant-hill, and hung up by the hind legs in a specially prepared chamber, in which (we trust) enjoyable position and state they are left until their contents are needed for the purposes of the community, when they are waked up, compelled to disgorge, and resume their ordinary life activities until the next season's honey-gathering begins. It scarcely need be pointed out what an unspeakable boon to the easily discouraged and unlucky the introduction of such a class as this into the human industrial community would be, especially if this method of storage could be employed for certain liquids.

Another most important class in the cell-community is the great group of the blood-corpuscles, [Pg 25] which in some respects appear to maintain their independence and freedom to a greater degree than almost any other class which can be found in the body. While nearly all other cells have become packed or felted together so as to form a fixed and solid tissue, these still remain entirely free and unattached. They float at large in the blood-current, much as their original ancestor, the amœba, did in the water of the stagnant ditch. And, curiously enough, the less numerous of the two great classes, the white, or leucocytes, are in appearance, structure, pseudopodic movements, and even method of engulfing food, almost exact replicas of their most primitive ancestor.

There is absolutely no fixed means of communication between the blood-corpuscles and the rest

of the body, not even by the tiniest branch of the great nerve-telegraph system, and yet they are the most loyal and devoted class among all the citizens of the cell-republic. They are called hither and thither partly by messenger-substances thrown into the blood, known as *hormones*, partly by the "smell of the battle afar off," the toxins of inflammation and infection as they pour through the blood.

The red ones lose their nuclei, their individuality, in order to become sponges, capable of saturating themselves with oxygen and carrying it to the gasping tissues. The white are the great mounted police, the sanitary patrol of the body. The moment that the alarm of injury is sounded in a part, all the vessels leading to it dilate, and their channels are crowded by swarms of the red [Pg 26] and white hurrying to the scene. The major part of the activity of the red cells can be accounted for by the mechanism of the heart and blood-vessels. They are simply thrown there by the handful and the shovelful, as it were, like so many pebbles or bits of chalk.

But the behavior of the white cells goes far beyond this. We are almost tempted to endow them with volition, though they are of course drawn or driven by chemical and physical attractions, like iron-filings by a magnet, or an acid by a base. Not only do all those normally circulating in the blood flowing through the injured part promptly stop and begin to scatter themselves through the underbrush and attack the foe at close quarters, but, as has been shown by Cabot's studies in leucocytosis, the moment that the red flag of fever is hoisted, or the inflammation alarm is sounded, the leucocytes come rushing out from their feeding-grounds in the tissue-interspaces, in the lymph-channels, in the great serous cavities, and pour themselves into the blood-stream, like minute-men leaving the plough and thronging the highways leading towards the frontier fortress which has been attacked. Arrived at the spot, if there be little of the pomp and pageantry of war in their movements, their practical devotion and heroism are simply unsurpassed anywhere, even in song and story. They never think of waiting for reinforcements or for orders from headquarters. They know only one thing, and that is to fight; and when the body has brought them to the spot, it has done all that is needed, like the Turkish Government when once it has got its sturdy peasantry upon the battlefield: they have not even the sense to retreat. And whether [Pg 27] they be present in tens, or in scores, or in millions, each one hurls himself upon the toxin or bacillus which stands directly in front of him. If he can destroy the bacillus and survive, so much the better; but if not, he will simply overwhelm him by the weight of his body-mass, and be swept on through the blood-stream into the great body-sewers, with the still living bacillus literally buried in his dead body. Like Arnold Winkelried, he will make his body a sheath for a score of the enemy's spears, so that his fellows can rush in through the gap that he has made. And it makes no difference whatever if the first ten or hundred or thousand are instantly mowed down by the bacillus or its deadly toxins, the rear ranks sweep forward without an instant's hesitation, and pour on in a living torrent, like the Zulu *impis* at Rorke's Drift, until the bacilli are battered down by the sheer impact of the bodies of their assailants, or smothered under the pile of their corpses. When this has happened, in the language of the old surgeon-philosophers, "suppuration is established," and the patient is saved.

Or if, as often happens, an antitoxin is formed, which protects the whole body, this is largely built out of substances set free from the bodies of slain leucocytes. And the only thing that dims our vision to the wonder and beauty of this drama, is that it happens every day, and we term it prosaically "the process of repair," and expect it as a matter of course. Every wound-healing is worthy of an epic, if we could only look at it from the point of view of these citizens of our great cell-republic. And if we were to ask the question, "Upon what does their peculiar value to the [Pg 28] body-politic depend?" we should find that it was largely the extent to which they retained their ancestral characteristics. They are born in the lymph-nodes, which are simply little islands of tissue of embryonic type, preserved in the body largely for the purpose of breeding this primitive type of cells. They are literally the Indian police, the scavengers, the Hibernians, as it were, of the entire body. They have the roving habits and fighting instincts of the savage. They cruise about continually through the waterways and marshes of the body, looking for trouble, and, like their Hibernian descendants, wherever they see a head they hit it. They are the incarnation of the fighting spirit of our ancestors, and if it were not for their retention of this characteristic in so high a degree, many classes of our fixed cells would not have been able to subside into such burgher like habits.

Although even here, as we shall see, it is only a question of quickness of response, for while the first bands of the enemy may be held at bay by the leucocyte cavalry, and a light attack repelled by their skirmish-line, yet when it comes to the heavy fighting of a fever-invasion, it is the slow but substantial burgher-like fixed cells of the body which form the real infantry masses of the campaign. And I believe that upon the proportional relation between these primitive and civilized cells of our body-politic will depend many of the singular differences, not only in degree but also in kind, in the immunity possessed by various individuals. While some surgeons and anatomists will show a temperature from the merest scratch, and yet either never develop any serious [Pg 29] infection or display very high resisting power in the later stages, others, again, will stand forty slight inoculations with absolute impunity, and yet, when once the leucocyte-barrier is broken down, will make apparently little resistance to a fatal systemic infection. And this, of course, is only one of a score of ways in which the leucocytes literally *pro patria moriuntur*. Our whole alimentary canal is continually patrolled by their squadrons, poured into it by the tonsils above and Peyer's patches below; if it were not for them we should probably be poisoned by the products of our own digestive processes.

If, then, the cells of the body-republic retain so much of their independence and individuality in

health, does it not seem highly probable that they do also in disease? This is known to be the case already in many morbid processes, and their number is being added to every day. The normal activities of any cell carried to excess may constitute disease, by disturbing the balance of the organism. Nay, most disease-processes on careful examination are found to be at bottom vital, often normal to the cells concerned in them. The great normal divisions of labor are paralleled by the great processes of degeneration into fat, fibrous tissue, and bone or chalk. A vital chemical change which would be perfectly healthy in one tissue or organ, in another may be fatal.

Ninety-nine times out of a hundred any group of cells acts loyally in the interests of the body; once in a hundred some group acts against them, and for its own, and disease is the result. There [Pg 30] is a perpetual struggle for survival going on between the different tissues and organs of the body. Like all other free competition, as a rule, it inures enormously to the benefit of the body-whole. Exceptionally, however, it fails to do so, and behold disease. This struggle and turmoil is not only necessary to life—it is life. Out of the varying chances of its warfare is born that incessant ebb and flow of chemical change, that inability to reach an equilibrium, which we term "vitality." The course of life, like that of a flying express train, is not a perfectly straight line, but an oscillating series of concentric curves. Without these oscillations movement could not be. Exaggerate one of them unduly, or fail to rectify it by a rebound oscillation, and you have disease.

Or it is like the children's game of shuttlecock. So long as the flying shuttle keeps moving in its restless course to and fro, life is. A single stop is death. The very same blow which, rightly placed, sends it like an arrow to the safe centre of the opposing racket, if it fall obliquely, or even with too great or too little force, drives it perilously wide of its mark. It can recover the safe track only by a sudden and often violent lunge of the opposing racket. The straight course is life, the tangent disease, the saving lunge recovery.

One and the same force produces all.

In the millions of tiny blows dealt every minute in our body-battle, what wonder if some go wide of the mark! [Pg 31]

CHAPTER II

OUR LEGACY OF HEALTH: THE POWER OF HEREDITY IN THE PREVENTION OF DISEASE

The evil in things always bulks large in our imaginations. It is no mere coincidence that the earliest gods of a race are invariably demons. Our first conception of the great forces of nature is that they are our enemies. This misconception is not only natural, but even necessary on the sternest of physical bases. The old darky, Jim, in Huckleberry Finn, hit upon a profound and far-reaching truth when he replied in answer to Huck's question whether among all the signs and portents with which his mind was crammed—like black cats and seeing the moon over your left shoulder and "harnts"—some were not indications of good luck instead of all being of evil omen:—

"Mighty few—an' *dey* ain't no use to a body. What fur you want to know when good luck's a-comin'? Want to keep it off?"

It isn't the good, either in the forces of nature or in our fellows, that keeps us watchful, but the evil. Hence our proneness to declare in all ages that evil is stronger than good and that "all men are liars." One injury done us by storm, by sunstroke, by lightning-flash, will make a more lasting impression upon our memories than a thousand benefits conferred by these same forces. Besides, evil has to be sharply looked out for and guarded against. Well enough can be safely let alone. [Pg 32]

The conviction is steadily growing, among both physicians and biologists, that this attitude has caused a serious, if not vital, misconception of the influence of that great conservative and preservative force of nature—heredity. We hear a great deal of hereditary disease, hereditary defect, hereditary insanity, but very little of hereditary powers of recovery, of inherited vigor, and the fact that ninety-nine and seven-tenths per cent of us are sane.

One instance of hereditary defect, of inherited degeneracy, fills us with horror and stirs us to move Heaven and earth to prevent another such. The inheritance of vigor, of healthfulness, and of sanity we placidly accept as a matter of course and bank upon it in our plans for the future, without so much as a thank you to the force that underlies it.

When once we clear away these inherited misconceptions and look the facts of the situation squarely in the face, we find that heredity is at least ten times as potent and as frequently concerned in the transmission and securing of health and vigor as of disease and weakness; that its influence on the perpetuation of bodily and mental defects has been enormously exaggerated and that there are exceedingly few hereditary diseases.

It is not necessary for our present purpose to enter into a discussion of the innumerable theories of that inevitable tendency of like to beget like, of child to resemble parent, which we call heredity. One reference, however, may be permitted to the controversy that has divided the [Pg 33] scientific world: whether *acquired* characters, changes occurring during the lifetime of the individual, can be inherited. Disease is nine times out of ten an acquired character; hence,

instead of the probabilities being that it would be inherited, the balance of evidence to date points in exactly the opposite direction. The burden of proof as to the inheritance of disease is absolutely upon those who believe in its possibility.

Another fundamental fact which renders the inheritance of disease upon a *priori* grounds improbable and upon practical grounds obviously difficult, is that characters or peculiarities, in order to be inherited certainly for more than a few generations, must be beneficial and helpful in the struggle. A moment's reflection will show this to be mathematically necessary, in that any family or race which tended to inherit defects and injurious characters would rapidly go down in the struggle for survival and become extinct. An inherited disease of any seriousness could not run for more than two or three generations in any family, simply for the reason that by the end of that time there would be no family left for it to run in. A slight defect or small peculiarity of undesirable character might run for a somewhat longer period, but even this would tend toward disappearance and elimination by the stern, selective influence of environment.

Naturally, this great conservative tendency of nature has, like all other influences, "the defects of its virtues," as the French say. It has no gifts of prophecy, and in the process of handing down to successive generations those mechanisms and powers which have been found useful in the long, [Pg 34] stern struggle of the past, it will also hand down some which, by reason of changes in the environment, are not only no longer useful, but even injurious. As the new light of biology has been turned on the human body and its diseases, it has revealed so many of these "left-overs," or remnants in the body-machine—some of most dramatic interest—that they at first sight have done much to justify the popular belief in the malignant tendencies of heredity.

Yet, broadly considered, the overwhelming majority of them should really be regarded as honorable scars, memorials of ancient victories, monuments to difficulties overcome, significant and encouraging indications of what our body-machine is still capable of accomplishing in the way of further adjustment to conditions in the future. The really surprising thing is not their number, but the infrequency with which they give rise to serious trouble.

The human automobile is not only astonishingly well built, with all the improvements that hundreds of thousands of generations of experience have been able to suggest, but it is self-repairing, self-cleaning, and self-improving. It never lets itself get out of date. If only given an adequate supply of fuel and water and not driven too hard, it will stand an astonishing amount of knocking about in all kinds of weather, repairing itself and recharging its batteries every night, supplying its own oil, its own paint and polish, and even regulating its own changes of gear, according to the nature of the work it has to do. Simply as an endurance racer it is the toughest [Pg 35] and longest-winded thing on earth and can run down and tire out every paw, pad, or hoof that strikes the ground—wolf, deer, horse, antelope, wild goat. This is only a sample of its toughness and resisting power all along the line.

These wide powers of self-support and adjustment overbalance a hundred times any little remnant defects in its machinery or gearing. Easily ninety-nine per cent of all our troubles through life are due to inevitable wear and tear, scarcity of food-fuel, of water, of rest, and external accidents—injuries and infectious diseases. Still, it occasionally happens that these little defects may furnish the point of least resistance at which external stresses and strains will cause the machine to break down. They are often the things which prevent us from living and "going to pieces all at once, all at once and nothing fust, just as bubbles do when they bust," like the immortal One-Hoss Shay. It is just as well that they should, for, of all deaths to die, the loneliest and the most to be dreaded is that by extreme old age.

These *vestigia* or remnants—instances of apparently hidebound conservatism on nature's part—are very much in the public eye at present, partly on account of their novelty and of their exceptional and extraordinary character. Easily first among these trouble-breeding remnants is that famous, or rather notorious, scrap of intestine, the *appendix vermiformis*, an obvious survival from that peaceful, ancestral period when we were more largely herbivorous in our diet and required a longer and more complicated food-tube, with larger side pouches in the course of [Pg 36] it, to dissolve and absorb our food. Its present utility is just about that of a grain of sand in the eye. Yet, considering that it is present in every human being born into the world, the really astonishing thing is not the frequency with which it causes trouble, but the surprisingly small amount of actual damage that arises from it. Never yet in even the most appendicitis-ridden community has it been found responsible for more than one half of one per cent of the deaths.

Then there is that curious and by no means uncommon tendency for a loop of the intestine to escape from the abdominal cavity, which we call hernia. This is one of a fair-sized group of dangers clearly due to the assumption of the erect position and our incomplete adjustment thereto. In the quadrupedal position this necessary weak spot—a partial opening through the abdominal wall—was developed in that region which was highest from the point of view of gravity and least exposed to strain. In the bipedal position it becomes lowest and most exposed; hence the much greater frequency of hernia in the human species as compared with any of the animals.

Another fragment, of the impertinence of whose presence many of us have had painful proof, is the third or last molar, so absurdly misnamed the wisdom tooth. If there be any wisdom involved in its appearance it is of the sort characterized by William Allen White's delicious definition: "That type of ponderous folly of the middle-aged which we term 'mature judgment.'" The last is sometimes worst as well as best, and this belated remnant is not only the last to appear, but the [Pg 37] first to disappear. In a considerable percentage of cases it is situated so far back in the jaw that there is no room for it to erupt properly, and it produces inflammatory disturbances and painful

pressure upon the nerves of the face and the jaw.

Even when it does appear it is often imperfectly developed, has fewer cusps and fewer roots than the other molars, is imperfectly covered with enamel and badly calcified. In no small percentage of cases it does not meet its fellow of the jaw below and hence is almost useless for purposes of mastication. But it comes in every child born into the world, simply because at an earlier day, when our jaws were longer—to give our canine teeth the swing they needed as our chief weapons of defense—there was plenty of room for it in the jaw and it was of some service to the organism. If the Indiana State Legislature would only pass a law prohibiting the eruption of wisdom teeth in future, and enforce it, it would save a large amount of suffering, inconvenience, and discomfort, with little appreciable lack of efficiency!

In this list of admitted charges against heredity must also come the gall-bladder, that curious little pouch budded out from the bile ducts, which has so little known utility as compared with its possibility as a starting-point for inflammations, gall-stones, and cancer.

Then there is that disfiguring facial defect, hare-lip, due to a failure of the three parts of which our upper jaw is built to unite properly,—this triple construction of the jaw being an echo of [Pg 38] ancestral fishlike and reptilian times when our jaws were built in five pieces to permit of wide distention in the act of swallowing our prey alive. All over the surface of the body are to be found innumerable little sebaceous glands originally intended to lubricate hairs, which have now atrophied and disappeared. These useless scraps, under various forms of irritation, both external and internal, become inflamed and give rise to pimples, acne, or "a bad complexion."

And so the list might be drawn out to most impressive length. But this length would be no indication of its real importance, inasmuch as the vast majority of entries upon it would come under the head of pathological curiosities, or conditions which were chiefly interesting on account of their rareness and unusual character. With the exception of the appendix, the gall-bladder, and hernia, these vestigial conditions may be practically disregarded as factors in the death-rate.

In the main, when the fullest possible study and recognition have been made of all the traces of experimentation and even of ancient failure that are to be found in this Twentieth Century body-machine of ours, the resulting impression is one of enormously increased respect for and confidence in the machine and its capabilities. While they are of great interest as indicating what the past history and experiences of the engine have been, and of highest value as enabling us to interpret and even anticipate certain weak spots in its construction and joints in its armor, their most striking influence is in the direction of emphasizing the enormous elasticity and [Pg 39] resourcefulness of the creature.

Not only has it met and survived all these difficulties, but it is continuing the selfsame processes to-day. So far as we are able to judge, it is as young and as adaptable as it ever was, and just as ready to "with a frolic welcome greet the thunder and the sunshine" as it ever was in the dawn of history.

These ancestral and experimental flaws, even when unrecognized and unguarded against, have probably not at any time been responsible for more than one or two per cent of the body's breakdowns; while, on the other hand, every process with which it fights disease, every trick of strategy which it uses against invading organisms, every step in the process of repair after wounds or injury, is a trick which it has learned in its million-year battle with its surroundings.

Take such a simple thing as the mere apparently blind habit possessed by the blood of coagulating as soon as it comes in contact with the edges of a cut or torn blood-vessel, and think what an enormous safeguard this has been and is against the possibility of death by hemorrhage. So well is it developed and so rapidly does it act that it is practically impossible to bleed some animals to death by cutting across any vessel smaller than one of the great aortic trunks. The rapidity and toughness of the clotting, combined with the other ancestral tricks of lowering the blood pressure and weakening down the heart, are so immensely effective that a slash across the great artery of the thigh in the groin of a dog will be closed completely before he can bleed to [Pg 40] death. So delicate and so purposeful is this adjustment that the blood will continue as fluid as milk for ten, twenty, forty, eighty years—as long as it remains in contact with healthy blood-vessels. But the instant it is brought in contact with a broken or wounded piece of a vessel-wall, that instant it will begin to clot. So inevitable is this result that it gives rise to some of the sudden forms of death by bloodclot in the brain or lung (apoplexy, "stroke"), the clot having formed upon the roughened inner surface of the heart or of one of the blood-vessels and then floated into the brain or lung.

Then take that matchless and ingenious process of the healing of wounds, whose wondrousness increases with every step that we take into the deeper details of its study. First, the quick outpouring and clotting of the blood after enough has escaped to wash most poisonous or offending substances out of the wound. This living, surgical cement, elastic, self-moulding, soothing, not only plugs the cut or torn mouths of the blood-vessels, but fills the gap of the wound level with the surface. Here, by contact with the air and in combination with the hairs of the animal it forms a tough, firm, protective coating or scab, completely shutting out cold, heat, irritants, or infectious germs.

Into the wedge-shaped, elastic clot which now fills the wound from bottom to top like jelly in a mould, the leucocytes or white blood-cells promptly migrate and convert it into a mesh of living

cells. They are merely the cavalry and skirmishers of the repair brigade and are quickly followed by the heavy infantry of the line in the shape of cells born of the injured tissues on either side of the wound. These join hands across the gap, the engineer corps and the commissariat department move up promptly to their support in the form of little vein-construction switches, which bud out from the wounded blood-vessels. The clot is transformed into what we term granulation tissue and begins to organize. A few days later this granulation tissue begins to contract and pull the lips of the wound together. If the gap has not been too wide the wound will be completely closed, its lips and deeper parts drawn together in nearly perfect line, separated only by a thin scar on the surface with a vertical keel of scar tissue descending from it. If the lips cannot be drawn together and there be no surgical skill at hand to assist them with stitches or bandages, then the gap will be filled up by the fibrous transformation of this granulation tissue and a thick, heavy scar result. Meanwhile, the skin-cells of the surface have not been idle, but are budding out on either side of the healing wound, pushing a little line of colonists forward across the raw surface. In longer or shorter time, according to the width of the gap, these two lines meet, and the site of our wound or the scar that it has left is perfectly coated over with a layer of healthy skin. This drama has occurred so many score of times in every one of us that custom has blinded our eyes to its ingenious perfection, but it took a million years to bring it to its present finish. [Pg 41]

It may be a healthy corrective to our overweening conceit to remind ourselves that, remarkable and valuable as it is, it is a mere infant in arms compared to the superb powers of replacement and repair possessed by our more remote ancestors. Most invertebrates and many of the lowest two classes of backboned animals, the fishes and the amphibians, cannot merely stop up a rent, but renew an entire limb, fin,—yes, even eye or head. Cut an earthworm in two and the rear half will grow a new head and the front half a new tail. It may even be cut in four or five segments, each of which will proceed to form a head at one end and a tail at the other. The lobster can regrow a complete gill and any number of claws or an eye. A salamander will reproduce a foot and part of a limb. Take out the crystalline lens in the eye of a salamander and the edge of the iris, or colored part of the eye, will grow another lens. Take out both the lens and the iris and the choroid coat of the eye will reproduce both. [Pg 42]

We are in the A, B, C class in powers of repair by comparison with the angleworm, the lobster, or the salamander. Yet we are not without gruesome echoes of this lost power of regeneration in that our whole brood of tumors, including the deadly cancer and sarcoma, are due to a strange resumption, on the part of some little knot of our body-cells, of the power of reproducing themselves or the organ in which they are situated, without any regard to the welfare of the rest of the body. Cancer is, in one sense, a throwing off of the allegiance to the body-state and a resumption of amphibian powers of independent growth on the part of certain groups of our body-cells—literally, a "rebellion of the cells."

These are but a handful of scores of instances that could be adduced, showing that the majority of the processes upon which we rely in combating disease and preserving life are the result of the hereditary experiences of our cells. Intelligent physicians are receding completely from that curiously warped and jaundiced view which led us to regard heredity chiefly as a factor in the *production* of disease. It was, perhaps, natural enough, since it was inevitably only its injurious, or, so to speak, malicious, effects which were brought to our attention to be corrected. But, just as in the growth of our ethnic religions it is Evil that is worshiped first as strongest and most aggressive, and the recognition of the greater power of good comes only at a later stage, so it has been in pathology. [Pg 43]

Not only do we regard heredity as a comparatively small and steadily receding factor in the production of disease, but we fully and frankly recognize it as the strongest and most important single force in its prevention. All our processes of repair, all the reactions of the body against the attack of accident or of disease, are hereditary endowments, worked out with infinite pains and labor through tens of thousands of generations. The utmost that we can do with our drugs and remedies is to appeal to and rouse into action the great healing power of nature, the classic "*Vis medicatrix Naturæ*," an incarnation of our past experiences handed down by heredity. Enormously valuable and important as are the services to human welfare, health, and happiness which can be rendered by the destruction of the living external causes of disease and the prevention of contagion, our most permanent and substantial victories are won by appealing to and increasing this long-descended and hard-won power of individual resistance. [Pg 44]

"But," says some one at once, "I thought there were a large number of hereditary diseases." Fifty years ago there were a score of such, twenty years ago the score had sunk to five or six. Now there is scarcely one left. There is no known disease which is directly inherited as such. There is scarcely even a disease in which we now regard heredity as playing a dominant or controlling part. Among the few diseases in which there is serious dispute as to this are tuberculosis, insanity, epilepsy, and cancer.

Then there are diseases which for a long time puzzled us as to the possibility of their inheritance, but which have now resolved themselves clearly into instances of the fact that a mother who happens to contract an acute infectious disease of any sort may communicate that disease to the unborn child. If this occurs at an early stage of development the child will naturally be promptly killed. In fact, this is the almost invariable result in smallpox and yellow fever. If, on the other hand, development be further advanced or the infection be of a milder character, like scarlet fever or syphilis, the child may be born suffering with the disease or with the virus in its blood, which will cause the disease to develop within a few days after birth. This, however, is clearly not

inheritance at all, but direct infection. We no longer use the term *hereditary* syphilis but have substituted for it the word *congenital*, which simply means that a child is born with the disease. [Pg 45]

There is no such thing as this disease extending "unto the third and fourth generation," like the wrath of Jehovah. One fact must, of course, be remembered, which has probably proved a source of confusion in the popular mind, and that is its extraordinary "long-windedness." It takes not merely two or three weeks or months to develop its complete drama, but anywhere from three to thirty years, so that it is possible for a child to be born with the taint in its blood and yet not exhibit to the non-expert eye any sign of the disease until its eighth, twelfth, or even fifteenth year.

The case of tuberculosis is almost equally clear-cut. In all the thousands of post-mortem examinations which have been held upon newborn children and upon mothers dying in or shortly after childbirth, the number of instances of the actual transference of the bacilli of tuberculosis from mother to child could be counted upon the fingers of two hands. It is one of the rarest of pathologic curiosities and, for practical purposes, may be entirely disregarded. When tuberculosis appears in several members of a family, in eight cases out of ten it is due to direct infection from parents or older children. This is strikingly brought out in the admirable work done by the Associated Dispensaries for Tuberculosis of the Charity Organization Society of New York.

One of the first steps in advance which they took was to establish in connection with every clinic for tuberculosis an attendant nurse, whose duty it was to visit the patients at their homes and advise and instruct them as to improvements in their methods of living, ventilation, food, and the [Pg 46] prevention of infection.

It was not long before these intelligent women began to bring back reports of other cases in the same family. Now the procedure is regularly adopted, whenever a case presents itself, of rounding up the remainder of the family group for examination, with the astounding result that where a mother or father is tuberculous, from twenty to sixty per cent of the children will be found to be suffering from some form of the infection. Instances of three infected children out of five living in the same room with a tuberculous mother are actually on record.

No one can practice long in any of our great climatic health resorts for tuberculosis, like Colorado or the Pacific Slope, without coming across scores of painful and distressing instances of children of tuberculous parents dying suddenly in convulsions from tuberculous meningitis, or by a wasting diarrhœa from tuberculosis of the bowels, or from a violent attack of distention of the bowels due to tuberculous peritonitis. The favorite breeding-place of the tubercle bacillus is unfortunately in the home.

On the other hand, while the vast majority of cases of so-called hereditary tuberculosis are due to direct infection, and may be prevented by proper disposal of the sputum and other methods for avoiding contagion, there is probably a hereditary element in the spread of tuberculosis to this degree: that, inasmuch as all of us have been exposed to the attack and invasion of the tubercle bacillus, not merely scores, but hundreds of times, and have been able to resist or throw off that [Pg 47] attack without apparent injury, the development of an invasion of the tubercle bacillus sufficiently extensive to endanger life is, in nine cases out of ten, in itself a proof of lowered resisting power on the part of the patient. This may be, and often is, only temporary, due to overwork, underfeeding, overconfinement, or that form of gradual suffocation which we politely term inadequate ventilation.

In a certain percentage of cases, however, it is due to a chronic lack of vigor and vitality; a lowering of the whole systemic tone, which may have existed from birth. In that case it is hardly to be expected that such an individual, becoming a parent, will be able to transmit to his or her offspring more vigor than he originally possessed. It is therefore probable that the children of a considerable percentage of tuberculous parents would not possess the same degree of resisting power against tuberculosis, or any other infection, as the average individual.

It is doubtful whether this factor of inherited lowered resistance plays any very important part in the propagation of tuberculosis, partly because it is comparatively seldom that consumptive marries consumptive, and such tendencies to lowered vigor and vitality as may be transmitted by one parent will be neutralized by the other; partly also because, by the superb and beneficent logic of nature, the pedigree of any disease is of the most mushroom and insignificant length, while the pedigree of health stretches back to the very dawn of time. In the struggle for dominance which takes place between the germ cells of the father and those of the mother, the [Pg 48] chances are at least ten to one in favor of the old ancestral traits of vigor, of resisting power, and of survival. How deeply this idea is implanted in the convictions of the scientific world, the bitterly and widely debated biologic question whether acquired characters or peculiarities can under any circumstances be inherited clearly shows. Victory for the present rests with those who deny the possibility of such inheritance, and disease is emphatically an acquired character.

Truth here, as everywhere, probably lies between the extremes, and both biologists and the students of disease have arrived at practically the same working compromise, namely, that while no gross defect, such as a mutilation, nor definite disease factor, such as a germ, nor even a cancer, can possibly be inherited, yet, inasmuch as the two cells, which by their development form the new individual, are nourished by the blood of the maternal body, influences which affect the nutritiousness or healthfulness of that blood may unfavorably influence the development of the offspring.

Disease cannot be inherited any more than a mutilating defect, but the results of both, in so far as they affect the nutrition of the offspring in the process of formation, may be transmitted, though to a very much smaller extent than we formerly believed. In the case of tuberculosis, if the mother, during the months that she is building up the body and framework of a child, is in a state of reduced or lowered nutrition on account of consumption or any other disease, or has her tissues saturated with the toxins of this disease, it is hardly to be expected that the development [Pg 49] of the child will proceed with the same perfection as it would under perfectly normal maternal surroundings.

However, even this influence is comparatively small; for one of the most marvelous things in nature is the perfection of the barrier which she has erected between the child before birth and any injurious conditions which may occur in the body of the mother. Here preference, so to speak, is given to the coming life, and whenever there is a contest for an adequate supply of nutrition, as, for instance, in cases of underfeeding or of famine, it is the mother who will suffer in her nutrition rather than the child. The unborn child, biologically considered, feeds upon the best she has to offer, rejecting all that is inferior, doing nothing and giving nothing in return.

How perfectly the coming generation is protected under the most unfavorable circumstances we have been given a striking object-lesson in one family of the lower animals. In the effective crusade against tuberculosis in dairy cattle waged by the sanitary authorities in Denmark, it was early discovered that the greatest practical obstacle to the extermination of tuberculosis in cattle was the enormous financial sacrifice involved in killing all animals infected. The disease was at that time particularly rife among the high-bred Jersey, Holstein, and other milking breeds. It was determined as a working compromise to test the truth of the modern belief that tuberculosis was transmitted only by direct infection, by permitting the more valuable cows to be saved alive for breeding purposes. They were isolated from the rest of the herd and given the best of care and [Pg 50] feeding. The moment that their calves were born they were removed from them altogether and brought up on the milk of perfectly healthy cows. The milk of the infected cows was either destroyed or sterilized and used for feeding pigs.

The results were brilliantly successful. Scarcely one of the calves thus isolated developed tuberculosis in spite of their highly infected ancestry. And not only were they not inferior in vigor and perfection of type to the remainder of their breed, but some of them have since become prize-winners. The additional care and more abundant feeding that they received more than compensated for any problematic defect in their heredity.

As to the heredity of cancer, all that can be said is that the burden of proof rests upon those who assert it. It is really curious how widespread the belief is that cancer "runs in families," and how exceedingly slender is the basis of evidence for such a belief. There are so many things that we do not know about cancer that any positive statement of any kind would be unbecoming. It would be absurd to declare that a disease, of which the cause is still unknown, either is or is not inherited. And this is our position in regard to cancer. An overwhelming majority of the evidence so far indicates that it is not a parasite; if it were, of course, we could say positively that it is not inherited. Although we are getting a discouraging degree of familiarity with the process and clearly recognize that it consists chiefly in the sudden revolt or rebellion of some group of cells, a tendency which quite conceivably might be transmitted to future generations, yet it is highly [Pg 51] improbable, on both biological and pathological grounds, that such is the case. If this rebellious tendency were transmitted we should at least have the right to expect that it would appear in the cells of the same organ or region of the body. It is a singular fact that in all the hundreds of cases in which cancer has appeared in the child of a cancerous parent it has almost invariably appeared in some different organ from that affected in the parent.

For instance, cancer of the lip in the father may be followed by cancer of the liver in the son or daughter, while cancer of the breast in the mother will be followed by cancer of the lip in a son. Further than this, the percentage of instances in which cancer appears in more than one member of a family is decidedly small, considering the frequency of the disease.

I took occasion to look into the matter carefully from a statistical point of view some ten or twelve years ago, and out of a collection of some fifty thousand cases of cancer less than six per cent were found to give any history of cancer in the family. And this, of course, simply means that some one of the relatives of the patient had at one time developed the disease.

In fact, the consensus of intelligent expert opinion upon the subject of heredity of cancer is, that though it may occur, we have comparatively little proof of the fact; that the percentage of cases in which there is cancer in the family is but little larger than might be expected on the doctrine of probabilities from the average distribution. Though possibly the offspring of a cancerous [Pg 52] individual may display a slightly greater tendency toward the development of that strange, curious process of "autonomy" than the offspring of the average individual, this tendency is so small and occurs so infrequently as to be a factor of small practical importance in the propagation and spread of the disease.

In insanity and epilepsy we have probably the last refuge and almost only valid instance of the old belief in the remorseless heredity of disease. But even here the part played by heredity is probably only a fraction of that which it is popularly, and even professionally, believed to play. It is, of course, obvious that diseases which tend quickly to destroy the life of the patient, especially those which kill or seriously cripple him before he has reached the age of reproduction, or prevent his long surviving that epoch, will not, for mechanical reasons, become hereditary. The Black Death, or the cholera, for instance, could not "run in a family." Supposing that children

were born with a special susceptibility to this disease, there would obviously soon be no family left.

The same is true in a lesser degree of milder or more chronic diseases. The family which was hereditarily predisposed to scarlet fever, measles, smallpox, or tuberculosis would not last long, and in fact the whole progress of civilization has been a continuous process of the weeding out of those who were most susceptible and the survival of those who were least so.

But when we come to deal with certain conditions, fortunately rare, such as functional disturbances of the nervous system, which neither seriously unfit their possessor for the struggle of life nor prevent him from reproducing his kind, then it becomes possible that a tendency to such disease may be transmitted through several successive generations. [Pg 53]

Such is the case with insanity, with epilepsy, with *hemophilia*, or "bleeders," and with certain rare and curious disturbances of the nervous system, such as the hereditary *ataxias* and "tics" of various sorts. However, even here the only conditions on which these diseases can continue to run in a family for more than one or two generations is either that they shall be mild in form or that only a comparatively small percentage of the total family shall be affected by them. If, for instance, two-thirds, one-half, or even a third of the descendants of a mentally unsound individual were to become insane, it would only need a few generations for that family to be crushed to the wall.

While the descendants of insane persons are distinctly more liable to become insane than the rest of the community, yet, on account of their fewness, this tendency probably does not account for more than a small fraction of the total insanity. We should, by all means, prevent the marriage of the insane and discourage that of their children, and the development of any well-defined form of insanity should act at once, *ipso facto*, as a ground and cause of divorce.

But the consoling fact remains that even of such children, providing, of course, as usually happens, that the other parent—husband or wife—is sound and sane, not more than ten or fifteen per cent would probably become insane. In other words, insanity is acquired and the result of individual stress and strain at least five times as frequently as it is inherited. We have absolutely no rational or statistical basis for gloomy predictions that, at present rates, within a couple of centuries more, we shall all be shut up in asylums with nobody left to support us and pay the taxes. The apparent increase of insanity of recent decades is probably only "on paper," due to better registration. [Pg 54]

To put it very roughly, probably ninety-eight per cent of us are so born, thanks to heredity, that the possibility of our becoming insane, even under the severest stress, is almost infinitesimal. Of the two per cent born with this taint, this possible tendency to mental unbalance, only about one-tenth now become completely insane,[1] and this percentage might be greatly diminished by general sanitary improvements. Our alienists now claim that, by checking the reproduction of the obviously unstable, and careful hygienic treatment and training of the predisposed two per cent, insanity is almost as preventable as tuberculosis.

In fine, from all the broad field of pathology, the mists of tradition which have dimmed the fair name and reputation of heredity are slowly but surely lifting, until we now behold it, not as our worst enemy, but as our best friend in the prevention of disease and the upbuilding of the race.

[Pg 55]

CHAPTER III

THE PHYSIOGNOMY OF DISEASE: WHAT A DOCTOR CAN TELL FROM APPEARANCES

It is our pride that medicine, from an art, and a pretty black one at that, originally, is becoming a science. And the most powerful factor in this development, its indispensable basis, in fact, has been the invention of instruments of precision—the microscope, the fever thermometer, the stethoscope, the ophthalmoscope, the test-tube, the culture medium, the triumphs of the bacteriologist and of the chemist. Any man who makes a final diagnosis in a serious case without resorting to some or all of these means is regarded—and justly—as careless and derelict in his duty to his patient.

At the same time, priceless and indispensable as are these laboratory methods of investigation, they should not be allowed to make us too scornful and neglectful of the evidence gained by the direct use of our five senses. We should still avail ourselves of every particle of information that can be gained by the trained eye, the educated ear, the expert touch,—the *tactus eruditus* of the medical classics,—and even the sense of smell. There is, in fact, a general complaint among the older members of the profession that the rising generation is being trained to neglect and even despise the direct evidence of the senses, and to accept no fact as a fact unless it has been seen through the microscope or demonstrated by a reaction in the test-tube. As one of our keenest observers and most philosophic thinkers expressed it a few months ago:— [Pg 56]

"I fear that certain physicians on their rounds are most careful to take with them their stethoscope, their thermometer, their hemoglobin papers, their sphygmomanometer, but leave

their eyes and their brains at home."

And it is certain that the art of sight diagnosis, which seems like half magic, possessed in such a wonderful degree by the older physicians of the passing and past generations, has been almost lost by the new.

A healthful reaction has, however, set in; and while we certainly do not love the Cæsar of laboratory methods and accuracy the less, we are beginning to have a juster affection for the Rome of the rich harvest that may be gained from the careful, painstaking, detective-like exercise of our eye, ear, and hand.

As a matter of fact, the conflict between the two methods is only apparent. Not only is each in its proper sphere indispensable, but they are enormously helpful one to the other. Instead of our being able to tell less by the careful, direct eye-and-hand examination of our patients than the doctor of a century ago, we can tell three to five times as much. Signs that he could interpret only by the slow and painful method of two-thirds of a lifetime of plodding experience, or by occasional flashes of half-inspired insight, we are now able to interpret absolutely upon a physiological—yes, a chemical—basis from the revelations of the microscope, the test-tube, and [Pg 57] the culture medium. His only way of determining the meaning of a particular tint of the complexion, or line about the mouth, or eruption on the skin, was by slowly and laboriously accumulating a long series of similar cases in which that particular symptom was found always to occur, and deducing its meaning. Now, we simply take a drop of our patient's blood, a scraping from his throat, a portion of some one of his secretions, a little slice of a tumor or growth, submit them to direct examination in the laboratory, and get a prompt and decisive answer.

The observant physician begins to gather information about a patient from the moment he enters the sick-room or the patient steps into his consulting-room; and the value of the information obtained in the first thirty seconds, before a word has been spoken, is sometimes astonishingly great. While no intelligent man would dream of depending upon this first *coup d'œil*, "stroke of the eye" as the French so graphically call it, for his final diagnosis, or accept its findings until he had submitted them to the most ruthless cross-examination with the stethoscope and in the laboratory, yet it will sometimes give him a clew of almost priceless value. It is positively uncanny to see the swift, intuitive manner in which an old, experienced, and thoughtful physician will grasp the probable nature of a case in one keen look at a patient. Often he can hardly explain to you himself how he does it, what are the data that determine it; yet not infrequently, three times out of five, your most elaborate and painstaking study of the case with all the modern methods [Pg 58] will bring you to the same conclusion as that sensed within forty-five seconds by this keen-eyed old sleuth-hound of the fever trails. Time and again, in my interne days, have I gone the rounds of the wards or the out-patient departments with some kindly-faced, keen-eyed old Sherlock Holmes of the profession, and seen him point to a new case across the ward with the question: "When did that pneumonia come in?" or pick out a pain-drawn, ashy mask in the waiting line, with an abrupt, "Bring me that case of cancer of the stomach. He's in pain. I'll take him first."

And, in later years, I have had colleagues with whom it was positively painful to walk down a crowded street, from the gruesome habit that they had of picking out, and condemning to lingering deaths, the cases of cancer, of Bright's disease, or of locomotor ataxia, that we happened to meet. Of course, they would be the first to admit that this was only what they would term a "long shot," a guess; but it was a guess based upon significant changes in the patient's countenance or gait, which their trained eye picked out at once, and it was surprising how often this snapshot diagnosis turned out to be correct.

The first thing that a medical student has to learn is that appearances are *not* deceptive—except to fools. Every line of the human figure, every proportion of a limb, every detail of size, shape, or relation in an organ, *means* something. Not a line upon any bone in the skeleton which was not made by the hand-grip or thumbprint of some muscle, tendon, or ligament; no bump or knuckle [Pg 59] which is not a lever or hand-hold for the grip of some muscle; not a line or a curve or an opening in that Chinese puzzle, the skull, which was not made to protect the brain, to accommodate an eye, to transmit a blood-vessel, or to allow the escape of a nerve. Every minutest detail of structure means something to the man who will take the pains to puzzle it out. And if this is true of the foundation structure of the body, is it to be expected that the law ceases to run upon the surface?

Not a line, not a tint, not a hollow of that living picture, the face, but means something, if we will take the time and labor to interpret it. Even coming events cast their shadows before upon that most exquisitely responsive surface—half mirror, half sensitive plate—the human countenance. The place where the moving finger of disease writes its clearest and most unmistakable message is the one to which we must naturally turn, the face; not merely for the infantile tenth part of a reason which we often hear alleged, that it is the only part of the body, except the hand, which is habitually exposed, and hence open to observation, but because here are grouped the indicators and registers of almost every important organ and system in the body.

What, of course, originally made the face the face, and, for the matter of that, the head the head, was the intake opening of the food-canal, the mouth. Around this necessarily grouped themselves the outlook departments, the special senses, the nose, the eyes, and ears; while later, by an exceedingly clumsy device of nature, part of the mouth was split off for the intake of a new [Pg 60] ventilating system. So that when we glance at the face we are looking first at the automatically controlled intake openings of the two most important systems in the body, the alimentary and the respiratory, whose muscles contract and relax, ripple in comfort or knot in agony, in response to

every important change that takes place throughout the entire extent of both.

Second, at the apertures of the two most important members of the outlook corps, the senses of sight and of smell. These are not only sharply alert to every external indication of danger, but by a curious reversal, which we will consider more carefully later, reflect signals of distress or discomfort from within. Last, but not least, the translucent tissues, the semi-transparent skin, barely veiling the pulsating mesh of myriad blood-vessels, is a superb color index, painting in vivid tints—"yellow, and ashy pale, and hectic red"—the living, ever changing, moving picture of the vigor of the life-centre, the blood-pump, and the richness of its crimson stream. Small wonder that the shrewd advice of a veteran physician to the medical student should be: "The first step in the examination is to look at your patient; the second is to look again, and the third to take another look at him; and keep on looking all through the examination."

It is no uncommon thing for an expert diagnostician deliberately to lead the patient into conversation upon some utterly irrelevant subjects, like the weather, the crops, or the incidents of his journey to the city, simply for the purpose of taking his mind off himself, putting him at his [Pg 61] ease, and meanwhile quietly deciphering the unmistakable cuneiform inscription, often twice palimpsest, written by the finger of disease upon his face. It takes time and infinite pains. In no other realm does genius come nearer to Buffon's famous description, "the capacity for taking pains," but it is well worth the while. And with all our boasted and really marvelous progress in precise knowledge of disease, accomplished through the microscope in the laboratory, it remains a fact of experience that so careful and so trustworthy is this face-picture when analyzed, that our best and most depended upon impressions as to the actual condition of patients, are still obtained from this source. Many and many a time have I heard the expression from a grizzled consultant in a desperate case, "Well, the last blood-count was better," or, "The fever is lower," or, "There is less albumen,—but I don't like the look of him a bit"; and within twenty-four hours you might be called in haste to find your patient down with a hemorrhage, or in a fatal chill, or sinking into the last coma.

It would really be difficult to say just what that careful and loving student of the *genus humanum* known as a doctor looks at first in the face of a patient. Indeed, he could probably hardly tell you himself, and after he has spent fifteen or twenty years at it, it has become such a second nature, such a matter of instinct with him, that he will often put together all the signs at once, note their relations, and come to a conclusion almost in the "stroke of an eye," as if by instinct, just as a weather-wise old salt will tell you by a single glance at the sky when and from what quarter a [Pg 62] storm is coming.

I shall never forget the remark of my greatest and most revered teacher, when he called me into his consultation-room to show me a case of typical locomotor ataxia, gave me a brief but significant history, put the patient through his paces, and asked for a diagnosis. I hesitated, blundered through a number of further unnecessary questions, and finally stumbled upon it. After the patient had left the room, I, feeling rather proud of myself, expected his commendation, but I didn't get it. "My boy," he said, "you are not up to the mark yet. You should be able to recognize a disease like that just as you know the face of an acquaintance on the street." A positive and full-blown diagnosis of this sort can, of course, only be made in two or three cases out of ten. But the method is both logical and scientific, and will give information of priceless value in ninety-nine cases out of a hundred.

Probably the first, if not the most important, character that catches the physician's eye when it first falls upon a patient is his expression. This, of course, is a complex of a number of different markings, but chiefly determined by certain lines and alterations of position of the skin of the face, which give to it, as we frequently hear it expressed, an air of cheerfulness or depression, comfort or discomfort, hope or despair. These lines, whether temporary or permanent, are made by the contractions of certain muscles passing from one part of the skin to another or from the underlying bones to the skin. These are known in our anatomical textbooks by the natural but [Pg 63] absurd name of "muscles of expression."

Their play, it is true, does make up about two-thirds of the wonderful shifting of relations, which makes the human countenance the most expressive thing in the world; but their original business is something totally different. Primarily considered, they are solely for the purpose of opening or closing, contracting or expanding, the different orifices which, as we have seen, appear upon the surface of the face. This naturally throws them into three great groups: those about and controlling the orifice of the alimentary canal, the mouth; those surrounding the joint openings of the air-tube and organ of smell, and those surrounding the eyes.

As there are some twenty-four pairs of these in an area only slightly greater than that of the outspread hand, and as they are capable of acting with every imaginable grade of vigor and in every possible combination, it can readily be seen what an infinite and complicated series of expressions—or, in other words, indications of the state of affairs within those different orifices—they are capable of. Only the barest and rudest outlines of their meaning and principles of interpretation can be attempted. To put it very roughly, the main underlying principle of interpretation is that we make our first instinctive judgment of the site of the disease from noting which of the three great orifices is distorted furthest from its normal condition. Then by constructing a parallel upon the similarity or the difference of the lines about the other two openings, we get what a surveyor would call our "lines of triangulation," and by following these [Pg 64] to their converging point can often arrive at a fairly accurate localization.

The greatest difficulty in the method, though at times our greatest help, is the extraordinary and

intimate sympathy which exists between all three of these groups. If pain, no matter where located, once becomes intense enough, its manifestations will travel over the face-dial, overflowing the organ or system in which it occurs, and eyes, nostrils, and mouth will alike reveal its presence. Here, of course, is where our second great process, so well known in all clew-following, elimination, comes in.

A patient comes in with pain-lines written all over his face. To put it very roughly—has he cancer of the stomach? Pneumonia? Brain tumor? If there be no play of the muscles distending and contracting the nostrils with each expiration, no increased rapidity of breathing, no gasp when a full breath is drawn, and no deep red fever blush on the cheeks, we mentally eliminate pneumonia. The absence of these nasal signs throws us back toward cancer or some other painful affection of the alimentary canal. If the pain-lines about the mouth are of recent formation, and have not graved themselves into the furrows of the forehead above and between the eyebrows; if the color, instead of ashy, be clear and red, we throw out cancer and think of colic, ulcer, hyperacidity, or some milder form of alimentary disease.

If, on the other hand, the pain-lines are heaviest about the brows, the eyes, and the forehead, with only a sympathetic droop or twist of the corners of the mouth, if the nostrils are not at all [Pg 65] distorted or too movable, if there is no fever flush and little wasting, and on turning to the eyes we find a difference between the pupils, or a wide distention or pin-point-like contraction of both or a slight squint, the picture of brain tumor would rise in the mind. Once started upon any one of these clews, then a hundred other data would be quickly looked for and asked after, and ultimately, assisted by a thorough and exhaustive examination with the instruments of precision and the tests in the laboratory, a conclusion is arrived at. This, of course, is but the roughest and crudest outline suggestive of the method of procedure.

Probably not more than once in three times will the first clew that we start on prove to be the right one; but the moment that we find this barred, we take up the next most probable, and in this manner hit upon the true scent.

As to the cause and rationale of these pain-lines, only the barest outlines can be given. Take the mouth for an example. When all is going well in the alimentary canal, without pain, without hunger, and both absorption of food and elimination of waste are proceeding normally, the tissues about the mouth, like those of the rest of the body, are apt to be plump and full; the muscles which open the aperture, having fulfilled their duty and received their regular wages, are quietly at rest; those that close the opening, having neither anticipation of an early call for the admission of necessary nutriment, nor an instinctive desire to shut out anything that may be [Pg 66] indigestible or undesirable, are now in their normal condition of peaceful, moderate contraction; the face has a comfortable, well-fed, wholesome look. On the other hand, let the digestive juices fail to do their duty properly, or the swarms of bacteria pets which we keep in our food-canals get beyond control; or if for any other reason the tissues be kept from getting their proper supply of nourishment from the food-canal, the state of affairs is quickly revealed in the mouth mirror. Those muscles which open the mouth, instead of resting peacefully in the consciousness of duty well done, are in a state of perpetual fidget, twitching, pulling, wondering whether they ought not to open the portal for the entrance of new supplies of material, since the tissues are crying for food.

As the strongest of these are those which pull the corners of the mouth outward and downward, the resultant expression is one of depression, with downward-curving angles to the mouth. The eyes, and even the nostrils, sympathetically follow suit, and we have that countenance which, by the cartoonist's well-known trick, can be produced by the alteration of one pair of lines, those at the angles of the mouth, turning a smiling countenance into a weeping one. On the other hand, if all these processes of nutrition and absorption are proceeding as they should, they are accompanied by mild sensations of comfort which, although they no longer reach our consciousness, reveal themselves in the mouth-opening muscles, and they gently contract upward and outward, in pleasurable anticipation of the next intake, and we get the grin or the smile. [Pg 67]

If, on the other hand, these digestive disturbances be accompanied by pain, then another shading appears on our magic mirror, and that is a curious contraction of the mouth, with distortion of the lines surrounding it, so violent in some cases as positively to whiten the lips or produce lines of paleness along the course of the muscles. This is the set or twisted mouth of agony, and is due to a curious transference and reflex on this order: that inasmuch as the last food which entered the alimentary canal seems to have caused this disturbance and pain, no more will be allowed to enter it at present under any conditions. And as our alimentary instincts are the most fundamental of all, by a due process of transference, mental agony calls into action this same set of muscles, to shut out any possible addition to the agony already present.

The lines of determination, similarly, about the mouth, are those of the individual who has the courage to say "No" to the tempting morsel when he doesn't need it; and the lines of weakness and irresolution are those of the nature which cannot resist either gastronomic or other temptation. Similarly, the well-known lines of disgust or of discontent about the corners of the mouth are the unconscious contractions accompanying nausea, and preparations to expel the offending morsel whether from stomach or mouth.

If, on the other hand, our first glance shows us that the deepest pain-lines are those about the nostrils and upper lip, especially if the wings of the nostrils can be seen to dilate with each breath, and breathing be faster than normal, our clew points in the direction of some disease of [Pg 68] the great organs above the diaphragm—that is, the lungs or heart.

Signs in this region might refer to either of these, for the reason that, although a sufficient intake of air is one of the necessary conditions of proper oxygenation, a free and abundant circulation of the blood through the air-cells is equally essential. In fact, that common phenomenon known as "shortness of breath" is more frequently due to disturbances of the heart and circulation than it is to the lungs, especially in patients who are able to be up and about. If, in addition to the danger signal of the rise and fall of the nostrils with each breath, we have a pale, translucent skin, with a light, hectic flush showing just below the knife-like lower edge of the cheekbone, a widely open, shining eye, and a clustering abundance of hair of a glossiness bordering on dampness, red lips slightly parted, showing the teeth between, a painfully strong suspicion of consumption would arise unbidden.

This pathetic type of face has that fatal gift which the French clinicians, with their usual happiness of phrase, term *La beauté du diable*. The eager eyes, dilated nostrils, parted lips, give that weird air of exaltation which, when it occurs, as it occasionally does in the dying, is interpreted as the result of glimpses into a spirit world. When to this is added the mild delirium of fever, when memories of happier days and of those who have passed before rise unbidden and babble themselves from the tongue, one can hardly wonder at this interpretation.

The last group of lines to be noted is that about the eyes and forehead. These are less reliable [Pg 69] than either of the other two, for the reason that they are so sympathetic as almost invariably to be present in addition, whenever the lower dial-plates of the face are disturbed. It is only when they appear alone that they are significant; then they may be interpreted as one of three things: first, and commonest, eye strain; second, disease in some part of the nervous system or muscular system, not connected with the organs of the chest or abdomen; and third, mental disturbances.

This last relation, of course, makes them in many respects the least reliable of all the face indices, because—as is household knowledge—they indicate mental conditions and operations, as well as bodily. "The wrinkled brow of thought," the "deep lines of perplexity," etc., are in the vocabulary of the grammar grades. They are, however, a valuable check upon the other two groups. They are not apt to be present in consumption and in other forms of serious disease, attended by fever, on account of the curious effect produced by the toxins of the disease, which is often not only stimulating, but even of an exhilarating nature, or will produce a slight stupor or lethargy, such as is typical of typhoid.

One of the most singular transformations in the sick-room, especially in serious disease marked by lethargy or stupor, is that in which the patient's countenance will appear like a sponged-off slate, so completely have the lines of worry and of thought been obliterated.

One distinct value of the pain-lines about the eyes and brow is that you can often test their genuineness. Just engage your hypochondriac or hysterical patient in lively conversation; or, on [Pg 70] the reverse principle, wound his vanity, so as to produce an outburst of temper, and see how the lines of undying agony will fade away and be replaced by the curves of amusement or by the straight-drawn brows of indignation.

As with the painter, next to line comes color. Every one, of course, knows that a fresh, rosy color is usually associated with health, while a pale, sallow complexion suggests disease. But our color signals, while more vivid, are much less reliable and more apt to deceive than our line-markings.

Surprising as it may sound, careful analyses have shown, first, that the kind of pigment present in the human skin of every race is absolutely one and the same. The only difference between the negro and the white man is that the negro has two or three times as much of it. Secondly, that every skin except that of the albino has a certain, and usually a considerable, amount of this pigment present in it.

"The red hue of health" is even more apt to mislead us, because, being due to the abundance of blood in the meshes of the skin, many fevers, by increasing the rapidity of the heart-beat and dilating the vessels in the skin, give a ruddiness of hue equal to or in excess of the normal.

However, a little careful checking up will eliminate most of the possible mistakes and enable us to obtain information of the greatest value from color. For instance, if our patient be of Southern blood, or tanned from the seashore, the good red blood in his arteries is pretty safe to show [Pg 71] through at the normal blush area on the cheeks; or, failing that, through the translucent epithelium of the lips and gums. If, on the other hand, this yellow tint be due to the escape of broken-down blood-pigments into the tissues, or a damming up of the bile, and a similar escape of its coloring matter, as in jaundice, then we turn to the whites of the eyes, and if a similar, but more delicate, yellowish tint confronts us there, we know we have to deal with a severe form of anæmia or jaundice, according to the tint. In extreme cases of the latter, the mucous membrane of the lips and of the gums will even show a distinctly yellowish hue. The frightful color of yellow fever, and the yellow "death mask," which appears just before the end of several fatal forms of blood poisoning, is due to the tremendous breaking down of the red cells of the blood under the attack of the fever toxins, and their leaking out into the tissues. A similar process of a milder and less serious extent occurs in those temporary anæmias of young girls, known for centuries past in the vernacular as "the green sickness." And a delicate lemon tint of this same origin, accompanied by a waxy pallor, is significant of the deadly, pernicious anæmia and the later stages of cancer.

The most significant single thing about the red flush, supposed to be indicative of health, is its location. If this be the normal "blush area," about the middle of each cheek,—which is one of

nature's sexual ornaments, placed, like a good advertisement, where it will attract most attention and add most beauty to the countenance,—and it fades off gradually at the edges into the clear [Pg 72] whiteness or brownness of the healthy skin, it is probably both healthy and genuine. If the work of either fever or of art, it will generally reveal itself as a base imitation. In eight cases out of ten of fever, the flush, instead of being confined to this definite area, extends all over the face, even up to the roots of the hair. The eyes, instead of being clear and bright, are congested and heavy-lidded; and if with these you have an increased rapidity of respiration, and a general air of discomfort and unrest, you are fairly safe in making a diagnosis of fever. If the first touch of the tips of the fingers on the wrist shows a hot skin and a rapid pulse, the diagnosis is almost as certain as with the thermometer.

Now for two of the instances in which it most commonly puzzles us. The first of these is consumption; for here the flush, both in position and in delicacy and gentle fading away at the proper margins, is an almost perfect imitation of health. It, however, usually appears, not as the normal flush of health does, upon a plump and rounded cheek, but upon a hollow and wasted one. It rises somewhat higher upon the cheekbones, throwing the latter out into ghastly prominence. The lips and the eyes will give us no clew, for the former are red from fever, and the latter are bright from the gentle, half-dreamy state produced by the toxins of the disease, the so-called "*spes phthisica*"—the everlasting and pathetic hopefulness of the consumptive. But here we call for help upon another of the features of disease—the hand. If, instead of being cool, and elastic, this is either dry and hot, or clammy and damp, and feels as if you were grasping a handful of [Pg 73] bones and nerves, and the finger-tips are clubbed and the nails curved like claws, then you have a strong *prima facie* case.

The other color condition which is apt to puzzle us is that of the plump and comfortable middle-aged gentleman with a fine rosy color, but a watery eye and loose and puffy mouth, a wheezy respiration and apparent excess of adipose. Here the high color is often due to a paralytic distention of the blood-vessels of the face and neck, and an examination of his heart and blood-vessels shows that his prospects are anything but as rosy as his countenance.

The varying expressions of the face of disease are by no means confined to the countenance. In fact, they extend to every portion of—in Trilby's immortal phrase—"the altogether." Disease can speak most eloquently through the hand, the carriage, the gait, and, in a way that the patient may be entirely unconscious of, the voice. These forms of expression are naturally not so frequent as those of the face, on account of the extraordinary importance of the great systems whose clock-dials and indices form what we term the human countenance. But when they do occur they are fully as graphic and more definitely and distinctively localizing.

Next in importance to the face comes the hand, and volumes have been written upon this alone. Containing, as it does, that throbbing little blood-tube, the radial artery, which has furnished us for centuries with one of our oldest and most reliable guides to health conditions, the pulse, it has [Pg 74] played a most important part in surface diagnoses. To this day, in fact, Arabic and Turkish physicians in visiting their patients on the feminine side of the family are allowed to see nothing of them except the hand, which is thrust through an opening in a curtain. How accurate their diagnoses are, based upon this slender clew, I should not like to aver, but a sharp observer might learn much even from this limited area.

We have—though, of course, in lesser degree—all the color and line pictures with which we have been dealing upon the face. Though not an index of any special system, it has the great advantage of being our one approach to an indication of the general muscular tone of the body, as indicated both in its grasp and in the poses it assumes at rest. The patient with a limp and nerveless hand-clasp, whose hand is inclined to lie palm upward and open instead of palm downward and half-closed, is apt to be either seriously ill, or not in a position to make much of a fight against the attack of disease.

The nails furnish one of our best indices of the color of the blood and condition of the circulation. Our best surface test of the vigor of the circulation is to press upon a nail, or the back of the finger just above it, until the blood is driven out of it, and when our thumb is removed from the whitened area to note the rapidity with which the red freshet of blood will rush back to reoccupy it.

In the natural growth of the nail, traveling steadily outward from root to free edge, its tissues, at first opaque and whitish, and thus forming the little white crescent, or *lunula*, found at the base [Pg 75] of most nails, gradually become more and more transparent, and hence pinker in color, from allowing the blood to show through. During a serious illness, the portion of the nail which is then forming suffers in its nutrition, and instead of going on normally to almost perfect transparency, it remains opaque. And the patient will, in consequence, carry a white bar across two or three of his nails for from three to nine months after the illness, according to the rate of growth of his nails. Not infrequently this white bar will enable you to ask a patient the question, "Did you not have a serious illness of some sort two, three, or six months ago?" according to the position of the bar. And his fearsome astonishment, if he answers your question in the affirmative, is amusing to see. You will be lucky if, in future, he doesn't incline to regard you as something uncanny and little less than a wizard.

Another of the score of interesting changes in the hand, which, though not very common, is exceedingly significant when found, is a curious thickening or clubbing of the ends of the fingers, with extreme curvature of the nails, which is associated with certain forms of consumption. So long has it been recognized that it is known as the "Hippocratic finger," on account of the vivid

description given of it by the Greek Father of Medicine, Hippocrates. It has lost, however, some of its exclusive significance, as it is found to be associated also with certain diseases of the heart. It seems to mean obstructed circulation through the lungs. [Pg 76]

Next after the face and the hand would come the carriage and gait. When a man is seriously sick he is sick all over. Every muscle in his body has lost its tone, and those concerned with the maintenance of the erect position, being last developed, suffer first and heaviest. The bowed back, the droop of the shoulders, the hanging jaw, and the shuffling gait, tell the story of chronic, wasting disease more graphically than words. We have a ludicrously inverted idea of cause and effect in our minds about "a good carriage." We imagine that a ramrod-like stiffening of the backbone, with the head erect, shoulders thrown back and chest protruded, is a cause of health, instead of simply being an effect, or one of the incidental symptoms thereof. And we often proceed to drill our unfortunate patients into this really cramped and irrational attitude, under the impression that by making them look better we shall cause them actually to become so. The head-erect, chest-out, fingers-down-the-seam-of-your trousers position of the drillmaster is little better than a pose intended chiefly for ornament, and has to be abandoned the moment that any attempt at movement or action is begun.

So complete is this unconscious muscular relaxation, that it is noticeable not only in the standing and sitting position, but also when lying down. When a patient is exceedingly ill, and in the last state of enfeeblement, he cannot even lie straight in bed, but collapses into a curled-up heap in the middle of the bed, the head even dropping from the pillow and falling on the chest. Between this *débâcle* and the slight droop of shoulders and jaw indicative of beginning trouble there are a [Pg 77] thousand shades of expression significant instantly to the experienced eye.

Though more limited in their application, yet most significant when found, are the alterations of the gait itself. Even a maker of proverbs can tell at a glance that "the legs of the lame are not equal." From the limp, coupled with the direction in which the toe or foot is turned, the tilt of the hips, the part of the foot that strikes first, the presence or absence of pain-lines on the face, a snap diagnosis can often be made as to whether the trouble is paralysis, hip-joint disease, knee or ankle mischief, or flatfoot, as your patient limps across the room. Even where both limbs are affected and there is no distinct limp, the form of shuffle is often significant.

Several of the forms of paralysis have each its significant gait. For instance, if a patient comes in with a firm, rather precise, calculated sort of gait, "clumping" each foot upon the floor as if he had struck it an inch sooner than he had expected, and clamping it there firmly for a moment before he lifts it again, as though he were walking on ice, with more knee action than seems necessary, you would have a strong suspicion that you had to deal with a case of *locomotor ataxia*, in which loss of sensation in the soles of the feet is one of the earliest symptoms. If so, your patient, on inquiry, will tell you that he feels as if there were a blanket or even a board between his soles and the surface on which he steps. If a quick glance at the pupils shows both smaller or larger than normal, and on turning his face to the light they fail to contract, your [Pg 78] suspicion is confirmed; while if, on asking him to be seated and cross his legs, a tap on the great extensor tendon of the knee-joint just below the patella fails to elicit any quick upward jerk of the foot, the so-called "knee-kick," then you may be almost sure of your diagnosis, and proceed to work it out at your leisure.

On the other hand, if an elderly gentleman enters with a curiously blank and rather melancholy expression of countenance, holding his cane out stiffly in front of him, and comes toward you at a rapid, toddling gait, throwing his feet forward in quick, short steps, as if, if he failed to do so, he would fall on his face, while at the same time a vibrating tremor carries his head quickly from side to side, you are justified in suspecting that you have to do with a case of *paralysis agitans*, or shaking palsy.

Last of all, your physiognomy of disease includes not merely its face, but its voice; not only the picture that it draws, but the sound that it makes. For, when all has been allowed and discounted that the most hardened cynic or pessimistic agnostic can say about speech being given to man to conceal his thoughts, and the hopeless unreliability of human testimony, two-thirds of what your patients tell you about their symptoms will be found to be literally the voice of the disease itself speaking through them. They may tell you much that is chiefly imaginary, but even imagination has got to have some physical basis as a starting-point. They may tell you much that is clearly and [Pg 79] ludicrously irrelevant, or untrue, on account of inaccuracy of observation, confusion of cause and effect, or a mental color-blindness produced by the disease itself. But these things can all be brushed aside like the chaff from the wheat if checked up by the picture of the disease in plain sight before you.

In the main, the great mass of what patients tell you is of great value and importance, and, with proper deductions, perfectly reliable. In fact, I think it would be safe to say that a sharp observer would be able to make a fairly and approximately accurate diagnosis in seven cases out of ten, simply by what his eye and his touch tell him while listening to symptoms recounted by the patient. Time and again have I seen an examination made of a reasonably intelligent patient, and when the recital had been finished and the hawk-like gaze had traveled from head to foot and back again, from ear-tip to finger-nail, from eye to chest, a symptom which the patient had simply forgotten to mention would be promptly supplied; and the gasp with which the patient would acknowledge the truth of the suggestion was worth traveling miles to see.

Of course, you pay no attention to any statement of the patient which flatly contradicts the evidence of your own senses. But even where patients, through some preconceived notion, or

from false ideas of shame or discredit attaching to some particular disease, are trying to mislead you, the very vigor of their efforts will often reveal their secret, just as the piteous broken-winged utterings of the mother partridge reveal instantly to the eye of the bird-lover the presence of the young which she is trying to lure him away from. Only let a patient talk enough about his or her symptoms, and the truth will leak out. [Pg 80]

The attitude of impatient incredulity toward the stories of our patients, typified by the story of that great surgeon, but greater bear, Dr. John Abernethy, has passed, never to return. When a lady of rank came into his consulting-room, and, having drawn off her wraps and comfortably settled herself in her chair, launched out into a luxurious recital of symptoms, including most of her family history and adventures, he, after listening about ten minutes pulled out his watch and looked at it. The lady naturally stopped, open-mouthed. "Madam, how long do you think it will take you to complete the recital of your symptoms?" "Oh, well,"—the lady floundered, embarrassed,—"I hardly know." "Well, do you think you could finish in three-quarters of an hour?" Well, she supposed she could, probably. "Very well, madam. I have an operation at the hospital in the next street. Pray continue with the recital of your symptoms, and I will return in three-quarters of an hour and proceed with the consideration of your case!"

When you can spare the time,—and no time is wasted which is spent in getting a thorough and exhaustive knowledge of a serious case,—it is as good as a play to let even your hypochondriac patients, and those who are suffering chiefly from "nervous prosperity" in its most acute form, set forth their agonies and their afflictions in their fullest and most luxurious length, breadth, and thickness, watching meanwhile the come and go of the lines about the face-dials, the changes of the color, the sparkling and dulling of the eye, the droop or pain-cramp, or luxurious loll of each group of muscles, and quietly draw your own conclusions from it all. Many and many a time, in the full luxury of self-explanation, they will reveal to you a clew which will prove to be the master-key to your control of the situation, and their restoration to comfort, if not health, which you couldn't have got in a week of forceps-and-scalpel cross-examination. [Pg 81]

In only one class of patients is this valuable aid to knowledge absent, and that is in very young children; and yet, by what may at first sight seem like a paradox, they are, of all others, the easiest in whom to make not merely a provisional, but a final, diagnosis. They cannot yet talk with their tongues and their lips, but they speak a living language in every line, every curve, every tint of their tiny, translucent bodies, from their little pink toes to the soft spot on the top of their downy heads. Not only have they all the muscle-signs about the face-dial, of pain or of comfort, but, also, these are absolutely uncomplicated by any cross-currents of what their elders are pleased to term "thought."

When a baby knits his brows he is not puzzling over his political chances or worrying about his immortal soul. He has got a pain somewhere in his little body. When his vocal organs emit sounds, whether the gurgle or coo of comfort, or the yell of dissatisfaction, they are just squeezed out of him by the pressure of his own internal sensations, and he is never talking just to hear himself talk. Further than this, his color is so exquisitely responsive to every breath of change in his interior mechanism, that watching his face is almost like observing a reaction in a test-tube, with its precipitate, or change of color. In addition, not only will he turn pale or flush, and his little muscles contract or relax, but so elastic are the tissues of his surface, and so abundant the mesh of blood-vessels just underneath, that, under the stroke of serious illness, he will literally shrivel like a green leaf picked from its stem, or wilt like a faded flower. [Pg 82]

A single glance at the tiny face on the cot pillow is usually enough to tell you whether or not the little morsel is seriously ill. Nothing could be further from the truth than the prevailing impression that, because babies can't talk, it is impossible, especially for a young doctor, to find out what is the matter with them. If they can't talk, neither can they tell lies, and when they yell "Pin!" they mean pin and nothing else.

In fact, the popular impression of the puzzled discomfiture of the doctor before a very small, ailing baby is about as rational as the attitude of a good Quaker lady in a little Western country town, who had induced her husband to subscribe liberally toward the expenses of a certain missionary on the West Coast of Africa. On his return, the missionary brought her as a mark of his gratitude a young half-grown parrot, of one of the good talking breeds. The good lady, though delighted, was considerably puzzled with the gift, and explained to a friend of mine that she really didn't know what to feed it, and it wasn't quite old enough to be able to talk and tell her what it wanted! [Pg 83]

CHAPTER IV

COLDS AND HOW TO CATCH THEM

Ancient vibrations are hard to stop, and still harder to control. Whether they date from our driving back by the polar ice-sheet, together with our titanic Big Game, the woolly rhinoceros, the mammoth, and the sabre-toothed tiger, from our hunting-grounds in Siberia and Norway, or from recollections of hunting parties pushing north from our tropical birth-lands, and getting trapped and stormbound by the advance of the strange giant, Winter, certain it is that our subconsciousness is full of ancestral memories which send a shiver through our very marrow at

the mere mention of "cold" or "sleet" or "wintry blasts."

From the earliest dawn of legend cold has always been ranked, with hunger and pestilence and storm, as one of the demons to be dreaded and fought. And, at a little later date, the ancient songs and sayings of every people have been full of quaint warnings against the danger of a chill, a draft, wet feet, or damp sheets. There is, of course, a bitterly substantial basis for this feeling, as the dozens of stiffened forms whose only winding-sheet was the curling snowdrift, or whose coffin the frozen sleet, bear ghastly witness. It was, however, long ago discovered that when we were properly fed and clothed, the Cold Demon could be absolutely defied, even in a tiny hut [Pg 84] made out of pressed snow and warmed by a smoky seal-blubber lamp; that the Storm King could be baffled just by burrowing into his own snowdrifts and curling up under the crust, like an Eskimo dog. Hence, nearly all the legends depict the hero as finally conquering the Storm King, like Shingebis in the Song of Hiawatha.

The ancient terror, however, still clings, with a hold the more tenacious as it becomes narrowed, to one large group of these calamities believed to be produced by cold,—namely, those diseases supposed to be caused by exposure to the weather. Even here, it still has a considerable basis in fact; but the general trend of opinion among thoughtful physicians is that this basis is much narrower than was at one time supposed, and is becoming still more restricted with the progress of scientific knowledge. For instance, fifty years ago, popular opinion, and even the majority of medical belief, was that consumption and all of its attendant miseries were chiefly due to exposure to cold. Now we know that, on the contrary, abundance of pure, fresh, cold air is the best cure for the disease, and foul air and overcrowding its chief cause. An almost equally complete about-face has been executed in regard to pneumonia. Prolonged and excessive exposure to cold may be the match that fires the mine, but we are absolutely certain that two other things are necessary, namely, the presence of the diplococcus, and a lowered and somewhat vitiated state of bodily resistance, due to age, overwork, underfeeding, or over-indulgence in alcohol. [Pg 85]

Not only do these two diseases not occur in the land of perpetual cold, the frozen North, except where they are introduced by civilized visitors,—and scarce a single death from pneumonia has ever yet occurred in the crew of an Arctic expedition,—but it has actually been proposed to fit up a ship for a summer trip through the Arctic regions, as a floating sanatorium for consumptives, on account of the purity of the air and the brilliancy of the sunlight.

There is one realm, however, where the swing of this ancient superstition vibrates with fullest intensity, and that is in those diseases which, as their name implies, are still believed to be due to exposure to a lowered temperature—"common colds." Here again it has a certain amount of rational basis, but this is growing less and less every day. The present attitude of thoughtful physicians may be graphically indicated by the flippant inquiry of the riddle-maker, "When is a cold not a cold?" and the answer, "Two-thirds of the time." This much we are certain of already: that the majority of so-called "colds" have little or nothing to do with exposure to a low temperature, that they are entirely misnamed, and that a better term for them would be *fouls*. In fact, this proportion can be clearly and definitely proved and traced as infections spreading from one victim to another. The best place to catch them is not out-of-doors, or even in drafty hallways, but in close, stuffy, infected hotel bedrooms, sleeping-cars, churches, and theatres.

Two arguments in rebuttal will at once be brought forward, both apparently conclusive. One is that colds are vastly more frequent in winter, and the other that when you sit in a draft until you [Pg 86] feel chilly, you inevitably have a cold afterward. Both these arguments alike, however, are based upon a misunderstanding. The frequency of colds in winter is chiefly due to the fact that, at this time of the year, we crowd into houses and rooms, shutting the doors and windows in order to keep warm, and thus provide a ready-made hothouse for the cultivation and transmission from one to another of the influenza and other bacilli. As the brilliant young English pulmonary expert, Dr. Leonard Williams, puts it, "a constant succession of colds implies a mode of life in which all aërial microbes are afforded abundant opportunities." At the same time, we take less exercise and sit far less in the open air, thus lowering our general vigor and resisting power and making us more susceptible to attack. Those who live out-of-doors winter and summer, and who ventilate their houses properly, even in cold weather, suffer comparatively little more from colds in the winter-time than they do in summer; although, of course, the most vigorous individual, in the best ventilated surroundings, will occasionally succumb to some particularly virulent infection.

The second fact of experience, catching cold after sitting in a draft or a chilly room until you begin to cough or sneeze, is one to which a majority of us would be willing to testify personally, and yet it is based upon something little better than an illusion. It is a well-known peculiarity of many fevers and infections to begin with a chill. The patient complains of shiverings up and down [Pg 87] his spine, his fingernails and his lips become blue, in extreme cases his teeth chatter, and his limbs begin to twitch and shake, and he ends up in a typical ague fit. The best known, because most striking, illustration is malaria, or fever and ague, "chills and fever," as it is variously termed. But this form of attack, milder and much slighter in degree, may occur in almost every known infection, such as pneumonia, typhoid, tuberculosis, scarlet fever, measles, and influenza. It has nothing whatever to do with either external or internal temperature; for if you slip a fever-thermometer under your chilling patient's tongue, it will usually register anywhere from 102 to 105°.

This method of attack is especially common, not only in influenza, but also in all the other so-called "common colds." In fact, when we begin to shiver and sneeze and hunt around for an

imaginary draft or lowering of the temperature which has caused it, we are actually in the first stage of the development of an infection which was contracted hours, or even days, before.

When you begin to shiver and sneeze and run at the eyes you are not "catching" cold; you have already caught it long before, and it is beginning to break out on you. Mere exposure to cold will never cause sneezing. It takes a definite irritation of the nasal mucous membrane, by gas or dust from without, or toxins from within, to produce a sneeze.

As to mere exposure to cold weather and wet and storm being able to produce it, it is the almost unanimous testimony of Arctic explorers that, during their sojourn of from two to three years in [Pg 88] the frozen North, they never had so much as a sneeze or a sore throat, even though frequently sheltered in extemporized huts, and running short of adequate food-supply before spring. Within a week of their return to civilization they would begin sneezing and coughing, and catch furious colds.

Lumbermen, trappers, hunters, and prospectors in Alaska give similar testimony. I have talked with scores of these pioneers, visiting them, in fact, in their camps under conditions of wet, cold, and exposure that would have made one afraid of either pneumonia or rheumatism before morning, and found that, so long as they remained up in the mountains or out in the snow, and no case of influenza, sore throat, or cold happened to be brought into the camp, they would be entirely free from coughs and colds; but that, upon returning to civilization and sleeping in the stuffy room of a rude frontier hotel, they would frequently catch cold within three days.

One unusually intelligent foreman of a lumber camp in Oregon told me that an experience of this kind had occurred to him three different times that he could distinctly recollect.

It is difficult to catch a cold or pneumonia unless the bacilli are there to be caught. Boswell has embalmed for us, in the amber of his matchless biography, the fact that it had been noted, even in those days, that the inhabitants of one of the Faroe Islands never had colds in the head except on the rare occasions when a ship would touch there—usually not oftener than once a year. Then, [Pg 89] within a week, half the population would be blowing and sneezing. The great Samuel commented upon the fact at length, and advanced the ingenious explanation that, as the harbor was so difficult of entry, the ships could beat in only when the wind was in a certain quarter, and that quarter was the nor'east. *Hinc illæ lacrimæ!* (Hence these weeps!) The colds were caused by the northeast wind of unsavory reputation! How often the wind got into the northeast without bringing a ship or colds he apparently did not speculate.

To come nearer yet, did you ever catch cold when camping out? I have waked in the morning with the snow drifting across the back of my neck, been wet to the skin all day, and gone to bed in my wet clothes, and slept myself dry; and have lain out all day in a November gale, in a hollow scooped in the half-frozen ground of the duck-marsh, and felt never a hair the worse. Scores of similar experiences will rise up in the minds of every camper, hunter, or fisherman. You *may* catch cold during the first day or two out, before you have got the foul city air, with its dust and bacteria, out of your lungs and throat, but even this rarely happens.

How seldom one catches cold from swimming, no matter how cold the water; or from boating, or fishing,—even without the standard prophylactic; or from picnicking, or anything that is done during a day in the open air.

So much for the negative side of the evidence, that colds are not often caught where infectious [Pg 90] materials are absent. Now for the positive side.

First of all, that typical cold of colds, influenza, or the grip, is now unanimously admitted by authorities to be a pure infection, due to a definite germ (the *bacillus influenzæ* of Pfeiffer) and one of the most contagious diseases known. Each of the great epidemics of it—1830-33, 1836-37, 1847-48, and, of most vivid and unblessed memory, 1889-90—can be traced in its stately march completely across the civilized world, beginning, as do nearly all our world-epidemics,—cholera, plague, influenza, etc.,—in China, and spreading, *via* India or Turkestan, to Russia, Berlin, London, New York, Chicago. Moreover, its rate of progress is precisely that of the means of travel: camel-train, post-chaise, railway, as the case may be. The earlier epidemics took two years to spread from Eastern Russia to New York; the later ones, forty to sixty days. Soon it will beat Jules Verne or George Francis Train. So intensely "catching" is it, that letters written by sufferers have been known to infect the correspondents who received them in a distant town, and become the starting-point of a local epidemic.

Of course, it may be urged that when we have proved the grip to be a definite infection, we have taken it out of the class of "colds" altogether, and that its bacterial origin proves nothing in regard to the rest. But a rather interesting state of affairs developed during the search for the true bacillus of influenza: this was that a dozen other bacilli and cocci were discovered, each of which seemed capable of causing all the symptoms of the *grip*, though in milder form. So that the [Pg 91] view of the majority of pathologists now is that these "influenzoid," or "grip-like" attacks, under which come a majority of all *common colds*, are probably due to a number of different milder micro-organisms.

The next fact in favor of the infectious character of a cold is that it begins with a chill, followed with a fever, runs a definite self-limited course, and, barring complications, gets well of itself in a certain time, just like the measles, scarlet fever, pneumonia, or any other frank infection.

Colds are also followed by inflammations, or toxic attacks in other organs of the body, lungs,

stomach, bowels, heart, kidneys, nerves, etc., just like diphtheria, scarlet fever, or typhoid, only, of course, of milder form and less frequently.

Last, but not least practically convincing, colds may be traced from one victim to another, may "run through" households, schools, factories, may occur after attending church or theatre, may be checked by isolating the sufferers; and are now most effectually treated by the inhalation of non-poisonous germicidal or antiseptic vapors and sprays.

One of my first experiences with this last method occurred in a most unexpected field. An old friend, a most interesting and intelligent German, was the proprietor of a wild-animal depot, importing foreign animals and birds and selling them to the zoölogical gardens and circuses. I used often to drop in there to see if he had anything new, and he would come up to see me, to tell [Pg 92] me his troubles and keep my dissecting-table supplied with interestingly diseased dead beasts and birds.

One day he came up in a state of great excitement, with a very dead and dilapidated parrot in his hand.

"Choost look, Dogdor; here's one of dose measley new pollies I god in from Zingapore. De rest iss coffin' an' sneezin' to plow dere peaks off, an' all de utter caitches iss kitchen him."

As parrots are worth from fifteen to thirty dollars apiece, "green" (not in color, but training), and he had fifty or sixty in the store, the situation was distinctly serious. Now, I was no specialist in the peculiar diseases of parrots, but something had to be done, and, with a boldness born of long practice, I drew my bow at a venture and let fly this suggestion:—

"Try formalin; it's pretty fierce on the eyes and nose, but it won't kill 'em; and, if you put a teaspoonful in the bottom of each cage, by the time it evaporates no germ that gets into that cage will live long enough to do any harm."

Five days later back he came, red-eyed but triumphant. "Dogdor, dot vormaleen iss de pest shtuff I effer saw. It mos' shteenk me out of de shtore, an' de pollies nearly sneeze dere fedders off, but it shtopt de spret, an' *it's cureenall de seek ones*, an' I het a cold in de het, *an' it's curt me*."

Before using it he had fourteen cases and three deaths; after, only three new cases and no more deaths. I would, however, hardly advise any human "coldie" to try such heroic treatment offhand, for the pungency and painfulness of formalin vapor is something ferocious, though the French [Pg 93] physicians, with characteristic courage, are making extensive use of it for this purpose, with excellent results under careful supervision.

Another curious straw pointing in the direction of the infectious nature of colds is the "annual cold," or "yearly sore throat," from which many of us suffer. When we have had it we usually feel fairly safe from colds for some months at least, often for a year. The only explanation that seems in the least to explain is that colds, like other infections, confer an immunity against another attack; only, unlike scarlet fever, measles, smallpox, etc., this immunity, instead of for life, is only for six months or a year. This immunity is due to the formation in the blood of protective substances known as *anti-bodies*, which destroy or render harmless the invading germs. Flabby, under-ventilated individuals, who are always "catching cold," have such weak resisting powers that they form hardly enough anti-bodies to terminate the first attack, without having enough left to protect them from another for more than a few weeks or months. Dr. Leonard Williams describes chronic cold-catchers as "people who wear flannel next their skins, ... who know they are in a draft because it makes them sneeze; who, in short, live thoroughly unwholesome, coddling lives." Strong and vigorous individuals may form enough to last them a year, or even two years.

Now comes the question, "What are we going to do about it?" Obviously, we cannot "go gunning" for these countless billions of germs, of fifteen or twenty different species. Nor can we [Pg 94] quarantine every one who has a cold. Fortunately, no such radical methods are necessary. All we have to do is to take nature's hint of the anti-bodies and improve upon it. Healthy cells can grow fat on a diet of such germs, and, if we keep ourselves vigorous, clean, and well ventilated, we can practically defy the "cold" devil and all his works.

Here is the *leitmotif* of the whole fascinating drama of infection and immunity. We can study only one phrasing here. We shall, of course, catch cold occasionally, but will throw it off quickly, and probably form anti-bodies enough to last us a year or more. How can this be done? First and foremost, by living and sleeping as much as possible in the open air. This helps in several different ways. First, by increasing the vigor and resisting power of our bodies; second, by helping to burn up, clean, and rid our tissues of waste products which are poisons if retained; third, by greatly reducing the risks of infection.

You can't catch cold by sitting in a field exposed to the draft from an open gate; though I understand that casuists of the old school of the "chill-and-damp" theory of colds are still discussing the case of the patient who "caught his death o' cold" by having his gruel served in a damp basin.

The first thing to do is to get the outdoor habit. This takes time to acquire, but, once formed, you wouldn't exchange it for anything else on earth. The next thing is to learn to sit or sleep in a gentle current of air all the time you are indoors. You ought to feel uncomfortable unless you can [Pg 95] feel air blowing across your face night and day. Then you are reasonably sure it is fresh, and it is

the only way to be sure of it.

But drafts are so dangerous! As the old rhyme runs,

> But when a draft blows through a hole,
> Make your will and mend your soul.

Pure superstition! It just shows what's in a name. Call it a gentle breeze, or a current of fresh air, and no one is afraid of it. Call it a "draft," and up go hands and eyebrows in horror at once. One of our highest authorities on diseases of the lungs, Dr. Norman Bridge, has well dubbed it "The Draft Fetich." It is a fetich, and as murderous as Moloch. The draft is a friend instead of an enemy. What converted most of us to a belief in the beneficence of drafts was the open-air treatment of consumption! Hardly could there have been a more spectacular proof, a more dramatic defiance of the bogey. To make a poor, wasted, shivering consumptive, in a hectic one hour and a drenching sweat the next, lie out exposed to the November weather all day and sleep in a ten-knot gale at night! It looked little short of murder! So much so to some of us, that we decided to test it on ourselves before risking our patients.

I can still vividly recall the astonishment with which I woke one frosty December morning, after sleeping all night in a breeze across my head that literally made

> Each particular hair to stand on end,
> Like quills upon the fretful porcupine,

not only without the sign of a sniffle, but feeling as if I'd been made new while I slept. [Pg 96]

Then we tried it in fear and trembling on our patients, and the delight of seeing the magic it worked! That is an old story now, but it has never lost its charm. To see the cough which has defied "dopes" and syrups and cough mixtures, domestic, patent, and professional, for months, subside and disappear in from three to ten days; the night sweats dry up within a week; the appetite come back; the fever fall; the strength and color return, as from the magic kiss of the free air of the woods, the prairies, the seacoast. There's nothing else quite like it on the green earth. Do you wonder that we become "fresh-air fiends"?

The only thing we dread in these camps is the imported "cold." Dr. Lawrence Flick was the first to show us the way in this respect as in several others. He put up a big sign at the entrance of White Haven Sanatorium, "No persons suffering from colds allowed to enter," and traced the only epidemic of colds in the sanatorium to the visit of a butcher with the grip. I put up a similar sign at the gate of my Oregon camp, and never had a patient catch cold from tenting out in the snow and "Oregon mists" until the small son of the cook came back from the village school, shivering and sneezing, when seven of the thirteen patients "caught it" within a week.

What will cure a consumptive will surely not kill a healthy man. I am delighted to say that it shows signs of becoming a fad now, and sleeping porches are being put on houses all over the country. No house in California is considered complete without them. The ideal bedroom is a small dressing-room, opening on a wide screened porch, or balcony, with a door wide enough to [Pg 97] allow the bed to be rolled inside during storms or in severest weather.

Sleep on a porch, or in a room with windows on two sides wide open, and the average living-room or office begins to feel stuffy and "smothery" at once. Apply the same treatment here. Learn to sit in a gentle draft, and you'll avoid two-thirds of your colds and three-fourths of your headaches. It may be necessary in winter to warm the draft, but don't let any patent method of ventilation delude you into keeping your windows shut any hour of the day or night.

On the other hand, don't fall into the widespread delusion that because air is cold it is necessarily pure. Some of the vilest air imaginable is that shut up in those sepulchres known as "best bedrooms," which chill your very marrow. The rheumatism or snuffles you get from sleeping between their icy sheets comes from the crop of bacilli which has lurked there since they were last aired. The "no heat in a bedroom" dogma is little better than superstition, born of those fecund parents which mate so often, stinginess and puritanism. Practically, the room which will *never* have a window opened in it in winter is the one without any heat.

Similarly, the air in an underheated church, hall, or theatre is almost sure to be foul. The janitor will keep every opening closed in order to get the temperature up. Some churches are never once decently ventilated from December to May. The same old air, with an ever richer crop of germs, is reheated and served up again every Sunday. The "odor of sanctity" is the residue of the breaths [Pg 98] and perspiration of successive generations. Cleanliness may be next to godliness, but it is sometimes an astonishingly long step behind it.

The next important step is to keep clean, both externally and internally: externally, by cold bathing, internally, by exercise. The only reason why a draft ever hurts us is because we are full of self-poisons, or germs. The self-poisons can be best got rid of by abundant exercise in the open air and plenty of pure, cold H_2O, internally and externally.

Food has very little to do with these autotoxins, and they are as likely to form on one diet as another. In fact, they form normally and in states of perfect health, and are poisonous only if retained too long. It is simply a question of burning them up, and getting rid of them quickly enough, by exercise, with its attendant deep breathing and perspiration. The lungs are great garbage-burners. Exercise every day till you puff and sweat.

A blast of cold air suddenly stops the escape of these poisons through the skin and throws them on the lungs, liver, or kidneys. The resulting disturbance is the second commonest form of a "cold," and covers perhaps a third of all cases occurring. This is the cold that can be prevented by the cold bath. Keep the skin hardened and toned up to such a pitch that no reasonable chill will stop it from excreting, and you are safe. Never depend on clothing. The more you pile on, the more you choke and "flabbify" the skin and make it ready to "strike" on the first breath of cold air. Too heavy flannels are cold-breeders, and chest-protectors inventions of the evil one. Trust the skin; it is one of the most important and toughest organs in the body, if only given half a chance. [Pg 99]

But the most frequent way in which drafts precipitate a cold is by temporarily lowering the vital resistance. This gives the swarms of germs present almost constantly in our noses, throats, stomachs, bowels, etc., the chance they have been looking for—to break through the cell barrier and run riot in the body.

So long as the pavement-cells of our mucous membranes are healthy, they can keep them out indefinitely. Lower their tone by cold, fatigue, underfeeding, and their line is pierced in a dozen places at once. One of the many horrifying things which bacteriology has revealed is that our bodies are simply alive with germs, even in perfect health. One enthusiastic dentist has discovered and described no less than *thirty-three* distinct species, each one numbering its billions, which inhabit our gums and teeth. Our noses, our stomachs, our intestines,—each boasts a similar population. Most of them do no harm at all; indeed, some probably assist in the processes of digestion; others are camp-followers, living on our leavings; others, captive enemies which have been clubbed into peaceful behavior by our leucocyte and anti-body police.

For instance, not a few healthy noses and throats contain the bacillus of diphtheria and the diplococcus of pneumonia. We are beginning to find that these last two groups will bear watching. Like camp-followers elsewhere, they carry knives, and are not above using them on the wounded after dark. In fact, they have a cheerful habit of taking a hand in any disturbance that starts in their bailiwick, and usually on the side against the body-cells. [Pg 100]

Finally, while clearly realizing that the best defense is attack, and that our chief reliance should be upon keeping ourselves in such fighting trim that we can "eat 'em alive" at any time, there is no sense in running easily avoidable risks, and we should keep away from infection as far as possible. If a child comes to school heavy-eyed, hoarse, and snuffling, the teacher should send him home at once. He will only waste his time attempting to study in that trim, and may infect a score of others. Moreover, it may be remarked, parenthetically, that these are also symptoms of the beginning of measles, scarlet fever, and diphtheria, and two-thirds of all cases of these would be sent home before they could infect any one else if this procedure were the rule.

If your own child develops a cold, if mild, keep him playing out-of-doors by himself; or if severe, keep him in bed, in a well-ventilated room, for three or four days. He'll get better twice as quick as if at school, and the rest of the household will escape.

When you wake with a stuffed head and aching bones, stay at home for a few days if possible, out of regard for your customers, your fellow-clerks, or your office force, as well as yourself. If one of your employees comes to work shivering, give him three days' vacation on full pay. If it runs through the force, you'll lose five times as much in enforced sick-leaves, slowness, and mistakes. Above all, don't go to any public gatherings,—to church, the theatre, or parties,—when you are snuffling and coughing. You are not exactly a joy to your beholders, even if you don't infect them. It is advisable, and well worth the trifling trouble and expense, to fumigate thoroughly with formalin all churches, theatres, and schoolrooms at least once a month. Reasonable and public-spirited precautions of this sort are advisable, not only to avoid colds themselves, which are disagreeable and dangerous enough, but because mild infections of this sort are far the commonest single means of making a breach in our body-ramparts through which more serious diseases like consumption, pneumonia, and rheumatism may force an entry. [Pg 101]

Colds do not "run into" consumption or pneumonia, but they bear much the same relation to them that good intentions are said to do to the infernal regions. They release the lid of a perfect Pandora's box of distempers—tuberculosis, pneumonia, rheumatism, bronchitis, Bright's disease, neuritis, endocarditis. A cold is no longer a joke. A generation ago a prominent physician was asked by an anxious mother, "Doctor, how would you treat a cold?"

"With contempt, madam," replied the great man.

That day is past, and has lasted too long. Intelligently regarded and handled, they are the least harmful of diseases; neglected, one of the most dangerous, because there are such legions of them. To sum up, if you wish to revel in colds, all that is necessary is to observe the following few and simple rules:—

Keep your windows shut. [Pg 102]

Avoid drafts as if they were a pestilence.

Take no exercise between meals.

Bathe seldom, and in warm water.

Wear heavy flannels, chest-protectors, abdominal bandages, and electric insoles.

Have no heat in your bedroom.

Never let anything keep you away from church, the theatre, or parties, in winter.

Never go out-of-doors when it's windy, or rainy, or wet underfoot, or cold, or hot, or looks as if it was going to be any of these.

Be just as intimate and affectionate as possible with every one you know who has a cold. Don't neglect them on any account. [Pg 103]

CHAPTER V

ADENOIDS, OR MOUTH-BREATHING: THEIR CAUSE AND THEIR CONSEQUENCES

In all ages it has been accounted a virtue to keep your mouth shut—chiefly, of course, upon moral or prudential grounds, for fear of what might issue from it if opened. Then came physiology to back up the maxim, on the ground that the open mouth was also dangerous on account of what might be inhaled into it. Oddly enough, in this instance, both morality and science have been beside the mark to the degree that they have been mistaking a symptom for a cause. This has led us to absurd and injurious extremes in both cases. On the moral and prudential side it has led to such outrageous exaggerations as the well-known and oft-quoted proverb, "Speech is silver, but silence is golden." Articulate speech, the chiefest triumph and highest single accomplishment of the human species, the handmaid of thought and the instrument of progress, is actually rated below silence, the attribute of the clod and of the dumb brute, the easy refuge of cowardice and of stupidity.

Easily eight-tenths of all speech is informing, educative, helpful in some modest degree; while fully that proportion of silence is due to lack of ideas, cowardice, or designs that can flourish only in darkness. It is not the abundance of words, but the scarcity of ideas, that makes us flee from [Pg 104] "the plugless word-spout" and avoid the chatterbox.

Similarly, upon the physical side, because children who breathe through the mouth are apt to have a vacant expression, to be stupid and inattentive, undersized, pigeon-breasted, with short upper lip and crowded teeth, we have leaped to the conclusion that it is a fearsome and dangerous thing to breathe through your mouth. All sorts of stories are told about the dangerousness of breathing frosty air directly into the lungs. Invalids shut themselves scrupulously indoors for weeks and even months at a stretch, for fear of the terrible results of a "blast of raw air" striking into their bronchial tubes. All sorts of absurd instruments of torture, in the form of "respirators" to tie over the mouth and nose and "keep out the fog," are invented, and those who have the slightest tendency to bronchial or lung disturbances are warned upon pain of their life to wrap up their mouths whenever they go out-of-doors.

As a matter of fact, there is exceedingly little evidence to show that pure, fresh, open air at any reasonable temperature and humidity ever did harm when inhaled directly into the lungs. In fact, a considerable proportion of us, when swinging along at a lively gait on the country roads, or playing tennis or football, or engaged in any form of active sport, will be found to keep our lips parted and to inhale from a sixth to a third of our breath in this way, and with no injurious results whatever. Nine-tenths of all the maladies believed to be due to breathing even the coldest and rawest of air are now known to be due to invading germs. [Pg 105]

Nevertheless, mouth-breathing in all ages has been regarded as a bad habit, and with good reason. It was only about thirty years ago that we began to find out why. A Danish throat surgeon, William Meyer, whose death occurred only a few months ago, discovered, in studying a number of children who were affected with mouth-breathing, that in all of them were present in the roof of the throat curious spongy growths, which blocked up the posterior opening of the nostrils. As this mass was made up of a number of smaller lobules, and the tissue appeared to be like that of a lymphatic gland, or "kernel," the name "adenoids" (gland-like) was given to them. Later they were termed *post-nasal growths*, from the fact that they lay just behind the rear opening of the nostrils; and these two names are used interchangeably. Our knowledge has spread and broadened from this starting-point, until we now know that adenoids are the chief, yes, almost the sole primary cause, not merely of mouth-breathing, but of at least two-thirds of the injurious effects which have been attributed to this habit.

Mouth-breathing is not simply a bad habit, a careless trick on the part of the child. We have come to realize that physical bad habits, as well as many mental and moral ones, have a definite physical cause, and that *no child ever becomes a mouth-breather as long as he can breathe comfortably through his nose*.

This clears the ground at once of a considerable amount of useless lumber in the shape of advice to train the child to keep his mouth shut. I have even known mothers who were in the habit of going around after their helpless offspring were asleep and gently but firmly pushing up the little [Pg 106] jaw and pressing the lips together until some sort of an attempt at respiration was made through the nostrils. Advertisements still appear of sling-like apparatuses for holding the jaws closed

during sleep.

To attempt to stop mouth-breathing before providing abundant air-space through the nostrils is not only irrational, but cruel. Of course, after the child has once become a mouth-breather, even after the nostrils have been made perfectly free, it will not at once abandon its habit of months or years, and disciplinary measures of some sort may then be needed for a time. But the hundred-times-repeated admonition, "For heaven's sake, child, shut your mouth! Don't go around with it hanging open like that!" unless preceded by proper treatment of the nostrils, will have just about as much effect upon the habit as the proverbial water on a duck's back. No use trying to close his mouth by any amount of opening of your own.

Fortunately, as does not always happen, with our discovery of the cause has come the knowledge of the cure; and we are able to say with confidence that, widespread and serious as are disturbances of health and growth associated with mouth-breathing, they can be absolutely prevented and abolished.

What, then, is the cause of this nasal obstruction, and when does it begin to operate? The primary cause is catarrhal inflammation, with swelling and thickening of the secretions, and it may begin to operate anywhere from the seventh month to the seventh year. A neglected attack, [Pg 107] or series of attacks, of "snuffles," colds in the head, catarrhs, in infants and young children, will set up a slow inflammation of this glandular mass at the back of the nostrils—a tonsil, by the way —and start its enlargement.

Whether we know anything about adenoids themselves or not, we are all familiar with their handiwork. The open mouth, giving a vacant expression to the countenance, the short upper lip, the pinched and contracted nostrils, the prominent and irregular teeth, the listless expression of the eyes, the slow response to request or demand, we have seen a score of times in every schoolroom. Coupled with these facial features are apt to be found on closer investigation a lack of interest in both work and play, an impaired appetite, restless sleep, and a curious general backwardness of development, both bodily and mental, so that the child may be from one to four inches below the normal height for his years, from five to fifteen pounds under weight, and from one to three grades behind his proper school position. Very often, also, his chest is inclined to be narrow, the tip of his breastbone to be sunken, and his abdomen larger in girth than his chest. Is it possible that the mere inhaling of air directly into the lungs, even though it be imperfectly warmed, moistened, and filtered, as compared with what it would be if drawn through the elaborate "steam-coils" in the nostrils for this purpose, can have produced this array of defects? It is incredible on the face of it and unfounded in fact. Fully two-thirds of these can be traced to the direct influence of the adenoids. [Pg 108]

These adenoids, it may briefly be stated, are the result of an enlargement of a *tonsil*, or group of small tonsils, identical in structure with the well-known bodies of the same name which can be seen on either side of the throat. They have the same unfortunate faculty as the other tonsils for getting into hot water, flaring up, inflaming, and swelling on the slightest irritation. And, unfortunately, they are so situated that their capacity for harm is far greater than that of the other tonsils. They seem painfully like the chip on the shoulder of a fighting man, ready to be knocked off at the lightest touch and plunge the whole body into a scrimmage. Their position is a little difficult to describe to one not familiar with the anatomy of the throat, especially as they cannot be seen except with a laryngeal mirror; but it may be roughly stated as in the middle of the roof of the throat, just at the back of the nostrils, and above the soft palate. From this coign of vantage they are in position to produce serious disturbances of two of our most important functions,—respiration and digestion,—and three out of the five senses,—smell, taste, and hearing.

We will begin with their most frequent and most serious injurious effect, though not the earliest, —the impairment of the child's power of attention and intelligence. So well known is their effect in this respect that there is scarcely an intelligent and progressive teacher nowadays who is not thoroughly posted on adenoids. Some of them will make a snap diagnosis as promptly and almost as accurately as a physician; and when once they suspect their presence, they will leave no stone [Pg 109] unturned to secure an examination of the child by a competent physician, and the removal of the growths, if present. They consider it a waste of time to endeavor to teach a child weighted with this handicap. How keenly awake they are to their importance is typified by the remark of a prominent educator five or six years ago:—

"When I hear a teacher say that a child is stupid, my first instinctive conclusion is either that the child has adenoids, or that the teacher is incompetent."

The lion's share of their influence upon the child's intelligence is brought about in a somewhat unexpected and even surprising manner, and that is by the *effects of the growths upon his hearing*. You will recall that this third tonsil was situated at the highest point in the roof of the pharynx, or back of the throat. The first effect of its enlargement is naturally to block the posterior opening of the nostrils. But it has another most serious vantage-ground for harm in its peculiar position. Only about three-fourths of an inch below it upon either side open the mouths of the Eustachian tubes, the little funnels which carry air from the throat out into the drum-cavity of the ear. You have frequently had practical demonstrations of their existence, by the well-known sensation, when blowing your nose vigorously, of feeling something go "pop" in the ear. This sensation was simply due to a bubble of air being driven out through this tube from the back of the throat, under pressure brought to bear in blowing the nose. The luckless position of the third tonsil could hardly have been better planned if it had been devised for the special purpose [Pg 110]

of setting up trouble in the mouths of these Eustachian tubes.

Just as soon as the enlargements become chronic, they pour out a thick mucous secretion, which quickly becomes purulent, or, in the vernacular, "matter." This trickles down on both sides of the throat, and drains right into the open mouth of the Eustachian tube. Not only so, but these Eustachian tubes are the remains of the first gill-slits of embryonic life, and, like all other gill-slits, have a little mass of this same lymphoid or tonsilar tissue surrounding them. This also becomes infected and inflamed, clogs the opening, and one fatal day the inflammation shoots out along the tube, and the child develops an attack of earache. At least two-thirds of all cases of earache, and, indeed, five-sixths of all cases of deafness in children, are due to adenoids.

Earache is simply the pain due to acute inflammation in the small drum-cavity of the ear. This in the large majority of cases will subside and drain back again into the throat through the Eustachian tube. In a fair percentage of instances, however, it will break in the opposite direction, and we have the familiar ruptured drum and discharge from the ear. In either case the drum becomes thickened, so that it can no longer vibrate properly; the delicate little chain of bones behind it, like the levers of a piano, becomes clogged, and the child becomes deaf, whether a chronic discharge be present or not.

This is the secret of his "inattention," his "indifference,"—even of his apparent disobedience and rebelliousness. What other children hear without an effort he has to strain every nerve to catch. [Pg 111] He misunderstands the question that is asked of him, makes an absurd answer, and is either scolded or laughed at. It isn't long before he falls into the attitude: "Well, I can't get it right, anyhow, no matter how I try, so I don't care." Up to five or ten years ago the puzzled and distracted teacher would simply report the child for stupidity, indifference, and even insubordination. In nine cases out of ten, when children are naughty or stupid, they are really sick.

Not content with dulling one of the child's senses, these thugs of the body-politic proceed to throttle two others—smell and taste. Obviously the only way of smelling anything is to sniff its odor into your nose. And if this be more or less, or completely, blocked up, and its delicate mucous membranes coated with a thick, ropy discharge, you will not be able to distinguish anything but the crudest and rankest of odors. But what has this to do with taste? Merely that two-thirds of what we term "taste" is really smell. Seal the nostrils and you can't "tell chalk from cheese," not even a cube of apple from a cube of onion, as scores of experiments have shown. We all know how flat tea, coffee, and even our own favorite dishes taste when we have a bad cold, and this, remember, is the permanent condition of the palate of the poor little mouth-breather. No wonder his appetite is apt to be poor, and that even what food he eats will not produce a flow of "appetite juice" in the stomach, which Pavloff has shown to be so necessary to digestion. No wonder his digestion is apt to go wrong, ably assisted by the continual drip of the chronic [Pg 112] discharge down the back of his throat; his bowels to become clogged and his abdomen distended.

But the resources for mischief of this pharyngeal "Old Man of the Sea" are not even yet exhausted. Next comes a very curious and unexpected one. We have all heard much of "the struggle for existence" among plants and animals, and have had painful demonstrations of its reality in our own personal experience. But we hardly suspected that it was going on in our own interior. Such, however, is the case; and when once one organ or structure falls behind the others in the race of growth, its neighbors promptly begin to encroach upon and take advantage of it. Emerson was right when he said, "I am the Cosmos," the universe.

Now, the mouth and the nose were originally one cavity. As Huxley long ago remarked, "When Nature undertook to build the skull of a land animal she was too lazy to start on new lines, and simply took the old fish-skull and made it over, for air-breathing purposes." And a clumsy job she made of it!

It may be remarked, in passing, that mouth-breathing, as a matter of history, is an exceedingly old and respectable habit, a reversion, in fact, to the method of breathing of the fish and the frog. "To drink like a fish" is a shameful and utterly unfounded aspersion upon a blameless creature of most correct habits and model deportment. What the poor goldfish in the bowl is really doing with his continual "gulp, gulp!" is breathing—not drinking. [Pg 113]

This remodeling starts at a very early period of our individual existence. A horizontal ridge begins to grow out on either side of our mouth-nose cavity, just above the roots of the teeth. This thickens and widens into a pair of shelves, which finally, about the third month of embryonic life, meet in the middle line to form the hard palate or roof of the mouth, which forms also the floor of the nose. Failure of the two shelves to meet properly causes the well-known "cleft-palate," and, if this failure extends forward to the jaw, "hare-lip." In the growth of a healthy child a balance is preserved between these lower and upper compartments of the original mouth-nose cavity, and the nose above growing as rapidly in depth and in breadth as the mouth below, the horizontal partition between—the floor of the nose and the roof of the mouth—is kept comparatively flat and level. In adenoids, however, the nostrils no longer being adequately used, and consequently failing to grow, and the mouth cavity below growing at the full normal rate, it is not long before the mouth begins to encroach upon the nostrils by pushing up the partition of the palate. As soon as this upward bulge of the roof of the mouth occurs, then there is a diminution of the resistance offered by the horizontal healthy palate to the continual pressure of the muscles of the cheeks and of mastication upon the sides of the upper jaw, the more readily as the tongue has dropped down from its proper resting position up in the roof of the mouth. These are pushed inward, the arch of the jaw and of the teeth is narrowed, the front teeth are made to project, and, instead of

erupting, with plenty of room, in even, regular lines, are crowded against and overlap one another. [Pg 114]

When from any cause the lower jaw habitually hangs down, as in the open mouth, it tends to be thrown slightly forward in its socket. Then, when the jaws close again, the arches of the upper and lower teeth no longer meet evenly. Instead of "locking" at almost every point, as they should, they overlap, or fall behind, or inside, or outside, of each other. So that instead of every tooth meeting its fellow of the jaw above evenly and firmly, they strike at an angle, slip past or even miss one another, and thus increase the already existing irregularity and overlapping. Each individual tooth, missing its best stimulus to healthy growth and vigor, firm and regular pressure and exercise against its fellow in the jaw above or below, gets a twist in its socket, wears away irregularly, and becomes an easy prey to decay, while from failure of the entire upper and lower arches of the teeth to meet squarely and press evenly and firmly against one another, the jaws fail to expand properly and the tendency to narrowing of the tooth-arches and upward vaulting of the palate is increased.

In short, we are coming to the conclusion that from half to two-thirds of all cases of "crowded mouth," irregular teeth, and high-arched palate in children are due to adenoids. Progressive dentists now are insisting upon their little patients, who come to them with these conditions, being examined for adenoids, and upon the removal of these, if found, as a preliminary measure to mechanical corrective treatment. Cases are now on record of children with two, three, or even [Pg 115] four generations of crowded teeth and narrow mouths behind them, but who, simply by being sharply watched for nasal obstruction and the symptoms of adenoids, by the removal of these latter as soon as they have put in an appearance, have grown up with even, regular, well-developed teeth and wide, healthy mouths and jaws. Unfortunately, attention to the adenoids will not remove these defects of the jaws and teeth after they have been produced. But, if the child be under ten, or even twelve, years of age, their removal may yet do much permanently to improve the condition, and is certainly well worth while on general principles.

Take care of the nose, and the jaws will take care of themselves. An ounce of adenoids-removal in the young child is worth a pound of *orthodontia*—teeth-straightening—in the boy or girl; though both are often necessary.

The dull, dead tone of the voice in these children is, of course, an obvious effect of the blocked nostrils. Similarly, the broken sleep, with dreams of suffocation and of "Things Sitting on the Chest," are readily explained by the desperate efforts that the little one makes to breathe through clogging nostrils, in which the discharges, blown and sneezed out in the daytime, dry and accumulate during sleep, until, half-suffocated, it "lets go" and draws in huge gulps of air through the open mouth. No child ever became a mouth-breather from choice, or until after a prolonged struggle to continue breathing through its nose.

This brings us to the question, What are these adenoids, and how do they come to produce such [Pg 116] serious disturbances? This can be partially answered by saying that they are tonsils and with all a tonsil's susceptibility to irritation and inflammation. But that only raises the further question, What is a tonsil? And to that no answer can be given but Echo's. They are one of the conundrums of physiology. All we know of them is that they are not true *glands*, as they have neither duct nor secretion, but masses of simple embryonic tissue called *lymphoid*, which has a habit of grouping itself about the openings of disused canals. This is what accounts for their position in the throat, as they have no known useful function. The two largest, or throat-tonsils, surround the inner openings of the second gill-slits of the embryo; the lingual tonsil, at the base of the tongue below, encircles the mouth of the duct of the thyroid gland (the *goitre* gland); and our own particular Pandora's Box above, in the roof of the pharynx, is grouped about the opening of another disused canal, which performs the singular and apparently most uncalled-for office of connecting the cavity of the brain with the throat. They can all of them be removed completely without any injury to the general health, and they all tend to shrink and become smaller—in the case of the topmost, or pharyngeal, almost disappear—after the twelfth or fourteenth year.

Not only have they an abundant crop of troubles of their own, as most of us can testify from painful experience, but they serve as a port of entry for the germs of many serious diseases, such as tuberculosis, rheumatism, diphtheria, and possibly scarlet fever. They appear to be a strange [Pg 117] sort of survival or remnant,—not even suitable for the bargain-counter,—a hereditary leisure class in the modern democracy of the body, a fertile soil for all sorts of trouble.

Here, then, we have this little bunch of idle tissue, about the size of a small hazelnut, ready for any mischief which our Satan-bacilli may find for its hands to do. A child kept in a badly ventilated room inhales into his nostrils irritating dust or gases, or, more commonly yet, the floating germs of some one or more of those dozen mild infections which we term "a common cold." Instantly irritation and swelling are set up in the exquisitely elastic tissues of the nostrils, thick, sticky mucous, instead of the normal watery secretion, is poured out, the child begins to sneeze and snuffle and "run at the nose," and either the bacteria are carried directly to this danger sponge, right at the back of the nostrils, or the inflammation gradually spreads to it. The mucous membrane and tissues of the nose have an abundance of vitality,—like most hard workers,—and usually react, overwhelm, and destroy the invading germs, and recover from the attack; but the useless and half-dead tissue of the pharyngeal tonsil has much less power of recuperation, and it smoulders and inflames, though ultimately, perhaps, it may swing round to recovery. Often, however, a new cold will be caught before this has fully occurred, and then another one a month or so later, until finally we get a chronically thickened, inflamed, and

enlarged condition of this interesting, but troublesome, body. What its capabilities are in this respect may be gathered from the fact that, while normally of the size of a small hazelnut, it is no [Pg 118] uncommon thing to find a mass which absolutely blocks up the whole of the upper part of the pharynx, and may vary from the size of a robin's egg to that of a large English walnut, or even a small hen's egg, according to the age of the child and the size of the throat.

Dirt has been defined as "matter out of place," and the pharyngeal tonsil is an excellent illustration. Nature is said never to make mistakes, but she is apt to be absent-minded at times, and we are tracing now not a few of the troubles that our flesh is heir to, to little oversights of hers—scraps of inflammable material left lying about among the cogs of the body-machine, such as the appendix, the gall-bladder, the wisdom teeth, and the tonsils. One day a spark drops on them, or they get too near a bearing or a "hot-box," and, in a flash, the whole machine is in a blaze.

Never neglect snuffles or "cold in the head" in a young child, and particularly in a baby. Have it treated at once antiseptically, by competent hands, and learn exactly what to do for it on the appearance of the earliest symptoms in the future, and you will not only save the little ones a great deal of temporary discomfort and distress,—for it is perfect torment to a child to breathe through its mouth at first,—but you will ward off many of the most serious troubles of infancy and childhood. We can hardly expect to prevent all development of adenoids by these prompt and painless stitches in time, for some children seem to be born peculiarly subject to them, either from the inheritance of a particular shape of nose and throat,—"the family nose," as it has been [Pg 119] called,—or from some peculiar sponginess and liability to inflammation and enlargement of all these tonsilar or lymphoid "glands" and "kernels" of the body generally—the old "lymphatic temperament."

We are, however, now coming to the opinion that this so-called "hereditary" narrow nose, short upper lip, and high-arched palate are, in a large percentage of cases, the *result of adenoids in infancy* in each successive generation of parents and grandparents. At all events, there are now on record cases of children whose parents, grandparents, and great-grandparents are known to have been mouth-breathers, and who have on that account been sharply watched for the possible development of adenoids in early life, and these removed as soon as they appeared, and they have grown up with well-developed, wide nostrils, broad, flat palates, and regular teeth, overcoming "hereditary defect" in a single generation.

Curiously enough, their origin and ancestral relations may have an important practical bearing, even in the twentieth century. At the upper end of this curious *throat-brain* canal lies another mass, the so-called *pituitary body*. This has been found to exert a profound influence over development and growth. Its enlargement is attended by giantism and another curious giant disease in which the hands, feet, and jaws enlarge enormously, known as *acromegaly*. It also pours into the blood a secretion which has a powerful effect upon both the circulation and the respiration. It is found shrunken and wasted in dwarfs. Some years ago it was suggested by my [Pg 120] distinguished friend, the late Dr. Harrison Allen, and myself, that some of the extraordinary dwarfing and growth-retarding effects of adenoids might be due to a reflex influence exerted on their old colleague, the pituitary body. This view has found its way into several of the textbooks. Blood is thicker than water, and old ancestral vibrations will sometimes be set up in most unexpected places.

Now comes the cheerful side of the picture. I should have hesitated to draw at such full length and in such lugubrious detail the direful possibilities and injurious effects of adenoids if its only result could have been to arouse apprehensions which could not be relieved.

Fortunately, just the reverse is the case, and there are few conditions affecting the child, so common and such a fertile source of all kinds of mischief, and at the same time so completely curable, and whose cure will be attended by such gratifying improvement on the part of the little sufferer. In the first place, as has been said, their formation may usually be prevented altogether by intelligent and up-to-date hygienic care of the nose and the throat. In the second place, even after they have occurred and developed to a considerable degree, they can be removed by a trifling and almost painless operation, and, if taken early enough, all their injurious effects overcome. If, however, they have been neglected too long, so that the child has passed the eighth or ninth year before any interference has been attempted, and still more, of course, if it has passed the twelfth or thirteenth year, then only a part of the disturbances that have been caused can be remedied by their removal. So soft and pulpy are these growths, so poorly supplied with [Pg 121] blood-vessels or nerves, and so slightly connected with the healthy tissues below them, that they may, in skilled hands, be completely removed by simply scraping with a dull surgical spoon (curette) or curved forceps, but never anything more knife-like than this. In fact, in the first seven years of life, when their removal is both easiest and will do most good, it is hardly proper to dignify the procedure by the name of an operation. It is attended by about the same degree of risk and of hemorrhage as the extraction of a tooth, and by less than half the amount of pain.

But, trifling and free from danger as is the operation, there is nothing in the entire realm of surgery which is followed by more brilliant and gratifying results. It seems almost incredible until one has seen it in half a dozen successive cases. Not merely doctors, but teachers and nurses, develop a positive enthusiasm for it. This was the operation that led to the comical, but pathetic, "Mothers' Riots" in the New York schools. The word went forth, "The Krishts are cutting the throats of your children"; and, with the shameful echoes of Kishineff ringing in their ears, the Yiddish mothers swarmed forth to battle for the lives of their offspring.

It is no uncommon thing to have a child of seven jump three to five inches in height, six to twelve pounds in weight, and one to three grades in his schooling, within the year following the operation. Ten years more of intelligence and hygienic teaching should see this scourge of childhood completely wiped out, or at least robbed of its possibilities for harm. When this is done, [Pg 122] at least two-thirds of all cases of deafness, more than half of all cases of arrested development, and three-fourths of those of backwardness in children will disappear. [Pg 123]

CHAPTER VI

TUBERCULOSIS, A SCOTCHED SNAKE

I

One of the darling habits of humanity is to discover that we are facing a crisis. One could safely offer a large prize for a group of ten commencement orations, or political platforms, at least a third of which did not announce this momentous fact. Either we are facing it or it confronts us, and unutterable things will happen unless we "gird up our loins," and vote the right ticket. An interesting feature about these loudly heralded crises is that they hardly ever "crise." The real crisis either strikes us so hard that we never know what hit us, or is over before we recognize that anything was going to happen. And most of our reflections about it are after ones—trying to explain what caused it. In fact, in public affairs, as in medicine, a crisis is a sign of recovery. Its occurrence is an indication that nature is preparing to throw off the disease. Nowhere is this truth more vividly illustrated than in the tuberculosis situation. When, about thirty years ago, the world began to awake from its stupor of centuries, and to realize that this one great disease alone was *killing one-seventh of all people born under civilization*, and crippling as many more; that its killed and wounded every year cast in the shade the bloodiest wars ever waged, and that it was apparently caused by the civilization which it ravaged,—no wonder that we were appalled [Pg 124] at the outlook.

Here was a disease of civilization, caused by the conditions of that civilization. Could it be cured without destroying its cause and reverting to barbarism? Yet this very apprehension was a sign of hope, a promise of improvement. That we were able to feel it was a sign that we were shaking off the old fatalistic attitude toward disease,—as inevitable or an act of Providence. It was brought about by the more accurate and systematic study of disease. We had long been sadly familiar with the fact that death by consumption, by "slow decline," by "wasting" or "slow fever," was frightfully common. "To fall into a decline" and die was one of the standard commonplaces of romantic literature. But that was quite different from knowing in cold, hard figures and inescapable percentages exactly how many of the race were killed by it. It is one of the striking illustrations of the advantages of good bookkeeping. Boards and departments of health had just fairly got on their feet and started an accurate system of state accounts in matters of deaths and births. We were beginning to recognize national health as an asset, and to scrutinize its fluctuations with keen interest accordingly.

We may decry statistics as much as we like, but when we see the effects of a disease set down in cold columns of black and white we have no longer any idea of submitting to it as inevitable. We are going to get right up and do some fighting. "One-seventh of all the deaths" has literally become the war cry of our new Holy War against tuberculosis. Still another stirring phrase of [Pg 125] inestimable value in rousing us from our torpor was that coined by the brilliant and lovable physician-philosopher, Oliver Wendell Holmes: "The Great White Plague of the North." This vivid epithet, abused as it may have been in later years, was of enormous service in fixing the public mind on consumption as a definite, individual disease, something to be fought and guarded against. Before that, we had been inclined to look upon it as just a natural failing of the vital forces, a thing that came from within, and was in no sense caused from without. The fair young girl, or the delicate boy whose vitality was hardly sufficient to carry him through the stern battle of life, under some slight shock, or even mental disappointment, would sink into a decline, gradually waste away, and die. What could be done in such a case, except to bow in submission to the inscrutable ways of Providence?

It seems incredible now, but such was the light in which smallpox was regarded by physicians of the Arabian and mediæval schools: a natural oozing forth of "peccant humors" in the blood of the young, a disagreeable, but perfectly natural, and even necessary, process. For if the patient did not get rid of these humors either he would die or his growth would be seriously impaired. Now smallpox has become little more than a memory in civilization, and consumption is due to follow its example.

Sanitary pioneers had already begun casting about eagerly for light upon the influence of housing, of drainage, of food, in the causation of tuberculosis, when a new and powerful weapon [Pg 126] was suddenly placed in their hands by the infant science of bacteriology. This was the now world-famous discovery by Robert Koch that consumption and other forms of tuberculosis were due to the attack of a definite bacillus. No tubercle bacillus—no consumption.

At first sight this discovery appeared to be anything but encouraging. In fact, it seemed to make the situation and the outlook even more hopeless. And when within a few years it was further

demonstrated in rapid succession that most of the diseases of the spine in children, of the group of symptoms associated with enlarged glands or kernels in the neck and known as "scrofula" or struma, most cases of hip-joint disease, of white swelling of the knee, a large percentage of chronic ulcerations of the skin known as *lupus*, a common form of fatal bowel disease in children, and many instances of peritonitis in adults, together with fully half of the fatal cases of convulsions in children, were due to the activity of this same ubiquitous bacillus, it looked as if the enemy were hopelessly entrenched against attack. And when it was further found that a similar bacillus was almost as common a cause of death and disease in cattle, particularly dairy cattle, and another in domestic fowls, it looked as if the heavens above and the earth beneath were so thickly strewn and so hopelessly infested with the germs that to war against them, or hope to escape from them, was like fighting back the Atlantic tides with a broom.

But this chill of discouragement quickly passed. Our foe had come down out of the clouds, and was spread out in battle array before us, in plain sight on the level earth. We were ready for the [Pg 127] conflict, and proposed to "fight it out on this line if it takes all summer." It was not long before we began to see joints in the enemy's armor and weaknesses in his positions. Then, when we lowered our field-glasses and turned to count our forces and prepare for the defense, we discovered with a shock of delighted relief that whole regiments of unexpected reinforcements had come up while we were studying the enemy's position. These new allies of ours were three of the great, silent forces of nature, which had fallen into line on either side and behind us, without hurry and without excitement, without even a bugle-blast to announce their coming.

The first was the great resisting power and vigor of the human organism, which we had gravely underestimated. The second, that power of adaptation to new circumstances, including even the attack of infectious diseases, which we call "survival of the fittest." The third, that great, sustaining, conservative power of nature—heredity. More cheering yet, these forces came, not merely fully armed, but bearing new weapons fitted for our hands. The vigor and unconquerable toughness of the human animal presented us with three glittering weapons, sunshine, food, and fresh air.

"If the deadly bacillus breaks through the lines, put me in the gap! With these weapons, with this triad, I will engage to hurl him back, shattered and broken." "Equip your vanguard with them, and the enemy will never break the line."

The survival of the fittest held out to us two weapons of strange and curious make, one of them [Pg 128] labeled "immunity," the other "quarantine." "Give me a little time," she said, "and with the first of these I will make seven-tenths of the soldiers in your army proof against the spears of the enemy, as Achilles was when dipped in the Styx. With the other, surround and isolate every roving band of the enemy that you can find; drive him out of the holes and caves in which he lives, into the sunlight. Hold him in the open for forty-eight hours, and he will die of light-stroke and starvation. Divide and conquer!"

These reinforcements of ours have proved no mere figure of speech. They have won many a battle for us already upon the tented field. They have not merely made good their promises, but gone beyond them, and we are only just beginning to appreciate their true worth, and how absolutely we can rely upon them.

The first outpost of the enemy was captured with the sunshine-food-air weapons, and a glorious victory it was,—great in itself, and even more important for its moral effect and its encouragement for the future. To pronounce an illness "consumption" had been from time immemorial equivalent to signing a death-warrant. Even the doctors could hardly believe it, when the first open-air enthusiasts began to claim that they had actually cured cases of genuine consumption. For long there was a tendency to mutter in the beard, "Well, it wasn't *genuine* consumption, or it wouldn't have got better."

But after a period of incredulity this gave way to delighted confidence. The open-air method would cure, and *did* cure, and the patients remained cured for years afterward. Our first claims [Pg 129] were barely for twenty-five or thirty per cent of the threatened victims. Then we were able to increase it to fifty per cent; sixty, seventy, and finally eighty were successively reached. But with the increase of our power over the cure of this disease came a realization of our knowledge of its limitations. It quickly proved itself to be no sovereign and universal panacea, which would cure all cases, however desperate, or however indiscriminately it was applied. And emphatically it had to be mixed with brains, on the part both of the physician and of the patient.

In the first place, the likelihood of a cure depended, with almost mathematical certainty, upon the earliness of the stage at which it was begun. Eight or ten years ago the outlook crystallized itself into the form which it has practically retained since: of cases put under treatment in the very early stage, from seventy to ninety per cent were practical cures; of ordinary so-called "first-stage" cases, sixty to seventy per cent; second-stage cases, or those in whom the disease was well developed, thirty to sixty per cent; and well-advanced cases, fifteen to thirty per cent of apparent cures. *The crux of the whole proposition lies in the early recognition of the disease by the physician*, and the prompt acceptance of the diagnosis by the patient, and his willingness to drop everything and fight intelligently and vigorously for his life. Physicians are now thoroughly awake on this point, and are concentrating their most careful attention and study upon methods of recognition at the earliest possible stages. At the same time those magnificent associations for [Pg 130] the study and prevention of tuberculosis, international, national, state, and local,—the greatest of which, the International Tuberculosis Congress, has just honored America, by meeting in Washington,—are straining every nerve to educate the public to understand the importance of

recognizing the earliest possible symptoms of this disease, no matter how trivial they may appear, and making every other consideration bend to the fight.

This new Word of Power, the open-air treatment, alone has transformed one of the most hopeless, most pathetic, and painful fields of disease into one of the most cheerful and hopeful. The vantage-ground won is something enormous. No longer need the family physician hang back, in dread and horror, from allowing himself even to recognize that the slow loss of weight, the increasing weakness, the flushed evening cheek, and the restless sleep, are signs of this dread malady. Instead of shrinking from pronouncing the patient's doom, he knows now that he has everything to gain and nothing to lose by promptly warning him of his danger, even while it is still problematical. On the other hand, the patient need no longer recoil in horror when told that he has consumption, and either go home to set his house in order and make his will, or hunt up another medical adviser who will take a more cheerful view of his case. All that he has to do is to turn and fight the disease vigorously, intelligently, persistently, with the certain knowledge that the chances are five to one in his favor; and that's a good fighting chance for any one. [Pg 131]

Even should there be reasonable ground for doubt as to the positive nature of the disease, he has nothing to lose and everything to gain by taking the steps required to cure it. There is nothing magical or irrational, least of all injurious, in any way about them. Simply rest, abundant feeding, and plenty of fresh air. Even if the bacillus has not yet lodged in his tissues, this treatment will relieve the conditions of depression from which he is suffering, and which would sooner or later render him a favorable lodging-place for this omnipresent, tiny enemy.

If he has the disease the treatment will cure it. If he hasn't got it, it will prevent it; and the gain in vigor, weight, and general efficiency will more than pay him for the time lost from his business or his study. It always pays to take time to put yourself back into a condition of good health and highest efficiency.

It was early recognized that the campaign could not be won with this weapon alone. Inexpressibly valuable and cheering as it was, it had obvious limitations. The first of these was the obvious reflection that it was idle to cure even eighty per cent of all who actually developed tuberculosis, unless something were done to stop the disease from developing at all. "Eighty per cent of cures," of course, sounds very encouraging, especially by contrast with the almost unbroken succession of deaths before. But even a twenty per cent mortality from such a common disease, if it were to proceed unchecked, would make enormous inroads every year upon our national vigor.

Secondly, it was quickly seen that those who recovered from the disease still bore the scars; that [Pg 132] while they might recover a fair degree of health and vigor, yet they were always handicapped by the time lost and the damage inflicted by this slow and obstinate malady; that many of them, while able to preserve good health under ideal conditions, were markedly and often distressingly limited in the range of their business activities for years after, and even for life. Finally, that as these cases were followed further and further, it was found that even after becoming cured they were sadly liable to relapse under some unexpected strain, or to slacken their vigilance and drop back into their former bad physical habits; while the conviction began to grow steadily upon men who had devoted one, two, or more decades to the study of this disease in the localities most resorted to for its cure, that the general vigor and vitality of these cured consumptives were apt to be not of the best; that their duration of life was not equal to the average; and that, even if they escaped a return of the disease, they were apt to go down before their normal time under the attack of some other malady. In short, *cure* was a poor weapon against the disease as compared with *prevention*.

But before this, a careful study of the enemy's position and investigation of our own resources had brought another most important and reassuring fact to light, and that is, that while a distressingly large number of persons died of tuberculosis, these represented only a comparatively small percentage of all who had actually been attacked by the disease. One of the reasons why consumption had come to be regarded as such a deadly disease was that the milder [Pg 133] cases of it were never recognized. It was, and is yet, a common phrase in the mouths of both the laity and of the medical profession: "He was seriously threatened with consumption"; "She came very near falling into a decline,"—*but* they recovered. If they didn't die of it, it wasn't "real" tuberculosis. Now we have changed all that, and have even begun to go to the opposite extreme, of declaring with the German experts, "*Jeder Mann ist am ende ein bischen tuberkulöse*." (Every one is some time or another a little bit tuberculous.) This sounds appalling at first hearing, but as a matter of fact it is immensely encouraging. Our first suspicion of it came from the records of that gruesome, but pricelessly valuable, treasure-house of solid facts in pathology—the post-mortem room, the dead-house. Systematic examinations of all the bodies brought to autopsy in our great hospitals and elsewhere revealed at first thirty, then, as the investigation became more minute and skillful, forty, sixty, seventy-five per cent of scars in the apices of the lungs, remains of healed cavities, infected glands, or other signs of an invasion by the tubercle bacillus. Of course, the skeptic challenged very properly at once:—

"But how do you know that these masses of chalky-material, these enlarged glands, are the result of tuberculosis? They may be due to some half-dozen other infections."

Almost before the question was asked a test was made by the troublesome but convincing method of cutting open these scars, dividing these enlarged glands, scraping materials out of [Pg 134] their centre, and injecting them into guinea pigs. Result: from thirty to seventy per cent of the guinea pigs died of tuberculosis. In other cases it was not necessary to inoculate, as scrapings or

sections from these scar-masses showed tubercle bacilli, clearly recognizable by their staining reaction.

Here, then, we have indisputable evidence of the fact that the tubercle bacillus may not only enter some of the openings of the body,—the nostrils, the mouth, the lungs,—but may actually form a lodgment and a growth-colony in the lungs themselves, and yet be completely defeated by the antitoxic powers of the blood and other tissues of the body, prevented from spreading throughout the rest of the lung, most of the invaders destroyed, and the crippled remnants imprisoned for life in the interior of a fibroid or chalky mass.

It gave one a distinct shock at the meeting of the British Medical Association devoted to tuberculosis, some ten years ago, to hear Sir Clifford Allbutt, one of the most brilliant and eminent physicians of the English-speaking world, remark, on opening his address, "Probably most of us here have had tuberculosis and recovered from it."

Here is evidently an asset of greatest and most practical value, which changes half the face of the field. Instead of saving, as best we may, from half to two-thirds of those who have allowed the disease to get the upper hand and begin to overrun their entire systems, it places before us the far more cheering task of building up and increasing this natural resisting power of the human body, until not merely seventy per cent of all who are attacked by it will throw it off, but eighty, [Pg 135] eighty-five, ninety! We can plan to stop *consumption by preventing the consumptive*. A very small additional percentage of vigor or of resisting power—such as could be produced by but a slight improvement in the abundance of the food-supply, the lighting and ventilating of the houses, the length and "fatiguingness" of the daily toil—might be the straw which would be sufficient to turn the scale and prevent the tuberculous individual from becoming consumptive.

Here comes in one of the most important and valuable features of our splendid sanatorium campaign for the cure of tuberculosis, and that is the nature of the methods employed. If we relied for the cure of the disease upon some drug, or antitoxin, even though we might save as many lives, the general reflex or secondary effect upon the community might not be in any way beneficial; at best it would probably be only negative. But when the only "drugs" that we use are fresh air, sunshine, and abundant food, and the only antitoxins those which are bred in the patient's own body; when, in fact, we are using for the cure of consumption *precisely those agencies and influences which will prevent the well from ever contracting it*, then the whole curative side of the movement becomes of enormous racial value. The very same measures that we rely upon for the cure of the sick are those which we would recommend to the well, in order to make them stronger, happier, and more vigorous.

If the whole civilized community could be placed upon a moderate form of the open-air treatment, it would be so vastly improved in health, vigor, and efficiency, and saved the [Pg 136] expenditure of such enormous sums upon hospitals, poor relief, and sick benefits, that it would be well worth all that it would cost, even if there were no such disease as tuberculosis on earth.

This is coming to be the real goal, the ultimate hope of the far-sighted leaders in our tuberculosis campaign,—to use the cure of consumption as a lever to raise to a higher plane the health, vigor, and happiness of the entire community.

Enormously valuable as is the open-air sanatorium as a means of saving thousands of valuable and beloved lives, its richest promise lies in its function as a school of education for the living demonstration of methods by which the health and happiness of the ninety-five per cent of the community who never will come within its walls may be built up. Every consumptive cured in it goes home to be a living example and an enthusiastic missionary in the fresh-air campaign. The ultimate aim of the sanatorium will be to turn every farmhouse, every village, every city, into an open-air resort. When it shall have done this it will have fulfilled its mission.

Our plan of campaign is growing broader and more ambitious, but more hopeful, every day. All we have to do is to keep on fighting and use our brains, and victory is certain. Our Teutonic fellow soldiers have already nailed their flag to the mast with the inscription:—

"No more tuberculosis after 1930!"

So much for the serried masses of the centre of our anti-tuberculosis army, upon which we [Pg 137] depend for the heavy, mass fighting and the great frontal attacks. But what of the right and the left wings, and the cloud of skirmishers and cavalry which is continually feeling the enemy's position and cutting off his outposts? Upon the right stretch the intrenchments of the bacteriologic brigade, with the complicated but marvelously effective weapons of precision given us by the discovery of the definite and living cause of the disease, the *Bacillus tuberculosis*. Upon the left wing lie camp after camp of native regiments, whose loyalty until of very recent years was more than doubtful,—heredity, acquired immunity, and the so-called improvements of modern civilization, steam, electricity, and their kinsmen.

To the artillerymen of the bacteriologic batteries appears to have been intrusted the most hopeless task, the forlorn hope,—the total extermination of a foe so tiny that he had to be magnified five hundred times before he was even visible, and of such countless myriads that he was at least a billion times as numerous as the human race. But here again, as in the centre of the battle-line, when we once made up our minds to fight, we were not long in discovering points of attack and weapons to assault him with.

First, and most fundamental of all, came the consoling discovery that though there could be no

consumption without the bacillus, not more than one individual in seven, of fair or average health, who was exposed to its attack in the form of a definite infection, succumbed to it; and that, as strongly suggested by the post-mortem findings already described, even those who [Pg 138] developed a serious or fatal form of the disease had thrown off from five to fifteen previous milder or slighter infections. So that, to put it roughly, all that would be necessary practically to neutralize the injuriousness of the bacillus would be to prevent about one-twentieth of the exposures to its invasion which actually occurred. The other nineteen-twentieths would take care of themselves. The bacilli are not the only ones who can be numbered in their billions. If there are billions of them there are billions of us. We are not mere units—scarcely even individuals—except in a broad and figurative sense. We are confederacies of billions upon billions of little, living animalcules which we call cells. These cells of ours are no Sunday-school class. They are old and tough and cunning to a degree. They are war-worn veterans, carrying the scars of a score of victories written all over them. *They* are animals; bacteria, bacilli, micrococci, and all *their* tribe are *vegetables*. The daily business, the regular means of livelihood of the animal cell for fifteen millions of years past has been eating and digesting the vegetable. And all that our body-cells need is a little intelligent encouragement to continue this performance, even upon disease germs; so that we needn't be afraid of being stampeded by sudden attack.

The next cheering find was that the worst enemies of the bacillus were our best friends. Sunlight will kill them just as certainly as it will give us new life. The germs of tuberculosis will live for weeks and even months in dark, damp, unventilated quarters, just precisely such surroundings as [Pg 139] are provided for them in the inside bedrooms of our tenements, and the dark, cellar-like rooms of many a peasant's cottage or farmhouse. In bright sunlight they will perish in from three to six hours; in bright daylight in less than half a day. This is one of the factors that helps to explain the apparent paradox, that the dust collected from the floors and walls of tents and cottages in which consumptives were treated was almost entirely free from tuberculous bacilli, while dust taken from the walls of tenement houses, the floors of street-cars, the walls of churches and theatres in New York City, was found to be simply alive with them. One of the most important elements in the value of sunlight in the treatment of consumption is its powerful germicidal effect. [Pg 140]

CHAPTER VII

TUBERCULOSIS, A SCOTCHED SNAKE

II

Closely allied to the discovery that sunlight and fresh air are fatal to the microörganisms of tuberculosis came the consoling fact that these bacilli, though most horribly ubiquitous and apparently infesting both the heavens above and the earth beneath, had neither wings nor legs, and were absolutely incapable of propelling themselves a fraction of an inch. They do not move —*they have to be carried*. More than this, like all other disease-germs, while incredibly tiny and infinitesimal, they have a definite weight of their own, and are subject to the law of gravity. They do not flit about hither and thither in the atmosphere, thistledown fashion, but rapidly fall to the floor of whatever room or receptacle they may be thrown in. And the problem of their transference is not that of direct carrying from one victim to the next, but the intermediate one of infected materials, such as are usually associated with visible dust or dirt. In short, keep dust or dirt from the floor, out of our food, away from our fingers or clothing or anything that can be brought to or near the mouth, and you will practically have abolished the possibility of the transference of tuberculosis. The consumptive himself is not a direct source of danger. It is only [Pg 141] his filthy or unsanitary surroundings. Put a consumptive, who is careful of his sputum and cleanly in his habits, in a well-lighted, well-ventilated room, or, better still, out of doors, and there will be exceedingly little danger of any other member of his family or of those in the house with him contracting the disease. Wherever there is dirt or dust there is danger, and there almost only. Thorough and effective house-reform—not merely in tenements, alas! but in myriads of private houses as well—would abolish two-thirds of the spread of tuberculosis.

It is not necessary to isolate every consumptive in order to stop the spread of the disease. All that is requisite is to prevent the bacilli in his sputum from reaching the floor or the walls, to have both the latter well lighted and aired, and, if possible, exposed to direct sunlight at some time during the day, and to see that dust from the floor is not raised in clouds by dry sweeping so as to be inhaled into the lungs or settle upon food, fingers, or clothing, and that children be not allowed to play upon such floors as may be even possibly contaminated. These precautions, combined with the five-to-one resisting power of the healthy human organism, will render the risk of transmission of the disease an exceedingly small one. To what infinitesimal proportions this risk can be reduced by intelligent and strict sanitation is illustrated by the fact, already alluded to, of the almost complete germ-freeness of the dust from walls and floors of sanitorium cottages, and by the even more convincing and conclusive practical result, that scarcely a single case is on record of the transmission of this disease to a nurse, a physician, or a servant, or other [Pg 142] employee in an institution for its cure.

There is absolutely no rational basis for this panic-stricken dread of an intelligent, cleanly consumptive, or for the cruel tendency to make him an outcast and raise the cry of the leper

against him: "Unclean! Unclean!"

It cannot be too strongly emphasized that consumption is transmitted *by way of the floor*; and if this relay-station be kept sterile there is little danger of its transmission by other means.

Practically all that is needed to break this link is the absolute suppression of what is universally and overwhelmingly regarded as not merely an unsanitary and indecent, but a filthy, vulgar, and disgusting habit—promiscuous expectoration. There is nothing new or unnatural in this repression, this *tabu* on expectoration. In fact, we are already provided with an instinct to back it. In every race, in every age, in every grade of civilization, the human saliva has been regarded as the most disgusting, the most dangerous and repulsive of substances, and the act of spitting as the last and deepest sign of contempt and hatred; and if directed toward an individual, the deadliest and most unbearable insult, which can be wiped out only by blood. Primitive literature and legend are full of stories of the poisonousness of human saliva and the deadliness of the human bite. It was the "bugs" in it that did it. It is most interesting to see how science has finally, thousands of years afterward, shown the substantial basis of, and gone far to justify, this instinctive horror and loathing. [Pg 143]

Not merely are the fluids of the human mouth liable to contain the tubercle bacillus, and that of diphtheria, of pneumonia, and half a dozen other definite disorders, but they are in perfectly healthy individuals, especially where the teeth are in poor condition, simply swarming with millions of bacteria of every sort, some of them harmless, others capable of setting up various forms of suppuration and septic inflammation if introduced into a wound, or even if taken into the stomach. Even if there were no such disease as tuberculosis a campaign to stamp out promiscuous expectoration would be well worth all it cost.

Of course, as a counsel of perfection, the ideal procedure would be promptly to remove each consumptive, as soon as discovered, from his house and place him in a public sanatorium, provided by the state, for the sake of removing him from the conditions which have produced his disease, of placing him under those conditions which alone can offer a hopeful prospect of cure, and of preventing the further infection of his surroundings. The only valid objections to such a plan are those of the expense, which, of course, would be very great. It would be not merely best, but kindest, for the consumptive himself, for his immediate family, and for the community. And enormous as the expense would be, when we have become properly aroused and awake to the huge and almost incredible burden which this disease, with its one hundred and fifty thousand deaths a year, is now imposing upon the United States,—five times as great as that of war or standing army in the most military-mad state in Christendom,—the community will ultimately [Pg 144] assume this expense. So long, however, as our motto inclines to remain, "Millions for cure, but not one cent for prevention," we shall dodge this issue.

There can be no question but that each state and each municipality of more than ten thousand inhabitants ought to provide an open-air camp or colony of sufficient capacity to receive all those who are willing to take the cure but unable to meet the expense of a private institution; and, also, some institution of adequate size, to which could be sent, by process of law, all those consumptives who, either through perversity, or the weakness and wretchedness due to their disease, or the apathy of approaching dissolution, fail or are unable to take proper precautions.

When we remember that the careful investigations of the various dispensaries for the treatment of tuberculosis in our larger cities, New York, Boston, Cleveland, report that on an average twenty to thirty per cent of all children living in the same room or apartment with a consumptive member of their family are found to show some form of tuberculosis, it will be seen how well worth while, from every point of view, this provision for the removal and sanatorium treatment of the poorer class of these unfortunates would be. These dispensaries now have, as a most important part of their campaign against the disease, one or more visiting nurses, who, whenever a patient with tuberculosis is brought into the dispensary, visit him in his home, show him how to ventilate and light his rooms as well as may be, give practical demonstrations of the methods of [Pg 145] preventing the spread of the disease, advise him as to his food, and see that he is supplied with adequate amounts of milk and eggs, and, finally, round up all the children of the family and any adults who are in a suspicious condition of health, and bring them to the dispensary for examination. Distressing as are these findings, reaching in some cases as high as fifty and sixty per cent of the children, they have already saved hundreds of children, and prevented hundreds of others from growing up crippled or handicapped.

It must be remembered that the tubercle bacillus causes not merely disease of the lungs in children but also a large majority of the crippling diseases of the bones, joints, and spine, together with the whole group of strumous or scrofulous disorders, and a large group of intestinal diseases and of brain lesions, resulting in convulsions, paralysis, hydrocephalus, and death. The battle-ground of the future against tuberculosis is the home.

We speak of the churchyard as "haunted," and we recoil in horror from the leper-house or the cholera-camp. Yet the deadliest known hotbed of horrors, the spawning ground of more deaths than cholera, smallpox, yellow fever, and the bubonic plague combined, is the dirty floor of the dark, unventilated living-room, whether in city tenement or village cottage, where children crawl and their elders spit.

It is scarcely to the credit of our species that for convincing, actual demonstrations of what can be done toward stamping out tuberculosis, by measures directed against the bacillus alone, we [Pg 146] are obliged to turn to the lower animals. By a humiliating paradox we are never quite able to put

ourselves under those conditions which we know to be ideal from a sanitary point of view. There are too many prejudices, too many vested interests, too many considerations of expense to be reckoned with. But with the lower animals that come under our care we have a clear field, free from obstruction by either our own prejudices or those of others. In this realm the stamping out of tuberculosis is not merely a rosy dream of the future but an accomplished fact, in some quarters even an old story. Two illustrations will suffice, one among domestic animals, the other among wild animals in captivity. The first is among pure-bred dairy cattle, the pedigreed Jerseys and Holsteins. No sooner did the discovery of the bacillus provide us with a means of identification, than the well-known "*perlsucht*" of the Germans, or "grapes" of the English veterinarians—both names being derived from the curious rounded masses or nodules of exudate found in the pleural cavity and the peritoneum (around the lungs and the bowels), and supposed to resemble pearls and grapes respectively—were identified as tuberculosis, and cows were found very widely infected with it. This unfortunately still remains the case with the large mass of dairy cattle. But certain of the more intelligent breeders owning valuable cattle proceeded to take steps to protect them.

The first step was to test their cows with tuberculin, promptly weeding out and isolating all those [Pg 147] that reacted to the disease. It was at first thought necessary to slaughter all these at once. But it was later found that, if they were completely isolated and prevented from communicating the disease to others, this extreme measure was necessary only with those extensively diseased. The others could be kept alive, and if their calves were promptly removed as soon as born, and fed only upon sterilized or perfectly healthy milk, they would be free from the disease. And thus the breeding-life of a particularly valuable and high-bred animal might be prolonged for a number of years. They must, however, be kept in separate buildings and fields, and preferably upon a separate farm from the rest of the herd.

Those cows found healthy were given the best of care, including a marked diminution of the amount of housing or confinement in barns, and were again tested at intervals of six months, several times, to weed out any others which might still have the infection in their systems. In a short time all signs of the disease disappeared, and no other cases developed in these herds unless fresh infection was introduced from without. To guard against this, each farm established a quarantine station, where all new-bought animals, after having been tested with tuberculin and shown to be free from reaction, are kept for a period of at least a year, for careful observation and study, before being allowed to mix with the rest of the herd. It is now a common requirement among intelligent breeders of pedigreed cattle to demand, as a formal condition of sale, their submission to the tuberculin test, or the certificate of a competent veterinarian that the animal [Pg 148] has been so tested without reacting. Protected herds have now been in existence under these conditions, notably in Denmark, where the method was first reduced to a system under the able leadership of Professor Bang, of Copenhagen, for ten years with scarcely a single case of tuberculosis developing. Only a fraction of one per cent of calves from the most diseased mothers are born diseased.

Not only is the method spreading rapidly among the more intelligent class of breeders, but many progressive countries of Europe and states of our Union require the passing of the tuberculin test as a requisite to the admission within their borders of cattle intended for breeding purposes. So that, while the problem is still an enormous one, it is now confidently believed that complete eradication of bovine tuberculosis is only a question of time.

The other instance furnishes a much more crucial test, as it is carried out upon wild animals under the unfavorable conditions of captivity in a strange climate, like our slum-dwellers from sunny Italy, and comes home to us more closely in many respects, inasmuch as it is concerned with our nearest animal relatives on the biological side—monkeys and apes, in zoölogical gardens.

Tuberculosis is a perfectly frightful scourge to these unfortunate captives, causing not infrequently thirty, fifty, and even sixty per cent of the deaths. This, however, is only in keeping with their frightful general mortality. The collection of monkeys in the London Zoo, for instance, some fifteen years ago, was absolutely exterminated by disease and started over afresh *every* [Pg 149] *three years*, a death-rate of thirty-five per cent per annum as compared with our human rate of about two per cent per annum. Here, it would seem, was an instance where there was little need to call in the bacillus. Brought from a tropical climate to one of raw, damp fog and smoke, from the freedom of the air-roads through the tree-tops to the confinement of dismal and often dirty cages in a stuffy, overheated house, condemned to a diet which at best could be but a feeble and far-distant imitation of their natural food, it seemed little wonder that they "jes' natcherly pined away an' died."

But let the results speak. A thorough system of quarantine was enforced, beginning with one of the Vienna gardens, and finally reaching one of its most brilliant and successful exemplifications in our own New York Zoölogical Gardens in the Bronx. All animals purchased or donated were tested with tuberculin, and those that reacted were either painlessly destroyed or disposed of. Those which appeared to be immune were kept in a thoroughly healthy, sanitary quarantine station for six months or a year, and again tested by tuberculin before being introduced into the cages. The original stock of monkeys was treated in the same manner or else destroyed completely, and the houses and cages thoroughly cleaned and sterilized or new ones constructed. Keepers employed in the monkey-house were carefully tested for signs of tuberculosis, and rejected or excluded if any appeared. Signs were posted forbidding any expectoration or feeding of the animals (which latter is often done with nuts or fruit which had been cracked or bitten [Pg 150]

before being handed to the monkeys) by the general public, and these rules were strictly enforced.

At the same time the houses were thoroughly ventilated and exposed to sunlight as much as possible, and the animals were turned out into open air cages whenever the weather would possibly permit. As a result the mortality from tuberculosis promptly sank from thirty per cent to five or six per cent. In our Bronx Zoo, for instance, it has become decidedly rare as a cause of death in monkeys, no case having occurred in the monkey-house for eighteen months past. What is even more gratifying, the general mortality declined also, though in less proportion, so that, instead of losing twenty-five to thirty per cent of the animals in the house every year, a mortality of ten to fifteen per cent is now considered large.

And to think that we might achieve the same results in our own species if we would only treat ourselves as well as we do our monkey captives! To "make a monkey of one's self" might have its advantages from a sanitary point of view.

"But this method," some one will remind us, "would silence only a part of the enemy's infection batteries." Even supposing that we could prevent the spread of the disease from human sources, what of the animal consumptives and their deadly bacilli? If the milk that we drink, and the beef, pork, and poultry that we eat, are liable to convey the infection, what hope have we of ever stopping the invasion? [Pg 151]

The question is a serious one. But here again a thorough and careful study of the enemy's position has shown the danger to be far less than it appeared at first sight. Even bacilli have what the French call "the defects of their virtues." Their astonishing and most disquieting powers of adjustment, of accommodation to the surroundings in which they find themselves, namely, the tissues and body-fluids of some particular host whom they attack, bring certain limitations with them. Just in so far as they have adjusted themselves to live in and overcome the opposition of the body-tissues of a certain species of animals, *just to that degree they have incapacitated themselves to live in the tissues of any other species*.

Some of the most interesting and far-reachingly important work that has been done in the bacteriology of tuberculosis of late years has concerned itself with the changes that have taken place in different varieties and strains of tubercle bacilli as the result of adjusting themselves to particular environments. The subject is so enormous that only the crudest outlines can be given here, and so new that it is impossible to announce any positive conclusions. But these appear to be the dominant tendencies of thought in the field so far.

Though nearly all domestic animals and birds, and a majority of wild animals under captivity, are subject to the attack of tuberculosis, practically all the infections hitherto studied are caused by one of three great varieties or species of the tubercle bacillus: the *human*, infesting our own species; the *bovine*, attacking cattle; and the *avian*, inhabiting the tissues of birds, especially the [Pg 152] domestic fowl. These three varieties or species so closely resemble one another that they were at one time regarded as identical, and we can well remember the wave of dismay which swept over the medical world when Robert Koch announced that the "*perlsucht*" of cattle was a genuine and unquestioned tuberculosis due to an unmistakable tubercle bacillus. But as these varieties were thoroughly and carefully studied, it was soon found that they presented definite marks of differentiation, until now they are universally admitted to be distinct varieties, each with its own life peculiarities, and, according to some authorities, even distinct species.

"But," we fancy we hear some one inquire impatiently, "what do those academic, technical distinctions matter to us? Whether the avian tuberculosis germ is a variety or a true species may be left to the taxonomists, but it is of no earthly importance to us."

On the contrary, it is of the greatest importance. For the distinctive feature about a particular species of parasite is that it will live and flourish where another species will die, and, vice versa, *will die in surroundings where its sister species might live and thrive*.

One of the first differences found to exist among these three types of bacteria was the extraordinary variation in their power of attacking different animals. For instance, while the guinea-pig and the rabbit could be readily inoculated with *human* bacilli, they could only be infected with difficulty by cultures of the *bovine* bacillus; while the only animal that could be inoculated at all with the *avian* or bird bacillus was the rabbit, and he only occasionally. In fact, [Pg 153] bacteriologists soon came to the consoling conclusion that the *avian* bacillus might be practically disregarded as a source of danger to human beings, so widely different were the conditions in their moist and moderately warm tissues to those of the dry and superheated tissues of the bird to which it had adjusted itself for so many generations.

And next came the bold pronunciamento of no less an authority than Koch himself, that the bovine bacillus also was so feebly infective to human beings that it might be practically disregarded as a source of danger. This promptly split the bacteriologists of the world into two opposing camps, and started a warfare which is still being waged with great vigor. As the question is still under hot dispute by even the highest authorities, it is, of course, impossible to pronounce any definite conclusions. But the net result to date appears to be that while Koch made a serious error of judgment in declaring that meat and milk as a source of danger to human beings of tuberculosis might be disregarded, yet, for practical purposes, his position is, in the main, correct: the actual danger from the bovine bacillus to human beings is relatively small.

There was nothing whatever improbable, in the first place, in the correctness of Koch's position.

It is one of the few consoling facts, well known to all students of comparative pathology or the diseases of the different species of animals, how peculiarly specialized they are in the choice of their diseases, or, perhaps, to put it more accurately, how particular and restricted disease-germs are in their choice of a host. For instance, out of twenty-eight actually infectious diseases [Pg 154] which are most common among the domestic animals and man, other than tuberculosis, only one —*rabies*—is readily communicable to more than three species; only three—*anthrax*, *tetanus*, and *foot-and-mouth disease*—are communicable to two species; while the remainder are almost absolutely confined to one species, even though this be thrown into closest contact with half a dozen others.

Again, we have half a dozen similar instances in the case of tuberculosis itself. The horse and the sheep, for instance, are both most intimately associated with cattle, pastured in the same fields, fed upon the same food, and yet tuberculosis is almost unknown in sheep and decidedly uncommon in horses, and when it does occur in them is from a human source. The goat is almost equally immune from both human and *bovine* forms, while the cat and the dog, although developing the infection with a low degree of frequency, almost invariably trace that infection to a human source.

There is, therefore, no *a priori* reason whatever why we should be any more susceptible to bovine tuberculosis than the remainder of the domestic animals. It is only fair to say, however, that the animal whose diet—and appetite—most closely resembles ours, the hog, is quite fairly susceptible to bovine tuberculosis if fed upon the milk or meat of tuberculous cattle.

Next came the particularly consoling fact that although nothing has been more striking than the great increase in the amounts of meat and milk consumed by the mass of the community during our last twenty years' progress in civilization, this has been accompanied not by any increase of [Pg 155] tuberculosis, but by a *diminution of from thirty-five to forty-five per cent*. The allegation so frequently made that there has been an increase in the amount of infantile tuberculosis has been shown, upon careful investigation by Shennan of Edinburgh, Guthrie of London, Kossel in Germany, Comby in France, Bovaird in New York, and others, to be practically without foundation.

Then, while repetitions of Koch's experiment, upon which his announcement was based, of inoculating calves and young cattle with *human* bacilli have proved that a certain number of them can be, under appropriate circumstances, made to develop tuberculosis, that number has never been a large percentage of the animals tested, and in many cases the infection has been a local one, or of a mild type, which has resulted in recovery. Lastly, while a number of bacilli, with *bovine* culture and other characteristics, have been recovered from the bodies of children dying of tuberculosis, and these bacilli have proved virulent to calves when injected into them, yet, as a matter of historical fact, the actual number of instances in which children or other human beings have been definitely proved to have contracted the disease from the milk of a tuberculous cow is still exceedingly and encouragingly small. A careful study of the entire literature of the past twenty years, some three years ago, revealed *only thirty-seven cases*; and of these thirty-seven Koch's careful investigations have since disproved the validity of nine.

On the other hand, it is anything but safe to accept Koch's practical dictum and neglect the meat [Pg 156] and milk of cattle as a source of danger in tuberculosis. First, because the degree of our immunity against the bovine bacilli is still far from settled; and, second, because, while bacteriologists are fairly agreed that the *avian*, the *bovine*, and the *human* represent three distinct and different variations, if not species, of the bacillus, they are almost equally agreed that they are probably the descendants of one common species, which may possibly be a bacillus commonly found upon meadow grasses, particularly the well-known timothy, and hence very frequently in the excreta of cattle, and known as the *grass bacillus* or *dung bacillus* of Mœller. This bacillus has all the staining, morphological, and even growth characteristics of the tubercle bacillus except that it produces only local irritation and little nodular masses, if injected into animals. Our knowledge of its existence is, however, of great practical importance, inasmuch as it warned us that in our earlier studies of the bacilli contained in milk and butter we have been mistaking this organism for a genuine tubercle bacillus. As a consequence, of late years our tests for the presence of tubercle bacilli in milk are made not only by searching for the organism with the microscope, but also by injecting the centrifugated sediment of the infected milk into guinea pigs, to see if it proves infectious. Many of our earlier statements as to the presence of tubercle bacilli in milk and butter are now invalidated on this account.

Not only are the three varieties of tubercle bacilli probably of common origin, but they may, under certain peculiar conditions, be transformed into one another, or, at least, enabled to live [Pg 157] under the conditions favorable to one another. This was shown nearly fifteen years ago by the ingenious experiments of Nocard, the great veterinary pathologist. He took a culture of bovine bacilli, which were entirely harmless to fowls, and, inclosing them in a collodion capsule, inserted them into the peritoneal cavity of a hen. The collodion capsule permitted the fluids of the body to enter and provide food for the bacilli, but prevented the admission of the leucocytes to attack and destroy them. After several weeks the capsule was removed, the bacilli found still alive, and transferred to another capsule in another fowl. When this process had been repeated some five or six times, the last generation of bacilli was injected into another fowl, which promptly developed tuberculosis, showing that by gradually exposing the bacilli for successive generations to the high temperature of the bird's body (from five to fifteen degrees above that of the mammal), they had become acclimated, as it were, and capable of developing. So that it is certainly quite conceivable that bovine bacilli introduced in milk or meat might manage to find a

haven of refuge or lodgment in some out-of-the-way gland or tissue of the human body, and there avoid destruction for a sufficiently long time to become acclimated and later infect the entire system.

This is the method which several leaders in bacteriology, including Behring (of antitoxin fame), believe to be the principal source and method of infection of the human species. The large majority, however, of bacteriologists and clinicians are of the opinion that ninety per cent of all [Pg 158] cases of human tuberculosis are contracted from some human source. So that, while we should on no account slacken our fight against tuberculosis in either cattle or birds, and should encourage in every way veterinarians and breeders to aim for its total destruction,—a consummation which would be well worth all it would cost them, purely upon economic grounds, just as the extermination of human tuberculosis would be to the human race,—yet we need not bear the burden of feeling that the odds against us in the fight for the salvation of our own species are so enormous as they would be, had we no natural protection against infection from animals and birds.

The more carefully we study all causes of tuberculosis in children, the larger and larger percentage of them do we find to be clearly traceable to infection from some member of the family or household. In Berlin, for instance, Kayserling reports that seventy per cent of all cases discovered can be traced to direct infection from some previous human case.

Lastly, what of the left wing of our army of extermination, composed of those light-horse auxiliaries—the general progress and new developments of civilization, and the net results upon the individual of the experiences of his ancestors, which we designate by the term "heredity"? For many years we were in serious doubt how far we could depend upon the loyalty of this group of auxiliaries, and many of the faint-hearted among us were inclined to regard their sympathies as really against us rather than with us, and prepared to see them desert to the enemy at any [Pg 159] time. It was pointed out, as of great apparent weight, that consumption was decidedly and emphatically a disease of civilization; that it was born of the tendency of men to gather themselves into clans and nations and crowd themselves into villages and those hives of industry called cities; that the percentage of deaths from tuberculosis in any community of a nation or any ward of a city was high in direct proportion to the density of its population; and that the whole tendency of civilization was to increase this concentration, this congestion of ground space, this piling of room upon room, of story upon story. How could we possibly, in reason, expect that the influences which had caused the disease could help us to cure it?

But the improbable has already happened. Never has there been a more rapid and extraordinary growth of our great cities as contrasted with our rural districts, never has there been a greater concentration of population in restricted areas than during the past thirty-five years. And yet, the prevalence of tuberculosis in that time, in all civilized countries of the earth, has shown not only no increase, *but a decrease of from thirty-five to fifty per cent*. To-day the world power which has the largest percentage of its inhabitants gathered within the limits of its great cities, England, has the lowest death-rate in the civilized world from tuberculosis, although closely pressed within the last few years by the United States, whose percentage of urban population is almost equally large, while England's sister island, Ireland, with one of the highest percentages of rural and the [Pg 160] lowest of urban population, has one of the highest death-rates from tuberculosis, and one which is, unfortunately, increasing.

The real cure for the evils of civilization would appear to be *more civilization*, or, better, perhaps, *higher* civilization. Nor are these exceptional instances. Take practically any city, state, or province in the civilized world, which has had an adequate system of recording all births and deaths for more than thirty years, and you will find a decrease in the percentage of deaths from tuberculosis in that time of from twenty to forty per cent. The city of New York's death-roll, for instance, from tuberculosis, per one thousand living, is some thirty-five per cent less than it was thirty years ago. So that our fight against the disease is beginning to bear fruit already. As Osler puts it, we run barely half the risk of dying of tuberculosis that our parents did and barely one-fourth of that of our grandparents.

But this gratifying improvement goes deeper, and is even more significant than this. It is, of course, only natural to expect that our vigorous fight against the spread of the infection of the disease would give us definite results. But the interesting feature of the situation is that this diminution in England and in Germany, for instance, began not merely twenty, but thirty, forty, even fifty years ago—two decades before we even knew that tuberculosis was an infectious disease with a contagion that could be fought.

In the case of England, for instance, we have the, at first sight, anomalous and even improbable fact that the rate of decline in the death-rate from tuberculosis for the twenty years preceding [Pg 161] the discovery of Koch's bacillus was almost as great as it has been in the twenty years since. In other words, the general tendency, born of civilization, toward sanitary reform, better housing, better drainage, higher wages and consequently more abundant food, rigid inspection of food materials, factory laws, etc., is of itself fighting against and diminishing the prevalence of the "great white plague" by improving the resisting power and building up the health of the individual. Civilization is curing its own ills.

It must be remembered that vital statistics, showing the decrease of a given disease within the past forty or fifty years, probably represent not merely a real decrease of the amount indicated by the figures but an even greater one in fact; because each succeeding decade, as our knowledge of disease and the perfection of our statistical machinery improves and increases, is sure to show

a prompter recognition and a more thorough and complete reporting of all cases of the disease occurring. Statistics, for instance, showing a moderate apparent rate of *increase* of a disease within the last thirty years are looked upon by statisticians as really indicating that it is at a standstill. It is almost certain that at least from ten to twenty per cent more of the cases actually occurring will be recognized during life and reported after death than was possible with our more limited knowledge and less effective methods of registration thirty years ago. So we need not hesitate to encourage ourselves to renewed effort by the reflection that we are enlisted in a winning campaign, one in which the battle-line is already making steady and even rapid progress, [Pg 162] and which can have only one termination so long as we retain our courage and our common-sense.

This decline of the tuberculosis death-rate is, of course, only a part of the general improvement of physique which is taking place under civilization. If we could only get out from under the influence of the "good old times" obsession and open our eyes to see what is going on about us! There is nothing mysterious about it. The soundest of physical grounds for improving health can be seen on every hand. We point with horror, and rightly, to the slum tenement house, but forget that it is a more sanitary human habitation than even the houses of the nobility in the Elizabethan age. We become almost hysterical over the prospect that the very fibre of the race is to be rotted by the adulteration of our food-supply, by oleomargarine in the butter, by boric acid in our canned meats, by glucose in our sugar, and aniline dyes in our candies, but forget that all these things represent extravagant luxuries unheard of upon the tables of any but the nobility until within the past two hundred, and in some cases, one hundred, years. Up to three hundred years ago even the most highly civilized countries of Europe were subject to periodic attacks of famine; our armies and navies were swept and decimated with scurvy, from bad and rotten food-supplies; almost every winter saw epidemics breaking out from the use of half-putrid salted and cured foods; only forty years ago, a careful investigation of one of our most conservative sociologists led [Pg 163] him to the conclusion that in Great Britain *thirty per cent of the population never in all their lives had quite as much as they could eat*, and for five months out of the year were never comfortably warm. The invention of steam, with its swift and cheap transportation of food-supplies, putting every part of the earth under tribute for our tables, meat every day instead of once a week for the workingman, and the introduction of sugar in cheap and abundant form, with the development of the dietary in fruits and cereals which this has made possible, have done more to improve the resisting power and build up the physique of the mass of the population in our civilized communities, than ten centuries of congestion and nerve-worry could do to break it down.

We shake our heads, and prate fatuously that "there were giants in those days," ignorant of the thoroughly attested fact, that the average stature of the European races has increased some four inches since the days of the Crusaders, as shown by the fact that the common British soldier of to-day—Mr. Kipling's renowned "Tommy Atkins," who is looked upon by the classes above him in the social scale as a short, undersized sort of person—can neither fit his chest and shoulders into their armor, get his hands comfortably on the hilts of their famous two-handed swords, nor even lie down in their coffins.

We are at last coming to acknowledge with our lips, although we scarcely dare yet to believe it in our heart of hearts, that not merely the death-rate from tuberculosis, but the general death-rate from all causes in civilized communities, is steadily and constantly declining; that the average [Pg 164] longevity has increased nearly ten years within the memory of most of us, chiefly by the enormous reduction in the mortality from infant diseases; and that, though the number of individuals in the community who attain a great or notable age is possibly not increasing, the percentage of those who live out their full, active life, play their man's or woman's part in the world, and leave a group of properly fed, vigorous, well-trained, and educated children behind them to carry on the work of the race, is far greater than ever before. Even in our much-denounced industrial conditions, made possible by the discovery of steam with its machinery and transportation, the gain has far exceeded the loss. While machinery has made the laborer's task more monotonous and more confining, the net result has been that it has shortened his hours and increased his efficiency.

Even more important, it has increased his intelligence by demanding and furnishing a premium for higher degrees of it. Naturally, one of the first uses which he has made of his increased intelligence has been to demand better wages and to combine for the enforcement of his demands. The premium placed upon intelligence has led both the broader-minded, more progressive, and more humane among employers, and the more intelligent among employees, to recognize the commercial value of health, and of sanitary surroundings, comfort, and healthy recreations, as a means of promoting this. The combined results of these forces are seen in the incontestable, living fact that the death-rate from tuberculosis among intelligent artisans and in [Pg 165] well-regulated factory suburbs is already below that of many classes of outdoor and even farm laborers, whose day is from twelve to fourteen hours, and whose children are worked, and often overworked, from the time that they can fairly walk alone, with as disastrous and stunting results as can be found in any mine or factory. Child-labor is one of the oldest of our racial evils, instead of, as we often imagine, the newest.

All over the civilized world to-day the average general death-rate of each city, slums included, is now below that of many rural districts in the same country. If I were to be asked to name the one factor which had done more than any other to check the spread and diminish the death-rate from tuberculosis I should unhesitatingly say, the *marked increase of wages among the great producing masses of the country*, with the consequent increased abundance of food, better

houses, better sanitary surroundings, and last, but not least, shorter hours of labor.

Underfeeding and overwork are responsible for more deaths from tuberculosis than any other ten factors. Rest and abundant feeding are the only known means for its cure.

This is one of the reasons why the medical profession has abandoned all thought of endeavoring to fight the disease single-handed, and is striving and straining every nerve to enlist the whole community in the fight. Its burden rests, not upon the unfortunate individual who has become tuberculous, but *upon the community* which, by its ignorance, its selfishness, and its greed, has [Pg 166] done much to make him so. What civilization has *caused* it is under the most solemn obligation to *cure*.

One more brigade of irregular troops on the extreme left remains to be briefly reviewed, and that is those forces resulting from the successive exposure of generations to the physical influences of civilization, including the infectious diseases. For years we never dreamed of even attempting to raise any levies among these border tribes of more than doubtful loyalty. Indeed, they were supposed to be our open enemies.

When we first attempted to take a world-view of tuberculosis, the first great fact that stood out plainly was that it was emphatically a disease of the walled town and the city; that the savage and the nomad barbarian were practically free from it; that range cattle and barnyard fowls seldom fell victims to it, while their housed and confined cousins in the dairy barn and the breeding-pens suffered frightfully. It was one of our commonplace sayings that we must "get back to nature," get away from the walled city into the open country, revert from the conditions of civilization in a considerable degree to those of barbarism, in order to escape. While, as for heredity, its influence was almost dead against us. How could a race be exposed to a disease like tuberculosis, generation after generation, without having its vital resistance impaired?

But a marked and cheering change has come over our attitude to this wing of the battle of life. So far from regarding it as in any sense necessary to revert to barbarism, still less to savagery, for [Pg 167] either the prevention or the cure of disease, we have discovered by the most convincing, practical experience, that we can, in the first place, with the assistance of the locomotive and trolley, combined with modern building skill and sanitary knowledge, put even our city-dwellers under conditions, in both home and workshop, which will render them far less likely to contract tuberculosis than if they were in a peasant's cottage or *the average farmhouse or merchant's house* of a hundred years ago, to say nothing of the cave, the dugout, or the hut of the savage.

In the second place, instead of simply "going back to nature" and living in brush-shelters on what we can catch or shoot, it takes *all the resources of civilization* to place our open-air patients in the ideal conditions for their recovery. Let any consumptive be reckless enough to "go back to nature," unencircled by the strong arm of civilized intelligence and power, and unprotected by her sanitary shield, and nature will kill him three times out of five. There could not be a more dangerous delusion than the all-too-common one—that all that is necessary for the cure of consumption is to turn the victim loose among the elements, even in the mildest and most favorable of climates.

He must be fed upon the most abundant and nutritious of foods, even the simplest being milk of a richness which is given by no kind of wild cattle, and which, indeed, only the most carefully bred and highly civilized strains of domestic cattle are capable of producing; eggs such as are laid by no wild bird or by any but the most highly specialized of domestic poultry at the season of the [Pg 168] year when they are most required; steaks and chops, hams and sides of bacon, sugar and fruits and nuts, which simply *are not produced anywhere outside of civilization*, and often only in the most intelligent and progressive sections of civilized communities.

Put him upon even the average diet of many people in this progressive and highly civilized United States the year round,—with its thin milk, its pulpy, half-sour butter, its tough meat, its half-rancid pickled pork, its short three months of really fresh vegetables and good fruit, and six months of eternal cabbage, potatoes, dried apples, and prunes,—and he will fail to build up the vigor necessary to fight the disease, even in the purest and best of air.

The saddest and most pitiful tragedies which the consumptive health-resort physician can relate are those of wretched sufferers,—even in a comparatively early stage of the disease,—whose misguided but well-meaning friends have raised money enough to pay their fare out to Colorado, California, Arizona, or New Mexico, and expect them to get work on a ranch, so as to earn their living and take the open-air treatment at the same time.

Three things are absolutely necessary for a reasonable prospect of cure of consumption. One is, abundance of fresh air, day and night. Another, abundance of the best quality of food. And the third, absolute—indeed, enforced—rest during the period of fever. Let any one of these be lacking, and your patient will die just as certainly as if all three were. *Not one in five* of those who [Pg 169] go out to climates with even a high reputation as health-resorts—expecting to earn their own living or to "rough it" in shacks or tents on three or four dollars a week, doing their own cooking and taking care of themselves—recovers. They have a four-to-one chance of recovery in *any* climate in which they can obtain these three simple requisites, and a four-to-one chance of dying in any climate in which any one of these is lacking.

Instead of nature being able to cure the consumptive unaided, as a matter of fact she has neither the ability nor the inclination to do anything of the sort. There is no class of patients whose recovery depends more absolutely upon a most careful and intelligent study and regulation of their diet, of every detail of their life throughout the entire twenty-four hours, and of the most careful adjustment of air, food, heat, cold, clothing, exercise, recreation, by the combined forces of sanitarian, nurse, and physician. So that, instead of feeling that only by reverting to savagery can consumption be prevented, we have no hesitation in saying that it is *only under civilization, and civilization of the highest type, that we have any reasonable prospect of cure*.

Finally, we are getting over our misgivings as to the intentions of the hereditary brigade. It is certainly not our enemy, and may probably turn out to be one of our best friends.

Our first sidelight on this question came in rather a surprising manner. It was taken for granted, almost as axiomatic, that if the conditions of savage life were such as to discourage, if not [Pg 170] prevent, tuberculosis, certainly, then, the race which had been exposed to these conditions for countless generations would have a high degree of resisting power to the disease. But what an awakening was in store for us! No sooner did the army surgeon and medical missionary settle down in the wake of that extraordinary world-movement of Teutonic unrest, which has resulted in the colonization of half the globe within the past two or three hundred years, than it was discovered that, although the hunting or nomad savage had not developed tuberculosis, and the disease was emphatically born of civilization, yet the moment that these healthy and vigorous children of nature were exposed to its infection, instead of showing the high degree of resisting power that might be expected, they died before it like sheep.

From all over the world—from the Indians of our Western plains, the negroes of our Southern States, the islanders of Polynesia, New Zealand, Hawaii, Samoa—came reports of tribes practically wiped out of existence by the "White Plague" of civilization. To-day the death-rate from tuberculosis among our Indian wards is from *three to six times* that of the surrounding white populations. The negro population of the Southern States has nearly three times the death-rate of the white populations of the same states. Instead of centuries of civilization having made us more susceptible to the disease than those savages who probably most nearly parallel our ancestral conditions of a thousand to fifteen hundred years ago, we seem to have acquired from three to five times their resisting power against it. Not only this, but those races among us which [Pg 171] have been continuous city-dwellers for a score of generations past have acquired a still higher degree of immunity.

In every civilized land the percentage of deaths from tuberculosis among the Jews, who, from racial and religious prejudices, have been prisoners of the Ghetto for centuries, is about half to one-third that of their Gentile neighbors. In certain blocks of the congested districts of New York and Chicago, for instance, the Jewish population shows a death-rate of only one hundred and sixty-three per hundred thousand living, while the Gentile inhabitants of similar blocks show the appalling rate of five hundred and sixty-five. Similarly, by a strange apparent paradox, the highest mortality from tuberculosis in the United States is not in those states having the greatest urban population, but, on the contrary, in those having the largest rural population.

The ten highest state tuberculosis death-rates contain the names of Tennessee, Kentucky, West Virginia, Virginia, and South Carolina, while New York, Pennsylvania, and Massachusetts are among the lowest.

The subject is far too wide and complicated to admit of any detailed discussion here. But, explain it as we may, the consoling fact remains that civilized races, including slum-dwellers, have a distinctly lower death-rate from tuberculosis than have savage tribes which are exposed to it even under most favorable climatic and hygienic conditions; that those races which have survived longest in city and even slum surroundings have a lower death-rate than the rest of the [Pg 172] community under those conditions; and that certain of our urban populations have lower death-rates than many of our rural ones.

As for the immediate effect of heredity in the production of the disease, the general consensus of opinion among thoughtful physicians and sanitarians now is that direct infection is at least five times as frequent a factor as is heredity; that at least eight-tenths of the cases occurring in the children of tuberculous parents are probably due to the direct communication of the disease, and that if the spread of the infection could be prevented, the element of heredity could be practically disregarded.

We are inclined to regard even the well-marked tendency of tuberculosis to attack a considerable number of the members of a given family to be due largely, in the first place, to direct infection; secondly, to the fact that that family were all submitted to the same unfavorable environment in the matter of food, of housing, of overwork, or of the New England conscience, with its deadly belief that "Satan finds some mischief still for idle hands to do."

Upon direct pathological grounds nothing is more definitely proven than that the actual inheritance of tuberculosis, in the sense of its transmission from a consumptive mother to the unborn child, is one of the rarest of occurrences. On the other hand, the feeling is general that, inasmuch as probably four-fifths of us are repeatedly exposed to the infection of tuberculosis and throw it off without developing a systemic attack of the disease, the development of a generalized [Pg 173] infection, such as we term consumption, is in itself a sign of a resisting power below the average. Should such an individual as this become a parent, the strong probability is that his children—unless, as fortunately often happens, their other parent should be as far above the average of

vigor and resisting power—would not be likely to inherit more vigor than that possessed by their ancestry. So that upon *a priori* grounds we should expect to find that the children born of tuberculous parents would be more susceptible to the infection to which they are so sure to be exposed than the average of the race. So that the marriage of consumptives should, unquestionably, upon racial grounds, be discouraged except after they have made a complete recovery and remained well at least five years.

To sum up: while the earlier steps of civilization unquestionably provide that environment which is necessary for the development of tuberculosis, the later stages, with their greatly increased power over the forces of nature, their higher intelligence and their broader humanity, not merely have it in their power to destroy it, but are already well on the way to do so. [Pg 174]

CHAPTER VIII

THE GREAT SCOURGE

Not only have most diseases a living cause, and a consequent natural history and course, but they have a special method of attack, which looks almost like a preference. It seems little wonder that the terror-stricken imagination of our Stone Age ancestors should have personified them as demons, "attacking" or leaping upon their victims and "seizing" them with malevolent delight. The concrete comparison was ready to their hand in the attack of fierce beasts of prey; and as the tiger leaps for the head to break the neck with one stroke of his paw, the wildcat flies at the face, the wolf springs for the slack of the flank or the hamstring, so these different disease demons appear each to have its favorite point of attack: smallpox, the skin; cholera, the bowels; the Black Death, the armpits and the groin; and pneumonia, the lung.

There are probably few diseases which are so clearly recognized by every one and about which popular impressions are in the main so clear-cut and so correct as pneumonia. The stabbing pain in the chest, the cough, the rusty or blood-stained expectoration, the rapid breathing, all stamp it unmistakably as a disease of the lung. Its furious onset with a teeth-chattering chill, followed by a high fever and flushed face, and its rapid course toward recovery or death, mark it off sharply [Pg 175] from all other lung infections.

Its popular names of "lung fever," "lung plague," "congestion of the lungs," are as graphic and distinctive as anything that medical science has invented. In fact, our most universally accepted term for it, pneumonia, is merely the Greek equivalent of the first of these.

It is remarkable how many of our disease-enemies appear to have a preference for the lung as a point of attack. In the language of *Old Man Means* in "The Hoosier Schoolmaster," the lung is "their fav'rit holt." Our deadliest diseases are lung diseases, headed by consumption, seconded by pneumonia, and followed by bronchitis, asthma, etc.; together, they manage to account for one-fourth to one-third of all the deaths that occur in a community, young or old. No other great organ or system of the body is responsible for more than half such a mortality. Now this bad eminence has long been a puzzle, since, foul as is the air or irritating as is the gas or dust that we may breathe into our lungs, they cannot compare for a moment with the awful concoctions in the shape of food which are loaded into our stomachs. Even from the point of view of infections, food is at least as likely to be contaminated with disease-germs as air is. Yet there is no disease or combination of diseases of the whole food canal which has half the mortality of consumption alone, in civilized communities, while in the Orient the pneumonic form of the plague is a greater scourge than cholera.

It has even been suggested that there may possibly be a historic or ancestral reason for this [Pg 176] weakness to attack, and one dating clear back to the days of the mud-fish. It is pointed out that the lung is the last of our great organs to develop, inasmuch as over half of our family tree is under water. When our mud-loving ancestor, the lung-fish (who was probably "one of three brothers" who came over in the Mayflower—the records have not been kept) began to crawl out on the tide-flats, he had every organ that he needed for land-life in excellent working condition and a fair degree of complexity: brain, stomach, heart, liver, kidneys; but he had to manufacture a lung, which he proceeded to do out of an old swim-bladder. This, of course, was several years ago. But the lung has not quite caught up yet. The two or three million year lead of the other organs was too much to be overcome all at once. So carelessly and hastily was this impromptu lung rigged up that it was allowed to open from the front of the gullet or œsophagus, instead of the back, while the upper part of the mouth was cut off for its intake tube, as we have already seen in considering adenoids, thus making every mouthful swallowed cut right across the air-passages, which had to be provided with a special valve-trap (the epiglottis) to prevent food from falling into the lungs.

So, whenever you choke at table, you have a right to call down a benediction upon the soul of your long departed ancestor, the lung-fish. However applicable or remote we may regard "the bearin's of this observation," the practical and most undesirable fact confronts us to-day that this crossing and mutual interference of the air and the food-passages is a fertile cause of pneumonia, [Pg 177] inasmuch as the germs of this disease have their habitat in the mouth, and are from that lurking-place probably inhaled into the lung, as is also the case with the germs of several milder bronchitic and catarrhal affections.

It may be also pointed out that, history apart, our lung-cells at the present day are at another disadvantage as compared with all the other cells of the body, except those of the skin; and that is, that they are in constant contact with air, instead of being submerged in water. Ninety-five per cent of our body-cells are still aquatic in their habits, and marine at that, and can live only saturated with, and bathed in, warm saline solution. Dry them, or even half-dry them, and they die. Even the pavement-cells coating our skin surfaces are practically dead before they reach the air, and are shed off daily in showers.

We speak of ourselves as "land animals," but it is only our lungs that are really so. All the rest of the body is still made up of sea creatures. It is little wonder that our lungs should pay the heaviest penalty of our change from the warm and equable sea water to the gusty and changeable air.

Even if we have set down the lung as a point of the least resistance in the body, we have by no means thereby explained its diseases. Our point of view has distinctly shifted in this respect within recent years. Twenty years ago pathologists were practically content with tracing a case of illness or death to an inflammation or disease of some particular organ, like the heart, the kidney, [Pg 178] the lung, or the stomach. Now, however, we are coming to see that not only may the causation of this heart disease, kidney disease, lung disease, have lain somewhere entirely outside of the heart, kidney, or lung, but that, as a rule, the entire body is affected by the disease, which simply expresses itself more violently, focuses, as it were, in this particular organ. In other words, diseases of definite organs are most commonly the local expressions of general diseases or infections; and this local aggravation of the disease would never have occurred if the general resisting power and vigor of the entire body had not been depressed below par. So that even in guarding against or curing a disease of a particular organ it is necessary to consider and to treat the whole body.

Nowhere is this new attitude better illustrated than in pneumonia. Frank and unquestioned infection as it is, wreaking two-thirds of its visible damage in the lung itself, the liability to its occurrence and the outlook for its cure depend almost wholly upon the general vigor and rallying power of the entire body. It is perfectly idle to endeavor to avoid it by measures directed toward the protection of the lung or of the air-passages, and equally futile to attempt to arrest its course by treatment directed to the lung, or even the chest. The best place to wear a chest-protector is on the soles of the feet, and poulticing the chest for pneumonia is about as effective as shampooing the scalp for brain-fag.

This clears the ground of a good many ancient misconceptions; for instance, that the chief cause of pneumonia is direct exposure to cold or a wetting, or the inhalation of raw, cold air. Few [Pg 179] beliefs were more firmly fixed in the popular mind—and, for the matter of that, in the medical—up to fifteen or twenty years ago. It has found its way into literature; and the hero of the shipwreck in an icy gale or of weeks of wandering in the Frozen North, who must be offered up for artistic reasons as a sacrifice to the plot, invariably dies a victim of pneumonia, from his "frightful exposure," just as the victim of disappointed love dies of "a broken heart," or the man who sees the ambitions of years come crashing about his ears, or the woman who has lost all that makes life worth living, invariably develops "brain fever."

There is a physical basis for all of these standard catastrophes, but it is much slenderer than is usually supposed. For instance, almost every one can tell you how friends of theirs have "brought on congestion of the lungs," or pneumonia, by going without an overcoat on a winter day, or breaking through the ice when skating, or even by getting their feet wet and not changing their stockings; and this single dramatic instance has firmly convinced them that the chief cause of "lung fever" is a chill or a wetting. Yet when we come to tabulate long series of causes, rising into thousands, we find that the percentage in which even the patients themselves attribute the disease to exposure, or a chill, sinks to a surprisingly small amount. For instance, in the largest series collected with this point in mind, that of Musser and Norris, out of forty-two hundred cases only seventeen per cent gave a history of exposure and "catching cold"; and the smaller series [Pg 180] range from ten to fifteen per cent. So that, even in the face of the returns, not more than one-fifth of all cases of pneumonia can reasonably be attributed to chill. And when we further remember that under this heading of exposure and "catching cold" are included many mere coincidences and the chilly sensations attending the beginning of those milder infections which we term "common colds," it is probable that even this small percentage could be reduced one-half. Indeed, most cautious investigators of the question have expressed themselves to this effect. This harmonizes with a number of obstinate facts which have long proved stumbling-blocks in the way of the theory of exposure as a cause of pneumonia. One of the classic ones was that, during Napoleon's frightful retreat from Moscow in the dead of winter, while his wretched soldiers died by thousands of frost-bite and starvation, exceedingly little pneumonia developed among them. Another was that, as we have already seen with colds, instead of being commoner and more frequent in the extreme Northern climate and on the borders of the Arctic Zone, pneumonia is almost unknown there. Of course, given the presence of the germ, prolonged exposure to cold may depress the vital powers sufficiently to permit an attack to develop.

Again, the ages at which pneumonia is both most common and most deadly, namely, under five and over sixty-five, are precisely those at which this feature of exposure to the weather plays the most insignificant part. Last and most conclusive of all, since definite statistics have begun to be [Pg 181] kept upon a large scale, pneumonia has been found to be emphatically a disease of cities, instead of country districts. Even under the favorable conditions existing in the United States, for instance, the death-rate per hundred thousand living, according to the last census, was in the

cities two hundred and thirty-three, and for the country districts one hundred and thirty-five,—in other words, nearly seventy per cent greater in city populations.

How, then, did the impression become so widely spread and so firmly rooted that pneumonia is chiefly due to exposure? Two things, I think, will explain most of this. One is, that the disease is most common in the winter-time, the other, that like all febrile diseases it most frequently begins with sensations of chilliness, varying all the way from a light shiver to a violent chill, or *rigor*. The savage, bone-freezing, teeth-rattling chill which ushers in an attack of pneumonia is one of the most striking characteristics of the disease, and occurs in twenty-five to fifty per cent of all cases.

Its chief occurrence in the winter-time is an equally well-known and undisputed fact, and it has been for centuries set down in medical works as one of the diseases chiefly due to changes in temperature, humidity, and directions of the wind. Years of research have been expended in order to trace the relations between the different factors in the weather and the occurrence of pneumonia, and volumes, yes, whole libraries, published, pointing out how each one of these factors, the temperature, humidity, direction of wind, barometric pressure, and electric tension, [Pg 182] is in succession the principal cause of the spread of this plague. Many interesting coincidences were shown. But one thing always puzzled us, and that was, that the heaviest mortality usually occurred, not just at the beginning of winter, when the shock of the cold would be severest, nor even in the months of lowest temperature, like December or January, but in the late winter and the early spring. Throughout the greater part of the temperate zone the death-rate for pneumonia begins to rise in December, increases in January, goes higher still in February, reaching its climax in that month or in March. April is almost as bad, and the decline often doesn't fairly set in until May.

No better illustration could probably be given of the danger of drawing conclusions when you are not in possession of all the facts. One thing was entirely overlooked in all this speculation until about twenty years ago,—that pneumonia was due not simply to the depressing effects of cold, but to a specific germ, the pneumococcus of Fraenkel. This threw an entirely new light upon our elaborate weather-causation theories. And while these still hold the field by weight of authority and that mental inertia which we term conservatism, yet the more thoughtful physicians and pathologists are now coming to regard these factors as chiefly important according to the extent to which we are crowded together in often badly lighted and ill-ventilated houses and rooms, with the windows and doors shut to save fuel, thus affording a magnificent hothouse hatching-ground for such germs as may be present, and ideal facilities for their communication from one victim to [Pg 183] another. At the same time, by this crowding and the cutting off of life and exercise in the open air which accompanies it, the resisting power of our bodies is lowered. And when these two processes have had an opportunity of progressing side by side for from two to three months; when, in other words, the soil has been carefully prepared, the seed sown, and the moist heat applied as in a forcing-house, then we suddenly reap the harvest. In other words, the heavy crop of pneumonia in January, February, and March is the logical result of the seed-sowing and forcing of the preceding two or three months.

The warmth of summer is even more depressing in its immediate effects than the cold of winter, but the heat carries with it one blessing, in that it drives us, willy-nilly, into the open air, day and night. And on looking at statistics we find precisely what might have been expected on this theory, that the death-rate for pneumonia is lowest in July and August.

It might be said in passing that, in spite of our vivid dread of sunstroke, of cholera, and of pestilence in hot weather, the hot months of the year in temperate climates are invariably the months of fewest diseases and fewest deaths. Our extraordinary dread of the summer heat has but slender rational physical basis. It may be but a subconscious after-vibration in our brain cells from the simoons, the choleras, and the pestilences of our tropical origin as a race. Open air, whether hot, cold, wet, dry, windy, or still, is our best friend, and house air our deadliest enemy. [Pg 184]

If this view be well founded, then the advance of modern civilization would tend to furnish a more and more favorable soil for the spread of this disease. This, unfortunately, is about the conclusion to which we are being most unwillingly driven. Almost every other known infectious disease is diminishing, both in frequency and in fatality, under civilization. Pneumonia alone defies our onslaughts. In fact, if statistics are to be taken at their surface-value, we are facing the appalling situation of an apparently marked increase both in its prevalence and in its mortality. For a number of years past, ever since, in fact, accurate statistics began to be kept, pneumonia has been listed as the second heaviest cause of death, its only superior being tuberculosis.

About ten years ago it began to be noticed that the second competitor in the race of death was overtaking its leader, and this ghastly rivalry continued until about three years ago pneumonia forged ahead. In some great American cities it now occupies the bad eminence of the most fatal single disease on the death-lists.

The situation is, however, far from being as serious and alarming as it might appear, simply from this bald statement of statistics. First of all, because the forging ahead of pneumonia has been due in greater degree to the falling behind of tuberculosis than to any actual advance on its part. The death-rate of tuberculosis within the last thirty years has diminished between thirty and forty per cent; and pneumonia at its worst has never yet equaled the old fatality of tuberculosis. Furthermore, all who have carefully studied the subject are convinced that much of this apparent [Pg 185] increase is due to more accurate and careful diagnosis. Up to ten years or so ago it was generally believed that pneumonia was rare in young children. Now, however, that we make the diagnosis with a microscope, we discover that a large percentage of the cases of capillary bronchitis,

broncho-pneumonia, and acute congestion of the lung in children are due to the presence of the pneumococcus. Similarly, at the other end of the line, deaths that were put down to bronchitis, asthma, heart failure, yes, even to old age, have now been shown on bacteriological examination to be due to this ubiquitous imp of malevolence; so that, on the whole, all that we are probably justified in saying is that pneumonia is not decreasing under civilization. This is not to be wondered at, inasmuch as the inevitable crowding and congestion which accompanies civilization, especially in its derivative sense of "citification," tends to foster it in every way, both by multiplying the opportunities for infection and lowering the resisting power of the crowded masses.

Moreover, it was only in the last ten years, yes, within the last five years, that we fairly grasped the real method and nature of the spread of the disease, and recognized the means that must be adopted against it. And as all of these factors are matters which are not only absolutely within our own control, but are included in that programme of general betterment of human comfort and vigor to which the truest intelligence and philanthropy of the nation are now being directed, the outlook for the future, instead of being gloomy, is distinctly encouraging. [Pg 186]

Our chief difficulty in discovering the cause of pneumonia lay in the swarm of applicants for the honor. Almost every self-respecting bacteriologist seemed to think it his duty to discover at least one, and the abundance and variety of germs constantly or accidentally present in the human saliva made it so difficult positively to isolate the real criminal that, although it was identified and described as long ago as 1884 by Fraenkel, the validity of its claim was not generally recognized and established until nearly ten years later.

It is a tiny, inoffensive-looking little organism, of an oval or lance-head shape, which, after masquerading under as many aliases as a confidence man, has finally come to be called the pneumococcus, for short, or "lung germ." Though by those who are more precise it is still known as the *Diplococcus pneumoniæ* or *Diplococcus lanceolatus*, from its faculty of usually appearing in pairs, and from its lance-like shape. Its conduct abounds in "ways that are dark and tricks that are vain," whose elucidation throws a flood of light upon a number of interesting problems in the spread of disease.

First of all, it literally fulfills the prognostic of Scripture, that "a man's foes shall be they of his own household," for its chosen abiding place and normal habitat is no less intimate a place than the human mouth. Outside of this warm and sheltering fold it perishes quickly, as cold, sunlight, and dryness are alike fatal to it.

We could hardly believe the evidence of our senses when studies of the saliva of perfectly healthy individuals showed this deadly little bacillus to be present in considerable numbers in from [Pg 187] fifteen to forty-five per cent of the cases examined. Why, then, does not every one develop pneumonia? The answer to this strikes the keynote of our modern knowledge of infectious disease, namely, that while an invading germ is necessary, a certain breaking down of the body defenses and a lowering of the vital resistance are equally necessary. These invaders lie in wait at the very gates of the citadel, below the muzzles of our guns, as it were, waiting for some slackening of discipline or of watchfulness to rush in and put the fortress to sack. Nowhere is this more strikingly true than in pneumonia. It is emphatically a disease where, in the language of the brilliant pathologist-philosopher Moxon, "While it is most important to know what kind of a disease the patient has got, it is even more important to know what kind of a patient the disease has got."

The death-rate in pneumonia is an almost mathematically accurate deduction from the age, vigor, and nutrition of the patient attacked. No other disease has such a brutal and inveterate habit of killing the weaklings. The half-stifled baby in the tenement, the underfed, overworked laboring man, the old man with rigid arteries and stiffening muscles or waning life vigor, the chronic sufferer from malnutrition, alcoholism, Bright's disease, heart disease—*these* are its chosen victims.

Another interesting feature about the pneumococcus is its vitality outside of the body. If the saliva in which it is contained be kept moist, and not exposed to the direct sunlight and in a fairly warm place, it may survive as long as two weeks. If dried, but kept in the dark, it will survive four [Pg 188] hours. If exposed to sunlight, or even diffuse daylight, it dies within an hour. In other words, under the conditions of dampness and darkness which often prevail in crowded tenements it may remain alive and malignant for weeks; in decently lighted and ventilated rooms, less than two hours. This explains why, in private practice and under civilized conditions, epidemics of this admittedly infectious disease are rare; while in jails, overcrowded barracks, prison ships, and winter camps of armies in the field they are by no means uncommon. This is vividly supported by the fact brought out in our later investigations of the sputum of slum-dwellers, carried out by city boards of health, that the percentage of individuals harboring the pneumococcus steadily increases all through the winter months, from ten per cent in December to forty-five, fifty, and even sixty per cent in February and March. The old proverb, "When want comes in at the door, Love flies out at the window," might be revised to read, "When sunlight comes in at the window the pneumococcus flies 'up the flue.'"

Authorities are still divided as to the meaning and even the precise frequency of the occurrence of the pneumococcus in the healthy human mouth. Some hold that its presence is due to recent infection which has either been unable to gain entrance to the system or is preparing its attack; others, that it is a survival from some previous mild attack of the disease, and the body tissues having acquired immunity against it, it remains in them as a harmless parasite, as is now well [Pg 189]

known to be the case with the germs of several of our infectious diseases—for instance, typhoid—for months and even years afterward. Others hold the highly suggestive view that it is a normal inhabitant of the healthy mouth, which can become injurious to the body, or *pathogenic*, only under certain depressed or disturbed conditions of the latter. In defense of this last it may be pointed out that dental bacteriologists have now already isolated and described some thirty different forms of organisms which inhabit the mouth and teeth; and the pneumococcus may well be one of these. Further, that a number of our most dangerous disease germs, like the typhoid bacillus, the bacillus of tuberculosis, and the bacillus of diphtheria, have almost perfect "doubles," law-abiding relatives, so to speak, among the germs that normally inhabit our throats, our intestines, or our immediate surroundings. The ultimate foundation question of the science of bacteriology is, How did the disease germs become disease germs? But the question is still unanswered.

However, fortunately, here, as in other human affairs, imperfect as our knowledge is, it is sufficient to serve as a guide for practical conduct. Widely present as the pneumococcus is, we know well that it is powerless for harm except in unhealthful surroundings. There is another interesting feature of its life history which is of practical importance, and that is, like many other bacilli it is increased in virulence and infectiousness by passing through the body of a patient. Flushed with victory over a weakened subject, it acquires courage to attack a stronger. This is the reason why, in those comparatively infrequent instances in which pneumonia runs through a [Pg 190] family, it is the strongest and most vigorous members of the family who are the last to be attacked. It also explains one of the paradoxes of this disease, that, while emphatically a disease of overcrowding and foul air, and attacking chiefly weakened individuals, it is a veritable scourge of camps, whether mining or military. When once three or four cases of pneumonia have occurred in a mining camp, even though this consist almost exclusively of vigorous men, most of them in the prime of life, it acquires a virulence like that of a pestilence, so that, while ordinarily not more than fifteen to twenty per cent of those attacked die, death-rates of forty, fifty, and even seventy per cent are by no means uncommon in mining camps. The fury and swiftness of this "miners' pneumonia" is equally incredible. Strong, vigorous men are taken with a chill while working in their sluicing ditches, are delirious before night, and die within forty-eight hours. So widely known are these facts, and so dreaded is the disease throughout the Far West and in mountain regions generally, that there is a widespread belief that pneumonia at high altitudes is particularly deadly.

I had occasion to interest myself in this question some years ago, and by writing to colleagues practicing at high elevations and collecting reports from the literature, especially of the surgeons of army posts in mountain regions, was somewhat surprised to find that the mortality of all cases occurring above five thousand feet elevation was almost identical with that of a similar class of [Pg 191] the population at sea-level. It is only when a sufficient number of cases occur in succession to raise the virulence of the pneumococcus in this curious manner that an epidemic with high fatality develops.

That this increase in virulence in the organism does occur was clearly demonstrated by a bacteriologist friend of mine, who succeeded in securing some of the sputum from a fatal case in the famous Tonopah epidemic of some years ago, an epidemic so fatal that it was locally known as the "Black Death." Upon injecting cultures from this sputum into guinea-pigs, the latter died in one-quarter of the time that it usually took them to succumb to a similar dose of an ordinary culture of the pneumococcus.

It is therefore evident that just as "no chain is stronger than its weakest link," so in the broad sense no community is stronger than its weakest group of individuals, and pneumonia, like other epidemics, may be well described as the vengeance which the "submerged tenth" may wreak from time to time upon their more fortunate brethren.

Now that we know that under decent and civilized conditions of light and ventilation the pneumococcus will live but an hour to an hour and a half, this reduces the risk of direct infection under these conditions to a minimum. It is obvious that the principal factors in the control of the disease are those which tend to build up the vigor and resisting power of all possible victims. The more broadly we study the disease the more clearly do the data point in this direction.

First of all, is the vivid and striking contrast between hospital statistics and those gathered from [Pg 192] private practice. While many individuals of a fair wage-earner's income and good bodily vigor are treated in our hospitals, yet the vast majority of hospital patients are technically known as the "hospital classes," apt to be both underfed, overworked, and overcrowded. On the other hand, while a great many both of the very poor and even of the destitute are treated in private practice, yet the majority of such cases who feel "able to afford a doctor," as they say, are among the comparatively vigorous, well-fed, and well-housed section of the community. And the difference between the death-rate of the two classes in pneumonia is most significant. In private practice, while epidemics differ in virulence, the rate ranges all the way from five per cent to fifteen per cent, the average being not much in excess of ten per cent, occasionally falling as low as three per cent. In the hospital reports on the contrary the death-rate begins at twenty per cent and climbs to thirty, forty, and forty-five per cent. It is only fair to say, of course, that hospital statistics probably include a larger percentage of more serious cases, the milder ones being taken care of at home, or not presenting themselves for treatment at all. But even when this allowance has been made, the contrast is convincing.

A similar influence is exercised by age. Although pneumonia is common at all ages, its heaviest

death-rate falls at the two extremes, under six years of age and over sixty, with a strong preponderance in the latter. Under five years of age, the mortality may reach twenty to thirty per cent; from five to twenty-five, not more than four to five per cent; from twenty-five to thirty-five, [Pg 193] from fifteen to twenty per cent; and so on, increasing gradually with every decade until by sixty years of age the mortality has reached fifty per cent, and from sixty to seventy-five may be expressed in terms of the age of the patient. One consoling feature, however, about it is that its mortality is lowest in the ages at which it is most frequent, namely, from ten to thirty-five years of age. And its frequency diminishes even more rapidly than its fatality increases in later years. So that while it is much more serious in a middle-aged man, he is less liable to develop it than a younger one. Where the mortality from pneumonia is highest, is in the most densely populated wards, especially among negroes and foreigners of the hospital class, in individuals who are victims of chronic alcoholism, and also among those who are for long periods insufficiently nourished. Lastly, it is only within comparatively recent years that we have come clearly to recognize the large rôle which pneumonia plays in giving the finishing stroke to chronic diseases and degenerative processes. It is, for instance, one of the commonest actual causes of death in Bright's disease, in diabetes, in lingering forms of tuberculosis, and in heart disease; and last of all, in that progressive process of normal degeneration and decay which we term "Old Age." It is one of the most frequent and fatal of what Flexner described a decade ago as "terminal infections." Very few human beings die by a gradual process of decay, still less go to pieces all at once, like the immortal "One-Hoss Shay." Just as soon as the process has progressed far enough [Pg 194] to lower the resisting power below a certain level, some acute infection steps in and mercifully ends the scene. This is peculiarly true of pneumonia in old age.

To the medical profession to "die of old age" is practically equivalent to dying of pneumonia. The disease is so mild in its symptoms and so rapid in its course that it often utterly escapes recognition as such.

The old man complains of a little pain in his chest, a failure of appetite, a sense of weakness and dizziness. He takes to his bed, within forty-eight hours he becomes unconscious, and within twenty-four more he is peacefully breathing his last. After death, two-thirds of the lung will be found consolidated. So mild and rapid and painless is the process that one physician-philosopher actually described pneumonia as "the friend of old age."

When once the disease has obtained a foothold in the body its course, like one of Napoleon's campaigns, is short, sharp, and decisive. Beginning typically with a vigorous chill, sometimes so suddenly as to wake the patient out of a sound sleep, followed by a stabbing pain in the side, cough, high fever, rapid respiration, the sputum rusty or orange-colored from leakage of blood from the congested lung, within forty-eight hours the attacked area of the lung has become congested; in forty-eight more, almost solidified by the thick, sticky exudate poured out from the blood-vessels, which coagulates and clots in the air cells. So complete is this solidification that sections of the attacked lung, instead of floating in water as normal lung-tissue will, sink [Pg 195] promptly. The severe pain usually subsides soon, but the fever, rapid respiration, flushed face, with or without delirium, will continue for from three to seven or eight days. Then, as suddenly as the initial attack, comes a plunge down of the temperature to normal. Pain and restlessness disappear, the respiration drops from thirty-five or forty to fifteen or twenty per minute, and the disease has practically ended by "*crisis*." Naturally, after such a furious onslaught, the patient is apt to be greatly weakened. He may have lost twenty or thirty pounds in the week of the fever, and from one to three weeks more in bed may be necessary for him to regain his strength. But the chief risk and danger are usually over within a week or ten days at the outside.

Violent and serious as are the changes in the lung, it is very seldom that death comes by interference with the breathing space. In fact, while regarded as a lung disease, we are now coming to recognize that the actual cause of death in fatal cases is the overwhelming of the heart by the toxins or poisons poured into the circulation from the affected lung. The mode of treatment is, therefore, to support the strength of the patient in every way, and measures directed to the affected lung are assuming less and less importance in our arsenal of remedies. Our attitude is now very similar to that in typhoid, to support the strength of the patient by judicious and liberal feeding, to reduce the fever and tone up his blood-vessels by cool sponging, packing, and even bathing; to relieve his pain by the mildest possible doses of sedatives, knowing [Pg 196] that the disease is self-limited, and that in patients in comfortable surroundings and fair nutrition from eighty to ninety per cent will throw off the attack within a week. So completely have we abandoned all idea of medicating or protecting the lung as such, that in place of overheated rooms, loaded with vapor by means of a steam kettle, for its supposed soothing effect upon the inflamed lung, we now throw the windows wide open. And some of our more enthusiastic clinicians of wide experience are actually introducing the open-air cure, which has worked such wonders in tuberculosis, in the treatment of pneumonia. In more than one of our New York hospitals now, particularly those devoted to the care of children, following the brilliant example of Dr. William Northrup, wards are established for pneumonia cases out on the roof of the hospital, even when the snow is banked up on either side, and the covering is a canvas tent. Nurses, physicians, and ward attendants are clothed in fur coats and gloves, the patients are kept muffled up to the ears, with only the face exposed; but instead of perishing from exposure, little, gasping, struggling tots, whose cases were regarded as practically hopeless in the wards below, often fall into the sleep that is the turning point toward recovery within a few hours after being placed in this winter roof-garden.

In short, our motto may be said to be, "Take care of the patient, and the disease will take care of

itself."

Though pneumonia is one of our most serious and most fatal of diseases, yet it is one over whose [Pg 197]
cause, spread, and cure we are obtaining greater and greater control every day, and which
certainly should, within the next decade, yield to our attack, as tuberculosis and typhoid are
already beginning to do. [Pg 198]

CHAPTER IX

THE NATURAL HISTORY OF TYPHOID FEVER

Why should not a disease have a natural history, as well as an individual? At first sight, this might appear like a reversion to the old, crude theory of disease as a demonic obsession, or invasion by an evil spirit, of which traces still remain in such expressions as, "She was *seized* with a convulsion," "He was strong enough to *throw off* the illness," "He was *attacked* by a fever," etc. But apart entirely from such conceptions, which were perfectly natural in the infancy of the race, while clearly recognizing that disease is simply a perverted state of nutrition or well-being in the body of the patient, a disturbance of balance, so to say, yet it is equally true that it has a birth, an ancestry, a life-course, and a natural termination, or death.

This recognition of the natural causation and development of disease has been one of the greatest triumphs, not merely of pathology, but of intelligence and rationalism. It has done more to diminish that dread of the unknown which hangs like a black pall of terror over the mind of the savage and the semi-civilized mind than any other one advance. It contributes enormously to our courage, our hopefulness, and our power of protection in more ways than one: first of all, by revealing to us the external cause of disease, usually some careless, dirty, or bad habit on the [Pg 199]
part of an individual or of the community, and thus enabling us to limit its spread and even exterminate it; secondly, by assuring us that nearly all diseases, excepting a few of the most obstinate and serious, have not only a definite beginning, but a definite end, are, in fact, if left to themselves, self-limited, either by the exhaustion and loss of virulence of their cause, or by the resisting power of the body.

All infectious diseases, and many others, tend to run a definite course of so many days, or so many weeks, within certain limits, and at least ninety per cent of them tend to terminate in recovery. It is a most serious and fatal disease which has a death-rate of more than twenty per cent. Typhoid, pneumonia, diphtheria, and yellow fever all fall below this, smallpox barely reaches it, and only the bubonic plague, cholera, and lockjaw rise habitually above it. The recognition of this fact has enormously increased the efficiency of the medical profession in dealing with disease, by putting us on the track of imitating the methods which the body itself uses for destroying, or checking the spread of, invading germs and leading us to trust nature and try to work with her instead of against her. Our antitoxins and anti-serums, which are our brightest hope in therapeutics at present, are simply antidotes which are formed in the blood of some healthy, vigorous animal against the bacillus whose virulence we wish to neutralize, such as that of diphtheria or septicemia.

Diphtheria antitoxin, for instance, the first and best known triumph of the new medicine, is the antidotal substance formed in the blood of a horse in response to a succession of increasing doses [Pg 200]
of the bacilli of diphtheria. Similar antidotal substances are formed in the blood in all other non-fatal cases of infectious diseases, such as typhoid, pneumonia, blood-poisoning, etc.; and the point at which they have accumulated in sufficient amounts to neutralize the poison of the invading germs, forms the crisis, or "turn" of the disease. So that when we speak of a disease "running its course," we mean continuing for such length of time as the body needs to produce anti-bodies in sufficient amounts to check it.

The principal obstacle to the securing of antitoxins like that of diphtheria for all our infectious diseases is, that their germs form their poison so slowly that it is difficult to collect it in sufficient amounts to produce a strong concentrated antitoxin in the animal into which it is injected. But the overcoming of this difficulty is probably only a question of time.

Obviously, if infectious disease be, as we say, "self-limited," that is to say, if the body will defeat the invaders with its own weapons, on an average in nine cases out of ten, our wisest course, as physicians, is to back up the body in its fight. This we now do in every possible way, by careful feeding, by rest, by bathing, by an abundance of pure water and fresh air, with the gratifying result that we have already reduced the death-rate in most fevers, even such as we have no antitoxin against, or may not even have discovered the causal germ of, to one-half and even three-fourths of their former fatality. The recognition of the fact that disease has a natural history, a birth, a term of natural life and a death, has already turned a hopeless fight in the dark [Pg 201]
into a victorious campaign in broad daylight. Huxley's pessimistic saying that typhoid was like a fight in the dark between the disease and the patient, and the doctor like a man with a club striking into the mélée, sometimes hitting the disease and sometimes the patient, is no longer true since the birth of bacteriology.

Nowhere can the natural history of disease be more clearly seen or more advantageously studied than in the case of typhoid fever.

The cause of typhoid is simplicity itself, merely drinking the excreta of some one else, "eating dirt," in the popular phrase; simple, but of a deadly effectiveness, and disgracefully common. The demon may be exorcised by an incantation of one sentence: *Keep human excreta out of the drinking water*. This sounds simple, but it is n't. Eternal vigilance is the price of health as well as of liberty.

We can, however, make our pedigree of typhoid a little more precise. It is not merely dirt of human origin which is injurious, but dirt of a particular type, namely, discharges from a previous case of the disease. Just as in the fight against malaria we have not the enormous problem of the extermination of all varieties of mosquito, but only of one particular genus, and only the infected specimens of that, so in typhoid, the contamination of water or food which we have to guard against is that from previous cases. From one point of view, this leaves the problem as wide as ever, for, obviously, the only way to insure against poisoning of water by typhoid discharges is to [Pg 202] shut out absolutely all sewage contamination. On the other hand, it is of immense advantage in this regard,—it enables us to fight the enemy at both ends of the line, to turn his flank as well as crush his centre.

While we are protecting our water-supplies against sewage, we can, in the meantime, render that sewage comparatively harmless by thoroughly disinfecting and sterilizing all discharges from every known case of the disease. A similar method is used in the fight against yellow fever and malaria. Not only are the breeding places of the two mosquito criminals broken up, but each known case of the disease is carefully screened, *so as to prevent the insects from becoming infected*, and thus able to transmit the disease to other human victims.

It cannot be too emphatically insisted upon that every case of typhoid, like every case of yellow fever and of malaria, *comes from a previous case*. It is neither healthy nor exhilarating to drink a clear solution of sewage, no matter how dilute; but, as a matter of fact, it is astonishing how long communities may drink sewage-laden water with comparative impunity, so long as the sewage contains no typhoid discharges. One case of typhoid fever imported into a watershed will set a city in a blaze.

The malevolent *Deus* in the sewage *machina* is, of course, a germ—the *Bacillus typhosus* of Eberth. The astonishing recentness of much of our most important knowledge is nowhere better illustrated than in the case of typhoid. Although there had been vague descriptions of a fatal fever, slow and lingering in its character and accompanied by prolonged stupor and delirium, [Pg 203] which was associated with camps and dirty cities and famines, from as far back as the age of Cæsar, the first description clear enough to be recognizable was that of Willis, of an epidemic during the English civil war in 1643, both Royalist and Roundhead armies being seriously crippled by it. Since that time a smouldering, slowly spreading fever has been pretty constantly associated with armies in camps, besieged cities, filthy jails, and famines, to which accordingly have been given the names, familiar in historical literature, of "famine fever," "jail fever," and "military fever."

So slowly, however, did accurate knowledge come, that it was actually not until 1837 that it was clearly and definitely recognized that this famine fever was, like Mrs. Malaprop's Cerberus, "two gentlemen at once," one form of it being typhus or "spotted fever," which has now become almost extinct in civilized communities; the other, the milder, but more persistent form, which, like the poor, we have always with us, called, from its resemblance to the former, "typhoid" (typhus-like).

Typhus was a far more virulent, rapid, and fatal fever than its twin survivor, though as to the relations between the two diseases, if any, we are quite in the dark, as the former practically disappeared before the days of bacteriology. The fact of its disappearance is both significant and interesting, in that it was unquestionably due to the ranker and viler forms of both municipal and individual filthiness and unsanitariness, which even our moderate progress in civilization has now [Pg 204] abolished. There can be no question that, with a step higher in the scale of cleanliness, and further quickening of the biologic conscience, typhoid will also disappear.

Typhus, the bubonic plague, the sweating sickness, were alike plagues and products of times when table-scraps were thrown on the dining-room floor and covered daily with fresh rushes for a week at a stretch, and fertilizer accumulated in a living-room as now in a modern stable. Clothing was put on for the season, shirts were unknown, and strong perfumes took the place of a bath. Michelet's famous characterization of the Middle Ages in one phrase as *Un mille ans sans bain* (a thousand years without a bath) was painfully accurate.

Doubtless certain habits of our own to-day will be regarded with equal disgust by our descendants. Typhus, by the way, may possibly be remembered by the dramatic "Black Assize" of Oxford, in 1577, in which not merely the wretched prisoners in the jail, but the jurors, the lawyers, the judges, and every official of the court were attacked, and many of them died.

It was only in 1856 that the method of transmission of the disease was clearly recognized, and in 1880 that the bacillus was discovered and identified by the bacteriologist Eberth, whose name it bears, so that it is only within the last thirty years that real weapons have been put into our hands with which to begin a fight of extermination against the disease.

What is the habitat of our organism, and is it increasing its spread? Its habitat is the entire civilized world, and it goes wherever civilization goes. In this sense its spread is increasing, but, [Pg 205] in every other, we have good ground for believing that it is on the wane. Positive assurance, either one way or the other, is, of course, impossible, simply for the reason that the disease was

not recognized until such a short time ago that no statistics of any real value for comparison are available; and, secondly, because even to-day, on account of its insidious character and the astonishing variety of its forms, and degrees of mildness and virulence, a considerable percentage of cases are yet unrecognized and unreported.

It might be mentioned in passing that this statement applies to the alleged increase of nearly all diseases which are popularly believed to be modern inventions, like appendicitis, insanity, and cancer. We have no statistics more than thirty years old which are of real value for purposes of comparison.

However, when it comes to the number of deaths from the disease, there is a striking and gratifying diminution for twenty years past, which is increasing in ratio instead of diminishing. That we are really getting control of typhoid is shown by the, at first sight, singular and decidedly unexpected fact that it is no longer a disease of cities, but of the country. The death-rate per thousand living in the cities of the United States is lower than in the rural districts. For instance, the mortality in the State of Maryland, outside of Baltimore, is two and one-half times as great as that in the city itself. Our period of greatest outbreak in the large cities is now the month of September, when city dwellers have just returned from their vacations in the pure and healthful [Pg 206] country, bringing the bacilli in their systems.

The moral is obvious. Great cities are developing some sort of a sanitary conscience. Farmers and country districts have as yet little or none. Bad as our city water often is, and defective as our systems of sewage, they cannot for a moment compare in deadliness with that most unheavenly pair of twins, the shallow well and the vault privy. A more ingenious combination for the dissemination of typhoid than this precious couple could hardly have been devised. The innocent householder sallies forth, and at an appropriate distance from his cot he digs two holes, one about thirty feet deep, the other about four. Into the shallower one he throws his excreta, while upon the surface of the ground he flings abroad his household waste from the back stoop. The gentle rain from heaven washes these various products down into the soil and percolates gradually into the deeper hole. When the interesting solution has accumulated to a sufficient depth, it is drawn up by the old oaken bucket or modern pump, and drunk. Is it any wonder that in this progressive and highly civilized country three hundred and fifty thousand cases of typhoid occur every year, with a death penalty of ten per cent? Counting half of these as workers, and the period of illness as two months, which would be very moderate estimates, gives a loss of productive working time equivalent to thirty thousand years. Talk of "cheap as dirt"! It is the most expensive thing there is. [Pg 207]

Typhoid still abundantly earns its old name of "military fever," and its sinister victories in war are even more renowned than its daily triumphs in peace. Strange as it may seem, the deadliest enemies of the soldier are not bullets but bacilli, and sewage is mightier than the sword. For instance, in the Franco-Prussian War, typhoid alone caused sixty per cent of all the deaths. In the Boer War it caused nearly six thousand deaths as compared with seven thousand five hundred from wounds in battle, while other diseases caused five thousand more. In the majority of modern campaigns, from two-thirds to five-sixths of all deaths are due to disease and not to battle. It may be that we sanitarians will achieve the ends of the peace congresses by an unexpected route, and make war a healthful and comparatively harmless form of national gymnastics. Its battle-mortality rate, for the number engaged, is not so very far above football now!

Given the bacillus, how does it get into the human system? Here the evidence is so abundant and overwhelming that we may content ourselves with bald statements of fact. The three great routes of this pestilence are water, milk, and flies. Of the three, the first is far the most common and important. While only a rough statement is possible, probably eighty-five per cent of all cases from water, five per cent from milk, five per cent through flies, and five per cent through other channels, would fairly represent the percentage.

That it is conveyed through water is as certain as that the sun rises and sets. The only embarrassment in proving it lies in selecting from the swarm of instances. There is the classic [Pg 208] case of the Swiss villages on opposite sides of the same mountain chain, the second of which drew its water-supply from a spring that came through the mountain from a brooklet running by the first village. Typhoid fever broke out in the first village, and twenty days later it appeared in the second village, twenty miles away on the other side of the mountain. Colored particles thrown into the brook on one side promptly appeared in the spring upon the other. Then there was the gruesome modern instance of Plymouth, Pennsylvania, in 1885. A single case of imported typhoid occurring on the watershed of a reservoir was followed, thirty days later, by an epidemic of eleven hundred cases in a population of eight thousand.

An equally vivid instance came under my own observation. A school and a penitentiary drew their water-supply from the same power-flume, carrying a superb volume of purest water from a mountain stream. Early in the autumn a single case of typhoid appeared in a small town near the head of the flume. The discharges were thrown into the swiftly running water. Two weeks later an epidemic of typhoid broke out in the school, and three weeks later in the penitentiary. An unexpected freak, however, was the appearance of fifteen or twenty cases in another state institution farther down on the same stream, which did not draw its water-supply from the flume, but from deep wells of tested purity. This was a puzzle, until it was found that, owing to a fall in the wells, the water from the flume had been used for sprinkling and washing purposes in the [Pg 209] institution, being allowed to run through the water-pipes only at night, while the well-water was used in the daytime. This was enough to contaminate the pipes, and a small epidemic began,

which promptly stopped as soon as the cause was suspected and the flume-water no longer used.

This last instance is peculiarly interesting, as illustrating how typhoid infection gets into milk, the second—though at a long interval—most frequent means of its spread. It does not come from the cow, for, fortunately, none of the domestic animals, with the possible exception of the cat, is subject to typhoid. Nor is it possible that cattle, drinking foul and even infected water, can transmit the bacillus in their milk. That superstition was exploded long ago. Every epidemic of typhoid spread by milk—and there are scores of them now on record—can be traced to the handling of the milk by persons suffering from mild forms of typhoid, or engaged in waiting upon members of the family who are ill of the disease, or the dilution of milk with infected water, or even, almost incredible as it may seem, to such slight contamination as washing the cans with infected water.

Health officers now watch like hawks for the appearance of any case of typhoid among or in the families of dairymen. The New York City Board of Health, for instance, requires the weekly filing of a certificate from the family physician of all dairymen that no such cases exist. And the more intelligent dairymen keep a vigilant eye upon any appearance of illness accompanied by fever among their employees, some that I have known even keeping a fever thermometer in the barn [Pg 210] for the purpose of testing every suspicious case. How effective such precautions can be made may be illustrated by the fact that, in the past five years, there has not been a single epidemic of typhoid traceable to milk in Greater New York, even with its inadequate corps of ten inspectors, and the six states they have to cover. The moment a single case of typhoid appears, the dairy or milkman supplying that customer is given a most rigid special inspection, and, if any source of infection can be discovered, the milk is shut out of New York City until the department is satisfied that all danger has been removed. One or two lessons of this sort are enough for a whole county of dairymen. The danger of transmission of typhoid through milk has been enormously exaggerated, and, as in the case of all other milk-borne diseases, is entirely due to filthy handling, and may be prevented by intelligent sanitary policing. Even with our present exceedingly imperfect systems, probably not more than between five and ten per cent of typhoid is transmitted in this way; and, if the water-supply were kept clean, this would practically disappear.

Typhoid may not only be transmitted from the earth beneath and the water under the earth, but also from the heavens above, through the medium of flies and dust. The first method is bulking larger every day, especially in country districts and in camps. The *modus operandi* is simplicity itself. The fly lives and moves and has its being in dirt. It breeds in dirt and it feeds on food, and, as it never wipes its feet, the interesting results can be imagined. Just to dispel any possible [Pg 211] doubt, plates of gelatine have been exposed where flies could walk on them, then placed in an incubator, and within forty-eight hours there was a clearly recorded track of the footprints of the flies written in clumps of bacilli sown by their filthy feet. More definitely, flies have been caught in the houses of typhoid patients, put under the microscope, and their feet, stomachs, and specks found swarming with typhoid bacilli. A single flyspeck may contain three thousand.

Fortunately, we have a simple and effective remedy. We cannot disinfect the fly nor make him wipe his feet, but we *can* exterminate him utterly! This sounds difficult, but it isn't. Like the mosquito, the fly can only breed in one particular kind of place, and that place is a heap of dirt, preferably horse manure, but, at a pinch, dust-bins, garbage-cans, sweepings under porches or behind furniture, vaults,—anywhere that dirt is allowed to remain undisturbed for more than a week at a stretch. Abolish, screen, or poison these dirt accumulations, and flies will disappear, and with them not merely risks from typhoid, but half a dozen other diseases, as well as all sorts of filth and much discomfort and inconvenience. It was largely through flies that the disgraceful epidemic of typhoid, which ravaged our camps on our own soil during the Spanish-American War and killed many times more than fell by Spanish bullets, was spread.

It is also believed that typhoid bacilli may be carried in the infected dust of streets and camps. Here again we are dealing with a dangerous public enemy to both health and comfort, which can [Pg 212] and ought to be abated by cleanliness, oilings, and sprinklings. Typhoid bacilli are also occasionally carried by shellfish, especially oysters, on account of the interesting modern custom of planting them in bays and harbors near the mouths of sewers to fatten them. The cheerful motto of the oysterman is, "The muddier the water the fatter the oyster." And nowhere do the bivalves plump up more quickly than near the mouth of a sewer.

The last method of transmission is by direct contact with the sick. This is a relatively rare means of spread, so much so that it is generally stated that typhoid is not contagious; but it is a real source of danger and one against which precautions should by all means be taken. The only method is, of course, by the soiling of the hands of the nurse or other attendant, and then eating or touching food, or putting the fingers into the mouth before thoroughly cleansing. If the hands be washed with a strong antiseptic solution after waiting upon the patient, and the cheerful habit sometimes indulged in of putting fruit or other delicacies into the sick-room for a day or so, in the hope that they may tempt the appetite of the patient, and then taking them out and letting the children eat them as a treat, be abolished, and the nurse be not allowed to officiate in the kitchen, risk from this source will be done away with.

When the bacillus has been introduced into the stomach through food or drink, it rapidly proceeds to diffuse itself throughout the tissues of the body. Because the most striking symptoms of the disease are diarrhœa, abdominal distention, and pain, and the most striking lesions after [Pg 213] death ulcers in the small intestine, it was supposed that the process was confined to the

abdominal organs. This is now known to be an error, as cultures and examinations made from the blood and various parts of the body have shown the presence of the typhoid bacillus in almost every organ and tissue. This process of scattering, or invasion of the body, takes from three to ten days to accomplish; and the first sign of trouble is usually a feeling of depression, with headache, and perhaps slight nausea, before any characteristic bowel symptoms begin to show themselves.

The general invasion of the system throws an interesting sidelight upon the subject of premonitions. There are several well authenticated cases on record where individuals just before coming down with typhoid have been strangely impressed with a sense of impending death, and have even gone so far as to make their wills and set their affairs in order. Because these strong impressions appeared before any clearly marked intestinal symptoms of the disease, they have been put down in popular literature as instances of the "second sight," or "sixth sense," which popular superstition believes many of us to possess under certain circumstances. Now, however, we know that the tissues of that individual were already swarming with bacilli, and his fear of impending death was simply the effect of his toxin-laden blood upon his brain centres. In other words, it was prophecy after the fact, like nearly all prophecies that happen to come true; and the "premonition" was an early symptom of the disease itself. [Pg 214]

As it is, of course, difficult to fix the precise drink of water or mouthful of food in which the infection was conveyed, we were for a long time in doubt as to the length of time which it took to spread through the system,—the "period of incubation," as it is termed,—although we knew in a general way that it averaged somewhere about ten days. But, about a year ago, fortune was kind to us. A nurse in one of the Parisian hospitals, in a fit of despondency, decided to commit suicide. Like a true Parisienne, she would be nothing if not up to date, and chose, as the most *recherché* and original method of departing this life, to swallow a pure culture of typhoid germs, which she abstracted from the laboratory. Three days later she began to complain of headache, and within a week had developed a beautiful crop of symptoms, and a typical case of typhoid, from which, under modern treatment, she promptly recovered,—a wiser and, we trust, a happier woman.

By just what avenue the infecting bacilli go from the stomach into the general system we do not know. Metschnikoff suggests that they can only penetrate the intestinal wall through wounds or abrasions of the mucous membrane, made by intestinal worms or other parasites. Certain it is that the average stomach has a considerable degree of resisting power against them, for in no known civil epidemic has the number of those who caught the disease exceeded ten per cent of the total number drinking the infected water or milk. In one or two camps in time of war the percentage has risen as high as eighteen or twenty per cent of those exposed, but this is exceptional. However, now that we know that intestinal symptoms do not constitute the entire [Pg 215] disease, and may even be entirely absent, we strongly suspect that many cases of slight depression, with feverishness, loss of appetite, and disturbances of the digestion, which occur during an epidemic, may really have been very mild cases of the disease.

One of the singular features of the disease is that, unlike many other infections, we are entirely unable to say what conditions or influences seem either to protect against it or to predispose toward it. In the days when we believed it to be an exclusively intestinal disease it was naturally supposed that chronic digestive disturbances, and especially acute attacks of bowel trouble or dysentery, would predispose to it, but this has been entirely disproved. Soldiers in barracks with chronic digestive disturbances, and even with dysentery, have shown no higher percentage of typhoid during an epidemic than others. Nor does it seem much more likely to occur in those who are constitutionally weak, or run down, or overworked, as some of the most violent and unmanageable cases occur in vigorous men and women, who were previously in perfect health. So that, although we have unquestionably a high degree of resistance against it, since not more than one in ten exposed contracts it, and only one in ten of those who contract it dies, we have not the least idea in what direction, so to speak, to build up our resisting powers in order to increase them.

The best remedy is to destroy the disease altogether, and this could be done in five years by intelligent concerted effort. It was at one time supposed that typhoid fever was a disease [Pg 216] exclusively confined to adult life; but it is now known to occur frequently in children, though often in such a mild and irregular form as to escape recognition. Something like seventy per cent of all cases occur between the fifteenth and the fortieth year, and it is, for some reason, though rarer, peculiarly serious and more often fatal after the fiftieth year.

When once the outer wall has been pierced, the sack of the city rapidly proceeds. The bacilli multiply everywhere, but seem for some reason to focalize chiefly in the alimentary canal, and especially the middle part of it, the small intestines. After headache, backache, and loss of appetite comes usually a mild diarrhœa. This diarrhœa is due to an attack of the bacillus or its toxins upon certain clumps of lymphoid tissue in the wall of the small intestine, known as the "patches of Peyer." This produces inflammation, followed by ulceration, which in severe cases may eat through the wall of a blood-vessel, causing profuse hemorrhages, or even perforate the bowel wall and set up a fatal peritonitis. The temperature begins to swing from two to five degrees above the normal level, following the usual daily vibration, and ranging from 100 degrees to 101 degrees in the morning up to 102 degrees to 105 degrees in the afternoon. The face becomes flushed.

There is usually comparatively little pain, and the patient lies in a sort of mild stupor, paying little attention to his surroundings. He is much enfeebled and seldom cares to lift his head from the

pillow. A slight rash appears upon the surface of the body, but this is so faint that it would escape attention unless carefully looked for. Little groups of vesicles, containing clear fluid, appear upon the chest and abdomen. If one of these faint rose-colored spots be pricked with a needle and a drop of blood be drawn, typhoid bacilli will often be found in it, and they will also be present in the clear fluid of the tiny sweat blisters. [Pg 217]

This condition will last for from ten days to four weeks, the patient gradually becoming weaker and more apathetic, and the temperature maintaining an afternoon level of 102 to 104 degrees. Then, in the vast majority of cases, a little decline of the temperature will be noticed. The patient begins to take a slight interest in his surroundings. He will perhaps ask for something to drink, or something to eat, instead of apathetically swallowing what is offered to him. Next day the temperature is a little lower still, and within a week, perhaps, will have returned to the normal level. The patient has lost from twenty to forty pounds, is weak as a kitten, and it may be ten days after the fever has disappeared before he asks to sit up in bed.

Then follows the period of return to health. The patient becomes a walking appetite, and, after weeks of liquid diet, will beg like a spoiled child for cookies or hard apples or pie, or something that he can set his teeth into. But his tissues are still swarming with the bacilli, and any indiscretion, either of diet, exposure, or exertion, at this time, may result in forming a secondary colony, or abscess, somewhere in the lungs, the liver, or the muscles. He must be kept quiet and warm, and abundantly, but judiciously, fed, for at least three weeks after the disappearance of the fever, if he wishes to avoid the thousand and one ambuscades set by the retreating enemy. [Pg 218]

Now, what has happened when recovery begins? One would suppose that either the bacilli had poisoned themselves, exhausted the supplies of nourishment in the body of the patient, so that the fever had "burnt itself out," as we used to say, or that the tissues had rallied from the attack and destroyed or thrown out the invaders. But, on the contrary, we find that our convalescent patient, even after he is up and walking about, is still full of the bacilli.

To put it very crudely, what has really happened is that the body has succeeded in forming such antidotes against the poison of the bacilli that, although they may be present in enormous numbers, they can no longer produce any injurious effect. In other words, it has acquired immunity against this particular germ and its toxin. In fact, one of our newest and most reliable tests for the disease consists in a curious "clumping" or paralyzing power over cultures of the *Bacillus typhosus*, shown by a drop of the patient's blood, even as early as the seventh or eighth day of the illness. And, while it is an immensely difficult and complicated subject, we are justified in saying that this immunity is not merely a substance formed in the body, the stock of which will shortly become exhausted, but a faculty acquired by the body-cells, which they will retain, like other results of education, for years, and even for life. When once the body has learned the wrestling trick of throwing and vanquishing a particular germ or bacillus, it no longer has much to dread from that germ. This is why the same individual is seldom attacked the second time by scarlet fever, measles, typhoid, and smallpox. [Pg 219]

While, however, the individual may be entirely immune to the germs of a given disease, he may carry them in his body in enormous numbers, and infect others while escaping himself.

This is peculiarly true of typhoid, and we are beginning to extend our sanitary care over recovered patients, not merely to the end of acute illness, but for the period of at least a month after they have apparently recovered. Several most disquieting cases are on record of so-called "typhoid carriers," or individuals who, having recovered from the disease itself, carried and spread the infection wherever they went for months and even years afterward. This, however, is probably a rare state of affairs, though a recent German health bulletin reports the discovery of some twenty cases during the past year. The lair of the bacilli is believed to be the gall-bladder.

As to treatment, it may be broadly stated that all authorities and schools are for once practically agreed:—

First, that we have no known specific drug for the cure of the disease.

Second, that we are content to take a leaf out of nature's book, and follow—so to speak—her instinctive methods: first of all, by putting the patient to bed the moment that a reasonable suspicion of the disease is formed; this conserves his strength, and greatly diminishes the danger of serious complications; cases of "walking typhoid" have among the highest death-rates; second, by meeting the great instinctive symptom of fever patients since the world began, thirst, encouraging the patient to drink large quantities of water, taking care, of course, that the water is pure and sterile. The days when we kept fever patients wrapped up to their necks in woolen blankets in hot, stuffy rooms, and rigorously limited the amount of water that they drank—in other words, fought against nature in the treatment of disease—have passed. A typhoid-fever patient now is not only given all he wants to drink, but encouraged to take more, and some authorities recommend an intake of at least three or four quarts, and, better, six and eight quarts a day. This internal bath helps not only to allay the temperature, but to make good the enormous loss by perspiration from the fevered skin, and to flush the toxins out of the body. [Pg 220]

Third, by liberal and regular feeding chiefly with some liquid or semi-liquid food, of which milk is the commonest form. The old attitude of mind represented by the proverb, "Feed a cold and starve a fever," has completely disappeared. One of the fathers of modern medicine asked on his death-bed, thirty years ago, that his epitaph should be, "He fed fevers."

Fourth. We respond to the other great thirst of fever patients, for coolness, by sponge baths and

tub baths, whenever the temperature rises above a certain degree.

Simple as these methods sound, they are extremely troublesome to put into execution, and require the greatest skill and judgment in their carrying out. But intelligent persistence in the careful elaboration of these methods of nature has resulted in already cutting the death-rate in two,—from fifteen or twenty per cent to less than ten per cent,—and where the full rigor of the tub bath is carried out it has been brought down to as low as five per cent. [Pg 221]

Meanwhile the bacteriologists are steadily at work on a vaccine or antitoxin. Wright, of the English Army Medical Staff, has already secured a serum, which has given remarkable results in protecting regiments sent out to South Africa and other infected regions. Chantemesse has imported some six hundred successive cases treated with an antitoxin, whose mortality was only about a third of the ordinary hospital rate, and the future is full of promise. [Pg 222]

CHAPTER X

DIPHTHERIA

That was a dark and stern saying, "Without the shedding of blood there is no remission," and, like all the words of the oracles, of limited application. But it proves true in some unexpected places outside of the realm of theology. Was there something prophetic in the legend that it was only by the sprinkling of the blood of the Paschal Lamb above the doorway that the plague of the firstborn could be stayed? To-day the guinea-pig is our burnt offering against a plague as deadly as any sent into Egypt.

Scarcely more than a decade ago, as the mother sat by the cradle of her firstborn, musing over his future, one moment fearfully reckoning the gauntlet of risks that his tiny life had to run, and the next building rosy air-castles of his happiness and success, there was one shadow that ever fell black and sinister across his tiny horoscope. Certain risks there were which were almost inevitable,—initiation ceremonies into life, mild expiations to be paid to the gods of the modern underworld, the diseases of infancy and of childhood. Most of these could be passed over with little more than a temporary wrinkle to break her smile. They were so trivial, so comparatively harmless: measles, a mere reddening of the eyelids and peppering of the throat, with a headache and purplish rash, dangerous only if neglected; chicken-pox, a child's-play at disease; scarlatina, a little more serious, but still with the chances of twenty to one in favor of recovery; diphtheria—ah! that drove the smile from her face and the blood from her lips. Not quite so common, not so inevitable as a prospect, but, as a possibility, full of terror, once its poison had passed the gates of the body fortress. The fight between the Angel of Life and the Angel of Death was waged on almost equal terms, with none daring to say which would be the victor, and none able to lift a hand with any certainty to aid. [Pg 223]

Nor was the doctor in much happier plight. Even when the life at stake was not one of his own loved ones,—though from the deadly contagiousness of the disease it sadly often was (I have known more doctors made childless by diphtheria than by any other disease except tuberculosis),—he faced his cases by the hundred instead of by twos and threes. The feeling of helplessness, the sense of foreboding, with which we faced every case was something appalling. Few of us who have been in practice twenty years or more, or even fifteen, will ever forget the shock of dismay which ran through us whenever a case to which we had been summoned revealed itself to be diphtheria. Of course, there was a fighting chance, and we made the most of it; for in the milder epidemics only ten to twenty per cent of the patients died, and even in the severest a third of them recovered. But what "turned our liver to water"—as the graphic Oriental phrase has it—was the knowledge which, like Banquo's ghost, would not down, that while many cases would recover of themselves, and in many border-line ones our skill would turn the balance in favor of recovery, yet if the disease happened to take a certain sadly familiar, virulent form we could do little more to stay its fatal course than we could to stop an avalanche, and we never knew when a particular epidemic or a particular case would take that turn. "Black" diphtheria was as deadly as the Black Death of the Middle Ages. [Pg 224]

The disease which caused all this terror and havoc is of singular character and history. It is not a modern invention or development, as is sometimes believed, for descriptions are on record of so-called "Egyptian ulcer of the throat" in the earliest centuries of our era; and it would appear to have been recognized by both Hippocrates and Galen. Epidemics of it also occurred in the Middle Ages; and, coming to more recent times, one of the many enemies which the Pilgrim Fathers had to fight was a series of epidemics of this "black sore throat," of particularly malignant character, in the seventeenth century. Nevertheless, it does not seem to have become sufficiently common to be distinctly recognized until it was named as a definite disease, and given the title which it now bears, by the celebrated French physician, Bretonneau, about eighty years ago. Since then it has become either more widely recognized or steadily more prevalent, and it is the general opinion of pathologists that the disease, up to some thirty or forty years ago, was steadily increasing, both in frequency and in severity.

So that we have not to deal with a disease which, like the other so-called diseases of childhood, has gradually become milder and milder by a sort of racial vaccination, with survival of the less susceptible, but one which is still full of virulence and of possibilities of future danger. [Pg 225]

Unlike the other diseases of childhood, also, one attack confers no positive immunity for the future, although it greatly diminishes the probabilities; and, further, while adults do not readily or frequently catch the disease, yet when they do the results are apt to be exceedingly serious. Indeed, we have practically come to the conclusion that one of the main reasons why adults do not develop diphtheria so frequently as children, is that they are not brought into such close and intimate contact with other children, nor are they in the habit of promptly and indiscriminately hugging and kissing every one who happens to attract their transient affection, and they have outgrown that cheerful spirit of comradeship which leads to the sharing of candy in alternate sucks, and the passing on of slate-pencils, chewing-gum, and other *objets d'art* from hand to hand, and from mouth to mouth. Statistics show that of nurses employed in diphtheria wards, before the cause or the exact method of contagion was clearly understood, nearly thirty per cent developed the disease; and even with every modern precaution there are few diseases which doctors more frequently catch from their patients than diphtheria. It is a significant fact that the risk of developing diphtheria is greatest precisely at the ages when there is not the slightest scruple about putting everything that may be picked up into the mouth,—namely, from the second to the fifth year,—and diminishes steadily as habits of cleanliness and caution in this [Pg 226] regard are developed, even though no immunity may have been gained by a mild or slight attack of the disease. The tendency to discourage and forbid the indiscriminate kissing of children, and the crusade against the uses of the mouth as a pencil-holder, pincushion, and general receptacle for odds and ends, would be thoroughly justified by the risks from diphtheria alone, to say nothing of tuberculosis and other infections.

In addition to being almost the only common disease of childhood which is not mild and becoming milder, diphtheria is unique in another respect, and that is its point of attack. Just as tuberculosis seizes its victims by the lungs, and typhoid fever by the bowels, diphtheria—like the weasel—grips at the throat. Its bacilli, entering through the mouth and gaining a foothold first upon the tonsils, the palate, or back of the throat (pharynx), multiply and spread until they swarm down into the larynx and windpipe, where their millions, swarming in the mesh of fibrin poured out by the outraged blood-vessels, grow into the deadly false membrane which fills the air-tube and slowly strangles its victim to death.

The horrors of a death like that can never fade from the memory of one who has once seen it, and will outweigh the lives of a thousand guinea-pigs. No wonder there was such a widespread and peculiar horror of the disease, as of some ghostly thug or strangler.

But not all of the dread of diphtheria went under its own name. Most of us can still remember when the commonest occupant of the nursery shelf was the bottle of ipecac or soothing-syrup as [Pg 227] a specific against croup. The thing that most often kept the mother or nurse of young children awake and listening through the night-watches was the sound of a cough, and the anxious waiting to hear whether the next explosion had a "croupy" or brassy sound. It was, of course, early recognized that there were two kinds of croup, the so-called "spasmodic" and the "membranous," the former comparatively common and correspondingly harmless, the latter one of the deadliest of known diseases. The fear that made the mother's heart leap into her mouth as she heard the ringing croup-cough was lest it might be membranous, or, if spasmodic, might turn into the deadly form later. To-day most young mothers hardly know the name of wine of ipecac or alum, and the coughs of young children awaken little more terror than a similar sound in an adult. Croup has almost ceased to be one of the bogies of the nursery. And why? Because membranous croup has been discovered to be diphtheria, and children will not develop diphtheria unless they have been exposed to the contagion, while, if they should be, we have a remedy against it.

He was a bold man who first ventured to announce this, and for years the battle raged hotly. It was early admitted that certain cases of so-called membranous croup in children occurred after or while other members of the family or household had diphtheria; and for a time the opposing camps used such words as "sporadic" or scattered croup, which was supposed to come of itself, [Pg 228] and "epidemic" or contagious croup, which was diphtheria. Now, however, these distinctions are swept away, and boards of health require isolation and quarantine against croup exactly as against any other form of diphtheria.

Cases of fatal croup still occasionally occur which cannot be directly traced to other cases of diphtheria, but the vast majority of them are clearly traceable to infection, usually from some case in another child, which was so mild that it was not recognized as diphtheria until the baby became "croupy" and search was made through the family throats for the bacilli.

For years we were in doubt as to the cause of diphtheria. Half a dozen different theories were advanced, bad sewerage, foul air, overcrowding; but it was not until shortly after the Columbus-like discovery, by Robert Koch, of the new continent of bacteriology, that the germ which caused it was arrested, tried, and found guilty, and our real knowledge of and control over the disease began. This was in 1883, when the bacteriologist Klebs discovered the organism, followed a few months later (in 1884) by Löffler, who made valuable additions to our knowledge of it; so that it has ever since been known as the Klebs-Löffler bacillus. This put us upon solid ground, and our progress was both sure and rapid: in ten years our knowledge of the causation, the method of spread, the mode of assault upon the body-fortress, and last, but not least, the cure, stood out clear cut as a die, a model and a prophecy of what may be hoped for in most other contagious diseases. [Pg 229]

Great as is the credit to which bacteriologists are entitled for this splendid piece of scientific

progress, there was another co-laborer, a silent partner, with them in all this triumph, an unsung hero and martyr of science who deserves his meed of praise—the tiny guinea-pig. He well deserves his niche in the temple of fame; and as other races and ages have worshiped the elephant, the snake, and the sacred cow, so this age should erect its temples to the guinea-pig. From one of the most trifling and unimportant,—kept merely as a pet and curiosity by the small boys of all ages,—he has become, after the horse, the cow, the pig, and the sheep, easily our most useful and important domestic animal. It may be urged that he deserves no credit, since his sacrifice—though of inestimable value—was entirely involuntary on his own part; but this should only make us the more deeply bound to acknowledge our obligation to him.

By a stern necessity of fate, which no one regrets more keenly than the laboratory workers themselves, the guinea-pig has had to be used as a stepping-stone for every inch of this progress. Upon it were conducted every one of the experiments whose results widened our knowledge, until we found that this bacillus and no other would cause diphtheria; that instead of getting, like many other disease-germs, into the blood, it chiefly limited itself to growing and multiplying upon a comparatively small patch of the body-surface, most commonly of the throat; that most of its serious and fatal results upon the body were produced, not by the entrance of the germs themselves into the blood, but by the absorption of the toxins or poisons produced by them on the [Pg 230] moist surface of the throat, just as the yeast plant will produce alcohol in grape juice or sweet cider.

Here was a most important clew. It was not necessary to fight the germs themselves in every part of the body, but merely to introduce some ferment or chemical substance which would have the power of neutralizing their poison. Instantly attention was turned in this direction, and it was quickly found that if a guinea-pig were injected with a very small dose of the diphtheria toxin and allowed to recover, he would then be able to throw off a still larger dose, until finally, after a number of weeks, he could be given a dose which would have promptly killed him in the beginning of the experiments, but which he now readily resisted and recovered from. Evidently some substance was produced in his blood which was a natural antidote for the toxin, and a little further search quickly resulted in discovering and filtering out of his body the now famous antitoxin. A dose of this injected into another guinea-pig suffering from diphtheria would promptly save its life.

Could this antitoxin be obtained in sufficient amounts to protect the body of a human being? The guinea-pig was so tiny and the process of antitoxin-forming so slow, that we naturally turned to larger animals as a possible source, and here it was quickly found that not only would the goat and the horse develop this antidote substance very quickly and in large amounts, but that a certain amount of it, or a substance acting as an antitoxin, was present in their blood to begin with. Of the two, the horse was found to give both the stronger antitoxin and the larger amounts [Pg 231] of it, so that he is now exclusively used for its production.

After his resisting power had been raised to the highest possible pitch by successive injections of increasing doses of the toxin, and his serum (the watery part of the blood which contains the healing body) had been used hundreds and hundreds of times to save the lives of diphtheria-stricken guinea-pigs, and had been shown over and over again to be not merely magically curative but absolutely harmless, it was tried with fear and trembling upon a gasping, struggling, suffocating child, as a last possible resort to save a life otherwise hopelessly doomed. Who could tell whether the "heal-serum," as the Germans call it, would act in a human being as it had upon all the other animals? In agonies of suspense, vibrating between hope and dread, doctors and parents hung over the couch. What was their delight, within a few hours, to see the muscles of the little one begin to relax, the fatal blueness of its lips to diminish, and its breathing become easier. In a few hours more the color had returned to the ashen face and it was breathing quietly. Then it began to cough and to bring up pieces of the loosened membrane that had been strangling it. Another dose was eagerly injected, and within twenty-four hours the child was sleeping peacefully—out of danger. And the most priceless and marvelous life-saving weapon of the century had been placed in the hand of the physician.

Of course there were many disappointments and failures in the earlier cases. Our first antitoxins were too weak and too variable. We were afraid to use them in sufficient doses. Often their [Pg 232] injection would not be consented to until the case had become hopeless. But courage and industry have conquered these difficulties one after another, until now the fact that the prompt and intelligent use of antitoxin will effect a cure of from ninety to ninety-five per cent of all cases of diphtheria is as thoroughly established as any other fact in medicine. The mass of figures from all parts of the world in support of its value has become so overwhelming that it is neither possible nor necessary to specify them in detail. The series of Bayeaux, covering two hundred and thirty thousand cases of diphtheria, chiefly from hospitals and hence of the severest type, showing that the death-rate had been reduced from over *fifty-five* per cent to below *sixteen* per cent already, and that this decrease was still continuing, will serve as a fair sample.

Three-quarters of even this sixteen per cent mortality is due to delay in the administration of the antitoxin, as is vividly shown in thousands of cases now on record, classified according to the day of the disease on which the antitoxin was given, of which MacCombie's "Report of the London Asylums Board" is a fair type. Of one hundred and eighty-seven cases treated the first day of the disease, none died; of eleven hundred and eighty-six injected on the second day of the disease, four and a half per cent died; of twelve hundred and thirty-three not treated until the third day of the disease, eleven per cent died; of nine hundred and sixty-three cases escaping treatment until the fourth day, seventeen per cent died; while of twelve hundred and sixty not seen until the fifth [Pg 233]

day, twenty per cent died. In other words, the chances for cure by the antitoxin are in precise proportion to the earliness with which it is administered, and are over four times as great during the first two days of the disease as they are after the fourth day. One "stick" in time saves five.

This brings us sharply to the fact that the most important factor in the cure of diphtheria, just as in the case of tuberculosis, is early recognition. How can this be secured? Here again the bacteriologist comes to our relief, and we needed his aid badly. The symptoms of a mild case of diphtheria for the first two, or even three, days are very much like those of an ordinary sore throat. As a rule, even the well-known membrane does not appear in sufficient amounts to be recognizable by the naked eye until the middle of the second, or sometimes even of the third, day. By any ordinary means, then, of diagnosis, we would often be in doubt as to whether a case were diphtheria or not, until it was both well advanced and had had time to infect other members of the family. With the help of the laboratory, however, we have a prompt, positive, and simple method of deciding at the very earliest stage. We merely take a sterilized swab of cotton on the end of a wire, rub it gently over the surface of the throat and tonsils, restore it to its glass tube, smearing it over the surface of some solidified blood-serum placed at the bottom of the tube, close the tube and send it to the nearest laboratory. The culture is put into an incubator at body heat, the germs sown upon the surface of the blood-serum grow and multiply, and in twelve [Pg 234] hours a positive diagnosis can be made by examining this growth with a microscope. Often, just smearing the mucus swabbed out of the throat over the surface of a glass slide, staining this smear, and putting it under a microscope, will enable us to decide within an hour. These tubes are now provided by all progressive city boards of health, and can be had free of charge at depots scattered all over the city, for use in any doubtful case, within half an hour. Twelve hours later a free report can be had from the public laboratory. If every case of suspicious sore throat in a child were promptly swabbed out, and a smear from the swab examined at a laboratory, it would not be long before diphtheria would be practically exterminated, as smallpox has been by vaccination, and this is what we are working toward and looking forward to.

Our knowledge of the precise cause of diphtheria, the Klebs-Löffler bacillus, has furnished us not only with the cure, but also with the means of preventing its spread. While under certain circumstances, particularly the presence of moisture and the absence of light, this germ may live and remain virulent for weeks outside of the body, careful study of its behavior under all sorts of conditions has revealed the consoling fact that its vitality outside of the human or some other living animal body is low; so that it is relatively seldom carried from one case to another by articles of clothing, books, or toys, and comparatively seldom even through a third party, except where the latter has come into very close contact with the disease, like a doctor, a nurse, or a [Pg 235] mother, or—without disrespect to the preceding—a pet cat or dog.

More than this, the bacillus must chiefly be transmitted in the moist condition and does not float in the air at all, clinging only to such objects as may have become smeared with the mucus from the child's throat, as by being coughed or sneezed upon. As with most of our germ-enemies, sunlight is its deadliest foe, and it will not live more than two or three days exposed to sunshine. So the principal danger against which we must be on our guard is that of direct personal contact, as in kissing, in the use of spoons or cups in common, in the interchange of candy or pencils, or through having the hands or clothing sprayed by a cough or a sneeze.

The bacillus comparatively seldom even gets on the floor or walls of a room where reasonable precautions against coughing and spitting have been taken; but it is, of course, advisable thoroughly to disinfect and sterilize the room of a patient and all its contents with corrosive sublimate and formalin, as a number of cases are on record in which the disease has been carried through books and articles of clothing which had been kept in damp, dark places for several months. The chief method of spread is through unrecognized mild cases of the disease, especially of the nasal form. For this reason boards of health now always insist upon smears being made from the throats and noses of every other child in the family or house where a case of diphtheria is recognized. No small percentages of these are found to be suffering from a mild form of the disease, so slight as to cause them little inconvenience and no interference with their attending [Pg 236] school. Unfortunately, a case caught from one of these mild forms may develop into the severest laryngeal type. If a child is running freely at the nose, keep it at home or keep your own child away from it. A profuse nasal discharge is generally infectious, in the case of influenza or other "colds," if not of diphtheria.

This also emphasizes the necessity for a thorough and expert medical inspection of school-children, to prevent these mild cases from spreading disease and death to their fellows. By an intelligent combination of the two methods, home examination of every infected family and strict school inspection, there is little difficulty in stamping out promptly a beginning infection before it has had time to reach the proportions of an epidemic.

One other step makes assurance doubly sure, and that is the prompt injection of all other children and young adults living in the family, where there is a case of diphtheria, with small doses of the antitoxin for preventive purposes. Its value in this respect has been only secondary to its use as a cure. There are now thousands of cases on record of children who had been exposed to diphtheria or were in hospitals where they were in danger of becoming exposed to it, with the delightful result that only a very small per cent of those so protected developed the disease, and of these not a single one died! This protective vaccination, however, cannot be used on a large scale, as in the case of smallpox, for the reason that the period of protection is a comparatively short one, probably not exceeding two or three weeks. [Pg 237]

Suppose that, in spite of all our precautions, the disease has gained a foothold in the throat, what will be its course? This will depend, first of all, upon whether the invading germs have lodged in their commonest point of attack, the tonsils, palate, and upper throat, or have penetrated down the air-passages into the larynx or voice-organ. In the former, which is far the commoner case, their presence will cause an irritation of the surface cells which brings out the leucocyte cavalry of the body to the defense, together with squads of the serum or watery fluid of the blood containing fibrin. These, together with the surface-cells, are rapidly coagulated and killed by the deadly toxin; and their remains form a coating upon the surface, which at first is scarcely perceptible, a thin, grayish film, but which in the course of twenty-four to forty-eight hours rapidly thickens to the well-known and dreaded false membrane. Before, however, it has thickened in more than occasional spots or patches, the toxin has begun to penetrate into the blood, and the little patient will complain of headache, feverishness, and backache, often—indeed, usually—before any very marked soreness in the throat is complained of. Roughly speaking, attacks of sore throat, which begin first of all with well-marked soreness and pain in the throat, followed later by headache, backache, and fever, are not very likely to be diphtheria. The bacilli multiply and increase in their deadly mat on the surface of the throat, larger and larger amounts of the poison are poured into the blood, the temperature goes up, the headache [Pg 238] increases, the child often begins to vomit, and becomes seriously ill. The glands of the neck, in their efforts to arrest and neutralize the poison, become swollen and sore to the touch, the breath becomes foul from the breaking down of the membrane in the throat, the pulse becomes rapid and weak from the effect of the poison upon the heart, and the dreaded picture of the disease rapidly develops.

This process in from sixty to eighty per cent of cases will continue for from three to seven days, when a check will come and the condition will gradually improve. This is a sign that the defensive tissues of the body have succeeded in rallying their forces against the attack, and have poured out sufficient amounts of their natural antitoxin to neutralize the poisons poured in by the invaders. The membrane begins to break down and peel off the throat, the temperature goes down, the headache disappears, the swelling in the glands of the neck may either subside or go on to suppuration and rupture, but within another week the child is fairly on the way to recovery.

Should the invaders, however, have secured a foothold in the larynx, then the picture is sadly different. The child may have even less headache, temperature, and general sense of illness; but he begins to cough, and the cough has a ringing, brassy sound. Within forty-eight, or even twenty-four, hours he begins to have difficulty in respiration. This rapidly increases as the delicate tissues of the larynx swell under the attack of the poison, and the very membrane which is created in an attempt at defense becomes the body's own undoing by increasing the blocking [Pg 239] of the air-passages. The difficulty of breathing becomes greater and greater, until the little victim tosses continually from side to side in one constant, agonizing struggle for breath. After a time, however, the accumulation of carbon dioxide in the blood produces its merciful narcotic effect, and the struggles cease. The breathing becomes shallower and shallower, the lips become first blue, then ashy pale, and the little torch of life goes out with a flicker. This was what we had to expect, in spite of our utmost effort, in from seventy to ninety per cent of these laryngeal cases, before the days of the blessed antitoxin. Now we actually reverse these percentages, prevent the vast majority of cases from developing serious laryngeal symptoms at all, and save from seventy to eighty per cent of those who do.

Our only resource in this form of the disease used to be by mechanical or surgical means, opening the windpipe below the level of the obstruction and inserting a curved silver tube—the so-called tracheotomy operation; or later, and less heroic, by pushing forcibly down into the larynx, and through and past the obstruction at the vocal cords, a small metal tube through which the child could manage to breathe. This was known as intubation. But these were both distressing and painful methods, and, what was far worse, pitifully broken reeds to depend upon. In spite of the utmost skill of our surgeons, from fifty to eighty per cent of cases that were tracheotomized, and from forty to sixty per cent of those that were intubated, died. In many cases [Pg 240] they were enabled to breathe, their attacks of suffocation were relieved—but still they died.

This leads us to the most important single fact about the course of the disease, and that is that the chief source of danger is not so much from direct suffocation as from general collapse, and particularly failure of the heart.

This has given us two other data of great importance and value, namely, that while the immediate and greatest peril is over when the membrane has become loosened and the temperature has begun to subside, in both ordinary throat and in laryngeal forms of the disease, the patient is by no means out of danger. While the antitoxins poured out by his body have completely defeated the invading toxins in the open field of the blood, yet almost every tissue of the body is still saturated with these latter and has often been seriously damaged by them before their course was checked. For instance, nearly two-thirds of our diphtheria cases, which are properly examined, will show albumin in the urine, showing that the kidney-cells have been attacked and poisoned by the toxin. This may go on to a fatal attack of uremia; but fortunately, not commonly, far less so than in scarlet fever. The kidneys usually recover completely, but this may take weeks and months. Again, many cases of diphtheria will show a weak and rapid pulse, which will persist for weeks after the patient has apparently recovered; and if the little ones are allowed to sit up too soon, or to indulge in any sudden movements or muscular strains, this weak and rapid pulse [Pg 241] will suddenly change into an attack of heart failure and, possibly, fatal collapse. This, again, illustrates the saturation of the poison, as these effects are now known to be due in part to a

direct poisoning of the muscle of the heart itself, and later to serious damage done to the nerves controlling the heart, chiefly the pneumo-gastric. Moral: Keep the little patient in bed for at least two weeks or, better, three. He will have to spend a month or more in quarantine, anyway.

Last of all, and by no means least interesting, are the effects which are produced upon the nervous system. One day, while the child is recovering, and is possibly beginning to sit up in bed, a glass of milk is handed to him. The little one drinks it eagerly and attempts to swallow, but suddenly it chokes, half strangles, and back comes the milk, pouring out through the nostrils. Paralysis of the soft palate has occurred from poisoning of the nerves controlling it, caused by direct penetration of the toxin. Sometimes the muscles of the eye become paralyzed and the little one squints, or can no longer see to read.

Fortunately, most of these alarming results go only to a certain degree, and then gradually fade away and disappear; but this may take months or even longer. In a certain number, however, the nerves of respiration, or those controlling the heart-beat, become affected, and the patient dies suddenly from heart failure.

This strange after-effect upon the nervous system, which was first clearly noticed in diphtheria and syphilis, has now been found to occur in lesser degree in a large number of our infectious diseases, so that many of our most serious paralyses and other diseases of the nervous system are now traceable to such causes. [Pg 242]

These effects of the diphtheria toxin are also of interest for a somewhat unexpected reason, since it has been claimed that they are effects of the antitoxin, by those who are opposed to its use. Every one of them was well recognized as a possible result of diphtheria long before the antitoxin was discovered, and every one of them can be readily produced by injections of diphtheria bacilli or their toxin into animals.

It is quite possibly true that there are more cases of nerve-poisoning (neuritis) and of paralysis following diphtheria than there were before the use of antitoxin, but that is for the simple and sufficient reason that there are more children left alive to display them! And between a child with a temporary squint and a dead child few mothers would hesitate long in their choice. [Pg 243]

CHAPTER XI

THE HERODS OF OUR DAY: SCARLET FEVER, MEASLES, AND WHOOPING-COUGH

Why is a disease a disease of childhood? First and fundamentally, because that is the earliest period at which a human being can have it. But the problem goes deeper than this. There is no more interesting and important group of diseases in the whole realm of pathology than those which we calmly dub "the diseases of childhood," and thereby dismiss to the limbo of unavoidable accidents and discomforts, like flies, mosquitoes, and stubbed toes, which are best treated with a shrug of the shoulders and such stoic philosophy as we can muster. They are interesting, because the moment we begin to study them intelligently we stumble upon some of the profoundest and most far-reaching problems of resistance to disease; important, because, trifling as we regard them, and indeed largely just because we so regard them, they kill, or handicap for life, more children in civilized communities than the most deadly pestilence. Measles, for instance, according to the last United States census, causes yearly nearly thirteen thousand deaths, while smallpox causes so few that it is not listed among the important causes of death. Scarlet fever causes sixty-three hundred and thirty-three deaths, as compared with barely five thousand from appendicitis and the same number from rheumatism. Whooping-cough causes ninety-nine hundred and fifty-eight deaths, more than double the mortality from diabetes and nearly equal to that of malarial fever. [Pg 244]

In medicine, as in war, the gravest and deadliest mistake that you can make is to despise your enemy. These trivial disorders, these trifling ailments, which every one takes as a matter of course, and expects to go through with, like teething, tight shoes, and learning to smoke, sweep away every year in these United States the lives of from forty to fifty thousand children, reaching the bad eminence of fifth upon our mortality lists, only consumption, pneumonia, heart disease, and diarrhœal diseases ranking above them. Of course, it is obvious that these diseases outrank many other more serious ones among the "captains of the men of death," largely upon the familiar principle of the old riddle, whereby the white sheep eat more grass than the black, "because there are more of them."

While only a relatively small percentage of us ever have the bad luck to be attacked by typhoid fever, rheumatism, or appendicitis, to say nothing of cholera and smallpox, the vast majority of us have gone through two or more of these diseases of childhood; so that, though the death-rate of each and all of them is low, yet the number of cases is so enormous that the absolute total mounts high. But the pity and, at the same time, the practical importance of this heavy death-roll is that *at least two-thirds of it is absolutely preventable*, and by the exercise of only a very moderate amount of intelligence and vigilance. It is, of course, obvious that in a group of diseases which numbers its victims literally by the million every year there will inevitably occur a certain minute percentage of fatal results due to what might be termed unavoidable causes, like a badly [Pg 245]

nourished condition of the child attacked, unusual circumstances preventing proper shelter or nursing, or an exceptional virulence of the disease, such as will occur in two or three cases of every thousand in even the most trifling infectious malady. But even after making liberal allowance for what might be termed the unavoidable fatalities, at least two-thirds, and more probably nine-tenths, of the deaths from children's diseases might be prevented upon two grounds:—

First, that they are contagious and absolutely dependent upon a living germ, whose spread can be prevented; and secondly, and practically even more important, that more than half the deaths from them are due, not to the disease itself, but to complications occurring during the period of recovery, caused, for the most part, by gross carelessness on the part of the mother or nurse. A large majority, for instance, of the nearly thirteen thousand deaths attributed to measles are due to bronchitis, caught by letting the child go out-of-doors too soon after recovery, which means, of course, either a chill falling upon the irritated and weakened bronchial mucous membrane, or an infection by one of the score of disease-germs, such as those of influenza, pneumonia, bronchitis, and even tuberculosis, which are continually lying in wait for just such an emergency as this— [Pg 246] just such a weakening of the vital resistance.

It is a sadly familiar statement in the history of fatal cases of tuberculosis that the trouble "began with an attack of measles," or whooping-cough, or a bad cold, and was mistaken for a mere "hanging on" of one of these milder maladies until it had gained a foothold that there was no dislodging. As breakers of the wall of the hollow square of the body-cells, drawn up to resist the cavalry charges of tuberculosis, pneumonia, and rheumatism, few can be compared in deadliness with the diseases of childhood and "common colds."

Further, while all of them except scarlet fever have a mortality so low that it might almost be described as what the French delicately term *une quantité négligeable*, yet a surprisingly large number of the survivors do not escape scot-free, but bear scars which they may carry to their graves, or which may even carry them to that bourne later. Again, the actual percentage of the survivors who are marked in this fashion is small, but such milliards of children are attacked every year that, on the old familiar principle, "if you throw plenty of mud some of it will stick," quite a serious number are more or less handicapped by these remainders. For instance, quite a noticeable percentage of cases of chronic eye troubles, particularly of the lids and conjunctiva, such as "granulated" lids, styes, ulcers of the cornea, date from an attack of measles or even whooping-cough. Many cases of nasal catarrh or chronic throat trouble or bronchitis in children date from the same source. A large group of chronic discharges from the ear and perforations of [Pg 247] the ear-drum are a direct after-result of scarlet fever; and the frequency with which this disease causes serious disturbances of the kidneys is almost a household word. Less definitely traceable, but even more serious in their entirety, are the large group of chronic depression of vigor, loss of appetite, various forms of indigestion and of bowel trouble, which are left behind after the visitation of one of these minor pests, particularly among the children of the poorer classes, who are unable to obtain the highly nutritious, appetizing, and delicately cooked foods which are so essential to the full recovery of the little invalids.

One of the English commissions which was investigating the alleged physical deterioration of city and town populations stumbled upon a singularly interesting and significant fact in this connection, while plotting the curves of the rate of growth of the children in a given district in Scotland during a series of years. They were struck with the fact that children born in certain years in the same families, neighborhoods, and presumably the same circumstances, grew more rapidly and had a lower death-rate than those born in other years; and that, on the other hand, children born in other years fell almost as far below the normal in their rate of growth. The only factor which they found to coincide with these differences was that in the years in which those children who made the slowest growth were born there had been unusually heavy epidemics of children's diseases and a high mortality; while, on the other hand, those years whose "crop" of children made the best growth had been unusually free from such epidemics and had a [Pg 248] correspondingly low mortality, showing clearly that even the survivors of children's diseases were not only not benefited, but distinctly handicapped and set back in their growth by the energy, so to speak, wasted in resisting the onslaught.

This brings us to an aspect of these diseases which from both a philosophic and a practical point of view is most interesting and profoundly significant; and that is the question with which we opened: Why is a disease a disease of childhood? The old, primitive view was as guileless and as simple as the age in which the diseases occurred. They were regarded not merely by the laity but by grave and reverend physicians of the Dark Ages as a sort of necessary vital crisis peculiar and appropriate to each particular age of life,—a sort of sweating out and erupting of "peccant humors" of the blood, which must be got rid of or else the individual would not thrive. Incredible as it may seem, so far was this idea extended, that the great Arabian physician-philosopher, Rhazes, actually included smallpox in this group, as the last of the "crises of growth" which had to appear and have its way in young manhood or womanhood. Quaint little echoes of this simple faith still ring in the popular mind, as, for instance, in the widespread notion about the dangerousness of doing anything to check the eruption in measles and cause it to "strike in." Any mother in Israel will tell you, the first time you propose a bath or a wet pack to reduce the temperature in measles, that if you so much as touch water to the skin of that child it will "drive [Pg 249] the rash in" and cause it to die in convulsions. And, of course, one of the commonest of a physician's memories is the expression of relief from the mother or aunt in any of these mild eruptive fevers, where the skin was well reddened and spotted: "Well, anyway, doctor, it is a

splendid thing to get the rash so well out!" Until within the last ten or fifteen years it was no uncommon thing to hear the expression: "Well, I suppose we might just as well let Willie and Susie go on to school and get the measles and have done with it. It seems to be a real mild sort this time." Of course this view was scientifically shattered two or more decades ago by our recognition of the infectious nature of these diseases, but practically its hold on the public mind constitutes one of the most serious and vital obstacles in the way of the health-officer when he endeavors to attack and break up an epidemic of measles, whooping-cough, or chicken-pox.

It cannot be too strongly emphasized that, mild and in their immediate results trifling, as most of these "little diseases" are, they are genuine members of that class of pathologic poison-snakes, the germ-infections; that when they bite, they bite to kill; that two to five times in every hundred they do kill; that, like all other infections, they are capable of inflicting serious and permanent damage upon the great vital organs, the heart, the kidneys, the liver, and the brain; and that they are the very jackals of diseases, tracing down and pointing out the prey to the lions that work in partnership with them. With whatever we may treat measles and whooping-cough, *never* treat them with contempt! [Pg 250]

The next conception of the "whyness" of children's diseases was that as one star differs from another in glory, so does one germ differ from another in virulence; that the germs of these particular diseases just happened to be from the beginning unusually mild and at the same time highly contagious, so that they remained permanently scattered about throughout the community, and attacked each successive brood of newborn children as quickly as they could conveniently get at them. Being so mild and so comparatively seldom fatal, little or no alarm was excited by them and few efforts made to check their spread, so that they continued to flourish, generation after generation. Upon this theory the germs of measles, chicken-pox, whooping-cough, mumps, would be in something like the same class as the numerous species of bacteria and other germs that normally inhabit the human mouth, stomach, and intestines; for the most part, comparatively harmless parasites, or what are technically now known as "*symbiotes*" (from two Greek words, *bios*, "life," and *syn*, "with"), a sort of little partners or non-paying boarders, for the most part harmless, but occasionally capable of making trouble. There are scores of species of such germs in our food-canals, some of which may be even slightly helpful in the process of digestion. Only a very small per cent of the bacilli of any sort in the world are harmful; the vast majority are exceedingly helpful.

There is evidently some truth in this view of children's diseases, especially so far as the reason for their steady persistence and undiminished spread is concerned, namely, the comparative [Pg 251] carelessness and indifference with which they are regarded and treated. But some rather striking developments of recent years have raised grave doubts in our minds as to whether they were always the mild and inoffensive "house cats" that they pass for at present. These are the astonishing and almost incredible developments that occur when for the first time these mild and harmless "diseaselets" are introduced to a savage or half-civilized tribe. Like an Arabian Nights' transformation, our sleepy, purring, but still able to scratch, "pussy cat" flashes out as a ravenous man-eating tiger, killing and maiming right and left. Measles—harmless, tickly, snuffly, "measly" little measles—kills from thirty to sixty per cent of whole villages and tribes of Indians and cripples half the remainder!

My first direct experience with this feature of our "household pets" was on the Pacific Coast. All the old settlers told me of a dread pestilence which had preceded the coming of the main wave of invading civilization, sweeping down the Columbia River. Not merely were whole clans and villages swept out of existence, but the valley was practically depopulated; so that, as one of the old patriarchs grimly remarked, "It made it a heap easier to settle it up quietly." So swift and so fatal had been its onslaught that villages would be found deserted. The canoes were rotting on the river bank above high-water mark. The curtains of the lodges were flapped and blown into shreds. The weapons and garments of the dead lay about them, rusting and rotting. The salmon-nets were still standing in the river, worn to tatters and fringes by the current. Yet, from the best [Pg 252] light that I was able to secure upon it, it appeared to have been nothing more than an epidemic of the measles, caught from the child of some pioneer or trapper and spreading like wildfire in the prairie grass. A little later I had an opportunity to see personally an epidemic of mumps in a group of Indians, and I have seldom seen fever patients, ill of any disease, who were more violently attacked and apparently more desperately ill than were sturdy young Indian boys attacked by this trifling malady. Their temperatures rose to one hundred and five or one hundred and six degrees, they became delirious, their faces were red and swollen, they ached in every limb, and the complications that occasionally follow mumps even in civilized patients were frequent and exceedingly severe. In like manner, influenza will slay its hundreds in a tribe of less than a thousand members. Chicken-pox will become so virulent as to be mistaken for smallpox. Several of the epidemics of alleged smallpox that have occurred among Indians and other savage tribes are now known to have been only measles. At first, pathologists were inclined to receive these reports with some degree of skepticism, and to regard them either as travelers' tales, or as instances of exceptional and accidental virulence in that particular tribe, the high death-rate due to bad nursing or horrible methods of voodoo treatment.

But from all over the world came ringing in the same story, not merely from scores of travelers, but also from army surgeons, medical missionaries, and medical explorers, until it has now [Pg 253] become a definitely established fact that the mild, trifling diseases of infancy, "colds" and influenzas of civilized races, leap to the proportions of a deadly pestilence when communicated to a savage tribe. Whether that tribe be the Eskimo of the Northern ice-sheet or the Terra del

Fuegian of the Southern, the Hawaiian of the islands of the Pacific or the Aymarás of the Amazon, all fall like grain before the scythe under the attack of a malady which is little more than the proverbial "little 'oliday" of three days in bed to civilized man. Evidently civilized man has acquired a degree and kind of immunity that uncivilized man has not. Either the disease has grown milder or civilized man tougher with the ages.

The probability is that both of these explanations are true. These diseases may originally have been comparatively severe and serious; but as generation after generation has been submitted to their attack, those who were most susceptible died or were so crippled as to be seriously handicapped in the race of life and have left fewer and less vigorous offspring. So that, by a gradual process of weeding out the more susceptible, the more resisting survived and became the resistant civilized races of to-day.

On the other hand, any disease which kills its victim so quickly that it has not time to make sure of its transmission to another one before his death, will not have so many chances of survival as will a milder and more chronic disorder. Hence, the milder and less fatal strains of germs would stand the better chance of survival. This, of course, is a very crude outline, but it probably [Pg 254] represents something of the process by which almost all known diseases, except a few untamable hyenas, like the Black Death, the cholera, and smallpox, have gradually grown milder with civilization. If we escape the attack of these attenuated diseases of infancy until fifteen or sixteen years of age, we can usually defy them afterward; though occasionally an unusually virulent strain will attack an adult, with troublesome consequences.

At all events, whatever explanation we may give, the consoling fact stands out clearly that civilized man is decidedly more resistant to these pests of civilization than is any half-civilized race, and there is good reason to believe that this is a typical instance of his comparative vigor and endurance all along the line.

If this view of the original character and taming of these diseases be correct, it also accounts for the extraordinary and otherwise inexplicable cases where they suddenly assume the virulence of cholera, or yellow fever, and kill within forty-eight or ninety-six hours, not merely in children but also in adults.

To group these three diseases together simply because they all happen to occur in children would appear scarcely a rational principle of classification. Yet, practically, widely different as they are in their ultimate results and, probably, in their origin, they have so many points in common as to their method of spread, prevention, and general treatment, that what is said of one will with certain modifications apply to all.

I said "probably" of widely different origin, because, by one of those strange paradoxes which so often confront us in real life, though the infectiousness and the method of spread of all these [Pg 255] diseases is as familiar as the alphabet and as firmly settled, the most careful study and innumerable researches have failed to identify positively the germ in any one of them. There are a number of "suspects" against which a great deal of circumstantial evidence exists: a streptococcus in scarlet fever, a bacillus in whooping-cough, and a protozoan in measles; but none of these have been definitely convicted. The principal reason for our failure is a very common one in bacteriological research, whose importance is not generally known, and that is, that there is not a single species of the lower animals that is subject to the diseases or can be inoculated with them. This unfortunate condition is the greatest barrier which can now exist to our discovery of the causation of any disease. We were absolutely blocked, for instance, by it in smallpox and syphilis until we discovered that our nearest blood relatives, the ape and the monkey, are susceptible to them; and then the *Cytoryctes Variolæ* and the *Treponema pallida* were discovered within comparatively a few months. Some lucky day, perhaps, we may stumble on the animal or bird which will take measles, scarlet fever, or whooping-cough, and then we will soon find out all about them.

But, fortunately, our knowledge of these little diseases, like Mercutio's wound, is "not so deep as a well, nor so wide as a church door; but 't is enough" for all practical purposes. The general plan of treatment in all of them might be roughly summed up as, rest in bed in a well-ventilated room; sponge-baths and packs for the fever; milk, eggs, bread, and fruit diet, with plenty of cool water [Pg 256] to drink, either plain, or disguised as lemonade or "fizzy" mixtures; mild local antiseptic washes for nose and throat, and mild internal antiseptics, with laxatives, for the bowels and kidneys. There is no known drug which is specific in any one of them, though their course may be made milder and the patient more comfortable by the intelligent use of a variety of remedies, which assist nature in her fight against the toxin. Not knowing the precise cause, we have as yet no reliable antitoxin for any.

Now very briefly as to the earmarks of each particular member of this children's group. It may be said in advance that the "openings" of all of them (as chess-players call the first moves) are very much alike. All of them are apt to begin with a little redness and itching of the mucous membranes of the nose, the throat, and the eyes, with consequent snuffling and blinking and complaints of sore throat. These are followed, or in severe, swift cases may be preceded, by flushed cheeks, complaints of headache or heaviness in the head, fever, sometimes rising very quickly to from one hundred and four to one hundred and five degrees, backache, pains in the limbs, and, in very severe cases, vomiting. In fact, the symptoms are almost identical with those of an attack of that commonest of all acute infections, a bad cold, and probably for the same reason, namely, that the germs, whatever they may be, attack and enter the system by way of the nose and throat.

One of the most difficult practical points about the beginning of this group of diseases is to distinguish them from one another, or from a common cold. The important thing to remember is [Pg 257] that, theoretically important as it may be to make this distinction, practically it isn't necessary at all, as they should all be treated exactly alike in the beginning. The only vital thing is to recognize that you are dealing with an infection of some sort, isolate promptly the little patient, put him to bed, and make your diagnosis later as the disease develops. Fortunately neither scarlet fever nor measles usually becomes acutely infectious until the rash appears, and as neither is particularly dangerous to adults, especially to such as have had them already, a one-room quarantine is sufficient for the first few days of any of these diseases. We will lose nothing and gain enormously by adopting this routine plan in all cases of snuffling noses, sore throats, headache, and fever in children, for these are the early symptoms of all their febrile diseases, from colds to diphtheria; all alike are infectious and all, even to the mildest, benefited by a few days of rest and seclusion.

After this first general blare of defiance on the part of the system to the enemy, whoever he may be, the battle begins to take on its characteristic form according to the nature of the invader. We will take first the campaign of scarlet fever, since this is the swiftest and first to disclose itself. After the preliminary snuffles and headache have lasted for a few hours, the temperature usually begins to rise; and when it does, by leaps and bounds often reaching one hundred and four or one hundred and five degrees within twelve hours, the skin becomes dry and hot, the throat sore, the tongue parched, and the little patient drowsy and heavy-eyed. Within from twenty-four to forty- [Pg 258] eight hours a bright red or pinkish rash appears, first on the neck and chest, and then rapidly spreading all over the surface of the body within another twenty-four hours.

Meanwhile the throat becomes sore and swollen, ranging, according to the severity of the case, from a slight reddening and swelling to a furious ulcerative inflammation, with the formation of a thick membrane-like exudate, which sometimes is so severe as to raise a suspicion of possible diphtheria. The tongue becomes red and naked, with the papillæ showing light against a red ground, so as to give rise to what has been known as "the strawberry tongue." The temperature is usually high, and the little patient when he drowses off to sleep is quite apt to become more or less delirious. In the vast majority of cases, after two to four days of this, the temperature goes down almost as swiftly as it came up, the rash begins to fade, the throat gets less sore, and the rebound toward recovery sets in. About this time the daily examination of the urine will begin to show traces of albumin, but this, under strict rest in bed and careful diet, will usually diminish and ultimately disappear. In the event of a relapse, however, or setback from any cause, the kidneys may become violently attacked, and a considerable per cent of the fatal cases die from suppression of the urine. After this crisis has occurred, however, in ninety-nine per cent of all cases it is comparatively plain sailing; the throat is still sore and troublesome, the skin itches and tickles, and the eyes smart, but the little patient steadily improves day by day. Anywhere from [Pg 259] three to five days after the break in the fever the skin begins to get rough and scaly, and gradually peels off, until in some cases the entire coating of the body is shed, having been killed, as it were, by the violence of the eruption. These *flakes and scales of the skin are exceedingly contagious*, and no case should be regarded as fit to be released from isolation until every particle has been shed and got rid of. This constitutes one of the most tiresome and annoying periods of the disease, as complete shedding is seldom finished before two weeks, and sometimes may last from three to five.

However, this long period of contagiousness has been found to be really a blessing in disguise, inasmuch as we now know that even more strikingly than in the other children's diseases it is the period of *recovery* that is the period of *greatest danger* in scarlet fever. Like the Parthians of Greek history it is most dangerous when in retreat. Keeping the child at rest for the greater part of the time, in bed or on a lounge, in a well-ventilated room, or later on a porch or terrace, for five weeks from the beginning of the disease, is well worth all the trouble and inconvenience that it causes, for the sake of the almost absolute protection it gives against dangerous and even fatal complications, particularly of the kidneys, heart, or lungs.

This is a fair description of what might be termed an average case of the disease. We also have the sadly familiar type described as the fulminant or, literally, "lightning-stroke" variety. The child goes down as if struck by an invisible hand; vomiting is one of the first symptoms; delirium [Pg 260] follows within ten or twelve hours; the eruption becomes not merely scarlet but purplish from hemorrhage under the skin, giving the name of "black" scarlet fever to this type. The throat becomes furiously swollen, the urine is absolutely suppressed, the child goes into convulsions, and dies within forty-eight hours from the beginning of the attack. Fortunately, this type is rare, but the important thing to remember is that it may develop in a child who caught the disease from one of the mildest of all possible cases! Hence every case should be treated with the strictest isolation, as if it were itself of the most malignant type.

Naturally, the mortality of scarlet fever varies according to the type. Not only may it assume a malignant form in individual cases, but whole epidemics may be of this character, with a mortality of from twenty to thirty per cent. Generally speaking, however, the death-rate is about one in twelve, ranging from as low as one in twenty-five to as high as one in five.

As in the case of diphtheria, the greatest danger and most powerful means of spread of the disease is through the mild, unrecognized cases, which are supposed to have nothing but a cold and are allowed to continue in school or play with other children. We have no antitoxin and no bacteriologic means of positive diagnosis. But one method will stop the spread and within ten or fifteen years exterminate every one of these infections—*isolate at once every child* that shows

symptoms of a cold, sore throat, or feverishness, both for its own sake and for that of the community!

In measles we have to deal with a much more harmless and more nearly domesticated "beast of prey," but one of a prevalence to correspond. Though probably (exact data being as yet lacking) not more than one-third of all individuals are attacked by scarlet fever, it would be safe to say that not more than one-third, and possibly not more than one-fifth, of us escape measles. Hence, though its mortality is scarcely one-fourth that of scarlet fever, it more than holds its own in the Herod class, as grimly shown by its total death-roll of over twelve thousand, compared with only a little over six thousand to the credit of scarlet fever. [Pg 261]

After the preliminary disturbances of snuffles, hot throat, headache, and feverishness, which it shares with all the other "little fevers," the first thing to mark off measles is usually that the itching and running at the nose and eyes become more prominent, the child begins to turn its face away from the light because it makes its eyes smart, and complains not so much of soreness as of a peppery, burning, itching sensation in its nose and throat. The tongue is coated, the stomach mildly upset; the little patient is more uncomfortable and fretful than seriously ill. This condition drags on, without apparently getting anywhere, for from two to four days, during which time it is often very difficult even for the most experienced physician to say positively what the sufferer has. But about the fourth day a rash begins to appear, typically first upon the cheeks or forehead in the shape of little widely separated dull-red blotches. These grow larger and deeper in color, rising in the middle and spreading at their edges, so that shortly the whole skin becomes puffed and swollen and of a mottled, pinkish-purple color. If the child's lower lip be pulled down, little red spots will be seen scattered over the lining membrane of the mouth, showing that the eruption is not confined to the skin. Indeed, these Koplik's spots (as they are called, after their discoverer) in the mouth will often appear a day or more before the eruption upon the skin and give the first clew to the nature of the disease. These are significant, because they probably illustrate the process of eruption, or, at least, irritation, which is taking place, not merely upon the skin, but also upon the mucous membranes of the eyes, nose, and throat, the windpipe and the bronchial tubes, and which is the cause of the burning, running, and, later, occasional serious inflammatory symptoms in all these regions. [Pg 262]

When you look at the hot, angry-looking, swollen skin of the little victim of measles, the weeping eyes and running nose, and remember that this same sort of process is either going on or is likely to occur all over his entire lining, so to speak, from lungs to bowels, you can easily grasp how important it is to keep him absolutely at rest and protected from every possible risk in the way of chill, over-exertion, or injudicious feeding, until the whole process has completely subsided and been forgotten. Neglect of these precautions is the reason why so many cases of measles, on the least and most trifling exposure and overstrain during the two or three weeks following the disease, will blaze up into a fatal bronchitis or pneumonia.

The rash takes about two or three days to get out, then it begins to fade and the skin to peel off in tiny, branny scales, so small and thin as to be almost invisible—unlike the huge flakes of scarlet fever. At the same time all the other symptoms recede. [Pg 263]

But, as in scarlet fever, all cases should be treated alike, by rest, sponging and packing for the fever, light diet with plenty of milk and fruit, and confinement to the room for at least ten days after the disappearance of the fever. The very mildest and most insignificant of attacks may be followed, through carelessness or exposure, by a fatal bronchitis. Indeed, in view of the distressing frequency with which our histories of tuberculosis in children contain the words, "Came on after measles," it is highly advisable to watch carefully every child as regards abundant feeding, avoidance of overwork or overstrain, and of all unnecessary exposure to infection, wind, or wet, for two months after an attack of measles instead of the customary two weeks. As the disease is acutely infectious, the little victim should be isolated for at least three weeks after the disappearance of the fever; but this again, as in the case of scarlet fever, is emphatically a blessing in disguise from his point of view, as well as a protection to the rest of the community.

Should the "little fever" prove to be whooping-cough, it will be later still in positively declaring its definite intentions. The cold or catarrhal stage will be much milder, the fever lower, the cough a trifle more marked, but will drag on for from a week to ten days before anything definite happens. Usually the child is supposed to be suffering with a slight cold, hence the prevailing impression that colds run into whooping-cough, if neglected. Then one day the child is suddenly seized with a coughing fit, consisting of from ten to fifteen short coughs in rapid succession of increasing intensity, until all the air seems literally pumped out of the lungs of the poor little patient; then, with a tremendous whoop, the youngster gets his breath again and the diagnosis is made. This distressing performance may occur only four or five times a day, or it may be repeated every half-hour or so. So violent is the paroxysm that the eyes of the child protrude, it becomes literally black in the face, and runs to its mother or nurse, or clutches a chair, to keep from falling. [Pg 264]

As the same great nerves which supply the lungs supply the stomach, the irritation frequently "radiates," or spills over, from one division of it to the other, and the coughing fit is frequently followed by vomiting. Unexpectedly enough this may often become the most serious practical symptom of the disease, inasmuch as the stomach is emptied so frequently that the poor little victim is unable to retain any nourishment long enough to absorb it, and may waste away frightfully, and even literally starve to death, or have its resisting power so greatly lowered that an attack of bronchial trouble or bowel disturbance will prove rapidly fatal.

So serious are the disturbances of the circulation all over the body by these spasmodic suffocation-fits, that rupture of small blood-vessels may occur in the eyes, the brain, in the lungs, and on the surface of the skin. The heart becomes distended, and if originally weakened may be seriously dilated or overstrained; the lungs become congested and inflamed, and any of the [Pg 265] numerous accidental germs which may be present will set up a broncho-pneumonia, which is the commonest cause of death in this disease, as in measles.

Strangely enough, while, as we do not positively know the germ, and hence cannot state definitely either the cause or the principal seat of the trouble, it is not generally believed that the condition of the lungs or the throat has much to do with the cough.

At all events, it is perfectly idle to treat the disease with cough mixtures or expectorants. The view toward which the majority of intelligent observers are inclined is that whooping-cough is an infection, the germ or toxin of which attacks the nervous system, and particularly the great "lung-stomach" (pneumo-gastric) nerve. At all events, the only remedies which appear to have any effect upon the disease are, in the early stages, mild local antiseptics in the nose and throat, and later those which diminish the irritability of the nerves without upsetting the appetite or depressing the general vigor. The disease is, for all its mildness, one of the most obstinate known.

A small percentage of cases run a violent course, in spite of the most intelligent and anxious care, both medical and household; but the vast majority of such complications as occur are either caused by carelessness or become serious only if neglected. Treating all children with whooping-cough as emphatically sick children, entitled to every care and excuse from exertion, every exemption and privilege that can be given them until the last whoop has been whooped, would prevent at least two-thirds of the almost ten thousand deaths from whooping-cough that yearly [Pg 266] disgrace the United States.

To sum up in fine: intelligent, effective isolation of all cases, the mild no less than the severe, would stamp out these Herods of the twentieth century within ten years. In the meantime, six weeks' sick-leave, with all the privileges and care appertaining thereto, will rob them of two-thirds of their terrors. [Pg 267]

CHAPTER XII

APPENDICITIS, OR NATURE'S REMNANT SALE

We were not made all at once, nor do we go to pieces all at once, like the "one-hoss shay." This is largely because we are not all of the same age, clear through. Some parts of us are older than other parts. We have always felt a difficulty, not to say a delicacy, in determining the age of a given member of the human species—especially of the gentler sex. Now we know the reason of it. From the biologic point of view, we are not an individual, but a colony; not a monarchy, but a confederacy of organ-states, each with its millions of cell-citizens. It is not merely editors and crowned heads who have a biologic right to say "We." Therefore, obviously, any statement that we make as to our age can be only in the nature of an average struck between the ages of our heart, lungs, liver, stomach; and as these vary in ancientness by thousands of years, the average must be both vague and misleading. The only reason why there is a mystery about a woman's age is that she is so intensely human and natural. The only statement as to our age that the facts would strictly justify us in making must partake of the vagueness of Mr. A. Ward's famous confession that he was "between twenty-three summers."

As we individually climb our own family-tree, from the first, one-celled droplet of animal jelly up, none of our organs is older than we are, but a number of them are younger. The appendix is one [Pg 268] of these. Now, by some curious coincidence, explain it as we may, some of our oldest organs are youngest, in the sense of most vigorous, elastic, and resisting, while some of our youngest are oldest, in the sense of decrepit, feeble, and unstable. It is perhaps only natural that an organ like the stomach, for instance, which has a record of honorable service and active duty millions of years long, should be better poised, more reliable, and more resourceful than one which, like the lung or the appendix, has, as it were, a "character" of only about one-tenth of that length. However this may be, the curious fact confronts us that scattered about through the body are structures and fragments, the remains of organs which at one time in our ancestral career were, under the then existing circumstances, of utility and value, but have now become mere survivals, remnants,—in the language of the day, "back numbers." Some of these have still a certain degree of utility, though diminished and still diminishing in size and functional importance, like our third molars or "wisdom" teeth, our fifth or "little" toes, our gall-bladder, our coccyx or tail-bone, the hair-glands scattered all over the now practically hairless surface of our bodies, and our once movable ears, which can no longer be "pricked," or laid back. These, though of far less utility and importance than they obviously were at one time, still earn their salt, and, though all capable of causing us considerable annoyance on slight provocation, seldom give rise to serious trouble or inconvenience. There are, however, a few of these "oversights" which are of little or no known [Pg 269] utility, and yet which, either by their structure or situation, may become the starting-point of serious trouble.

The best known members of this small group are the openings through the abdominal wall,

which, originally placed at the strongest and safest position in the quadrupedal attitude, are now, in the erect attitude, at the weakest and most dangerous, and furnish opportunity for those serious and sometimes fatal escapes of portions of the intestines which we call hernia; the tonsils; and our friend the *appendix vermiformis*.

For once its name expresses it exactly. It *is* an "appendix," an afterthought; and it is "*vermiformis*," a worm-like creature,—and, like the worm, will sometimes turn when trodden on. Its worm-likeness is significant in another sense also, in that it is this very diminutiveness in size —the coils into which it is thrown, the spongy thickness of its walls, and the readiness with which its calibre or its circulation is blocked—that is the fundamental cause of its tendency to disease.

The cause of appendicitis is the appendix.

"Despise not the day of small things" is good pathology as well as Scripture. Here we have a little, worm-shaped tag, or side branch, of the food-tube, barely three or four inches long, of about the diameter of a small quill and of a calibre that will barely admit an ordinary knitting needle. And yet we speak of it with bated breath. When we remember that this little, twisted, blind tube opens directly out of one of the largest pouches of the intestines (the *cæcum*), and that it is easy for anything that may be present in the large pouch—food, irritating fragments of waste matter, or bacteria—to find its way into this fatal little trap, but very difficult to find the way out again, we can form some idea of what a literal death-trap it may become. [Pg 270]

How did such a useless and dangerous structure ever come to develop in a body in which for the most part there is mutual helpfulness, utility, and perfect smoothness of working through all the great machine? To attempt to answer this would carry us very far back into ancient history. But to make such backward search is absolutely the only means of reaching an answer.

"But," some one will object, "how perfectly irrational, not to say absurd, to propose to go back hundreds of thousands of years into ancient history, to account for a disease which has been discovered—according to some, invented—within the past twenty-five years!"

Appendicitis is a mark, not a result, of a high grade of civilization. To have had an operation for it is one of the insignia of modern rank and culture. Our new biologic aristocracy, the "Appendix-Free," look down with gentle disdain upon their appendiciferous fellows who still bear in their bodies this troublesome mark of their lowly origin. In short, the general impression prevails that appendicitis is a new disease, a disease which has become common, or perhaps occurred at all, only within the last quarter of a century, and which therefore—with the usual flying leap of popular logic—is a serious menace to our future, if it keeps on increasing in frequency and ferocity at anything like the same rate which it has apparently shown for the past fifteen years. [Pg 271]

As this feeling of apprehension is in many minds quite genuine, it may be well to say briefly, before proceeding further, first, that, if there be any disease which absolutely and almost exclusively depends upon definite peculiarities of structure, it is appendicitis, and that these structural peculiarities of this tiny, cramped tag of the food-canal have existed from the earliest infancy of the race. So it is almost unthinkable that man should not have been subject to fatal disturbances of this organ from the very earliest times. On the post-mortem table, the appendix of the lowest savage is the same useless, shriveled, and inflammable worm as that of the most highly civilized Aryan, though perhaps an inch or so longer. Secondly, there is absolutely no adequate proof that appendicitis is increasing in frequency among civilized races. It is only about twenty-five years ago that it was first definitely described, and barely fifteen that the profession began at all generally to recognize it.

But all of us whose memory extends backward a quarter of a century can clearly recall that, while we did not see any cases of "appendicitis," we saw dozens of cases of "acute enteritis," "idiopathic (self-caused) peritonitis," "acute inflammation of the bowels," "acute obstruction of the bowels," of which patients died both painfully and promptly, and which we now know were really appendicitis.

In short, from a careful study of all the data, including the claims so frequently made of freedom from appendicitis on the part of Oriental races, colored races, less civilized tribes, vegetarians, and others, we are tending toward the conclusion that the percentage of appendicitis in a given community is simply the percentage of its recognition,—in other words, of the intelligence and alertness, first of its physicians, and then of its laity. As an illustration, my friend Dr. Bloodgood kindly had the statistics of the surgical patients treated in the great Johns Hopkins Hospital at Baltimore investigated for me, and found almost precisely the same percentage of cases of appendicitis among colored patients as among white patients. [Pg 272]

The earlier impression, first among physicians and now in the laity, that appendicitis is an almost invariably fatal disease, is not well founded, and we now know that a large percentage of cases recover, at least from the first attack; so that it is quite possible for from half to two-thirds of the cases of appendicitis actually occurring in a given community to escape recognition, unless promptly reported, carefully examined, and accurately diagnosed. Thirdly, in spite of the remarkable notoriety which the disease has attained, the general dread of its occurrence,—which has been recently well expressed in a statement that everybody either has had it, or expects to have it, or knows somebody who has had it,—the actual percentage of occurrence of grave appendicitis is small. In the United States census of 1900, which was the first census in which it was recognized as a separate cause of death, it was responsible for only 5000 deaths in the entire United States for the ten years preceding, or about one death in two hundred. This rate is [Pg 273]

corroborated by the data, now reaching into thousands, from the post-mortem rooms of our great hospitals, which report an average of between a half and one per cent. A disease which, in spite of the widespread terror of it, kills only one in two hundred of those who actually die—or about one in every ten thousand of our population—is certainly nothing to become seriously excited over from a racial point of view.

While appendicitis is one of the "realest" and most substantial of diseases, and, in its serious form, highly dangerous to life, there can be little doubt that there has come, first of all, a state of mind almost approaching panic in regard to it; and, second, a preference for it as a diagnosis, as so much more *distingué* than such plebeian names as "colic," "indigestion," "enteritis," or the plain old Saxon "belly-ache," which has reached almost the proportions of a fad. It is certain that nowadays physicians have almost as frequently to refuse to operate on those who are clamoring for the distinction, as to urge a needed operation upon those unwilling to submit to it.

The satirical proposal that a "closed season" should be established by law for appendicitis as for game birds, during which none might be taken, would apply almost as often to the laity as to the profession, even the surgical half.

Since the chief cause of appendicitis is the appendix, the first question for disposal is, How did the appendix become an appendix? To this biology can render a fairly satisfactory answer. It is [Pg 274] the remains of one of Mother Nature's experiments with her 'prentice hand upon the mammalian food-tube. As is now generally known, the food-canal in animals was originally a comparatively straight tube, running the length of the body from mouth to anus. It early distends into a moderate pouch, about a third of the way down from the mouth, forming a *stomach*, or storage and churning-place for the food. Below this, it lengthens into coils (the so-called *small intestine*), which, as the body becomes more complex, increase in number and length until they reach four to ten times the length of the body. Later, the lower third of the tube distends and sacculates out into a so-called *large intestine*, in which the last remnants of nutritive material and of moisture are extracted from the food-residues before they are discharged from the body. Just at the junction of this large intestine with the small intestine, nature took it into her head to develop a second pouch, a sort of copy of the stomach. This pouch, from the fact that it ends in a blind sac, is known as the *cæcum* (or "blind" pouch), and is apparently simply a means of delaying the passage of the foodstuffs until all the nutriment and moisture have been absorbed out of them for the service of the body. Naturally, it has developed to the largest degree and size in those animals which have lived upon the bulkiest and grassiest of foods, the so-called *Herbivora*, or grass-eaters. In the *Carnivora*, or flesh-eaters, it is usually small, and in one family, the bears, entirely absent. This pouch is no mere figure of speech, as may be gathered from the fact that in [Pg 275] certain of the rodent *Herbivora*, like the common guinea-pig, it may have a capacity equal to all of the rest of the alimentary canal, and in the horse it will hold something like four times as much as the stomach. Oddly enough, among the grass-eaters, for some reason which we do not understand, it appears to occur in a sort of inverse proportion to the stomach; those which have large, sacculate, pouched stomachs, like the cow, sheep, and the ruminants generally, having smaller *cæca*. In other *Herbivora* with small stomachs, like the rabbit and the horse, it develops greater size.

Our primitive ancestors were mixed feeders, and, though probably more largely herbivorous than we are to-day, had a medium-sized *cæcum*, and maintained it up to the point at which the anthropoid apes began to branch off from our family-tree. But at about this point, for some reason, possibly connected with the increasing variety and improved quality and concentration of the food, due to greater intelligence and ability to obtain it, this large *cæcum* became unnecessary, and began to shrivel.

Here, however, is where nature makes her first afterthought mistake. Instead of allowing this pouch to contract and shrivel uniformly throughout its entire length, she allowed the farther (or *distal*) two-thirds of it to shrivel down at a much faster rate than the central (or *proximal*) third; so that the once evenly distended sausage-shaped pouch, about six to eight inches long and two inches in diameter, has become distorted down into a narrow, contracted end portion, about a quarter of an inch in diameter, and a distended first portion, for all the world like a corncob pipe [Pg 276] with a crooked stem and an unusually large bowl. And behold—the modern *appendix vermiformis*, with all its fatal possibilities!

If we want something distinctly human to be proud of, we may take the appendix, for man is the only animal that has this in its perfection. A somewhat similarly shriveled last four inches of the *cæcum* is found in the anthropoid apes and in the wombat, a burrowing marsupial of Australia. In some of the monkeys, and in certain rodents like the guinea-pig, a curious imitation appendix is found, which consists simply of a contracted last four or five inches of the *cæcum*, which, however, on distention with air, is found to relax and expand until of the same size as the rest of the gut.

The most strikingly and distinctly human thing about us is not our brain, but our appendix. And, while recognizing its power for mischief, it is only fair to remember that it is an incident and a mark of progress, of difficulties overcome, of dangers survived. In all probability, it was our change to a more carnivorous diet, and consequently predatory habits, which enabled our ancestors to step out from the ruck of the "*Bandar-Log*," the Monkey Peoples. An increase in carnivorousness must have been a powerful help to our survival, both by widening our range of diet, so that we could live and thrive on anything and everything we could get our hands on, and by inspiring greater respect in the bosoms of our enemies. Let us therefore respect the appendix

as a mark and sign of historic progress and triumph, even while recognizing to the full its unfortunate capabilities for mischief. [Pg 277]

But what has this ancient history to do with us in the twentieth century? Much in every way. First, because it furnishes the physical basis of our troubles; and second, and most important, because, like other history, it is not merely repeating itself, but continuing. This process of shriveling on the part of the appendix is not ancient history at all, but exceedingly modern; indeed, it is still going on in our bodies, unless we are over sixty-five years of age.

In the first place, we have actually passed through two-thirds of this process in our own individual experience.

At the first appearance of the *cæcum*, or blind pouch, in our prenatal life, it is of the same calibre as the rest of the intestine, and of uniform size from base to tip. About three weeks later the tip begins to shrivel, and from this on the process steadily continues, until at birth it has contracted to about one-fifteenth of the bulk of the *cæcum*. But the process doesn't stop here, though its progress is slower. By about the fifth year of life the stem of the cæco-appendix pipe has diminished to about one-thirtieth of the size of the bowl, which is the proportion that it maintains practically throughout the rest of adult life. For a long time we concluded that the process was here finished, and that the appendix underwent no further spontaneous changes during life; but, after appendicitis became clearly recognized, a more careful study was made of the condition of the appendix in bodies coming to the post-mortem table, dead of other diseases, at all ages of life. [Pg 278] This quickly revealed an extraordinary and most significant fact, that, while the appendix was no longer decreasing in apparent size, its internal capacity or calibre was still diminishing, and at such a rate that by the thirty-fifth year it had contracted down so as to become cut off from the cavity of the *cæcum* in about twenty-five to thirty per cent of all individuals. By the forty-fifth year, according to the anatomist Ribbert (who has made the most extensive study of the subject), nearly fifty per cent of all appendices are found to be cut off, and by the sixty-fifth year nearly seventy per cent.

This explains at once why appendicitis is so emphatically a disease of young life, the largest number of cases occurring before the twenty-fifth year (fifty per cent of all cases occur between ten and thirty years of age), and becoming distinctly rarer after the thirty-fifth, only about twenty per cent occurring after this age. As soon as the cavity of the appendix is cut off from that of the intestine, it is of course obvious that infectious or other irritating materials can no longer enter its cavity to cause trouble, although, of course, it is still subject to accidents due to kinks, or twists, or interference with its blood-supply; but these are not so dangerous, providing there be no infectious germs present.

Here, then, we have a clear and adequate physical basis for appendicitis. A small, twisted, shriveling spur or side twig of the intestine, opening from a point which has become a kind of settling basin in the food-tube, its mouth gaping, as it were, to admit any poisonous or irritating [Pg 279] food, infectious materials, disease-germs, the ordinary bacteria which swarm in the alimentary canal, or irritating foreign bodies, like particles of dirt, sand, hairs, fragments of bone, pins, etc., which may have been accidentally swallowed. Once these irritating and infectious materials have entered it, spasm of its muscular coat is promptly set up, their escape is blocked, and a violent inflammation easily follows, which may end in rupture, perforation, or gangrene.

Not only may any infection which is sweeping along the alimentary canal, thrown off and resisted by the vigorous, full-sized, well-fed intestine, find a point of lowered resistance and an easy victim for its attack in the appendix, but there is now much evidence to indicate that the ordinary bacteria which inhabit the alimentary canal, particularly that first cousin of the typhoid bacillus, the colon bacillus, when once trapped in this *cul-de-sac*, may quickly acquire dangerous powers and set up an acute inflammation. It is not necessary to suppose that any particular germ or infection causes appendicitis. Any one which passes through, or attacks, the alimentary canal is quite capable of it, and probably does cause its share of the attacks.

Numerous attempts have been made to show that appendicitis is particularly likely to follow typhoid fever, rheumatism, influenza, tonsilitis, and half a dozen other infectious or inflammatory processes. But about all that has been demonstrated is that it may follow any of them, though in none with sufficient frequency or constancy to enable it to be regarded as one of the chief or [Pg 280] even one of the important causes of the disease.

One dread, however, we may relieve our anxious souls of, and that is the famous grape-seed or cherry-stone terror. To use a Hibernianism, one of our most positive conclusions in regard to the cause of appendicitis is a negative one: that it is not chiefly, or indeed frequently, due to the presence of foreign bodies. This was a most natural conclusion in the early days of the disease, since, given a tiny blind pouch with a constricted opening gaping upon the cavity of the food-canal, nothing could be more natural than to suppose that small irritating food remnants or foreign bodies, slipping into it and becoming lodged, would block it and give rise to serious inflammation. And, moreover, this *a priori* expectation was apparently confirmed by the discovery, in many appendices removed by operation, of small oval or rounded masses, closely resembling the seed of some vegetable or fruit. Whereupon anxious mothers promptly proceeded to order their children to "spit out," with even more religious care than formerly, every grape-seed and cherry-stone. The increased use of fresh and preserved fruits was actually gravely cited, particularly by our Continental brethren, as one of the causes of this new American disease. Barely ten years ago I was spending the summer in the Adirondacks, and was bitterly reproached by the host of one of the Lake hotels, because the profession had so terrified the public about the

dangers of appendicitis from fruit-seeds that he was utterly unable to serve upon his tables a large stock of delicious preserved and canned raspberries, blackberries, and grapes which he had [Pg 281] put up the previous years. "Why," he said, "more than half the people that come up here will no more eat them than they would poison, for fear that some of the seeds will give 'em appendicitis." This dread, however, has been deprived of all rational basis, first, by finding that many inflamed appendices removed, after the operation became more common, contained no foreign body whatever; secondly, that many perfectly healthy appendices examined on the post-mortem table, death being due to other diseases, contain these apparently foreign bodies; and thirdly, that when these "foreign bodies" were cut into, they were found to be not seeds or pits of any description, but hardened and, in some cases, partially calcareous masses of the fæces.

We are in a nearly similar position in regard to the third alleged cause of appendicitis, and that is food. Many are the accusations which have been made in this field. On the one hand, meat and animal foods generally have been denounced, on account of their supposed "heating" or "uric-acid-forming" properties; while on the other, vegetables and fruits have been equally hotly incriminated, on account of their seeds, fibres, husks, and irritating substances, and the danger of their being contaminated by bacteria and other parasites from the soil. These charges appear to have little adequate foundation, and, so far as we are in a position now to judge, the only way a food can give, or be accessory to, appendicitis is by its being taken in such excessive amounts as to set up fermentive or putrefactive changes in the alimentary canal, or by its being in an [Pg 282] unsound, decaying, or actually diseased condition. Any amounts or quality of food which are capable of giving rise to an attack of acute indigestion may secondarily lead to an attack of appendicitis. The only single article of diet whose ingestion is declared by Osler to be rather frequently followed by an attack of appendicitis is the peanut.

Therefore, the best thing to do in the way of taking precautions against the occurrence of appendicitis is, in the language of the day, to "forget it" as completely as possible, reassuring ourselves that, in spite of its extraordinary notoriety and popularity, it is a comparatively rare disease in its fatal form, responsible for not more than one-half of one per cent of the deaths, and that the older we grow, the better become our chances of escaping it.

Whatever we may have decided in regard to our brains, by the time we reach fifty, we may feel reasonably sure we've no appendix.

But the question will at once arise, if the appendix be so tiny in size, so insignificant in capacity, and so devoid of useful function, what is the use of disturbing ourselves over the question of what may become of it? If it is going to decay and drop off, why not permit it to do so, with the philosophic indifference with which we would sacrifice the tip of our little fingers in a planing-mill? Here, however, is just the rub, and the fact that gives to appendicitis all its terrors, and to the question of what to do in each particular case its difficulties and perplexities. [Pg 283]

The appendix does not, unfortunately, hang out from the surface of the body, where it could peacefully decay and drop off without prejudice to the rest of the body, or be quickly lopped off in the event of its giving trouble. On the contrary, it projects its stubby and insignificant length right into the midst of the most delicate and susceptible cavity of the body, the general cavity of the abdomen, or peritoneum. The thin, sensitive sheet of peritoneum which lines this cavity covers every fold and part of the food-tube, from the stomach down to the rectum. And when once infection or inflammation has occurred at any point in it, there is nothing to prevent its spreading like a prairie fire, all over the entire abdominal cavity from diaphragm to pelvis. If this wretched little remnant were a coil of explosive fuse within the brain-cavity itself, which any jar might set off, it could hardly be richer in possibilities of danger.

A redeeming feature of appendicitis is that the appendix lies—so to speak—in a corner, or wide-mouthed pouch, of the great peritoneal cavity; and if the inflammation set up in it can be "walled off" from the rest of the peritoneal cavity, and limited strictly to this little corner or pouch, all will be well. This is what occurs in those cases of severe appendicitis which spontaneously recover. If, however, this disturbance bursts its barriers, and lights up an inflammation of the entire peritoneal cavity, then the result is likely to be a fatal one. Just how far nature can be trusted in each particular case to limit and stamp out the process in this manner is the core of the problem that confronts us, as attending physicians. [Pg 284]

In the majority of cases, fortunately, the peritoneal fire brigade acts promptly, pours out a wall of exudate, and locks up the appendix in a living prison, to fight out its own battles and sink or swim by itself. But unfortunately, in a minority of cases, by a wretched sort of "senatorial courtesy" which exists in the body, the appendix is given its ancestral or traditional rights and allowed to inflict its petty troubles upon the entire abdominal cavity, and include the body in its downfall.

Lastly come the two most pertinent and appealing questions:—

What is the outlook for me if I should develop appendicitis? And what is to be done?

In regard to the first of these, it is safe to say that our answer is much less alarming than it was in the earlier stage of our knowledge. Naturally enough, in the beginning, only the severest and most unmistakable forms of the disease and those which showed no tendency to localization, were recognized, or at least came under the eye of the surgeon; and as a large percentage of these resulted fatally, the conclusion was reached, both in the medical profession and by the laity, that appendicitis was an exceedingly dangerous disease, with a high fatality in all cases. As, however, physicians became more expert in the recognition of the disease, it was discovered to

be vastly more common, while side by side came the consoling knowledge that a considerable percentage of cases got well of themselves, in the sense of the inflammation being limited to the lower right-hand corner of the abdominal cavity, though, of course, with the possibility of leaving a smouldering fuse which might light up another explosion under any stress in future. [Pg 285]

Further, as the attention of the post-mortem investigators at our large hospitals was directed to the subject, it was found that a very considerable percentage of all bodies, ranging from twenty to—according to some estimates—as high as sixty per cent, showed changes in the appendix and its neighborhood which were believed to be due to old inflammations; so that, while it is possible to speak only with great caution and reserve, the balance of opinion among clinicians and pathologists of wide experience and the more conservative surgeons appears to be that from one-half to two-thirds of all cases of appendicitis will recover of themselves, in the sense of subsiding more or less permanently, without causing death.

On the other hand, it must be remembered that the appendix is an organ which, so far as any evidence has been adduced, is entirely without useful function; that it is in process of shriveling and disappearance, if left entirely alone, and that the best result which can be expected from a self-cured attack of appendicitis is the destruction of the appendix and its elimination as a further possible cause of mischief. By avoiding an operation in appendicitis, we may be practically certain that we save nothing that is worth saving—except the fee. Moreover, even though only from one-fourth to one-third of all cases develop serious complications, you never can be quite sure in which division your particular case will fall.

The situation is in fact a little bit like one related in the experience of Edison, the inventor. The trustees of a church in a neighboring town had just completed a beautiful new church building with a high spire, projecting far above any other building in the town. When it was nearing completion, the question arose, should they put on a lightning-rod. The great church itself had strained their financial resources, and one party in the board were of the opinion that they should avoid this unnecessary expense, supporting their economic attitude by the argument that, to put on a lightning-rod, would argue a lack of trust in Providence. Finally, after much debate, it was decided, as the great electrician was readily accessible, to submit the question to him. Mr. Edison listened gravely to the arguments presented, pro and con. [Pg 286]

"What is the height of the building, gentlemen?"

The number of feet was given.

"How much is that above that of any surrounding structures?"

The data were supplied.

"It is a church, you say?"

"Yes."

"Well," said the great man, "on the whole, I should advise you to put on a lightning-rod. Providence is apt to be, at times, a trifle absent-minded."

The chances are in favor of your recovery, but—put on a lightning-rod, in the shape of the best and most competent doctor you know, and be guided entirely by his opinion. An attack of appendicitis is like shooting the Grand Lachine Rapids. Probably you will come through all right; but there is always the possibility of landing at a moment's notice on the rocks or in the whirlpools. With a good pilot your risk doesn't exceed a fraction of one per cent. And fortunately this condition has been not merely theoretically but practically reached already; for the later series of case-groups of appendicitis treated in this intelligent way by coöperation between the physician and surgeon from the start, with prompt interference in those cases which to the practiced eye show signs of making trouble, has reduced the actual recorded mortality of the disease to between two and five per cent. Even of those cases which come to operation now, the death-rate has been reduced as low as five per cent, in series of from 400 to 600 successive operations. When we contrast this with the first results of operation, when the cases as a rule were seen too late for the best time of interference, and from twenty per cent to thirty per cent died; and with the intermediate stage, when surgeons as a rule were inclined to advise operation at the earliest possible moment that the disease could be recognized, and from ten per cent to fifteen per cent died, we can see how steady the improvement has been, and how encouraging the outlook is for the future. [Pg 287]

Cases which have weathered one attack of appendicitis are of course by no means free from the risk of another. Indeed, at one time it was believed that a recurrence was almost certain to occur. Later investigations, based upon larger numbers of cases, now running up into the thousands, give the reassuring result that though this danger is a real one, it is not so great as it was at one time supposed, as the average number in whom a second attack occurs appears to be about twenty per cent. This, however, is a large enough risk to be worthy of serious consideration; and in view of the fact that the mortality of operations done between attacks is less than one per cent, it is generally the feeling of the profession that, where there is any appreciable soreness, or tenderness, or liability to attacks of pain in the right iliac region, in an individual who has had one attack of appendicitis, the really conservative and prudent procedure is to have the source of the trouble removed once and for all. [Pg 288]

The four principal symptoms of appendicitis are: pain, which is usually felt most keenly

somewhere between the umbilicus and the right groin, though this is by no means invariable; tenderness in that same region upon pressure; rigidity of the muscles of the abdominal wall on the right side; and temperature, or fever.

No matter how much and how variegated pain you may have in the abdomen, or how high your temperature may run, if you are not distinctly sore on firm pressure down in this right lower or southwest quadrant of the abdomen,—but be careful not to press too hard, it isn't safe,—you may feel fairly sure that you haven't got appendicitis. If you are, you may still not have it, but you'd better send for the doctor, to be sure. [Pg 289]

CHAPTER XIII

MALARIA: THE PESTILENCE THAT WALKETH IN DARKNESS; THE GREATEST FOE OF THE PIONEER

Malaria has probably killed more human beings than all the wars that have ever devastated the globe. Some day the epic of medicine will be written, and will show what a large and unexpected part it has played in the progress of civilization. Valuable and essential to that progress as were the classic great discoveries of fire, ships, wheeled carriages, steam, gunpowder, and electricity, they are almost paralleled by the victories of sanitary science and medicine in the cure and prevention of that greatest disrupter of the social organism—disease. No sooner does the primitive human hive reach that degree of density which is the one indispensable condition of civilization, than it is apt to breed a pestilence which will decimate and even scatter it. Smallpox, cholera, and bubonic plague have blazed up at intervals in the centres of greatest congestion, to scourge and shatter the civilization that has bred them. No civilization could long make headway while it incurred the dangers from its own dirtiness; and to-day the most massive and imposing remains of past and gone empires are their aqueducts, their sewers, and their public baths. What chance has a community of building up a steady and efficient working force, or even an army large enough for adequate defense, when it has a constant death-rate of ten per cent per annum, [Pg 290] and an ever recurrent one of twenty to thirty per cent, by the sweep of some pestilence? The bubonic plague alone is estimated to have slain thirty millions of people within two centuries in Mediæval Europe, and to have turned whole provinces into little better than deserts.

In malaria, however, we have a disease enemy of somewhat different class and habits. While other great infections attack man usually where he is strongest and most numerous, malaria, on the contrary, lies in wait for him where he is weakest and most scattered, upon the frontiers of civilization and the borders of the wilderness. It is only of late years that we have begun to realize what a deadly and persistent enemy of the frontiersman and pioneer it is. We used to hear much of climate as an obstacle to civilization and barrier to settlement. Now, for climate we read "malaria." Whether on the prairies or even the tundras of the North, or by the jungles and swamps of the Equator, the *thing that killed* was eight times out of ten the winged messenger of death with his burden of malaria-infection. The "chills and fever," "fevernager," "mylary," that chattered the teeth and racked the joints of the pioneer, from Michigan to Mississippi, was one and the same plague with the deadly "jungle fever," "African fever," "black fever" of the tropics, from Panama to Singapore. Hardly a generation ago, along the advancing front of civilization in the Middle West, the whole life of the community was colored with a malarial tinge and the taste of quinine was as familiar as that of sugar. To this day, over something like three-quarters of the [Pg 291] area of these United States, the South, Middle West, and Far West, if you feel headachy and bilious and "run down," you sum it all up by saying that you are feeling "malarious." Dwellers upon the rich bottom-lands expected to shake every spring and fall with almost the same regularity as they put on and shed their winter clothing. Readers of Frank Stockton will remember the gales of merriment excited by his quaint touch of the incongruous in making the prospective bridegroom of the immortal Pomona change the date of their wedding day from Tuesday to Monday, because, on figuring the matter out, he had discovered that Tuesday was his "chill-day."

Though the sufferer from ague seldom received very much sympathy at the time, but was considered a fair butt for genial ridicule and chaff, yet even there the trouble had its serious side. Through all those communities there stalked a well-known and dreaded spectre, the so-called "congestive chill," what is now known in technical language as the pernicious malarial paroxysm. These were like the three warnings of death in the old parable. You would probably survive the first and might never have another; but if you had your second, it was considered equivalent to a notice to quit the country promptly and without counting the cost. In my boyhood days in the Middle West, I can recall hearing old pioneers tell of little groups of one or more families moving out on to some particularly rich and virgin bottom-land and losing two or three or more members [Pg 292] out of each family by congestive chills within the first year, and in some cases being driven in from the outpost and back to civilization by the fearful death-loss.

A pall of dread hangs over the whole west coast of Africa. The factories and trading-posts are haunted by the ghosts of former agents and explorers who have died there. Some years ago one German company had the sinister record that of its hundreds of agents sent out to the Gold Coast under a three years' contract, not one had fulfilled the term! All had either died, or been invalided and returned home. It was malaria more than any other five influences combined that

thwarted the French in their attempt to dig the Panama Canal and that made the Panama Railroad bear the ghastly stigma of having built its forty miles of track with a human body for every tie.

Malaria ever has been, and is yet, the great barrier against the invasion of the tropics by the white races; nor has its injurious influence been confined to the deaths that it causes, for these gaps in the fighting line might be filled by fresh levies drawn from the wholesome North. Its fearfully depressing and degenerating effects upon even those who recover from its attacks have been still more injurious. It has been held by careful students of tropical disease and conditions that no small part of that singular apathy and indifference which steal over the mind and body of the white colonist in the tropics, numbing even his moral sense, and alternating with furious outbursts of what the French have termed "tropical wrath," characterized by unnatural cruelty [Pg 293] and abnormal disregard for the rights of others, is the deadly work of malaria. It is the most powerful cause, not merely of the extinction of the white colonist in the tropics, but of the peculiar degeneracy—physical, mental, and moral—which is apt to steal over even the survivors who succeed in retaining a foothold. Two particularly ingenious investigators have even advanced the theory that the importation of malaria into the islands of Greece and the Italian peninsula by soldiers returning from African and Southern Asiatic conquests had much to do with accelerating, if not actually promoting, the classic decay of both of these superb civilizations.

To come nearer home, there can be little question that the baneful, persistent influence of malaria, together with the hookworm disease, has had much to do both with the degeneracy of the Southern "cracker," or "mean white," and with those wild outbursts of primitive ferocity in all classes which take the form of White Cap raids and lynching mobs.

However this may be, the disease and the colonization habit brought in a crude way their own remedy. The Spanish conquerors of Peru were told by the natives that a certain bark which grew upon the slopes of the Andes was a sovereign remedy for those terrible ague seizures. Indian remedies did not stand as high in popular esteem as they do now; but they were in desperate straits and jumped at the chance. To their delight, it proved a positive specific, and a Spanish lady of rank, the Countess Chincona, was so delighted with her own recovery that she carried [Pg 294] back a package of the precious Peruvian bark on her return to Europe, and endeavored to introduce it. So furious was the opposition of the Church, however, to this "pagan" remedy that she was completely defeated in her praiseworthy attempt and was obliged to confine her ministrations to those who belonged to her, the peasantry on her own estate. About half a century later, the new remedy excited so much discussion by the numerous cures that it effected, that it was considered worthy of a special council of the Jesuits, who formally pronounced it suitable for the use of the faithful, thereby attaching to it for many years the name of "Jesuit's bark." Virtue, however, is sometimes rewarded in this world, and the devoted and enlightened countess has, all unknown to herself, attained immortality by attaching her name, Chincona, softened into *cinchona*, and hardened into *quinine*, to the greatest therapeutic gift of the gods to mankind. It is not too much to say that the modern colonization of the tropics and subtropics by Northern races, which is one of the greatest and most significant triumphs of our civilization, would have been almost impossible without it. Its advance depended upon two powders, one white and the other black,—quinine and gunpowder.

For nearly three centuries we rested content with the knowledge that in quinine we had a remedy for malaria, which, if administered at the proper time and in adequate doses, would break up and cure ninety per cent of all cases. Just how it did it we were utterly in the dark, and many were the speculations that were indulged in. It was not until 1880, that Laveran, a French [Pg 295] army surgeon stationed in Algeria, announced the discovery in the blood of malarial patients of an organism which at first bore his name, the *Hematozoon-Laveran*, now known as the *Plasmodium malariæ*. This organism, of all curious places, burrowed into and found a home in the little red corpuscles of the blood. At periods of forty-eight hours it ripened a crop of spores, and would burst out of the corpuscles, scattering throughout the blood and the tissues of the body, and producing the famous paroxysm. This accounted for the most curious and well-marked feature of the disease, namely, its intermittent character, chill and fever one day, and then a day of comparative health, followed by another chill day and so on, as long as the infection continued. One problem, however, was left open, and that was why certain forms of the disease had their chills every fourth day and so were called *quartan* ague. This was quickly solved by the discovery of another form of the organism, which ripened its spores in three days instead of two. So the whole curious rhythm of the disease was established by the rate of breeding or ripening of the spores of the organism. Later still another form was discovered, which had no such regular period of incubation and gave rise to the so-called irregular, or *autumnal*, malarial fevers. That form of the fever which had a paroxysm every day, the classic *quotidian* ague, remained a puzzle for a little longer, but was finally discovered to be due chiefly to the presence of two broods, or infections, of the organism, which ripened on alternate days and hence kept the entire time of the [Pg 296] unfortunate patient occupied.

The mystery of the remedial effect of quinine was also solved, as it was found that, if administered at the time which centuries of experience has shown us to be the most effective, between or shortly before the paroxysms, it either prevented sporulation or killed the spores. So that at one triumphant stroke the mystery of centuries was cleared up.

But here will challenge some twentieth-century *Gradgrind*: "This is all very pretty from the point of view of abstract science, but what is the practical value of it? The discovery of the plasmodium and its peculiarities has merely shown us the how and the why of a fact that we had known well

and utilized for centuries, namely, that quinine will cure malaria." Just listen to what follows. The story of the plasmodium is one of the most beautiful illustrations of the fact that there is no such thing as useless or unpractical knowledge. The only thing that makes any knowledge unpractical is our more or less temporary ignorance of how to apply it. The first question which instantly raised itself was, "How did the plasmodium get into human blood?" The very sickle-shape of the plasmodium turned itself into an interrogation mark. The first clew that was given was the new and interesting one that this organism was a new departure in the germ line in that it was an animal, instead of a plant, like all the other hitherto known bacilli, bacteria, and other disease-germs.

It may be remarked in passing that its discovery had another incidental practical lesson of [Pg 297] enormous value, and that was that it paved the way for the identification of a whole class of animal parasites causing infectious diseases, which already includes the organisms of Texas fever in cattle, dourine in horses, the *tsetse* fly disease, the dreaded sleeping sickness, and finally such world-renowned plagues as syphilis and perhaps smallpox.

Being an animal, the plasmodium naturally would not grow upon culture-media like the vegetable bacilli and bacteria, and this very fact had delayed its recognition, but raised at once the probability that it must be conveyed into the human body by some other animal. Obviously, the only animals that bite our human species with sufficient frequency and regularity to act as transmitters of such a common disease are those Ishmaelites of the animal world, the insects. As all the evidence pointed toward malaria being contracted in the open air, attested by its popular though unscientific name *mal-aria*, "bad air," and as of all forms of "bad air" the night air was incomparably the worst, it must be some insect which flew and bit by night; which by Sherlock Holmes's process promptly led the mosquito into the dock as the suspected criminal. It wasn't long before he was, in the immortal language of Mr. Devery, "caught with the goods on"; and in 1895 Dr. Ronald Ross, of the Indian Medical Service, discovered and positively identified the plasmodium undergoing a cycle of its development in the body of the mosquito. He attempted to communicate the disease to birds and animals by allowing infected mosquitoes to bite them, but [Pg 298] was unsuccessful. Two Italian investigators, Bignami and Grassi, saw that the problem was one for human experiment and that nothing less would solve it. Volunteers were called for and promptly offered themselves. Their blood was carefully examined to make sure that they were not suffering from any latent form of malaria. They then allowed themselves to be bitten by infected mosquitoes, and within periods varying from six to ten days, eight-tenths of them developed the disease. It may be some consolation to our national pride to know that although the organism was first identified in the mosquito by an Englishman and its transmission to human beings in its bite by Italians, the first definite and carefully worked-out statement of the relation of the mosquito to malaria was made by an American, King of Washington, in 1882; though it is only fair to say that suggestions of the possible connection between mosquitoes and malaria had, so to speak, been in the air and been made from scores of different sources, from the age of Augustus onward.

Another mystery was solved—and what a flood of light it did pour upon our speculations as to the how and wherefore of the catching of malaria! In some respects it curiously corroborated and increased our respect for popular beliefs and impressions. While "bad air" had nothing to do with causing the disease, except in so far as it was inhabited by songsters of the *Anopheles* genus, yet it was precisely the air of marshy places which was most likely to be "bad" in this sense. So that, [Pg 299] while in one sense those local wiseacres, who would point out to you the pearly mists of evening as they rose over low-lying meadows and bottom-lands, and inform you that there before your very eyes was the "mylary just a-risin' out of the ground," were ludicrously mistaken, in another their practical conclusion was absolutely sound; for it is in just such air, at such levels above the surface of the water, that the *Anopheles* most delights to disport himself. Furthermore, while all raw or misty air is "bad," the night air is infinitely more so than that of the day, because this is the time at which mosquitoes are chiefly abroad. In fact, there can be little doubt that this is part of the foundation for that rabid and unreasonable dread of the night air which we fresh-air crusaders find the bitterest and most tenacious foe we have to fight. We have literally discovered the Powers of Darkness in both visible and audible form, and they have wings and bite, just like the vampire.

It was also a widespread belief in malarial regions that the hours when you are most likely to "git mylary inter yer system" were those just before and just after sundown; and now entomologists inform us that these are precisely the hours at which the *Anopheles* mosquito, the only genus that carries malaria, flies abroad.

Of course, a number of popular causes, such as bad drainage, the drinking of water from shallow surface wells, damp subsoils under the houses, and especially that peculiarly widespread and firmly held article of belief that new settlements, where large areas of prairie sod were being freshly upturned by the plough, were peculiarly liable to the attack and spread of malaria, had to [Pg 300] go by the board,—with this important reservation, however, that almost every one of these alleged causes either implied or was pretty safe to be associated with pools or swamps of stagnant water in the neighborhood, which would furnish breeding-spots for the mosquitoes.

The discovery explains at once a score of hitherto puzzling facts as to the distribution of malaria. Why, for instance, in all tropical or other malarious countries, those who slept in second and third story bedrooms were less likely to contract the disease, supposedly because "bad air didn't rise to that height," is clearly seen to be due to the fact that the mosquito seldom flies more than ten or twelve feet above the level of the ground or marsh in which he breeds, except when swept by prevailing winds. It also explained why in our Western and Southwestern states the inhabitants of

the houses situated on the south bank of a river, though but a short distance back from the stream, would suffer very slightly from malaria, while those living upon the north bank, half a mile back, or even upon bluffs fifteen or twenty feet above the water level, were simply plagued with it. The prevailing winds during the summer are from the south and mosquitoes cannot fly a foot against the wind, but will fly hundreds of yards, and even the best part of a mile, with it. The well-known seasonal preference of the disease for warm spring and summer months, and its prompt subsidence after a killing frost, were seen simply to be due to the influence of the weather upon the flight of mosquitoes. Shakespeare's favorite reference to "the sun of March [Pg 301] that breedeth agues" has been placed upon a solid entomological basis by the discovery that, like his pious little brother insect, the bee, the one converted and church-going member of a large criminal family, the mosquito hies himself abroad on his affairs at the very first gleam of spring sunshine, and will even reappear upon a warm, sunny day in November or December. Perhaps even some of the popular prejudice against "unseasonable weather" in winter may be traceable to this fact.

Granted that mosquitoes do cause and are the only cause of malaria, what are you going to do about it? At first sight any campaign against malaria which involves the extermination of the mosquito would appear about as hopeless as Mrs. Partington's attempt to sweep back the rising Atlantic tide with her broom. But a little further investigation showed that it is not only within the limits of possibility, but perfectly feasible, to exterminate malaria absolutely from the mosquito end. In the first place, it was quickly found that by a most merciful squeamishness on the part of the plasmodium, it could live only in the juices of one particular genus of mosquito, the *Anopheles*; and as nowhere, not even in the most benighted regions of Jersey, has this genus been found to form more than about four or five per cent of the total mosquito population, this cuts down our problem to one-twentieth of its apparent original dimensions at once. The ordinary mosquito of commerce (known as *Culex*) is any number of different kinds of a nuisance, but she [Pg 302] does not carry malaria.

Here the trails of the extermination party fork, one of them taking the perfectly obvious but rather troublesome direction of protecting houses and particularly bedrooms with suitable screens and keeping the inhabitants safely behind them from about an hour before sundown on. By this simple method alone, parties of explorers, of campers, of railroad-builders going through swamps, of the laborers on our Panama Canal, have been enabled to live for weeks and months in the most malarious regions with perfect impunity, so long as these precautions were strictly observed. The first experiment of this sort was carried out by Bignami upon a group of laborers in the famous, or rather infamous, Roman Campagna, whose deadly malarial fevers have a classic reputation, and has achieved its latest triumphs in the superb success of Colonel Gorgas at Panama. While this procedure should never be neglected, it is obvious that it involves a good deal of irksome confinement and interferes with freedom of movement, and it will probably be carried out completely only under military or official discipline, or in tropical regions where the risks are so great that its observance is literally a matter of life or death.

The other division of malaria-hunters pursued the trail of the *Anopheles* to her lair. There they discovered facts which give us practically the whip-hand over malarial and other tropical fevers whenever we choose to exercise it. It had long been known that the breeding-place of mosquitoes was in water; that their eggs when deposited in water floated upon the surface like tiny boats, [Pg 303] usually glued together into a raft; that they then turned into larvæ, of which the well-known "wigglers" in the water-butt or the rain-barrel are familiar examples; and that they finally hatched into the complete insect and rose into the air.

Obviously, there were two points at which the destroyers might strike, the egg and the larvæ. It was first found that, while the eggs required no air for their development, the larvæ wiggled up to the surface and inhaled it through curious little tubes developed for this purpose, oddly enough from their tail-ends. If some kind of film could be spread over the surface of the water, through which the larvæ could not obtain air, they would suffocate. The well-known property of oil in "scumming over" water was recalled, two or three stagnant pools were treated with it, and to the delight of the experimenters, not a single larva was able to develop under the circumstances. Here was insecticide number one. The cheapest of oils, crude petroleum, if applied to the pool or marsh in which mosquitoes breed, will almost completely exterminate them. Scores of regions and areas to-day, which were once almost uninhabitable on account of the plague of mosquitoes, are now nearly completely free from these pests by this simple means. An ounce to each fifteen square feet of water-surface is all that is required, though the oiling needs to be repeated carefully several times during the season.

But what of the eggs? They require no air, and it was found impossible to poison them without simply saturating the water with powerful poisons; but an unexpected ally was at our hand. It [Pg 304] was early noted that mosquitoes would not breed freely in open rivers or in large ponds or lakes, but why this should be the case was a puzzle. One day an enthusiastic mosquito-student brought home a number of eggs of different species, which he had collected from the neighboring marshes, and put them into his laboratory aquarium for the sake of watching them develop and identifying their species. The next morning, when he went to look at them, they had totally disappeared. Thinking that perhaps the laboratory cat had taken them, and overlooking a most contented twinkle in the corner of the eyes of the minnows that inhabited the aquarium, he went out and collected another series. This time the minnows were ready for him, and before his astonished eyes promptly pounced on the raft of eggs and swallowed them whole. Here was the answer at once: mosquitoes would not develop freely where fish had free access; and this fact is

our second most important weapon in the crusade for their extermination. If the pond be large enough, all that is necessary is simply to stock it with any of the local fish, minnows, killies, perch, dace, bass,—and presto! the mosquitoes practically disappear. If it be near some larger lake or river containing fish, then a channel connecting the two, to allow of its stocking, is all that is required.

On the Hackensack marshes to-day trenches are cut to let the water out of the tidal pools; while in low-lying areas, which cannot be thus drained, the central lowest spot is selected, a barrel is [Pg 305] sunk at this spot, and four or five "killie" fish are placed in it. Trenches are cut converging into this barrel from the whole of the area to be drained, and behold, no more mosquitoes can breed in that area, and, in the language of the day, "get away with it."

Finally, most consoling of all, it was discovered that, while the ordinary *Culex* mosquito can breed, going through all the stages from the egg to the complete insect, in about fourteen days, so that any puddle which will remain wet for that length of time, or even such exceedingly temporary collections of water as the rain caught in a tomato-can, in an old rubber boot, in broken crockery, etc., will serve her for a breeding-place, the *Anopheles* on the other hand takes nearly three months for the completion of her development. So that, while a region might be simply swarming with ordinary mosquitoes, it would frequently be found that the only places which fulfilled all the requirements for breeding-homes for the *Anopheles*, that is, isolation from running water or larger streams, absence of fish, and persistence for at least three months continuously, would not exceed five or six to the square mile. Drain, fill up, or kerosene these puddles,—for they are often little more than that,—and you put a stop to the malarial infection of that particular region. Incredible as it may seem, places in such a hotbed of fevers as the west coast of Africa, which have been thoroughly investigated, drained, and cleaned up by mosquito-brigades, have actually been freed from further attacks of fever by draining and filling not to [Pg 306] exceed twenty or thirty of these breeding-pools.

In short, science is prepared to say to the community: "I have done my part in the problem of malaria. It is for you to do the rest." There is literally no neighborhood in the temperate zone, and exceedingly few in the tropics, which cannot, by intelligent coöperation and a moderate expense, be absolutely rid first of malaria, and second of all mosquito-pests. It is only a question of intelligence, coöperation, and money. The range of flight of the ordinary mosquito is seldom over two or three hundred yards, save when blown by the wind, and more commonly not more than as many feet, and thorough investigation of the ground within the radius of a quarter of a mile of your house will practically disclose all the danger you have to apprehend from mosquitoes. It is a good thing to begin with your own back yard, including the water-butt, any puddles or open cesspools or cisterns, and any ornamental water gardens or lily-ponds. These latter should be stocked with fish or slightly oiled occasionally. If there be any accumulations of water, like rain-barrels or cisterns, which cannot be abolished, they should either be kept closely covered or well screened with mosquito netting.

It might be remarked incidentally in passing, that the only really dangerous sex in mosquitodom, as elsewhere, is the female. The male mosquito, if he were taxed with transmitting malaria, would have a chance to reëcho Adam's cowardly evasion in the Garden of Eden, "It was the woman that thou gavest me." Both sexes of mosquitoes under ordinary conditions are vegetable [Pg 307] feeders, living upon the juices of plants. But when the female has thrown upon her the tremendous task of ripening and preparing her eggs for deposition, she requires a meal of blood —which may be a comfort to our vegetarian friends, or it may not. Either she requires a meal of blood to nerve her up to her criminal deed, or, when she has some real work to do, she has to have some real food.

The mosquito-brigade have still another method of checking the spread of malaria, at first sight almost a whimsical one,—no less than screening the patient. The mosquito, of course, criminal as she is, does not hatch the parasites *de novo* in her own body, but simply sucks them up in a meal of blood from some previous victim. Hence by careful screening of every known case of malaria, mosquitoes are prevented from becoming infected and transmitting the disease. Instead of the screens protecting the victims from the mosquitoes, they protect the mosquitoes against the victim.

This explains why hunters, trappers, and Indians may range a region for years, without once suffering from malaria, while as soon as settlers begin to come in in considerable numbers, it becomes highly malarious. It had to be infected by the coming of a case of the disease.

The notorious prevalence of malaria on the frontier is due to the introduction of the plasmodium into a region swarming with mosquitoes, where there are few window-screens or two-story houses. [Pg 308]

No known race has any real immunity against malaria. The negro and other colored races, it is true, are far less susceptible; but this we now know applies only to adults, as the studies of Koch in Africa showed that a large percentage of negro children had the plasmodium in their blood. No small percentage of them die of malaria, but those who recover acquire a certain degree of immunity. Possibly they may be able to acquire this immunity more easily and with less fatality than the white race, but this is the extent of their superiority in this regard. The negro races probably represent the survivors of primitive men, who were too unenterprising to get away from the tropics, and have had to adjust themselves as best they might.

The serious injury wrought in the body by malaria is a household word, and a matter of painfully

familiar experience. Scarcely an organ in the body escapes damage, though this may not be discovered till long after the "fever-and-ague" has been recovered from.

As the parasite breeds in the red cells of the blood, naturally its first effect is to destroy huge numbers of these, producing the typical malarial *anæmia*, or bloodlessness. Instead of 5,000,000 to the cubic centimetre of blood the red cells may be reduced to 2,000,000 or even 1,500,000. The breaking down of these red cells throws their pigment or coloring-matter afloat in the blood; and soaking through all the tissues of the body, this turns a greenish-yellow and gives the well-known sallow skin and yellowish whites of the eyes of swamp-dwellers and "river-rats."

The broken-down scraps of the red blood-cells, together with the toxins of the parasite, are [Pg 309] carried to the liver and spleen to be burned up or purified in such quantities that both become congested and diseased, causing the familiar "biliousness," so characteristic of malaria.

The spleen often becomes so enormously enlarged that it can be readily felt with the hand in the left side below the ribs, so that it is not only relied upon as a sign of malaria in doubtful cases, but has even received the popular name of the "ague-cake" in malarious districts.

So full is the blood of the parasites, that they may actually choke up the tiny blood-vessels and capillaries in various organs, so as to block the circulation and cause serious and even fatal congestions. Obstructions of this sort may occur in the brain, the liver, the coats of the stomach, or intestines, and the kidneys; and they are the chief cause of the deadly "congestive chills," or pernicious malarial paroxysms, which we have alluded to.

The kidneys are particularly liable to be attacked in this way; indeed, one of their involvements is so serious and fatal in the tropics as to have been given a separate name, "Blackwater fever," from the quantities of broken-down blood which appear in and blacken the urine.

The vast majority of attacks of malaria are completely recovered from, like any other infection, but it can easily be seen what an injurious effect upon the system may be produced by successive attacks, keeping the entire body saturated with the poison; while there is serious risk of the [Pg 310] parasite sooner or later finding some weak spot in the body,—kidney, liver, nervous system,—where its incessant battering works permanent damage.

How long the infection may lurk in the body is uncertain; certainly for months, and possibly for years. Many cases are on record which had typical chills and fever, with abundance of plasmodia in the blood, years after leaving the tropics or other malarious districts; but there is often the possibility of a recent re-infection.

Altogether, malaria is a remarkably bad citizen in any community, and its stamping-out is well worth all it costs. [Pg 311]

CHAPTER XIV

RHEUMATISM: WHAT IT IS, AND PARTICULARLY WHAT IT ISN'T

What's in a name? All the aches and pains that came out of Pandora's box, if the name happens to be rheumatism. It is a term of wondrous elasticity. It will cover every imaginable twinge in any and every region of the body—and explain none of them. It is a name that means just nothing, and yet it is in every man's vocabulary, from proudest prince to dullest peasant. Its derivative meaning is little short of an absurdity in its inappropriateness, from the Greek *reuma* (a flowing), hence, a cold or catarrh. It is still preserved for us in the familiar "salt rheum" (eczema) and "rheum of the eyes" of our rural districts. But this very indefiniteness, absurdity if you will, is a comfort both to the sufferer and to the physician. Moreover, incidentally, to paraphrase Portia's famous plea,—

> It blesseth him that *has* and him that *treats*;
> 'T is mightier than the mightiest.
> It doth *fit* the thronéd monarch *closer* than his crown.

To the patient it is a satisfying diagnosis and satisfactory explanation in one; to the doctor, a great saving of brain-fag. When we call a disease rheumatism, we know what to give for it—even if we don't know what it is. As the old German distich runs,— [Pg 312]

> Was man kann nicht erkennen,
> Muss er Rheumatismus nennen.[2]

However, in spite of the confusion produced by this wholesale and indiscriminate application of the term to a host of widely different, painful conditions, many of which have little else in common save that they hurt and can be covered by this charitable name-blanket, a few definite facts are crystallizing here and there out of the chaos. The first is, that out of this swarm of different conditions there can be isolated one large and important central group which has the characters of a well-defined and constant disease-entity. This is the disease known popularly as rheumatic fever, and technically as acute rheumatism or acute articular rheumatism. In fact, the commonest division is to separate the "rheumatisms" into two great groups: acute, covering the "fever" form, and chronic, containing all the others. From a purely scientific point of view, this

classification has rather an undesirable degree of resemblance to General Grant's famous division of all music into two tunes: one of which was Old Hundred, and the other wasn't. But for practical purposes it has certain merits and may pass.

Every one has seen, or known, or had, the acute articular form of rheumatism, and when once seen there is no difficulty in recognizing it again. It is one of the most striking and most abominable of disease-pictures, beginning with high fever and headache, then tenderness, quickly increasing to extreme sensitiveness in one or more of the larger joints, followed by drenching sweats of penetrating acid odor. The joint attacked becomes red, swollen, and glossy, [Pg 313] so tender that merely pointing a finger at it will send a twinge of agony through the entire body, and the patient lies rigid and cramped for fear of the agony caused by the slightest movement. The tongue becomes coated and foul, the blood-cells are rapidly broken down, and the victim becomes ashy pale. He is worn out with pain and fever, yet afraid to fall asleep for fear of unconsciously moving the inflamed joint and waking in tortures; and altogether is about as acutely uncomfortable and completely miserable as any human being can well be made in so short a time.

Fortunately, as with its twin brother, the grip, the bark of rheumatism is far worse than its bite; and a striking feature of the disease is its low fatality, especially when contrasted with the fury of its onslaught and the profoundness of the prostration which it produces. Though it will torture its victim almost to the limits of his endurance for days and even weeks at a stretch, it seldom kills directly. Its chief danger lies in the legacies which it bequeaths. Though, like nearly all fevers, it is self-limited, tends to run its course and subside when the body has manufactured an antitoxin in sufficient amounts, it is unique in another respect, and that is in the extraordinary variability of the length of its "course." This may range anywhere from ten days to as many weeks, the "average expectation of life" being about six weeks. The agonizing intensity of the pain and acute edge of the discomfort usually subside in from five to fifteen days, especially under competent [Pg 314] care. When the temperature falls, the drenching sweats cease, the joints become less exquisitely painful, and the patient gradually begins to pull himself together and to feel as if life were once more worth living. He is not yet out of the woods, however, for while the pain is subsiding in the joints which have been first attacked, another joint may suddenly flare up within ten or twelve hours, and the whole distressing process be repeated, though usually on a somewhat milder and shorter scale. This uncertainty as to how many joints in the body may be attacked, is, in fact, one of the chief elements in making the duration of the disease so irregular and incalculable.

Even when the frank and open progress of the disease through the joints of the body has come to an end, the enemy is still lying in wait and reserving his most deadly assault. Distressing and crippling as are the effects of rheumatism upon the joints and tendons, its most deadly and permanent damage is wrought upon the heart. Fortunately, this vital organ is not attacked in more than about half the cases of acute rheumatism, and in probably not more than one-third of these are the changes produced either serious or permanent, especially if the case be carefully watched and managed. But it is not too much to say that, of all cases of serious or "organic" heart disease, rheumatism is probably responsible for from fifty to seventy per cent. The same germ or toxin which produces the striking inflammatory changes in the joints may be carried in the blood to the heart, and there attack either the lining and valves of the heart (endocardium), which is [Pg 315] commonest, or the covering of the heart (pericardium), or the heart-muscle. So intense is the inflammation, that parts of the valves may be literally eaten away by ulceration, and when these ulcers heal with formation of scar-tissue as everywhere else in the body, the flaps of the valves may be either tied together or pulled out of shape, so that they can no longer properly close the openings of the heart-pump. This condition, or some modification of it, is what we usually mean when we speak of "heart disease," or "organic heart disease." The effect upon the heart-pump is similar to that which would be produced by cutting or twisting the valve in the "bucket" of a pump or in a bulb syringe.

In severe cases of rheumatism the heart may be attacked within the first few days of the disease, but usually it is not involved until after the trouble in the joints has begun to subside; and no patient should be considered safe from this danger until at least six weeks have elapsed from the beginning of the fever. The few cases (not to exceed one or two per cent) of rheumatic fever which go rapidly on to a fatal termination, usually die from this inflammation of the heart, technically known as endocarditis. The best way of preventing this serious complication and of keeping it within moderate limits, if it occurs, is absolute rest in bed, until the danger period is completely passed.

Now comes another redeeming feature of this troublesome disease, and that is the comparatively small permanent effects which it produces upon the joints in the way of crippling, or even [Pg 316] stiffening. To gaze upon a rheumatic knee-joint, for instance, in the height of the attack,—swollen to the size of a hornet's nest, hot, red, throbbing with agony, and looking as if it were on the point of bursting,—one would almost despair of saving the joint, and the best one would feel entitled to expect would be a roughening of its surfaces and a permanent stiffening of its movements.

On the contrary, when once the fury of the attack has passed its climax, especially if another joint should become involved, the whole picture changes as if by magic. The pain fades away to one-fifth of its former intensity within twenty-four, or even within twelve hours; three-fourths of the swelling follows suit in forty-eight hours; and within three or four days' time the patient is moving the joint with comparative ease and comfort. After he gets up at the end of his six weeks, the knee, though still weak and stiff and sore, within a few weeks' time "limbers up" completely, and usually becomes practically as good as ever. In short, the violence and swiftness of the onset are

only matched by the rapidity and completeness of the retreat. It would probably be safe to say that not more than one joint in fifty, attacked by rheumatism, is left in any way permanently the worse.

But, alas! to counterbalance this mercifulness in the matter of permanent damage, unlike most other infections, one attack of rheumatic fever, so far from protecting against another, renders both the individual and the joint more liable to other attacks. The historic motto of the British in the War of 1812 might be paraphrased into, "Once rheumatic, always rheumatic." The disease [Pg 317] appears to be lost to all sense of decency and reason; and to such unprincipled lengths may it go, that I have actually known one luckless individual who had the unenviable record of seventeen separate and successive attacks of rheumatic fever. As he expressed it, he had "had rheumatism every spring but two for nineteen years past." Yet only one ankle-joint was appreciably the worse for this terrific experience.

Obviously, the picture of acute rheumatism carries upon its face a strong suggestion of its real nature and causation. The high temperature, the headache, the sweats, the fierce attack and rapid decline, the self-limited course, the tendency to spread from one joint to another, from the joints to the heart, from the heart to the lungs and the kidneys, all stamp it unmistakably as an infection, a fever. On the other hand, there are two rather important elements lacking in the infection-picture: one, that, although it does at times occur in epidemics, it is very seldom transmitted to others; the other, that one attack does not produce immunity or protect against another. The majority of experts are now practically agreed that *acute* rheumatism, or *rheumatic fever*, is probably due to the invasion of the system by some microörganism or germ. When, however, we come to fixing upon the particular bacillus, or micrococcus, there is a wide divergence of opinion, some six or seven different eminent investigators having each his favorite candidate for the doubtful honor. In fact, it is our inability as yet positively to identify and agree upon the causal germ that makes our knowledge of the entire subject still so regrettably vague, [Pg 318] and renders either a definite classification or successful treatment so difficult.

The attitude of the most careful and experienced physicians and broad-minded bacteriologists may be roughly summed up in the statement that acute rheumatism is probably due to some germ or germs, but that the question is still open which particular germ is at fault, and even whether the group of symptoms which we call rheumatism may not possibly be produced by a number of different organisms, acting upon a particular type of constitution or susceptibility. There is no difficulty in finding germs of all sorts, principally micrococci, in the blood, in the tissues about the joints, and on the heart-valves of patients with rheumatism, and these germs, when injected into animals, will not infrequently produce fever and inflammatory changes in the joints, roughly resembling rheumatism. But the difficulty so far has been, first, that these organisms are of several different kinds and distinct species; and second, and even more important, that almost any of the organisms of the common infectious diseases are capable at times of producing inflammation of the joints and tendons. For instance, the third commonest point of attack of the tubercle bacillus, after the lungs and the glands, is the bones and joints, as illustrated in the sadly familiar "white-swelling of the knee" and hip-joint disease. All the so-called septic organisms, which produce suppuration and blood-poisoning in wounds and surgery, may, and very frequently do, attack the joints; while nearly all the common infections, such as typhoid, scarlet fever, pneumonia, and even measles, influenza, and tonsillitis, may be followed by severe [Pg 319] joint symptoms.

In fact, we are coming to recognize that diseases of the joints, like diseases of the nervous system, are among the frequent results of any and all of the acute infectious diseases or fevers; and we now trace from fifty to seventy-five per cent of both joint troubles and degenerations of the nervous system to this cause. Two-thirds, for instance, of our cases of hip-joint disease and of spinal disease (*caries*) are due to tuberculosis.

The puzzling problem now before pathologists is the sorting out of these innumerable forms of joint inflammations and the splitting off of those which are clearly due to certain specific diseases, from the great, central group of true rheumatism. Most of these joint inflammations which are due to recognized germs, such as the pus-organisms of surgical fevers, tuberculosis, and typhoid, differ from true rheumatism in that they go on to suppuration (formation of "matter") and permanently cripple the joint to a greater or less degree. So that there is probably a germ or group of germs which produces the swift attack and rapid subsidence and other characteristic features of true rheumatism, even though we have not yet succeeded in sorting them out of the swarm. So confident do we feel of this, that although, as will be shown, there are probably other factors involved, such as exposure, housing, occupation, food, and heredity, yet the best thought of the profession is practically agreed that none of these would alone produce the disease, but that they are only accessory causes plus the micrococcus. In practically all our [Pg 320] modern textbooks of medicine, rheumatism is included under the head of infections.

This theory of causation, confessedly provisional and imperfect as it is, helps us to harmonize the other known facts about the disease; it has already greatly improved our treatment and given us a foothold for attacking the problem of prevention. For instance, it has long been known that rheumatism was very apt to follow tonsillitis or other forms of sore throat; indeed, many of the earlier authorities put down tonsillitis as one of the great group of "rheumatic" disturbances, and persons of rheumatic family tendency were supposed to have tonsillitis in childhood and rheumatism in later life. Not more than ten or fifteen per cent of all cases gave a history of tonsillitis; but since we have broadened our conception of infection and begun to inquire, not merely for symptoms of tonsillitis, but also for those of influenza, "common colds," measles,

whooping-cough, and the like, we reach the most significant result of finding that forty to sixty per cent of our cases of rheumatism have been preceded, anywhere from one to three weeks before, by an attack of some sort of "cold," sore throat, catarrhal fever, cough, bronchitis, or other group of disturbances due to a mild infection. Further, it has long been notorious that when a rheumatic individual "catches cold" it is exceedingly apt to "settle in the joints," and, if these cases happen to come under the eye of a physician, they are recognized as secondary attacks of true rheumatism. In other words, the "cold" may simply be a second dose of the same germ which caused the primary attack of rheumatism. [Pg 321]

This brings us to the widespread article of popular belief that rheumatism is most commonly due to cold, exposure, chill, or damp. Much of this is found on investigation to be due to the well-known historic confusion between "cold," in the sense of exposure to cold air, and "cold," in the sense of a catarrh or influenza, with running at the nose, coughing, sore throat, and fever, a group of symptoms now clearly recognized to be due to an infection. In short, the vast majority of common colds are unmistakably infections, and spread from one victim to another, and this is the type of "cold" which causes the majority of rheumatic attacks.

The chill, which any one who is "coming down" with a cold experiences, and usually refers to a draft or a cold room, is, in nine cases out of ten, the rigor which precedes the fever, and has nothing whatever to do with the external temperature. The large majority of our cases of rheumatism can give no clear or convincing history of exposure to wet, cold, or damp. But popular impression is seldom entirely mistaken, and there can be no question that, given the presence of the infectious germ, a prolonged exposure to cold, and particularly to wet, will often prove to be the last straw which will break down the patient's power of resistance, and determine an attack of rheumatism.

This climatic influence, however, is probably not responsible for more than fifteen or twenty per cent of all cases, and, popular impression to the contrary notwithstanding, the liability of outdoor workers who are subject to severe exposure, such as lumbermen, fishermen, and sailors, is only slightly greater than that of indoor workers. The highest susceptibility, in fact, not merely to the [Pg 322] disease, but also to the development of serious heart involvements, is found among domestic servants, particularly servant girls, agricultural laborers and their families (in districts where wages are low and cottages bad), and slum-dwellers; in fact, those classes which are underfed, overworked, badly housed, and crowded together. Diet has exceeding little to do with the disease, and, so far from meat or high living of any sort predisposing to it, it is most common and most serious in precisely those classes which get least meat or luxuries of any sort, and are from stern necessity compelled to live upon a diet of cereals, potatoes, cheap fats, and coarse vegetables.

Even its relations to the weather and seasons support the infection theory. Its seasonal occurrence is very similar to that of pneumonia,—rarest in summer, commonest in winter, the highest percentage of cases occurring in the late fall and in the early spring; in other words, just at those times when people are first beginning to shut themselves up for the winter, light fires, and close windows, and at the end of their long period of winter imprisonment, when both their resisting power has been reduced to the lowest ebb in the year and infections of all sorts have had their most favorable conditions of growth for months.

The epidemics of rheumatism, which occasionally occur, probably follow epidemics of influenza, tonsillitis, or other mild infections, and instances of two or more cases of rheumatism in one family or household are most rationally explained as due to the spread of the precedent infection [Pg 323] from one member of the family to the other. Instances of the direct transmission of the disease from one patient to another are exceedingly rare.

Our view of the infectious causation of rheumatism, vague as it is, has given us already our first intelligent prospect of prevention. Whatever may be the character of a germ or germs, the vast majority of them agree in making the nose and throat their first point of attack and of entry into the system. Hence, vigorous antiseptic and other rational treatment of all acute disturbances of the nose and throat, however slight, will prove a valuable preventive and diminisher of the percentage of rheumatism. This simply emphasizes again the truth and importance of the dictum of modern medicine, "Never neglect a cold," since we are already able to trace, not merely rheumatism, but from two-thirds to three-fourths of our cases of heart disease, of kidney trouble, and of inflammations of the nervous system, to those mild infections which we term "colds," or to other definite infectious diseases.

Not only is this good *a priori* reasoning, but it has been demonstrated in practice. One of our largest United States army posts had acquired an unenviable reputation from the amount of rheumatism occurring in the troops stationed there. A new surgeon coming to take charge of the post set about investigating the cause of this state of affairs, and came to the conclusion that the disease began as, or closely followed, tonsillitis and other forms of sore throat. He accordingly saw to it that every case of tonsillitis, of cold in the head, or sore throat was vigorously treated with local germicides and with intestinal antiseptics and laxatives, until it was completely cured; [Pg 324] with the result that in less than a year he succeeded in lowering the percentage of cases of rheumatism per company nearly sixty per cent.

At some of our large health-resorts, where great numbers of cases of rheumatism are treated, it has been discovered that if a case of common cold, or tonsillitis, happens to come into the establishment, and runs through the inmates, nearly half of the rheumatic patients attacked will have a relapse or new seizure of their rheumatism. Accordingly, a rigorous and hawk-like watch

is kept for every possible case of cold, tonsillitis, or sore throat entering the house; the patient is promptly isolated and treated on rigidly antiseptic principles, with the result that epidemics of relapses of rheumatism in the inmates have greatly diminished in frequency.

If every case of cold or sore throat were promptly and thoroughly treated with antiseptic sprays and washes such as any competent physician can direct his patients to keep in the house, in readiness for such an emergency, combined with laxatives and intestinal antiseptic treatment, and, above all, with rest in bed as long as any rise of temperature is present, there would be a marked diminution in both the frequency and the severity of rheumatism. If to this were added an abundant and nutritious dietary, good ventilation and pure air, an avoidance of overwork and overstrain, we should soon begin to get the better of this distressing disease. In fact, while positive data are lacking, on account of the small fatality of rheumatism and its consequent infrequent appearance among the causes of death in our vital statistics, yet it is the almost [Pg 325] unanimous opinion of physicians of experience that the disease is distinctly diminishing, as a result of the marked improvement in food, housing, wages, and living conditions generally, which modern civilization has already brought about.

So much for acute rheumatism. Vague and unsatisfactory as is our knowledge of it, it is, unfortunately, clearness and precision itself when contrasted with the welter of confusion and fog which covers our ideas about the *chronic* variety. The catholicity of the term is something incredible. Every chronic pain and twinge, from corns to locomotor ataxia, and from stone-in-the-kidney to tic-douloureux, has been put down as "rheumatism." It is little better than a diagnostic garbage-dump or dust-heap, where can be shot down all kinds of vague and wandering pains in joints, bones, muscles, and nerves, which have no visible or readily ascertainable cause. Probably at least half of all the discomforts which are put down as "rheumatism" of the ankle, the elbow, the shoulder, are not rheumatism at all, in any true or reasonable sense of the term, but merely painful symptoms due to other perfectly definite disease conditions of every imaginable sort. The remaining half may be divided into two great groups of nearly equal size. One of these, like acute rheumatism, is closely related to, and probably caused by, the attack of acute infections of milder character, falling upon less favorable soil. The other is of a vaguer type and is due, probably, to the accumulation of poisonous waste-products in the tissues, setting up irritative and even [Pg 326] inflammatory changes in nerve, muscle, and joint. Either of these may be made worse by exposure to cold or changes in the weather. In fact, this is the type of rheumatism which has such a wide reputation as a barometer and weather prophet, second only to that of the United States Signal Service. When you "feel it in your bones," you know it is going to snow, or to rain, or to clear up, or become cloudy, or whatever else may happen to follow the sensation, merely because all poisoned and irritated nerves are more sensitive to changes in temperature, wind-direction, moisture, and electric tension, than sound and normal ones. The change in the weather does not cause the rheumatism. It is the rheumatism that enables us to predict the change in the weather, though we have no clear idea what that change will be.

Probably the only statement of wide application that can be made in regard to the nature of chronic rheumatism is that a very considerable percentage of it is due to the accumulation of poisons (toxins) in the nerves supplying joints and muscles, setting up an irritation (neurotoxis), or, in extreme cases, an inflammation of the nerve (neuritis), which may even go on to partial paralysis, with wasting of the muscles supplied. The same broad principles of causation and prevention, therefore, apply here as in acute rheumatism.

The most important single fact for rheumatics of all sorts, whether acute or chronic, to remember is that they must *avoid exposure to colds*, in the sense of infections of all sorts, as they would a pestilence; that they must eat plenty of rich, sound, nourishing food; live in well-ventilated rooms; [Pg 327] take plenty of exercise in the open air, to burn up any waste poisons that may be accumulating in the tissues; dress lightly but warmly (there is no special virtue in flannels), and treat every cold or mild infection which they may be unfortunate enough to catch, according to the strictest rigor of the antiseptic law.

The influence of diet in chronic rheumatism is almost as slight as in the acute form. Persons past middle age who can afford to indulge their appetites and are inclined to eat and drink more than is good for them, and, what is far more important, to exercise much less, may so embarrass their liver and kidneys as to create accumulations of waste products in the blood sufficient to cause rheumatic twinges. The vast majority, however, of the sufferers from chronic rheumatism, like those from the acute form, are underfed rather than overfed, and a liberal and abundant dietary, including plenty of red meats, eggs, fresh butter, green vegetables, and fresh fruits, will improve their nutrition and diminish their tendency to the attacks.

There appears to be absolutely no rational foundation for the popular belief that red meats cause rheumatism, either from the point of view of practical experience, or from that of chemical composition. We now know that white meats of all sorts are quite as rich in those elements known as the purin bodies, or uric-acid group, as red meats, and many of them much richer. It may be said in passing, that this last-mentioned bugbear of our diet-reformers is now believed to have nothing whatever to do with rheumatism, and probably very little with gout, and that the [Pg 328] ravings of Haig and the Uric-Acid School generally are now thoroughly discredited. Certainly, whenever you see any remedy or any method of treatment vaunted as a cure for rheumatism, by neutralizing or washing out uric acid, you may safely set it down as a fraud.

One rather curious and unexpected fact should, however, be mentioned in regard to the relation of diet to rheumatism, and that is that many rheumatic patients have a peculiar susceptibility to

some one article of food. This may be a perfectly harmless and wholesome thing for the vast majority of the species, but to this individual it acts as a poison and will promptly produce pains in the joints, redness, and even swelling, sometimes accompanied by a rash and severe disturbances of the digestive tract. The commonest offenders form a curious group in their apparent harmlessness, headed as they are by strawberries, followed by raspberries, cherries, bananas, oranges; then clams, crabs, and oysters; then cheese, especially overripe kinds; and finally, but very rarely, certain meats, like mutton and beef. What is the cause of this curious susceptibility we do not know, but it not infrequently occurs with this group of foods in rheumatics and also in asthmatics.

Both rheumatics and asthmatics are also subject to attacks of urticaria or "hives" (nettle-rash), from these and other special articles of diet.

As to principles of treatment in a disease of so varied and indefinite a character, due to such a multitude of causes, obviously nothing can be said except in the broadest and sketchiest of outline. The prevailing tendency is, for the acute form, rest in bed, the first and most important, [Pg 329] also the second, the third, and the last element in the treatment. This will do more to diminish the severity of the attack and prevent the occurrence of heart and other complications than any other single procedure.

After this has been secured, the usual plan is to assist nature in the elimination of the toxins by alkalies, alkaline mineral waters, and other laxatives; to relieve the pain, promote the comfort, and improve the rest of the patient by a variety of harmless nerve-deadeners or pain-relievers, chief among which are the salicylates, aspirin, and the milder coal-tar products. By a judicious use of these in competent hands the pain and distress of the disease can be very greatly relieved, but it has not been found that its duration is much shortened thereby, or even that the danger of heart and other complication is greatly lessened. The agony of the inflamed joints may be much diminished by swathing in cotton-wool and flannel bandages, or in cloths wrung out of hot alkalies covered with oiled silk, or by light bandages kept saturated with some evaporating lotion containing alcohol. As soon as the fever has subsided, then hot baths and gentle massage of the affected joints give great relief and hasten the cure. But, when all is said and done, the most important curative element, as has already been intimated, is six weeks in bed.

In the chronic form the same remedies to relieve the pain are sometimes useful, but very much less effective, and often of little or no value. Dry heat, moist heat, gentle massage, and prolonged [Pg 330] baking in special metal ovens, will often give much relief. Liniments of all sorts, from spavin cures to skunk oil, are chiefly of value in proportion to the amount of friction and massage administered when they are rubbed in.

In short, there is no disease under heaven in which so much depends upon a careful study of each individual case and adaptation of treatment to it personally, according to its cause and the patient in whom it occurs. Rheumatism, unfortunately, does tend to "run in families." Apparently some peculiar susceptibility of the nervous system to influences which would be comparatively harmless to normal nerves and cells is capable of being inherited. But this inheritance is almost invariably "recessive," in Mendelian terms, and a majority of the children of even the most rheumatic parent may entirely escape the disease, especially if they live rationally and vigorously, feed themselves abundantly, and avoid overwork and overcrowding. [Pg 331]

CHAPTER XV

GERM-FOES THAT FOLLOW THE KNIFE, OR DEATH UNDER THE FINGER-NAIL

Our principal dread of a wound is from fear that it may fester instead of healing quickly. We don't exactly enjoy being shot, or stabbed, or scratched, though, as a matter of fact, in what Mulvaney calls the "fog av fightin'" we hardly notice such trifles unless immediately disabling. But our greatest fear after the bleeding has stopped is lest blood-poisoning may set in. And we do well to dread it, for in the olden days,—that is, barely fifty years ago,—in wounds of any size or seriousness, two-thirds of the risk remained to be run after the bleeding had been stopped and the bandages put on. Nowadays the danger is only a fraction of one per cent, but till half a century ago every wound was expected to form "matter" or *pus* in the process of healing, as a matter of course. Most of us can recall the favorite and brilliant repartee of our boyhood days in answer to the inquisitive query, "What's the matter?" "Nuthin': it hasn't come to matter yet. It's only a fresh cut!"

Even surgeons thought it a necessary part of the process of healing, and the approving term "laudable pus" was applied to a soft, creamy discharge, without either offensive odor or tinge of blood, upon the surfaces of the healing wound; and the hospital records of that day noted with [Pg 332] satisfaction that, after an operation, "suppuration was established." So strongly was this idea intrenched, that a free discharge or outpouring of some sort was necessary to the proper healing of the wound, that in the Middle Ages it was regarded as exceedingly dangerous to permit wounds to close too quickly. Wounds that had partially united were actually torn apart, and liquids like oil and wine and strong acids, which tended to keep them from closing and to set up

suppuration, were actually poured into them; and in some instances their sides were actually burned with hot irons. There was a solid basis of reason underlying even these extraordinary methods, viz., the "rule of thumb" observation, handed down from one generation to another, that wounds that discharged freely and "sweetly," while they were slow in healing and left disfiguring scars, usually did not give rise to serious or fatal attacks of blood-poison or wound-fever. And of two evils they chose the less. Plenty of pus and a big ugly scar in preference to an attack of dangerous blood-poisoning. Even if it didn't kill you, it might easily cripple you for life by involving a joint. The trouble was with their logic, or rather with their premises. They were firmly convinced that the danger came from within, that there was a sort of morbid humor which must be allowed to escape, or it would be dammed up in the system with disastrous results.

One day a brilliant skeptic by the name of Lister (who is still living) took it into his head that perhaps the fathers of surgery and their generations of imitators might have been wrong. He tried the experiment, shut germs out of his wounds, and behold, antiseptic surgery, with all its [Pg 333] magnificent line of triumphs, was born!

Now a single drop of pus in an operation wound is as deep a disgrace as a bedbug on the pillow of a model housekeeper, and calls for as vigorous an overhauling of equipment, from cellar to skylight; while a second drop means a commission of inquiry and a drumhead court-martial. This is the secret of the advances of modern surgery,—not that our surgeons are any more skillful with the knife, but that they can enter cavities like those of the skull, the spinal cord, the abdomen, and the chest, remove what is necessary, and get out again with almost perfect safety; whereas these cavities were absolutely forbidden ground to their forefathers, on account of the twenty, forty, yes, seventy per cent death risk from suppuration and blood-poison.

The triumphs of antisepsis and asepsis, or keeping the "bugs" out of the cuts, have been illustrated scores of times already by abler pens, and are a household word, but certain of its practical appliances in the wounds and scratches and trifling injuries of every-day life are not yet so thoroughly familiar as they should be. When once we know who our wound-enemies are, whence they came, and how they are carried, the fate of the battle is practically in our own hands.

Like most disease-germs our wound-infection foes are literally "they of our own household." They don't pounce down upon us from the trees, or lie in wait for us in the thickets, or creep in the grass, or grow in the soil, or swarm in our food. They live and can live only within the shelter of our own bodies, where it is warm and moist and comfortable. This is one great (in the expressive [Pg 334] vernacular) "cinch" that we have on the vast majority of disease-germs, whether medical or surgical, that they do not flourish and breed outside of the body, or of houses closed and warm; and this grip can be improved, with skill and determination, into a veritable strangle-hold on most of them. In the language of biology, most of them have become "adapted to their environment" so closely that they can scarcely flourish and breed anywhere outside of the warm, moist, fertile soil of a living body, and many of them cannot even live long at temperatures more than ten degrees above or fifteen degrees below that of the body. At all events, so poorly are these pus-germs able to preserve their vigor and power of attack, not merely outside of the human body, but outside of some wound or sore spot, that it is practically certain that eight-tenths of all cases of wound-infection or blood-poisoning come directly from some previous festering wound, sore, ulcer, scab, boil, or pimple, in or on some other human being or animal. Practically whenever we get pus in a wound in a hospital, we insist upon finding the precise previous case of pus from which that originated, and seldom is our search unsuccessful. If we kept not only our wounds surgically clean, but our gums, noses, throats, skins, and fingernails, and burned and sterilized everything that came in contact with a sore, pustule, or scab, we should wipe out nine-tenths of our cases of wound-infection and suppuration; in fact, practically all of them, except such small percentage as may come from contact with infections in animals. [Pg 335] This is the reason why, up to half a century ago, by a strange paradox hospitals were among the most dangerous places to perform operations in, on account of the abundance of wounds or sores always present for the pus-germs to breed in, and the fact that out of fifty or more wound-cases, there was practically certain to be one or two infected ones to poison the whole lot.

Surgeons, ignorant of antisepsis, and careless nurses, spread the infection along, until in some instances it reached a virulence which burst into the dreaded "hospital gangrene." This dread disease was the scourge of all hospitals, especially military ones, all over the civilized world, as recently as our War of Secession. In some wards of our military hospitals, from thirty to fifty per cent of all the wounded received were attacked, and over five thousand cases were formally reported during the war, of which nearly fifty per cent died. This plague was born solely of those two great mothers of evils, ignorance and dirt, and is to-day, in civilized lands, as extinct as the dodo. Then the dread that the community had of hospitals, as places that "help the poor to die," in Browning's phrase, had a certain amount of foundation; and cases operated upon in a farmhouse kitchen, where no one in the family happened to have had a boil or a catarrh or a festering cut within a month or so, and where the knife happened to be clean or new, would recover with less suppuration than hospital cases. Nowadays, from incessant and eternal vigilance, a hospital is surgically the cleanest and safest place in the world for an operation, so [Pg 336] that most surgeons decline to operate outside of one, except in emergencies; and some will not even operate except in one with which they are personally connected, so that they know every step in the process of protection.

It was this terrible risk of the surgeon carrying infection from one case to another, that made the coroner of London declare, barely sixty years ago, that he would hold an inquest upon the next

case of death after ovariotomy that was reported to him, on account of the fearful pus-mortality that followed this serious operation, which now has a possible death-rate from all causes connected with the operation of only a fraction of one per cent.

The brusque reply is still remembered of Lawson Tait, the great English ovariotomist, to a distinguished German colleague, who had inquired the secret of his then marvelously low death-rate: after a glance at the bands of mourning on the ends of the other's fingers, he said, "I keep my fingernails clean, sir!" There was sadly too much truth in the saying of another eminent surgeon, that in the pre-Listerian days many a poor woman's death warrant was written under the fingernails of her surgeon. This reproach has been wiped out, thank Heaven! but the labor, pains, and persistence after heart-breaking failures which it took to do it! Never was there a more vivid illustration of the declaration that genius is the capacity for taking pains, than antiseptic surgery! Not a loophole must be left unstopped, not a possibility unconsidered, not a thing in, or about, or connected with, the operating-room left unsterilized, except the patient and [Pg 337] the surgeon; and these are brought as near to it as is possible without danger to life.

In the first place, the operating-room itself must be like a bath room, or, more accurately, the inside of a cistern. Walls, floor, and ceiling are all waterproof and capable of being washed down with a hose. There must be no casings or cornices of any sort to catch dust; and in the best appointed hospitals no one is permitted to enter, under any pretext, whose hands and garments have not been sterilized.

In the second place, everything that is brought into the room for use in, or during, the operation, is first thoroughly sterilized. The knives, instruments, and other operative objects are sterilized by boiling, or by the use of superheated steam; and the towels, dressings, bandages, sheets, etc., by boiling, baking, or superheated steam. Then begins the preparation of the surgeon and the nurse. Dressing-rooms are provided, in which the outer garments are removed, and the hands given an ordinary wash. Then the scrubbing-room is entered, where, at a series of basins provided with running hot and cold water, whose faucets are turned by pressure with the foot so as to avoid any necessity for touching them with the hand, the hands are thoroughly scrubbed with hot water, boiled soap, and a boiled nail-brush. Then they are plunged into, and thoroughly soaked in, some strong antiseptic solution, then washed again; then plunged into another antiseptic solution, containing some fat solvent like ether or alcohol, to wash off any dirt that may have been protected by the natural oil of the skin. Then they are thoroughly scrubbed with soap [Pg 338] and hot water again, to remove all traces of the antiseptics, most of which are irritating to wounded tissues; then washed in absolute alcohol, then in boiled or distilled water. Then the nurse, whose hands are already sterilized, takes out of the original package in which it came from the sterilizing oven, a linen surgical gown or suit which covers the operator from neck to toes. A sterilized linen or cotton cap is placed upon his head and pulled down so that the scales or germs of any sort may not fall into the wound. Some surgeons of stout and comfortable habit, who are apt to perspire in the high temperature of an operating-room, will tie a band of gauze around their foreheads, to prevent any unexpected drops of perspiration from falling into the wound; while some purists muffle up the mouth and lower part of the face lightly in a similar comforter.

You would think that by this time the hands were clean enough to go anywhere with safety, but no risks are going to be taken. A pair of rubber or cotton gloves, the former taken right out of a strong antiseptic solution, the latter out of the sterilizing oven, are pulled carefully on by the nurse. Holding his sacred hands spread out rigidly before him, like the front paws of a kangaroo, the surgeon carefully edges his way into the operating-room, waiting for any doors that he may have to pass through to be opened by the nurse, or awkwardly pushing them with his elbow. In that attitude of benediction, the hands are maintained until the operation is ready to begin. [Pg 339]

Then comes the patient! If his condition will in any wise permit, he has been given a boiling hot bath and scrub the night before, and put to bed in a sterilized nightgown between sterilized sheets. The region which is to be operated upon has, at the same time, been scrubbed and rubbed and flushed with hot water, germicides, alcohol, soap,—in fact, has gone through the same sacred ceremonial of cleansing through which the surgeons' hands have passed; and a large, closely fitting antiseptic dressing, covering the whole field, has been applied and tightly bound. He is brought into a waiting-room and put under ether by an anæsthetist, through a sterilized mask; he is then wheeled into the operating-room, the dressing is removed, a thorough double scrub is again given, for "good measure," to the whole area in which the wound is to be made. A big sheet is thrown over the lower part of his body, another over the upper part, a third, with an oval opening in the centre of it, thrown over the region to be operated upon. The instrument nurse takes a boiled knife out of a sterilized dish of distilled water, hands it to the surgeon, who takes it in his gloved hand, and the operation begins.

Now, if you can think of any possible chink through which a wandering streptococcus can, by any possibility, sneak into that wound, please suggest it, and it shall be closed immediately!

The intruders against whom all these preparations are made are two in number: *Streptococcus pyogenes* and *Staphylococcus pyogenes*—cousins, as you see, by their names. Their last (not family) name really means something, and is not half so alarming as it sounds, as it is Greek for [Pg 340] "pus-making." Their real family name, *Coccus*, which means a berry, was suggested, by their rounded shape under the microscope, to some poetically minded microscopist. Undesirable citizens, both of them! But the older, or *Strepto*, cousin is by far the more dangerous character and desperate individual, giving rise to and being concerned in nearly all the civilized and

dangerous wound-fevers—septicæmia, erysipelas, etc. *Staphylococcus* is a milder and less harmful individual, seldom going farther than to produce the milder forms of festering, discharging, refusing to heal, pustules, etc. He is not to be given a yard of leeway, however, for if he can get a sufficient number of dirty wounds to run through, he can work himself up to a high degree of virulence and poisoning power. Indeed, this faculty of his may possibly furnish a clew as to how these pus-makers developed their power of living in wounds, and almost nowhere else. There is another cousin also, in the group, called *Staphylococcus pyogenes albus*, to distinguish him (*albus*, "white") from the other two, who have the tag name aureus (golden). He is an almost harmless denizen of the surfaces of our bodies, particularly the mouths of the sweat-ducts, and the openings of the hair follicles. Under peculiarly favorable circumstances, such as a very big wound, an aggravated chafe, or the application of that champion "bug-breeder," a poultice, he may summon up courage enough to attack some half-dead skin-cells and make a few drops of pus on his own account. He is the criminal concerned in the so-called stitch-abscesses, or tiny points [Pg 341] of pus which form around the stitches of a big wound and in some of the smaller pimples which turn to "matter." It is conceivable that this feeble and harmless white coccus may at some time have been accelerated under favorable circumstances to where he was endowed with "yellow" powers, and even, upon another turn of the screw, with strepto-virulence. But this is a mere academic question. Practically the only thing needful is to keep all the rascals out of every wound.

Now comes the question, how is this to be done? Fortunately it is not necessary to hunt out and destroy the pus-germs in their breeding-places outside of the human body. As we have seen, they do not long retain their vitality out of doors, or as a rule even in the dust of rooms and dirt of houses, unless the latter have been recently contaminated with the dressings of, or discharges from, wounds. There are two main things to be watched: first, the wound itself, and second, any unwashed or unsterilized part of your own or some other living body. Dirt of all sorts is a mighty good thing to keep absolutely out of the wound, but practically a whole handful of ordinary soil or dust rubbed into a wound might not, unless it happened to contain fertilizer of some sort, be half so dangerous as a single touch with a finger which had been dressing a wound, picking a scab out of the nose, rubbing an ulcerated gum, or scratching an itching scalp. If it be a cut on the finger, or scratch on the hand, for instance, don't suck it, or lick it, unless you can give an absolutely clean bill of health to your gums and teeth. If not thoroughly brushed three or four [Pg 342] times a day, they are sure to be swarming with germs of twenty or thirty different species, which not infrequently include one or both of the pus-germs. Indeed, the real reason why the bite of certain animals, and above all of a man, particularly of a "blue-gum nigger," is regarded as so dangerous is on account of the swarms of germs that breed in any remnants of food left between the teeth or in the pockets of ulcerating gums. Many a human bite is almost as dangerous as a rattlesnake's. The devoted hero who sucks the poison of the dagger out of the wound may be conferring a doubtful benefit, if he happens to be suffering from Rigg's disease.

Don't try to stop the bleeding unless it comes in spurts or the flow is serious. The loss of a few teaspoonfuls, tablespoonfuls, or, for the matter of that, cupfuls, of blood won't do you any harm, and its free flow will wash out the cut from the bottom, and carry out most of the germs that may happen to be present on the knife or nail. If water and dressings are not accessible, let the blood cake and dry over the wound without disturbing it, even though it does look rather gory.

A slight cut with a clean knife, or other instrument, into which no dirt has been rubbed, will often require no other dressing than its own blood-scab. If, however, as oftener happens, you cannot be sure of the cleanness of the knife, tool, or nail, hold the wound under running water from a pump or tap (this is not germ-free, but practically never contains pus-germs), until the wound has been thoroughly washed out, wiping any gravel or dirt out of the cut with soft rags which have been [Pg 343] recently washed, or baked in the oven; then dry with a small piece of linen, or white goods, put on a dressing of absorbent cotton such as can be purchased for a few cents an ounce at any drug store. Absorbent or surgical cotton makes a good dressing, because it both sucks up any fluids which might leak out of the wound, and forms a mesh-filter through which no germs can penetrate.

It is not advisable to use sticking-plaster for any but the most trivial wounds, and seldom even for these, for several reasons. First, because its application usually involves licking it to make it stick; second, because it must cover a sufficient amount of skin on either side of the wound to give it firm grip, and this area of skin contains a considerable number of both sweat-ducts and hair-follicles, which will keep on discharging under the plaster, producing a moist and unhealthy condition of the lips of the wound. Moreover, these sweat-ducts and hair-follicles will, as we have seen, frequently contain white staphylococci, which are at times capable of setting up a low grade of inflammation in the wound. A wound always heals better if its surfaces and coverings can be kept dry. This is why cotton makes such an ideal dressing, since it permits the free evaporation of moisture, a moderate access of air, and yet keeps out all germs.

If the cut or scratch is of any depth or seriousness whatever, or the knife, tool, or other instrument be dirty, or if any considerable amount of street-dust or garden-soil has got into the wound, then it is, by all means, advisable to go to a physician, have the wound thoroughly [Pg 344] cleaned on antiseptic principles, and put up in antiseptic dressing. A single treatment of this sort, in a comparatively trifling wound which has become in any way contaminated, may save weeks of suffering and disability, and often danger of life, and will in eight cases out of ten shorten the time of healing from forty to sixty per cent. The rapidity with which a wound in a reasonably healthy individual, cleaned and dressed on modern surgical principles, will heal, is almost

incredible, until it has actually been seen.

The principal danger of garden-soil or street-dust in a wound is not so much from pus-germs, though these may be present, as from another "bug"—the tetanus or lockjaw bacillus. This deadly organism lives in the alimentary canal of the horse, and hence is to be found in any dirt or soil which contains horse manure. It is, fortunately, not very common, or widely spread, but enough so to make it the part of prudence to have thoroughly asepticized and dressed any wound into which considerable amounts of garden-soil, or street-dust, have been rubbed. The reason why wounds of the feet and hands have had such a bad reputation, both for festering and giving rise to lockjaw, is that it is precisely in these situations that they are most likely to get garden-soil, or stable manure, into them. The classic rusty nail does not deserve the bad reputation as a wound-maker which it enjoys, its bad odor being chiefly due to the fact already referred to, that injuries inflicted by it are most apt to be in the palm of the hand, or in the sole of the foot, and hence [Pg 345] peculiarly liable to contamination by the tetanus and other soil bacilli.

For some reason or other which we don't as yet thoroughly understand, burns from a toy pistol in particular, and Fourth of July fireworks in general, seem to be peculiarly liable to be followed by tetanus. The fulminate used in the cap of a toy pistol, and the paper and explosives of several of the brands of firecrackers, have been thoroughly examined bacteriologically, but without finding any tetanus germs in them. So many cases of lockjaw used to follow the Fourth of July celebrations a few years ago, that Boards of Health became alarmed, and not only forbade outright the sale of deadly toy pistols, but provided supplies of the tetanus antitoxin at various depots throughout the cities, so that all patriotic wounds of this description could have it dropped into them when they were dressed. Since then, the lockjaw penalty which we pay for our highly intelligent method of celebrating the Fourth, has diminished considerably. It is probable that the mortality was chiefly due to infection of the ugly, slow-healing, dirty little wounds with city-dust, a large percentage of which, of course, is dried horse manure. What with the tetanus bacillus and the swarms of flies which breed chiefly in stable manure, and carry summer diseases, typhoid, diphtheria, and tuberculosis in every direction, it will not be long before the keeping of horses within city limits will be as strictly forbidden as pigpens now are.

So definite is the connection between the tetanus bacilli and the soil, that tetanus fields or lockjaw gardens are now recognized and listed by the health authorities, on account of their [Pg 346] having given rise to several successive cases of the disease. Workers in such fields or gardens, who scratch or cut themselves, are warned to report themselves promptly for treatment with the tetanus antitoxin.

Apart from the tetanus germ, however, the problem of the treatment of wounds—while there should be perfect cleanliness, the spotlessness of the model housekeeper multiplied fivefold—is yet not so much a matter of keeping dirt in general out of the wound, as of keeping out that *particular form of dirt which consists of or contains, discharges from some previous wound, sore, ulcer, or boil!*

While both these pus-organisms can breed and flourish freely only in wounds or sores, this is but their starting-point where they gather strength to invade the entire organism. We used to make a distinction between those cases in which their toxins or poison-products got into the blood, with the production of fever, headache, backache, delirium, sweats, etc., which we term *septicæmia*, and other cases in which the cocci themselves were carried into the blood and swept all over the body by forming fresh foci, or breeding-places, which resulted in abscesses all over the body, which we call *pyæmia*. But now we know that there is no hard and fast line to be drawn, and that the germs get into the blood much more easily than we supposed; and the degree and dangerousness of the fever which they set up depend, first, upon their virulence, or poisonousness, and, second, upon the resisting power of the patient at the time. Anything which [Pg 347] lowers the general health and strength and weakens the resisting power of the body will make it much easier for pus-germs to get an entrance into it, and overwhelm it; so that, after prolonged famines for instance, or among the population of besieged cities, or in armies or exploring expeditions which have been deprived of food and exposed to great hardship, the merest scratch will fester and inflame, and give rise to a serious and even fatal attack of blood-poisoning, erysipelas, hospital gangrene, etc. Famines and sieges in fact are not infrequently followed by positive epidemics of blood-poisoning, often in exceedingly severe and fatal forms.

It was long ago noted by the chroniclers that the death-rate from wound-fever among the soldiers of a defeated army was apt to be much greater than among those of the victorious one, and this was quoted as one of the stock evidences of the influence of mind over body. But we now know that armies are not beaten without some physical cause, that the defeated soldiers are apt to be in poorer physical condition to begin with; that they have often been cut off from their base of supplies, have made desperate forced marches without food or shelter in the course of their retreat; and, until within comparatively recent years, were never half so well treated or well fed as their captors.

As the invading germs pass into the body, they travel most commonly through the lymph-channels and skin; are arrested and threatened with destruction by the so-called lymphatic glands, or lymph-nodes. This is why, if you have a festering wound or boil on your hand or wrist, [Pg 348] the "kernels" or lymph-nodes up in your armpit will swell and become painful. If the lymph-nodes can conquer the germs and eat them up, the swelling goes down and the pain disappears. But if the germs, on the other hand, succeed in poisoning and killing the cells of the body, these latter melt down and turn to pus, and we get what we call a "secondary abscess."

The next commonest point of attack of these pus-germs, if they once get into the body, and by far the most dangerous, is the heart, as in rheumatism and other fevers. Some will also attack the kidneys, giving rise to albumin in the urine, while others attack the membranes of the joints (*synovia*) and cause suppuration of one or more joints in the body, which is very apt to be followed by very serious stiffening or crippling. So that, common, and, in many instances, comparatively mild as they are, the pus-germs in the aggregate are responsible for a very large amount of damage to the human body.

This is the way the *streptococcus* and *staphylococcus* behave in an open wound, or sore; but they have two other methods of operating which are somewhat special and peculiar. One of these is where the germ digs and burrows, as it were, underground, in a limited space, resulting in that charming product known as a boil, or a carbuncle. The other, where it spreads rapidly over the surface just under the skin, after the fashion of the prairie fire, producing *erysipelas*. In the first of these he behaves like the famous burrowing owl of our Western plains, who forms, with the [Pg 349] prairie-dog, the so-called "happy family." He never makes his own burrow, he simply uses one which is already provided for him by nature, and that is the little close-fitting pouch surrounding the root of a hair. Whether the criminal is a harmless native white coccus which has suddenly developed anti-social tendencies, or a Mongolian immigrant who has been accidentally introduced, is still an open question. The probabilities are that it is more frequently the latter, as, while boils are absolutely no respecters, either of persons or places, and may rear their horrid heads in every possible region of the human form divine, yet they display a very decided tendency to appear most frequently in regions like the back of the neck, the wrist, the hips, and the nose. One thing that these areas have in common is that they are liable to a considerable amount of chafing and scratching as by collars and stocks on the neck, and cuffs on the wrists, or of friction from belts, or pressure or chafing from chairs or saddles. When the tissues have been bruised or chafed after such fashion, especially if the surface of the skin has been at the same time broken, and any pus-organism is either present in the hair-follicle, like the white coccus, or rubbed into it by a finger or finger-nail which has just been sucked in the mouth, used to pick the nose, or possibly engaged in dressing some wound, or cutting meat, or handling fertilizer, then all the materials for an explosion are at hand. [Pg 350]

CHAPTER XVI

CANCER, OR TREASON IN THE BODY-STATE

The imagination of the race has ever endowed Cancer with a peculiar individuality of its own. Although it has vaguely personified in darkest ages other diseases, like the Plague, the Pestilence, and *Maya* (the Smallpox), these have rapidly faded away in even the earliest light of civilization, and have never approached in concreteness and definiteness the malevolent personality of Cancer. Its sudden appearance, the utter absence of any discoverable cause, the twinges of agonizing pain that shoot out from it in all directions, its stone-like hardness in the soft, elastic flesh of the body, the ruthless way in which it eats into and destroys every organ and tissue that come in its way, make this impression, not merely of personality, but of positive malevolence, almost unescapable.

Its very name is instinct and bristling with this idea: *Krebs*, in German, *Cancer*, in Latin, French, and English, *Carcinoma*, in Greek, all alike mean "Crab," a ghastly, flesh-eating parasite, gnawing its way into the body. The simile is sufficiently obvious. The hard mass is the body of the beast; the pain of the growth is due to his bite; the hard ridges of scar tissue which radiate in all directions into the surrounding skin are his claws.

The singular thing is that, while brushing aside, of course, all these grotesque similes, the most [Pg 351] advanced researches of science are developing more and more clearly the conception of the independent individuality—as they term it, the *autonomy*—of cancer.

More and more decidedly are they drifting toward the unwelcome conclusion that in cancer we have to deal with a process of revolt of a part of the body against the remainder, "a rebellion of the cells," as an eminent surgeon-philosopher terms it. Unwelcome, because a man's worst foes are "they of his own household." Successful and even invigorating warfare can be waged against enemies without, but a contest with traitors within dulls the spear and paralyzes the arm. Against the frankly foreign epidemic enemies of the race a sturdy and, of late years, a highly successful battle has been fought. We have banished the plague, drawn the teeth of smallpox, riddled the armor of diphtheria, and robbed consumption of half its terrors. In spite of the ravings and gallery-play of the Lombroso school anent "degeneracy," our bills of mortality show a marked diminution in the fatality of almost every important disease of external origin which afflicts humanity.

The world-riddle of pathology the past twenty years has been: Is cancer due to the invasion of a parasite, a veritable microscopic crab, or is it due to alterations in the communal relations, or, to speak metaphorically, the allegiance of the cells? Disappointing as it may be, the balance of proof and the opinion of the ablest and broadest-minded experts are against the parasitic theory, so far, and becoming more decidedly so. In other words, cancer appears to be an evil which the [Pg 352] body breeds within itself.

There is absolutely no adequate ground for the tone of lamentation and the Cassandra-like prophecy which pervade all popular, and a considerable part of medical, discussion of the race aspects of the cancer problem. The reasoning of most of these Jeremiahs is something on this wise: That, inasmuch as the deaths from cancer have apparently nearly trebled in proportion to the population within the last thirty years, it only needs a piece of paper and a pencil to be able to figure out with absolute certainty that in a certain number of decades, at this geometric ratio, there will be more deaths from cancer than there are human beings living.

There could be no more striking illustration, both of the dangerousness of "a little knowledge" and of the absurdity of applying rigid logic to premises which contain a large percentage of error. Too blind a confidence in the inerrancy of logic is almost as dangerous as superstition. Space will not permit us to enter into details, but suffice it to say:—

First, that expert statisticians are in grave doubt whether this increase is real or only apparent, due to more accurate diagnosis and more complete recording of all cases occurring. Certainly a large proportion of it is due to the gross imperfection of our records thirty years ago.

Second, that the apparent increase is little greater than that of deaths due to other diseases of later life, such as nervous, kidney, and heart diseases. Our heaviest saving of life so far is in the [Pg 353] first five-year period, and more children are surviving to reach the cancer and Bright's disease age.

Third, that a disease, eighty per cent of whose death-rate occurs after forty-five years of age, is scarcely likely to threaten the continued existence of the race.

The nature of the process is a revolt of a group of cells. The cause of it is legion, for it embraces any influence which may detach the cell from its normal surroundings,—"isolate it," as one pathologist expresses it. The cure is early and complete amputation of not only the rebellious cells, but of the entire organ or region in which they occur.

A cancer is a biologic anomaly. Everywhere else in the cell-state we find each organ, each part, strictly subordinated, both in form and function, to the interests of the whole.

Here this relation is utterly disregarded. In the body-republic, where we have come to regard harmony and loyalty as the invariable rule, we find ourselves suddenly confronted by anarchy and revolt.

The process begins in one great class of cells, the epithelium of the secreting glands. This is a group of cell-citizens of the highest rank, descended originally from the great primitive skin-sheet, which have formed themselves into chemical laboratories, ferment-factories for the production of the various secretions required by the body, from the simplest watery mucus, as in the mouth, or the mere lubricant, as in the fat-glands of the hair-follicles, to the most complex gastric or pancreatic juice. They form one of the most active and important groups in the body, [Pg 354] and their revolt is dangerous in proportion.

The movement of the process is usually somewhat upon this order: After forty, fifty, or even sixty years of loyal service, the cells lining one of the tubules of a gland—for instance, of the lip, or tongue, or stomach—begin to grow and increase in number. Soon they block up the gland-tube, then begin to push out in the form of finger-or root-like columns of cells into the surrounding tissues.

These columns appear to have the curious power of either turning their natural digestive ferments against the surrounding tissues, or secreting new ferments for the purpose, closely resembling pepsin, and thus literally eating their way into them. So rapidly do these cells continue to breed and grow and spread resistlessly in every direction, that soon the entire gland, and next the neighboring tissues, become packed and swollen, so that a hard lump is formed, the pressure upon the nerve-trunks gives rise to shooting pains, and the first act of the drama is complete.

But these new columns and masses, like most other results of such rapid cell-breeding in the body, are literally a mushroom growth. Scarcely are they formed before they begin to break down, with various results. If they lie near a surface, either external or internal, they crumble under the slightest pressure or irritation, and an ulcer is formed, which may either spread slowly over the surface, from the size of a shilling to that of a dinner-plate, or deepen so rapidly as to destroy the entire organ, or perforate a blood-vessel and cause death by hemorrhage. The cancer [Pg 355] is breaking down in its centre, while it continues to grow and spread at its edge. Truly a "magnificent scheme of decay."

Then comes the last and strangest act of this weird tragedy. In the course of the resistless onward march of these rebel cell-columns some of their skirmishers push through the wall of a lymph-channel, or even, by some rare chance, a vein, and are swept away by the stream. Surely now the regular leucocyte cavalry have them at their mercy, and can cut them down at leisure. We little realize the fiendish resourcefulness of the cancer-cell. One such adrift in the body is like a ferret in a rabbit warren; no other cell can face it for an instant. It simply floats unmolested along the lymph-channels until its progress is arrested in some way, when it promptly settles down wherever it may happen to have landed, begins to multiply and push out columns in every direction, into and at the expense of the surrounding tissues, and behold, a new cancer, or "secondary nodule," is born (*metastasis*).

In fact, it is a genuine "animal spore," or seed-cell, capable of taking root and reproducing its kind in any favorable soil; and, unfortunately, almost every inch of a cancer patient's body seems to be such. It is merely a question of where the spore-cells happen to drift and lodge. The lymph-nodes or "settling basins" of the drainage area of the primary cancer are the first to become infected, probably in an attempt to check the invaders; but the spores soon force their way past them toward the central citadels of the body, and, one after another, the great, vital organs—the liver, the lungs, the spleen, the brain—are riddled by the deadly columns and choked by decaying masses of new cells, until the functions of one of them are so seriously interfered with that death results. [Pg 356]

Obviously, this is a totally different process, not merely in degree, but in kind, from anything that takes place as a result of the invasion of the body by an infectious germ or parasite of any sort. There is a certain delusive similarity between the cancer process and an infection. But the more closely and carefully this similarity is examined the more superficial and unreal does it become. The invading germ may multiply chiefly at one point or focus, like cancer, and from this spread throughout the body and form new foci, and may even produce swarms of masses of cells resembling tumors, as, for instance, in tuberculosis and syphilis. But here the analogy ends.

The great fundamental difference between cancer and any infection lies in the fact that, in an infection, the inflammations and poisonings and local swellings are due solely and invariably to the presence and multiplication of the invading germs, which may be recovered in millions from every organ and region affected, while swellings or new masses produced are merely the outpouring of the body-cells in an attempt to attack and overwhelm these invaders. In cancer, on the contrary, the destroying organism is a group of perverted body-cells. The invasion of other parts of the body is carried out by transference of their bastard and abortive offspring. Most significant of all, the new growths and swellings that are formed in other parts of the body are composed, not of the outpourings of the local tissues, but of *the descendants of these pirate cells*. This is one of the most singular and incredible things about the cancer process: that a cancer starting, say, in the pancreas, and spreading to the brain, will there pile up a mass—not of brain-cells, or even of connective tissue-cells—but of gland-cells, resembling crudely the organ in which it was born. So far will this resemblance go that a secondary cancer of the pancreas found in the lung will yield on analysis large amounts of trypsin, the digestive ferment of the pancreas. Similarly a cancer of the rectum, invading the liver, will there pile up in the midst of the liver-tissue abortive attempts at building up glands of intestinal mucous membrane. [Pg 357]

This fundamental and vital difference between the two processes is further illustrated by this fact: While an ordinary infection may be transferred from one individual to another, not merely of the same species, but of half a dozen different species, with perfect certainty, and for any number of successive generations, no case of cancer has ever yet been known to be transferred from one human being to another. In other words, the cancer-cell appears utterly unable to live in any other body except the one in which it originated.

So confident have surgeons and pathologists become of this that a score of instances are on record where physicians and pathologists, among them the famous surgeon-pathologist, Senn, of Chicago, only a few years ago, have voluntarily ingrafted portions of cancerous tissue from patients into their own arms, with absolutely no resulting growth. In fact, the cancer-cell behaves like every other cell of the normal body, in that, though portions of it can be grafted into appropriate places in the bodies of other human beings and live for a period of days, or even months, they ultimately are completely absorbed and disappear. The only apparent exception is the epithelium of the skin, which can be used in grafting or skinning over a wide raw surface in another individual. However, even here the probability appears to be that the taking root of the foreign cells is only temporary, and makes a preliminary covering or protection for the surface until the patient's own skin-cells can multiply fast and far enough to take its place. [Pg 358]

A similarly reassuring result has been obtained in animals. Not a single authenticated case is on record of the transference of a human cancer to one of the lower animals; and of all the thousands and thousands of experiments that have been made in attempting to transfer cancers from one animal to another, only one variety of tumor with the microscopic appearance of cancer—the so-called Jensen's tumor of mice—has yet been found which can be transferred from one animal to another.

So we may absolutely disabuse our minds of the fear which some of our enthusiastic believers in the parasitic theory of cancer have done much to foster, that there is any danger of cancer "spreading," like an infectious disease. Disastrous and gruesome as are the conditions produced by this disease, they are absolutely free from danger to those living with or caring for the unfortunate victim. In the hundreds of thousands of cases of cancers which have been treated, in private practice, in general hospitals, and in hospitals devoted exclusively to their care, not a single case is on record of the transference of the disease to a husband, wife, or child, nurse or medical attendant. So that the cancer problem, like the Kingdom of Heaven, is within us. [Pg 359]

This conclusion is further supported by the disappointing result of the magnificent crusade of research for the discovery of the cancer "parasite," whether vegetable or animal, which has been pursued with a splendid enthusiasm, industry, and ability by the best blood and brains of the pathological world for twenty years past. I say disappointing, because a positive result—the discovery and identification of a parasite which causes cancer—would be one of the greatest boons that could be granted to humanity; not so much on account of the actual loss of life produced by the disease as for the agonies of apprehension engendered by the fact of the

absolute remorselessness and blindness with which it may strike, and our comparative powerlessness to cure. So far the results have been distressingly uniform and hopelessly negative.

Scores, yes, hundreds, of different organisms have been discovered in and about cancerous growths, and announced by the proud discoverer as the cause of cancer. Not one of these, however, has stood the test of being able to produce a similiar growth by inoculation into another body; and all which have been deemed worthy of a test-research by other investigators besides the paternal one have been found to be mere accidental contaminations, and present in a score of other diseases, or even in normal conditions. Many of them have been shown to be abnormal [Pg 360] products of the cells of the body in the course of the cancer process, and some even such ludicrous misfits as impurities in the chemical reagents used, scrapings from the corks of bottles, dust from the air, or even air-bubbles. These "discoveries" have ranged the whole realm of unicellular life,—bacilli, bacteria, spirilla, yeasts, moulds, protozoa,—yet the overwhelming judgment of broad-minded and reputable experts the world over is the Scotch verdict of "not proven"; and we are more and more coming to turn our attention to the other aspect of the problem, the factors which cause or condition this isolation and assumption of autonomy on the part of the cells.

This is not by any means to say that there is no causative organism, and that this will not some day be discovered. Human knowledge is a blind and short-sighted thing at best, and it may be that some invading cell, which, from its very similarity to the body-cells, has escaped our search, will one day be discovered. Nor will the investigators diminish one whit of their vigor and enthusiasm on account of their failure thus far.

The most strikingly suggestive proof of the native-born character of cancer comes from two of its biologic characters. The first is that its habit of beginning with a mass formation, rapidly deploying into columns and driving its way into the tissues in a ghastly flying wedge, is simply a perfect imitation and repetition of the method by which glands are formed during the development of the body. The flat, or epithelial, cells of the lining of the stomach, for instance, [Pg 361] begin to pile up in a little swarm, or mass, elongate into a column, push their way down into the deeper tissue, and then hollow out in their interior to form a tubular gland. The only thing that cancer lacks is the last step of forming a tube, and thereby becoming a servant of the body instead of a parasite upon it.

Nor is this process confined to our embryonic or prenatal existence. Take any gland which has cause to increase in size during adult life, as, for instance, the mammary gland, in preparation for lactation, and you will find massing columns and nests of cells pushing out into the surrounding tissue in all directions, in a way that is absolutely undistinguishable in its earlier stages from the formation of cancer. It is a fact of gruesome significance that the two organs—the mammary gland and the uterus—in which this process habitually takes place in adult life are the two most fatally liable to the attack of cancer.

Another biologic character is even more striking and significant. A couple of years ago it was discovered by Murray and Bashford, of the English Imperial Cancer Research Commission, that the cells of cancer, in their swift and irregular reproduction, showed an unexpected peculiarity. In the simplest form of reproduction, one cell cutting itself in two to make two new ones, known as mitosis, the change begins in the nucleus, or kernel. This kernel splits itself up into a series of threads or loops, known as the chromosomes, half of which go into each of the daughter cells. When, however, sex is born and a male germ-cell unites with a female germ-cell to form a new [Pg 362] organism, each cell proceeds, as the first step in the process, to get rid of half of these chromosomes, so that the new organism has precisely the normal number of chromosomes, half of which are derived from the father and the other half from the mother germ-cell. This, by the way, is the mechanical basis of heredity.

It has been long known that the mitotic processes of cancer and the forming and dividing of the chromosomes were riotous and irregular, like the rest of its growth. But it was reserved for these investigators to discover the extraordinary fact that the majority of dividing and multiplying cancer-cells had, instead of the normal number of chromosomes, exactly half the quota. In other words, they had resumed the powers of the germ, or sexual, cells from which the entire body was originally built up, and were, like them, capable of an indefinite amount of multiplication and reproduction. How extraordinary and limitless this power is may be seen from the fact that a little group of cancer-cells grafted into a mouse to produce a Jensen tumor, from which a graft is again taken and transplanted into another mouse, and so on, is capable, in a comparatively few generations, of producing cancerous masses a thousand times the weight of the original mouse in which the tumor started!

In short, cancer-cells are obviously a small, isolated group of the body-cells, which in a ghastly fashion have found the fountain of perpetual youth, and can ride through and over the law-abiding citizens of the body-state with the primitive vigor of the dawn of life. [Pg 363]

This brings us to the most practical and important questions of the problem: What are the influences which condition this isolation and outlawry of the cells? What can we do to prevent or suppress the rebellion? To the first of these science can only return a tentative and approximate answer. The subject is beset with difficulties, chief among which is the fact that we are unable to produce the disease with certainty in animals, with the single exception of the Jensen's tumors in mice referred to, nor is it transferred from one human being to another, so that we can make even an approximate guess at the precise time at, or conditions under, which the process began.

Many theories have been advanced, but most investigators who have studied the problem in a broad-minded spirit are coming gradually to agree to this extent:—

First of all, that one of the most powerful influences conditioning this isolation and revolt of the cells is age, both of the individual and of the organ concerned. Not only does far the heaviest cancer mortality fall between the ages of forty-five and sixty, but the organs most frequently and severely attacked are those which between these years are beginning to lose their function and waste away. First and most striking, the mammary gland and the uterus in women, and the shriveling lips and tongue of elderly men. To put it metaphorically, the mammary gland and the uterus, after the change of life, the lip, after the decay of the teeth, have done their work, outlived their usefulness, and are being placed upon a starvation pension by a grateful country. Nineteen out of twenty accept the situation without protest and sink slowly to a mere vegetative [Pg 364] state of existence, but, in the twentieth, some little knot of cells rebel, revert to an ancestral power of breeding rapidly to escape extinction, begin to make ravages, and cancer is born.

The age-preferences are well marked. Cancer is emphatically a disease of senility, of age; but, as Roger Williams has pointed out in his admirable monograph, not of "completed" senility.

To express it in percentages, barely twenty per cent of the cases occur before forty years of age, sixty per cent between forty and sixty, and twenty per cent between sixty and eighty. Thus the early period of decline, the transition stage between full functional vigor and declared atrophy (wasting) of the glands, is clearly the period of greatest danger; precisely the period in which the gland-cells, though losing their function,—and income,—have still the strength to inaugurate a rebellion, and a sufficient supply of the sinews of war, either in their own possession or within easy striking distance in the tissues about them, to make it successful. Not less than sixty-five to seventy-five per cent of all cancers in women occur in atrophying organs, the uterus and mammary glands.

A rather alluring suggestion was made by Cohnheim, years ago, that cancers might be due to the sudden resumption of growth on the part of islands or *rests* of embryonic tissue, left scattered about in various parts of the body. But these are now believed to play but a small part, if indeed any, in the production of true cancer. [Pg 365]

Finally, what can be done to prevent or cure this grotesque yet deadly process? So far as it is conditioned by age, it is, of course, obvious that little can be done, for not even the most radical vivisector would propose preventing in any way as large a proportion as possible of the human race from reaching fifty or sixty, or even seventy years, to avoid the barely six per cent liability to cancer after forty-five.

As regards the influence of chronic inflammations and irritation, much can be done, and here is our most hopeful field for prevention. Warts and birthmarks that are in any way subject to pressure or friction from clothing or movements should be promptly removed, as both show a distinctly greater tendency than normal tissue to develop into cancer. Cracks, fissures, chafes, and ulcers of all sorts, especially about the lips, tongue, mammary gland, uterus, and rectum, should be early and aseptically dealt with. Jagged remnants of teeth should be removed, all suppurative processes of the gums antiseptically treated, and the whole mouth-parts kept in a thoroughly aseptic condition.

Thorough and conscientious attention to this sort of surgical toilet work is valuable, not only for its preventive effect,—which is considerable,—but also because it will insure the bringing under competent observation at the earliest possible moment the beginnings of true cancer.

For the disease itself, after it has once started, there is, like treason in the body-politic, but one remedy—capital punishment. Parleying with the rebels is worse than useless. Pastes, caustics, X-rays, trypsin, radium,—all are fatally defective, because they suppress a symptom only and leave [Pg 366] the cause untouched. Only in one form of surface-cancer, the so-called flat-celled or rodent ulcer, which has little or no tendency to form spore-cells and attack the deeper organs, are they effective.

Nothing is easier and nothing more idle than to destroy and break down cells which have actually become cancerous; but so long as there remains in the body a single nest, or even cell, of the organ in which the revolt started, so long the life of the patient is in danger.

Absolutely the only remedy which is of the slightest value is complete removal with the knife. The one superiority of the knife, shudder as we may at the name of it, over every other means of removal lies solely in this fact, that with it can be removed not merely the actual cancer, but the entire gland or group of surrounding cells in which this malignant, parricidal change has begun to occur.

The modern radical operations for cancer take not merely the tumor, but the entire diseased breast, for instance, and all the lymph-glands into which it drains, clear up into the armpit, with the muscles beneath it down to the ribs. Where this is done early enough, the disease does not recur. Such radical and complete amputation of an organ or region as this is possible in from two-thirds to three-fourths of all cases if seen reasonably early.

With watchfulness and courage, our attitude toward the cancer problem is one of hopeful confidence. [Pg 367]

CHAPTER XVII

HEADACHE: THE MOST USEFUL PAIN IN THE WORLD

Greatness always has its penalties. Other ills besides death love a shining mark. Pain is one of them, and headache its best exemplar. If there be one thing about our bodies of which we are peculiarly and inordinately proud it is that expanded brain-bulb which we call the head. Yet it aches oftener than all the rest of us put together. Headache is the commonest of all pains, which fact gives the slight consolation that everybody can sympathize with you when you have it. One touch of headache makes the whole world kin, and the man or woman who has never had it would be looked upon as a creature abnormal and "a thing apart." It has even become incorporated into our social fabric as one of the sacred institutions of the game of polite society. How could we possibly protect ourselves against our instructors in youth and our would-be friends in later life if there were no such words as "a severe headache"?

What is a headache, and why does it ache the head? This is a wide and hotly disputed problem. But one fact, which is obvious at the first intelligent glance, becomes clearer and more important with deeper study, and that is that it *is not the fault of the head*. When the head aches, it is, nine times out of ten, simply doing a combination of scapegoat and fire-alarm duty for the rest of the [Pg 368] body. Just as the brain is the servant of the body, rather than its master, so the devoted head meekly offers itself as a sort of vicarious atonement for the sins of the entire body. It is the eloquent spokesman of such "mute, inglorious Miltons" as the stomach, the liver, the muscles, and the heart. The humblest and least distinguished of all the organs of the body can order the lordly head to ache for it, and the head has no alternative but to obey.

To discuss the cause of headaches is like discussing the cause of the human species. It is one of the commonest facts of every-day observation, and can be demonstrated almost at will, that any one of a hundred different causes,—a stuffy room, a broken night's sleep, a troublesome letter, a few extra hours of work, eating something that disagrees, a cold, a glare of light in the eyes,—any and all of these may bring on a headache. The problem of avoiding headaches is the problem of the whole conduct of life.

Two or three broad generalizations, however, can be made from the confused and enormous mass of data at our disposal, which are of both philosophic interest and practical value. One of these is that, while headache is felt in the head, and particularly in those regions that lie over the brain, the brain has comparatively little to do with the pain. Headache is neither a mark of intellectuality, nor, with rare exceptions, a sign of cerebral disturbance. Indeed, it is far more a matter of the digestion, the muscles, and the ductless glands, than it is of the brain, or even of the nervous system. It is, therefore, idle to endeavor either to treat or try to prevent it by [Pg 369] measures directed to the head, the brain, or even the nervous system as such.

Secondly, it is coming to be more and more clearly recognized that, while its causes are legion, a very large percentage of these practically and eventually operate by producing a toxic, or poisoned, condition of the blood, which, circulating through certain delicate and sensitive nerve-strands in the head and face, give rise to the sensation of pain.

Thirdly, the tissues which give out this pain-cry under the torture of the toxins in the blood are, in a large majority of cases, neither the brain, nor the nerves of the eye, nor other special senses, but the nerves of common sensation which supply the face, the scalp, and the structures of the head generally, most of them derived from one great pair of nerve-trunks, the so-called *Trigeminus*, or fifth pair of cranial nerves. Strange as it may seem, the brain substance is comparatively insensitive to pain, and the acutest pain of an operation upon it, such as for the removal of a tumor, is over when the skin and scalp have been cut through. These poisons, of course, go all over the body, wherever the circulation goes, but they produce their promptest and loudest pain outcry, so to speak, in the region where the nerves are most exquisitely sensitive. When your head aches, nine times out of ten your whole body is suffering, but other regions of it are not able to express themselves so promptly and so clearly.

These newer and clearer views of the nature of headache dispose at once of some of the most [Pg 370] time-honored controversies in regard to its nature. In my student-days one of the most hotly debated problems in medicine was as to whether headaches were due to lack of blood (anæmia) or excess of blood (hyperæmia) in the brain. Few things could have been more natural for both the sufferer in, and the observer of, a case of throbbing, bursting headache, where every pulse-beat is registered as a thrill of agony, than to draw the conclusion that the pain was due to a huge engorgement and swelling of the brain with blood, resulting in agonizing pressure against its rigid, bony skull-walls.

One of the most naïve and vivid illustrations of this conception of headache is the remedy adopted for generations past, in this all too familiar and distressing condition, by the Irish peasantry. It consists of a band or strip of tough cloth, or better, of twisted or plaited straw, which is tied around the head and then tightened vigorously by means of a stick inserted tourniquet fashion. This is believed to prevent the head, which is aching "fit to split," from actually bursting open, and is considered a cure of wondrous merit through many a countryside. Ludicrous as is the reason which is gravely assigned for its use, it does, in some cases, greatly relieve the pain, a fact which we were entirely at a loss to account for until our later knowledge showed us that the pain, instead of being inside the skull, was outside of it in the sensitive nerves

supplying the scalp. By steady pressure of this sort upon the trunks of these nerves, pressing them against the bone, they can be gradually numbed into a condition of anæsthesia, when naturally the pain would diminish. [Pg 371]

In politer circles a similar misapprehension has also given rise to a favorite form of treatment. That is the application of cold in the form of the classic wet cloth sprinkled with *eau de Cologne*. The mere mention of headache calls up in the minds of most of us memories of a darkened room, a pale face on the pillow with a ghastly bandage over the eyes, and a pervading smell of *eau de Cologne*. It was a perfectly natural conclusion that, because the head throbbed and felt hot and bursting, there must be some inflammation, or at least congestion, present, and that the application of cold would relieve this. The results seemed to justify this belief, for in many cases the sense of coolness to the aching head gives great relief; but this is apt to be only temporary, and in really severe cases makes the situation worse by adding another depressing influence—cold—to the toxin-burdens that are weighing upon the tortured nerves. The chief virtue in these cold cloths and handkerchiefs soaked in cologne was that you were compelled to lie down and keep perfectly still in order to keep them on, while at the same time they mechanically blindfolded you. Few better devices for automatically insuring that absolute rest, which is the best and only rational cure for a headache, have ever been invented.

We were not long in discovering that headaches, both of the mildest and the severest types, might be accompanied either by a rush of blood to the head, with flushing of the skin, reddening of the eyes, and a bursting sense of oppression in the head, or, on the other hand, by an absolute draining of the whole floating surplus of the blood into the so-called "abdominal pool," the huge network of vessels supplying the digestive organs, which, when distended, will contain nearly two-thirds of the entire blood of the body, leaving the face blanched, the eyes white and staring, and the brain so nearly emptied of blood as to cause loss of consciousness or swooning. Other headaches, again, will be accompanied by a fresh, natural color and a perfectly normal and healthy distribution of the blood-supply. In short, the amount of blood in the head, whether plus or minus, has practically nothing to do with the pain, but depends solely upon the effect of the poisons producing it upon the heart and great blood-vessels. [Pg 372]

A good illustration of the full-blooded type of headache is that which so very frequently, indeed almost invariably, occurs in the early stage of a fever or other acute infection, such as typhoid, pneumonia, or blood-poisoning, Here the face is red, the eyes are bloodshot and abnormally bright, the pulse is rapid and full, the headache so severe as to become the first disabling symptom in the disease,—all because this is the effect of the poison (toxin) of the disease upon the heart, the temperature, and the surface blood-vessels. Fortunately for the sufferer, this head-pain, like most others in the course of severe infections, is only preliminary, for as soon as the tissues of the body have become thoroughly saturated with the toxins, the nerves become dulled and semi-narcotized, so that they no longer respond with the pain-cry. As the patient settles down into the depression and dullness of the regular course of the fever, the headache usually subsides into little more than a sense of heaviness, or oppression and vague discomfort. [Pg 373]

Moral: It is a sign of health to be able to feel a headache, an indication that your body is still fighting vigorously against the enemy, whether traitor within or foe without.

On the other hand, many of our most agonizing, and particularly our most persistent and obstinate headaches, occur in individuals who are markedly anæmic, with a low, weak pulse, poor circulation, blanched lips, and dull, lackluster eyes. The one and only thing in common between these two classes of "head-achers" is that their blood and tissues are loaded with poisons. Whether produced by invading germs or by starvation and malnutrition of the body-tissues makes no difference to the headache nerves. Their business, like good watchdogs, is to bark every time they smell danger of any sort, whether it be bears or book-agents. One of the most valuable services rendered us by our priceless heads is aching.

This view of the nature of headache explains at once why it is so extraordinarily frequent and so extraordinarily varied in causation. It is not too much to say that *any* influence that injuriously affects the body may cause a headache. It would, of course, be idle even to attempt to enumerate the different causes and kinds of this pain, as it would involve a review of the entire environment of the human species, internal and external. It makes not the slightest difference how the poison gets into the blood, or where it starts. A piece of tainted meat or a salad made from spoiled tomatoes will produce a headache just as promptly and effectively as an over-exposure to the July sun or an attack of influenza. It is even practically impossible to pick out from such a wealth of origins two or three, or even a score of, conditions which are the most frequent, most important, or the most interesting causes. The most exasperating thing about dealing with a headache is that we never know, until its history has been most carefully examined, whether we have to do with a mere temporary expression of discomfort and unbalance, due to overfatigue, errors in diet, a stuffy room, lack of exercise, or what-not, which can be promptly relieved by removing the cause; or whether we have to deal with the first symptoms of a dangerous fever, the beginning of a nervous breakdown, or an early warning of some grave trouble in kidneys, liver, or heart. [Pg 374]

The one thing, however, that stands out clearly is that *headache always means something*; that it should be promptly and thoroughly investigated with a view to finding and removing the cause,—never as something which is to be cured as quickly as possible, as the police cure social discontent, by clubbing it over the head, with some narcotic or other symptom-smotherer. Nor should it be regarded as a malady so trifling that it is best treated with contempt, and still less as a mere "thorn in the flesh," whose ignoring is to be counted a virtue, or whose patient endurance

without sign a mark of saintship. Martyrdom is magnificent when it is necessary, but many forms of it are sheer stupidity. Don't either gulp down some capsule, or "grin and bear it." Look for the cause. The more trivial it is, the easier it will be to discover and remove before serious harm has been done. The less easy you find it to put your finger upon it, the more likely it is to be serious or chronic, and the more necessary it is to remove it. [Pg 375]

Once, however, we have clearly recognized that no headache should be treated too lightly or indifferently, it may be frankly admitted that practically the vast majority of headaches in which we are keenly interested—that is, the kind that we individually or the members of our family habitually indulge in—do form a moderately uniform class among the hundreds of varieties, and are in the main due to some six or seven great groups of causes. We have learned by repeated and unpleasant experience that they are very apt to "come on" in about a certain way, after a certain set of circumstances; that they last about so long, that they are made worse by such and such things, that they are helped by other things, and that they generally get better after a good night's sleep.

One of the commonest causes of this group of recurrent and self-limited headaches is fatigue, whether bodily, mental, or emotional. This was long an apparent stumbling-block in the way of a poison theory of headache, but now it is one of its best illustrations. Physiologists years ago discovered that what produced not merely the sensation but also the fact of fatigue, or tiredness, was the accumulation in the muscles or nerves of the waste-products of their own activities. [Pg 376] Simply washing these out with a salt solution would start the utterly fatigued muscle contracting again, without any fresh nourishment or even period for rest. It has become an axiom with physiologists that fatigue is simply a form of self-poisoning, or, as they sonorously phrase it, autointoxication. One of the reasons why we are so easily fatigued when we are already ill, or, as we say, "out of sorts," is that our tissues are already so saturated with waste-products or other poisons that the slightest addition of the fatigue poisons is enough to overwhelm them. This also explains why our pet variety of headache, which we may have clearly recognized to be due to overwork or overstrain of some sort, whether with eye, brain, or muscles, is so much more easily brought on by such comparatively small amounts of over-exertion whenever we are already below par and out of sorts. People who are "born tired," who are neurasthenic and easily fatigued and "ached," are probably in a chronic state of self-poisoning due to some defect in their body-chemistry. Further, the somewhat greater frequency and acuteness of headache in brain workers —although the difference between them and muscle workers in this regard has been exaggerated —is probably due in part to the greater sensitiveness of their nerves; but more so to the curious fact, discovered in careful experiments upon the nervous system, that the fatigue products of the nerve-cells are the deadliest and most powerful poisons produced in the body. Hence some brain workers can work only a few half-hours a day, or even minutes at a time; for instance, Darwin, Spencer, and Descartes. [Pg 377]

A very frequent cause of these habitual headaches, really a subdivision of the great fatigue group, is eye-strain. This is due to an abnormal or imperfect shape of the eye, which is usually present from birth. Hence, the only possible way of correcting it is by the addition to the imperfect eye of carefully fitted lenses or spectacles which will neutralize this mechanical defect. To put it very roughly, if the eye is too flat to bring the light-rays to a focus upon the retina, which is far the commonest condition (the well-known "long sight," or hyperopia), we put a plus or bulging glass before the eye and thus correct its shape. But if the eye is too round and bulging, producing the familiar "short sight," or myopia, we put a minus or concave lens before the eye, and thus bring it back to the normal. By a curious paradox, however, it often happens that the headache due to eye-strain is caused not by the grosser defects, such as interfere with vision so seriously as absolutely to demand the wearing of glasses to see decently, but from slighter and more irregular degrees and kinds of misshapenness in the eye, most of which fall under the well-known heading of astigmatism. These interfere only slightly with vision, but keep the eye perpetually on the strain, on a twist, as it were, rasping the entire nervous system into a state of chronic irritation. Our motto now, in all cases of chronic headache, is, first examine the patient's habits of life, next his eyes.

Many forms of headache are really stomach-ache in disguise, due to digestive disturbances, the absorption of poisons from the food-tube, whether from tainted, spoiled, or decayed foods, as in [Pg 378] the now familiar ptomaine poisoning, or from imperfect processes of digestion. The immediate effect, however, of diet in the causation of headache is not so great as we once believed. We have no adequate basis for believing that any particular kinds or amounts of food are especially likely to produce either headache or what we might call the headache habit, except in so far as they upset the digestion. In a certain number of susceptible individuals, however, it will be found that some particular kind of food, often perfectly wholesome and harmless in itself, will bring on an attack of headache whenever it is indulged in. Very frequently the disturbances of digestion which are put down as the *cause* of a headache are only *symptoms* of some general constitutional lack of balance, as eye-strain or neurasthenia, which is the cause of both these discomforts. Far fewer headaches can be cured by dieting than we at one time believed, and underfeeding is a more frequent cause than overeating.

By an odd *bouleversement* the one type of headache which we have almost unanimously in the past attributed to digestive disturbances, the famous, or, rather, infamous, "sick headache," is now known to have little or nothing to do with the stomach in its origin. In fact, incredible as it may seem at first sight, it is the headache that causes the sickness, not the sickness the headache. Stop the pain of a sick headache in the early stage, and the sickness will never develop

at all. The vomiting of sick headache is an interesting illustration of vomiting due to disturbances of the brain and nervous system, technically known as central vomiting. Another illustration is [Pg 379] the vomiting of seasickness, due solely to dizziness from the gross contradiction between the testimony of our eyes and of the balancing canals in the inner ear. The stomach or its contents has no more to do with seasickness than the water in a pump has with the plunger. Injuries to the head will bring on severe and uncontrollable vomiting, and the severer type of fevers is very frequently ushered in by this curious sign. As to what it means, we are as yet utterly in the dark, for in none of these conditions does the process do the slightest good, but simply adds to the discomfort of the situation. It would appear to be a curious echo of ancestral times, when the animal was pretty much all stomach, and hence emptying that organ would probably relieve two-thirds of his discomforts. Whatever the explanation, the fact remains that whenever our nervous system gets about so panic-stricken, it promptly begins throwing its cargo overboard, in the blind hope that this may somehow relieve the situation. The bile that we bring up at the end of these interesting acrobatic performances and which makes us feel so much better,—because we have now got the cause of the trouble out of our system,—is simply due to the prolonged vomiting, which has reversed the normal current and caused the perfectly healthy bile from our unoffending liver to pass upward into the stomach, instead of downward into the bowels.

In another great group of headaches natural poisons or waste-products are not burned up or got rid of through the body-sewers and pores as rapidly as they should be; for instance, the familiar [Pg 380] headache from sitting too long in a stuffy room. Your well-known and well-earned discomfort is, of course, due in part to the irritating and often poisonous gases, dust, and bacteria, which are present in the air of an unventilated room; but it is also due to the steady piling up of the waste products of your own tissues. These poisons are normally oxidized in the muscles, burned up and exhaled through the lungs, and sweated out through the skin,—all three of which relief agencies are, of course, practically paralyzed, or working at lowest possible level, while you are sitting at your desk.

The well-known headache of sluggish bowels is an obvious case in point; and one of the early signs of beginning failure of the kidneys, as in Bright's disease, is a headache of a peculiar type due to accumulation in the system of the poisons which it is their duty to get rid of.

There are few things the head resents more keenly than loss of sleep. The pillow is the best headache medicine. If this loss of sleep be due to the encroachments of work or of amusements, then the mechanism of its production is obvious. The fatigue poisons produced during the day and normally completely neutralized and burned up during sleep are not entirely disposed of and remain in the tissues to torture the nerves. The headache of insomnia, or habitual sleeplessness, on the other hand, is not, strictly speaking, caused by loss of sleep. Paradoxical as it may sound, the fatigue poisons, which in moderate amounts will produce drowsiness and promote sleep, in excessive amounts will cause wakefulness and inability to sleep. Insomnia and headache are [Pg 381] usually symptoms of this overfatigued, or poisoned, condition, and should both be regarded and treated as symptoms by the removal of their causes, *not* by the use of coal-tar products and hypnotics.

Another common cause of headache is nasal obstruction, such as may be due to adenoids or deformities of the septum, or chronic catarrhal conditions. These probably act by their interference with breathing and consequent imperfect ventilation of the blood, as well as by obstruction and inflammation of the great air-spaces in the bones of the skull, closely underlying the brain, which open and drain into the nose.

It may be remarked in passing that "sick headache," or *migraine*, though long and painfully familiar to us, is still a puzzle as to its cause. But the view which seems to come nearest to explaining its many eccentricities is that it is usually due to a congenital defect, not so much of the nervous system as of the entire body, by which the poisons normally produced in its processes fail to be neutralized and got rid of, and gradually accumulate until they saturate the system to such a degree as to produce a furious explosion of pain. This defect may quite possibly be in one of the ductless glands or in some of the internal secretions, rather than in the nervous system.

Obviously, after what has been said of the world-wide causation of headache, to attempt to discuss its treatment would be as absurd as to undertake to advise what should be done for the relief of hunger, for "that tired feeling," or for a pain in the knee. The treatment for a headache [Pg 382] due to an inflammation or tumor of the brain would, of course, be wide as the poles from that which would relieve an ordinary fatigue or indigestion pain. Besides, it is utterly irrational and often harmful to attempt *to treat any headache as such*. That is the open road to the morphine habit and drug addictions of all sorts. Remedies—and there are plenty of them—which simply relieve the pain without doing anything to remove its cause, merely make the latter state of that individual worse than the first. Headache is always and everywhere nature's vivid warning that something is going wrong, like the shrieking of a wagon-axle or the clatter of a broken cog in machinery.

There is, however, fortunately one remedy which alone will cure ninety-nine per cent of all headaches, and that is rest. The first thing an intelligent machinist does when squeaking or rattling begins is to stop the machinery. This has the double advantage of preventing the damage from going any further and of enabling him to get at the cause. Headache, like pain anywhere, is nature's imperative order *to Halt*, at least long enough to find out what you are doing to yourself that you shouldn't. It makes little difference what you take for your headache, so long as you

follow it up by lying down for an hour or two, or, better still, by going to bed for the remainder of the day and sleeping through until the next morning. If more headaches were treated in this way there would not only be fewer headaches, but two-thirds of the risks of nervous breakdown, collapse, insomnia, and chronic degenerative changes in the liver, kidneys, and blood-vessels would be avoided. [Pg 383]

This, of course, is a counsel of perfection, and incapable of general application for the sternest of reasons; but it does indicate the rational attitude toward headache and its treatment, and one which is coming to be more and more adopted. No motorist would dream of pushing ahead with a shrieking axle or a scorching hot box, unless his journey were one of most momentous importance or a matter of life and death. Pain is nature's automatic speed regulator. It is often necessary to disregard it, to get the work of the world done and to discharge our sacred obligations to others; but this disregarding should not be exalted to too high a pinnacle of virtue, and least of all worshiped as inherently and everywhere a mark of piety and one of the insignia of saintship.

A business firm or a factory, for instance, which would send home for the day each of its employees who reported a genuine case of bad headache, would, in the long run, save money by avoiding accidents, mistakes, muddles, and confusions, often involving a whole department, due to the kind of work that is done by a man or woman who is physically unfit to attempt it. And the higher the type of work that has to be done, the more the elements of insight, grasp, and sound judgment enter into it, the graver and costlier are the mistakes that are likely to be made under such circumstances.

Of course, it will probably be objected at this point: "What is the use of wasting a day, or even half a day, when by taking two or three capsules of So-and-So's Headache Cure I can get rid of the pain and go right on with my work?" It is perfectly true that there are a number of remedies which will relieve the average headache; but there are two important things to be borne in mind. The first is that all of these are simply weaker or stronger nerve-deadeners; most of them actual narcotics. All that they do is to stop the pain and thus cheat you into the impression that you are better. You are just as tired and as unfit for work as you were before. Your nervous system is just as saturated with poisons, and the chances are ten to one that the quality of the work that you do will be just as bad as if you had taken no medicine. Further, like alcohol, when used as a "pick-me-up" under somewhat similar conditions, the remedy which you have taken, while producing a false sense of comfort and even exhilaration by deadening your pain and discomfort, in that very process itself takes off the finer edge of your judgment, the best keenness of your insight, and the highest balance of your control. In short, your nervous system has to struggle with all the poisons that were present before, with another one added to them! [Pg 384]

After you have taken nature's wise advice, and obeyed her orders, and put yourself at rest, then there are a number of mild sedatives, with which every physician is familiar, one of which, according to the special circumstances of your case, it may be perfectly legitimate to take in moderate doses, with the approval of a physician, as a means of relieving the pain and helping to get that sleep which will complete the cure. [Pg 385]

One other measure of relief, which, like rest, is also indicated by instinct, is worth mentioning, and that is gentle friction of the head. One of the most instinctive tendencies of most of us when suffering from a severe headache is to put the hands to the head, either for the purpose of frantically clutching at it, rubbing as if our lives depended upon it, or pressing hard over the aching region. The mere picture of a man with his head in his hands instantly suggests the idea of headache. Part of this is, of course, little more than a blind impulse to do something to or with the offending member. We would sometimes like to throw it away if we could, or at others to bang it against the wall. But part of it is due to the discovery, ages ago, that pressure and friction would give a certain amount of relief.

For some curious reason the nerves most frequently involved are those which are most readily accessible for this kind of treatment, namely, the long nerve-threads which run from the inner third of the eyebrow up the forehead and over the crown of the head (the so-called supraorbital or frontal branches). A corresponding pair run up the back of the neck, about half-way between the back of the ear and the spinal column, supplying the back of the head and the crown (these form the cervical plexus); and a smaller pair run up just in front of the ear into the temple, and from there on upward to join the other two pairs at the top of the head.

Broadly speaking, the position of the pain depends upon which pair of these nerves is lifting up its voice most vigorously in protest. If it be the front pair (supraorbitals) then we get the well-known frontal or forehead headache; if the back pair (known as the occipitals) then we have the deadly, constricting, band-around-the-head pain which clutches us across the back of the neck and base of the brain. If the lateral pair are chiefly affected then we get the classic throbbing temples. Practically all of these aches, however, are of the "fire-alarm" character; and while certain of these nerve-gongs show some tendency to respond more readily to calls coming in from certain regions of the body, as, for instance, the forehead nerves to eye-strain, the back-of-the-head nerves (occipital) to grave toxic states of the system, the tips of any of the nerves in the crown of the head to pelvic disturbances and anæmic conditions, the lateral branches in the temples to diseases of the teeth and throat, yet there is little fixed uniformity in these relations. Eye-strain, for instance, may cause either frontal or occipital headache; and, as every one knows from experience, the pain may be felt in all parts of the head at once. [Pg 386]

Gentle and intelligent massage over the course of these nerves of the scalp, according to the

location of the pain, will often do much to relieve the severity of the suffering.

Treat headache as a danger signal, by rest and the removal of its cause, and it will prevent at least ten times as much suffering and disability as it causes. [Pg 387]

CHAPTER XVIII

NERVES AND NERVOUSNESS

Nerves are real things. In spite of their connection with imaginary diseases and mental disturbances, there is nothing imaginary or unsubstantial about them. There is no more genuine and obstinate malady on earth than a nervous disease. Because nerves lie in that twilight borderland between mind and matter, body and soul, the real and the ideal, the impression has got abroad that they are little better than figures of speech. Though their disturbances give rise to visions of all sorts there is nothing visionary about them; they are just as genuine and substantial a part of our bodily structure as our bones, muscles, and blood-vessels. In fact, it was this very substantiality that at the beginning prevented their proper recognition, and handicapped them with their present absurd and inappropriate name.

"Nerve" is from the Greek *neuron*, meaning tendon, or sinew, and was originally applied indiscriminately to all the different shining cords which run down the limbs and among the muscles. In fact the first recognition of nerves was an utter failure to recognize. The tendon cords, which are the ropes with which the muscles work the joint pulleys, were actually included under one head with the less numerous but almost equally large and tough cords of grayer color, flatter outline, and less glistening hue, which were afterwards found to be nerve-trunks. Cutting [Pg 388] either paralyzed the limb below the cut,—and what more proof could you ask of their having the same function?

Such is the persistence of ancient memories, that any physician could tell you of scores of cases in which he has heard the naïve remark, in reference most frequently to a deep gash across the wrist, that the "nerves" were cut, and the hand was paralyzed, when what had happened was simply that the tendons had been cut across. When, after centuries of blundering in every possible direction until the right one was finally stumbled upon (which is the mechanism of progress), it was realized that some of these "nerves," the grayer and flatter ones, carried messages instead of pulling ropes, they were still far from being properly understood.

It is an amusing illustration of the blissful ignorance and charming naïveté which marked their study and discussion at this time, that nerves were for centuries regarded as hollow tubes, carrying a supply of "animal spirits" from the central reservoir of the brain to the different limbs. So seriously was this believed, that, in amputations, the cut nerve-trunks were carefully sought out and tied, for fear the vital spirits would leak out and the patient thus literally bleed to death. One can imagine how this must have added to the comfort of the luckless patient.

The term "nerves" still persists, in the old sense, in both botany and entomology, which speak of the "nerves" of a butterfly's wing, or the "nervation" of a leaf, meaning simply the branching, [Pg 389] fibrous framework of each.

It comes in the nature of a surprise to most of us to learn that "nerves" are real things. I shall never forget the shock of my own first convincing demonstration of this fact. It was in one of the first surgical clinics that I attended as a medical student. A woman patient was brought in, with a history of suffering the tortures of the damned for a year past, from an uncontrollable sciatica.

It was a recognized procedure in those days (and is resorted to still), when all medical, electrical, and other remedial measures had failed to relieve a furious neuralgia, for the surgeon to cut down upon the nerve-trunk, free it from its surrounding attachments, and, slipping his tenaculum or finger under it, stretch the nerve with a considerable degree of force. Whether it acts by merely setting up some trophic change in the nerve-tissue, or by tearing loose inflammatory adhesions which are binding down the nerve-trunk, the procedure gives excellent results, nearly always temporary relief, and sometimes a permanent cure.

The patient was placed upon the table and anæsthetized, and the surgeon made a free, sweeping incision down the back of the thigh, exposing the sciatic nerve. He thrust his finger into the wound, loosened up the adhesions about the nerve, hooked two fingers underneath it, and, to my wide-eyed astonishment, heaved upward upon it, until he brought into view through the gaping wound a flattened, bluish-gray cord about twice the size of a clothesline, with which he [Pg 390] proceeded to lift the hips of the patient clear of the table. In my ignorant horror, I expected every moment to see the thing snap and the patient go down with a bump, paralyzed for life; but I never doubted after that that nerves were real things. Though it has nothing to do with this discussion, for the benefit of those of my readers who cannot bear to have a story left unfinished, I will add that the operation was as successful as it was dramatic, and the patient left the hospital completely relieved of her sciatica.

When at last it was clearly recognized that the nerves were concerned in the sending of messages from the centre to the brain, known as *sensory*, or centripetal, and carrying back messages from the brain to the muscles and surface, known as *motor*, or centrifugal,—in other

words that they were the organs of the mind,—still another source of confusion sprang up, and that was the determination on the part of some to regard them from a purely mental and, so to speak, spiritual point of view, and on the part of others to regard them from a physical and anatomical point of view. This confusion is of course in full riot at the present time.

The term "nerves," and its adjective, "nervous," are used in two totally distinct senses: one, that which is vague and unsubstantial, purely mental or subjective, and, in the realm of disease at least, imaginary; the other, purely anatomical, referring to certain strands of tissue devoted to the purpose of transmitting impulses, and the condition affecting these strands. I am not so rash as to raise the question here,—still less to attempt to settle it,—which of these two views is the [Pg 391] right and rational one. Whether the brain secretes thought as the liver does bile, or whether the mind created the brain and nervous system, or, as it has been epigrammatically put in a recent work on psychology, "whether the mind has a body, or the body has a mind," I merely call attention to the fact that this confusion of meanings exists, and that its injection into the field of medicine and pathology, at least, has done an enormous amount of harm in the way of confusing problems and preventing a proper recognition of the actual facts.

The more carefully and exhaustively and dispassionately we study the disorders of the nervous system which come in the field of medicine, the more irresistibly we are drawn to the conclusion that from neurasthenia and hysteria to insanity and paralysis they are every one of them the result of some definite morbid change in some cell or strand of the nervous system. The man or woman who is nervous has poisoned nerve-cells, either from hereditary defect, or direct saturation of the tissues with toxic substances. The patient who has an imaginary disease is suffering from some kind of a hallucination produced by poison-soaked nerve-cells, such as in highest degree give rise to the delirium of fevers, and the horrid spectres of delirium tremens.

Even the man who is suffering from a "mind diseased," and confined in one of our merciful asylums for the insane, is in that condition and position on account of physical disease, not merely of his brain, but of his entire body. The lunatic is insane, in the for once correct derivative [Pg 392] sense of unhealthy, to the very tips of his fingers. Not merely his mind and his brain, but his liver, his stomach, his skin, his hair and fingernails, the very sweat-glands of his surface which control his bodily odor, are diseased and have been so usually for years before his mind breaks down.

Tell a competent expert to pick out of a crowd of a thousand men and women the ten who are likely to become insane, and his selection will be found almost invariably to include the two or three who will actually become so.

In fact, from even the crudest and scantiest knowledge of the actual growth of our own bodies from the ovum to the adult, it will be difficult to conceive how this relation could be otherwise, The nerve-cells and their long processes, which form the nerve-trunks, are simply one of a score of different specialized cells which exist side by side in the body. Primarily all our body-cells had the power of responding to stimuli, of digesting and elaborating food, of moving by contraction, of reproducing their kind. The nerve-cells are simply a group which have specialized exclusively upon the power of receiving and transmitting impulses. They still take food, but it has to be prepared for them by the other cells; and here, as we shall see later, is one of the dangers to which they are exposed. They still reproduce their kind, but in very much smaller and more limited degree. They still, incredible as it may seem, probably have slight powers of movement or contraction, and can draw in their processes. But they have surrendered many of their rights and neglected some of their primitive accomplishments, in order to devote themselves more [Pg 393] exclusively and perfectly to the carrying out of one or two things.

In spite of all this, however, they still remain blood-brothers and comrades to every other cell in the body. In the language of Shylock, "If you cut them, they will bleed; if you tickle them, they will laugh; if you starve them, they will die." In all this development, which continued up to a late hour last night, and is still going on, the nerve-tissue has lain side by side with every other tissue in the body, fed by the same blood, supplied with the same oxygen, saturated with the same body-lymph.

It is of course perfectly clear that any influence, whether beneficial or injurious, affecting the body, will also be likely to affect the nervous system, as a part of it; and this is precisely the fact, as we find it. If the body be well fed, well warmed, sufficiently exercised, without being overworked, and allowed a liberal allowance of that recharging of the human battery which we call sleep, then the nervous system will work smoothly and easily, at peace with itself and with all mankind. Its sense-organs will receive external impressions promptly and accurately. Its conducting fibres will transmit them to the centre with neither delay nor friction. The brain clearing-house will receive and dispose of them with ease and good judgment. And then, just because his nervous system is working to perfection, we say that such an individual "has no nerves."

If the triumph of art be to conceal art, then the nerves have achieved this. They have literally [Pg 394] effaced themselves in the well-being of the body.

If on the other hand, the food-supply is inadequate, if the sleep allowance has been cut short, whether by the demands of work or by those of fashion, if the body has been starved of oxygen and deprived of sunlight, if the whole system has been kept on the rack, whether in the sweatshop, or in the furnace of affliction, what is the effect on the nervous system? Just what might have been expected. The sense-organs shy, like a frightened horse, at every shadow or fluttering leaf. The conducting wires break, and cross, and tangle in every imaginable fashion.

The central exchange, half wild with hunger, or crazed with fatigue-toxins, shrieks out as each distorted message comes in, or sulks because it can't understand them. And then, with charming logicality, we declare that such an one is "all nerves."

The brain, by which we mean the biggest one near the mouth,—we have little brains, or *ganglia* all over our bodies,—so far from being an absolute monarch, is not even a constitutional one, or a president of a republic, but a mere house of congress of the modern type, which can do little but register and obey the demands of its constituents. The brain originates nothing. Impulses are brought to it from the sense-organs by the nerves. They set up in it certain vibrations, or chemical disturbances. It responds to these much as blue litmus paper turns red when a weak acid is dropped on it, or as lemonade fizzes when you put soda in it. If more than one of these vibrations are set up simultaneously, it "chooses" between them, by responding to the strongest. [Pg 395] If the response differs from the stimulus, it is because of its huge deference to precedent as established by the records of previous stimuli with which its tissues are stored.

This brings us to the interesting and important question, What are the causes of these disturbances of the nerve-tissues? Probably the most important single result that has been reached in our study of nervous diseases in the last fifteen years, is that the cause of them in easily eighty per cent of all cases *lies entirely outside of the nervous system*.

The stomach burns, the nerve-tissues send in the fire alarm and order out the engines. The liver goes on a strike, and the body-garbage, which it has failed to burn to clean ashes and clear smoke, poisons the nerve-cells, and they remonstrate accordingly, on behalf of the other tissues. The heart, or blood-vessels, fails to supply a certain muscle with its due rations of blood and the nerves of the region cry out in the agony of cramp.

We have discovered, by half a century of careful study in the hospital and in the sick-room, not only that the nerve-tissues are usually poisoned by defect of other tissues of the body, but that they are among the very last of the body-stuffs to succumb to an intoxication. The complications of a given disease involving the nervous system are almost invariably the last of all to appear. This is one of the things that has given nervous diseases such a bad name for unmanageableness and incurableness, and that for years made us regard their study as so nearly hopeless, so far as [Pg 396] any helpful results were concerned.

When a disease has, so to speak, soaked into the inmost core of the nerve-fibre, it has got a hold which it will take months and even years to dislodge. And before your remedies can reach it, it will often have done irreparable damage. An illustration of the care taken to spare the nervous system is furnished by its behavior in starvation. If a man or an animal has almost died of starvation, the tissues of the body will be found to have been wasted in very varying degrees, the fat, of course, most of all; in fact this will have almost entirely disappeared, all but three per cent. Then come the liver and great glands, which will have shrunk about sixty per cent; then the muscles, thirty per cent; then the heart and blood-vessels. Last of all, the nervous system, which will scarcely have wasted to any appreciable degree. In fact, it is an obvious instance of jettison on the part of the body, throwing overboard those tissues which it could most easily spare, and hanging on like grim death to those which were absolutely essential to its continued existence, viz., the heart and the nervous system. To use a cannibalistic and more correct illustration, it is killing and eating the less useful and valuable members of its family, in order that their flesh may keep alive the two or three most indispensable.

Another illustration is the actual behavior of the nerve-stuff in disease. This is most clearly shown in those clear-cut disturbances which are definitely known to be due to a specific infection; in other words, invasion of the body by a disease-organism, or germ. [Pg 397]

First of all, it may be stated that physicians are now substantially agreed that two-thirds of the general diseases of the nervous system are due to the extension of one of these acute infections to the nerve-tissue; and this extension almost invariably comes late in the disease. The only exceptions to this rule in the whole list of infectious diseases are two, epidemic cerebro-spinal meningitis (spotted fever), and tetanus (lockjaw). Both of these have an extraordinary and deadly preference for the nervous system from the very start, and this is what gives them their frightful mortality and discouraging outlook. Even of this small number of exceptions, we are not altogether certain as to epidemic meningitis, inasmuch as we do not know how long the germ may have existed in the other tissues of the body before it succeeded in working its way to and attacking the brain and spinal cord.

The case of tetanus, however, is perfectly clear in this regard, and exceedingly interesting, inasmuch as it explains why a disease specially involving the nervous system from the start is so excessively hard to check or cure. The germ of the disease, long ago identified as one having its habitat in farm or garden soils,—particularly those which have been heavily fertilized with horse manure,—gets into the system through a cut or scratch upon the surface, into which the soil is rubbed. These infected cuts, for obvious reasons, are most frequently upon the hands or feet.

Small doses of the organism have been injected into animals; then, when they have recovered, [Pg 398] larger ones, and so on, after the manner of the bacillus of diphtheria, until a powerful antitoxin can be obtained from their blood, very minute quantities of which will promptly kill the bacilli in a test-tube. For seven or eight years past we have been injecting this into every patient with tetanus that came under our observation, but so far with very limited benefit, even though the injections were made directly into the spinal cord, or brain substance. The problem puzzled us for years, until finally Cattani stumbled upon the explanation. While we had been supposing that the

poison was carried, as almost every other known poison is, through the blood-vessels, or lymph-channels, to the heart and thence to the brain, he clearly proved that it ran up the central axis of the nerve-trunks, and consequently, when it had got once fairly started up this channel, was as safe from the attack of any antitoxin merely present in the general circulation and fluids of the body, as the copper of the Atlantic cable is from the eroding action of the sea-water. If, in his experimental animals, he carefully sought for the cut end of the nerve-trunk in the wound that had been infected, and injected the antitoxin directly into that, the disease was stopped. Or it might even be "headed off" by the crude method of cutting directly across the nerve-trunk at a point above that yet reached by the infection.

The commonest and most fatal of all forms of general diseases of the nervous system are those which are due to the later extensions of general infections. [Pg 399]

First and foremost stands syphilis, due to the invasion of the blood by a clearly defined *spirillum*, the *Treponema pallida* of Schaudinn. This first attacks the mucous membranes of the throat and mouth, then the skin, then the great internal organs like the liver and stomach, then the bones, and, last of all, the nervous system. The length of time which the poison takes to reach the nervous system is something which at first sight is almost incredible, viz., from one and a half to fifteen years. It is true that in rare instances brain symptoms will manifest themselves within six or eight months; but these are usually due to pressure by inflammatory growths on the bones of the skull and its lining membrane (*dura mater*). It is not too much to say that this disease plays the greatest single rôle in nervous pathology. Three of the commonest and most fatal diseases of the spinal cord and brain, *paresis* (general paralysis of the insane), *locomotor ataxia*, and *lateral sclerosis*, are due to it.

Naturally, when a poison has taken a decade or a decade and a half to penetrate to the nerve-tissues, it does irreparable damage long before it can be dislodged or neutralized.

A similar aftermath may occur in almost all of the acute infectious diseases. Every year adds a new one to the list capable of causing cerebral complications. Tuberculosis, diphtheria, scarlet fever, typhoid, smallpox, influenza, have now well-recognized cerebral and nervous complications, some temporary, some permanent. A form of tuberculosis attacking the coverings (*meninges*) of the brain—hence known as meningitis—is far the commonest fatal brain-disease of [Pg 400] infancy and childhood.

Perhaps the most striking illustration of just how acute affections attack the nervous system, is that furnished by diphtheria. A child develops an attack of this disease, passes the crisis safely, and begins to recover. A few days later, it is allowed to sit up in bed. Suddenly, after some slight exertion, or often without any apparent cause, the face blanches, the eyes stare widely, the child gasps two or three times, and is dead: sudden heart failure, due to the poisoning either of the heart muscle itself, or of the nerves supplying the heart, by the toxin of the disease. Moral: Keep diphtheria patients strictly at rest in bed for at least a week after the crisis is past. Another case will pass this period safely, though perhaps with a rapid and weak heart, for days or weeks; then one morning the child will choke when swallowing milk. The next time it is attempted, the milk, instead of going down the throat, comes back through the nostrils. Paralysis of the soft palate has developed, apparently from a local saturation of the nerves with the poison. This may go no further, or it may extend, as it commonly does, to the nerves of the eye, and the child squints and can no longer read, if old enough, because the muscle of accommodation also is paralyzed. The arms and limbs may be affected, and in extreme cases the nerves of respiration supplying the diaphragm may be involved, and the child dies of suffocation. In the majority of cases, however, fortunately, after this paralysis has lasted from three to six weeks, it gradually subsides, and may [Pg 401] clear up completely, though not at all infrequently one or more muscles may remain permanently damaged by the attack, giving, for instance, a palatal tone to the voice, or interfering with the production of singing tones. Occasionally a permanent squint may follow.

It might be said in passing, that, with one of the charming logicalities of popular reasoning, these nerve complications have been said to be *caused by* antitoxin, simply because the use of the antitoxin saves more children alive to develop them.

The next group of nervous diseases may be roughly described as due to the failure of some part of the digestive system, like the stomach and intestines, properly to elaborate its food; or of one of the great glands, like the liver, thyroid, or suprarenal, properly to supply its secretion, which is needed to neutralize the poisons normally produced in the body. This class is very large and very important. It has long been known how surely a disordered liver "predicts damnation"; melancholia, or "black bilious condition," hypochondria, or "under the rib-cartilages" (where the liver lies), are every-day figures of speech. A thorough house-cleaning of the alimentary canal, together with proper stimulation of the skin and kidneys, and an intelligent regulation of diet, are our most important measures in the treatment of diseases of the nervous system, even in those extreme forms known as insanity.

Closely allied to these are those disturbances of the nervous system lumped together under the soul-satisfying designation of "neurasthenia," which are chiefly due to the accumulation in the [Pg 402] system of the fatigue poisons, or substances due to prolonged overstrain, under-rest, or underfeeding of the system. Neurasthenia is the "fatigue neurosis," as a leading expert terms it. It may be due to any morbid condition under heaven. It is "that blessed word Mesopotamia" of the slipshod diagnostician. Nearly one-fourth of the cases which come into our sanatoria for tuberculosis have been diagnosed and treated for months and even years as "neurasthenia." It satisfies the patient—and it means nothing; though some experts contend for a distinct disease

entity of this name but admit its rarity.

The intelligent neurologist, nowadays, has practically no known specific for any form of nervous disease, no remedy which acts directly and curatively upon the nervous system itself. He relies chiefly—and this applies to the asylum physician also—upon intestinal antisepsis, upon rest, upon baths, upon regulation diet, and habits of life.

A number of the more sudden and fatal disturbances of the nervous system, as for instance, the familiar "stroke of paralysis," or apoplexy, of later middle life, are due to a defect, not in the nervous system at all, but in the blood-vessels supplying the brain; rupture of a vessel, and consequent escape of blood, destroys so much of the surrounding brain-tissue as to produce paralysis, and, in extreme cases, death. Just why the blood-vessels of the brain in general, and of one part of the basal ganglia in particular (the *Lenticulostriate* artery in the internal capsule of the *corpus striatum*, the old jaw ganglion), are so liable to rupture we do not know; but it [Pg 403] certainly is chiefly from a defect of the blood-vessels, and not of the brain. All of which brings us to the following important practical conclusions.

First of all, that every attack or touch, however light, of "nervousness," "nerves," "imagination," "neurasthenia," yes, hysteria, *means* something. It is the cry of protest of a smaller or larger part of the nervous system against underfed blood, under-ventilated muscles, lack of sunlight, lack of exercise, lack of sleep, excess of work, or bad habits. In other words, it is the danger signal, the red light showing the open switch, and we will disregard it at our peril. Unfortunately, by that power of *esprit de corps* of the entire system, known as "pluck" or "grit," or the veto-power, physiologically termed inhibition, we may ignore and for a time suppress the symptom, but this in the long run is just as rational as cutting the wire that rings a fire alarm, or blowing out the red light without closing the switch.

Nervousness is a *symptom* which should always have *something done for it*, especially in children. In fact, it has passed into an axiom both with intelligent teachers and with physicians who have much to do with the little ones, that crossness, fretfulness, laziness, lack of initiative, and readiness to weep, in children, are almost invariably the signs of physical disease. And this doctrine will apply to a considerable percentage of children of larger growth.

Unfortunately, one of the first and most decided tendencies on the part of the badly fed or poisoned nervous system, is to exaggerate the difficulties of the situation, and to minimize its [Pg 404] good features. The individual "has lost his nerve," is afraid to undertake things, shrinks from responsibility, exaggerates the difficulties that may be in the way; hence the floods of tears, or outbursts of temper, with which nervous children will greet the suggestion of any task or duty, however trifling. If the nervous individual has reached that stage of maturity when she realizes that she is not merely "naughty," but sick, then this same process applies itself to her disease. She is sure that she is going to die, that another attack like that will end in paralysis; as a patient of mine once expressed it to me, "My heart jumps up in my mouth, I bite a couple of pieces off it, and it falls back again." In short, she so obviously and grossly exaggerates every symptom and phase of her disease, that the impression irresistibly arises that the disease itself is a fabrication. This view of her condition by her family or her physician is the tragedy of the neurasthenic.

Broadly speaking, *no* disease, even of the nervous system, is ever purely imaginary. Some part of the patient's nervous system is poisoned, or he would not imagine himself to be sick. We can all of us find trouble enough in some part of our complex bodily machinery, if we go around hunting for it; but this is precisely what the healthy man, or woman, *never* does. They have other things to occupy them, and are far more liable to run into danger by pushing ahead at full steam, and neglecting small creakings and jarrings until something important in the gear jams, or goes snap, [Pg 405] and brings them to a halt, than they are to be wasting time and energy worrying over things that may never happen.

Worry, in fact, is a sign of disease instead of a cause. To put it very crudely, whenever the blood and fluids of a body become impoverished below a certain degree, or become loaded with fatigue poisons, or other waste products above a certain point, then the nervous system proceeds to make itself felt. Either the perceptive end-organs become color-blind and read yellow for blue, or are astigmatic and report oval for round; or the conducting nerve-strands tangle up the messages, or deliver them to the wrong centre; or the central clearing-house, puzzled by the crooked messages, loses its head, and begins to throw the inkstands about, or goes down in a sulk. In other words, the nervous system goes on a strike. But it is perfectly idle to endeavor to treat it with cheering words, or kindly meant falsehoods, to the effect that "nothing is really the matter." Like any other strike, it can be rationally dealt with only by improving the conditions under which the operatives have to work, and meeting their demands for higher wages, or shorter hours.

We were accustomed at one time to divide diseases into two great classes, organic and functional. By the former, we meant those in which there was some positive defect of structure, which could be recognized by the eye or the microscope; by the latter, those diseases in which this could not be discovered, in which, so to speak, the machine was all right, but simply wouldn't work. It goes without saying that the latter class was simply a confession of our ignorance, and [Pg 406] one which is steadily and rapidly diminishing as science progresses.

If the machine won't work, there is a reason for it somewhere, and our business is to find it out, and not loftily to assure our patients that there is nothing much the matter, and all they need is rest, or a little cheerful occupation. Furthermore, the most inane thing that a sympathizing friend

or kindly physician can do to a neurasthenic, is to advise him to take his mind off himself or his symptoms. The utter inability to do that very thing is one of the chief symptoms of the disease, which will not disappear until the underlying cause has been carefully studied out and removed.

"Nerves," "neurasthenia," "psychasthenia," and "hysteria," are all the names of *symptoms* of *definite bodily disease*. The modern physician regards it as his duty to study out and discover the nature of this disease, and, if possible, remove it, rather than to give high-sounding, soul-satisfying names to the symptoms, and advise the patient to "cheer up"; which advice costs nothing—and is worth just what it costs.

"But," some one will say at once, "if nervous diseases are simply the reflection of general bodily states, as sanitary conditions improve under civilization, should they not become less frequent? And yet, any newspaper will tell you that nervous diseases are rapidly on the increase." This is a widespread belief, not only on the part of the public, but of many scientists and a considerable number of physicians; but it is, I believe, unfounded. [Pg 407]

In the first place, we have no reliable statistical basis for a positive statement, either one way or another. Our ignorance of the precise prevalence of disease in savagery, in barbarism, and even under civilization up to fifty years ago, is absolute and profound. It is only since 1840 that vital statistics of any value, except as to gross deaths and births, began to be kept. So far as we are able to judge from our study of savage tribes by the explorer, the army surgeon, and the medical missionary, the savage nervous system is far less well balanced and adjustable than that of civilized man. Hysteria, instead of occurring only in individual instances, attacks whole villages and tribes. In fact, the average savage lives in a state alternating between naïve and childish self-satisfaction and panic-stricken terror, with their resultant cowardice and cruelty on the one hand, and unbridled lust and delusions of grandeur on the other. The much-vaunted strain of civilization upon the nervous system is not one-fifth that of savagery.

Think of living in a state when any night might see your village raided, your hut burned, yourself killed or tortured at the stake, and your wife and children carried into slavery. Read the old hymns and see how devoutly thankful our pious ancestors *were every day* at finding themselves alive in the morning,—"Safely through another night,"—and fancy the nerve-strain of never knowing, when you lay down to sleep, whether some one of the djinns, or voodoos, or vampires would swoop down upon you before morning. Think of facing death by famine every winter, by drought or cyclone every summer, and by open war or secret scalp-raid every month in the year; [Pg 408] and then say that the racking nerve-strain of the commuter's time-table, the deadly clash of the wheat-pit, or the rasping grind of office-hours, would be ruinous to the uncivilized nervous system. Certainly, in those belated savages, the dwellers in our slums, hysteria, diseases of the imagination, enjoyment of ill health, and the whole brood of functional nervous disturbances are just as common as they are on Fifth Avenue.

It is not even certain that insanity is increasing. Insanity is quite common among savages; just how common is difficult to say, on account of their peculiar methods of treating it. The stupid and the dangerous forms are very apt to be simply knocked on the head, while the more harmless and fantastic varieties are turned into priests and prophets and become the founders of the earlier religions. A somewhat similar state of affairs of course prevailed among civilized races up to within the last three-quarters of a century. The idiot and the harmless lunatic were permitted to run at large, and the latter, as court and village fools, furnished no small part of popular entertainment, since organized into vaudeville. Only the dangerous or violent maniacs were actually shut up; consequently, the number of insane in a community a century ago refers solely to this class. Hence, in every country where statistics have been kept, as larger and larger percentages of these unfortunates have been gathered into hospitals, where they can be kindly cared for and intelligently treated, the number of the registered insane has steadily increased up to a certain point. This was reached some fifteen years ago in Great Britain, in Germany, in [Pg 409] Sweden, and in other countries which have taken the lead in asylum reform, and has remained practically stationary since, at the comparatively low rate of from two to three per thousand living. This limit shows signs of having been reached in the United States already; and this gradual increase of recognition and registration is the only basis for the alleged increase of insanity under modern conditions.

It is also a significant fact that the lower and less favorably situated stratum of our population furnishes not only the largest number of inmates, but the largest percentage of insanity in proportion to their numbers, while the most highly educated and highly civilized classes furnish the lowest. Immigrants furnish nearly three times as many inmates per thousand to our American asylums as the native born.

It is, however, true that in each succeeding census a steadily increasing number and percentage of the deaths is attributed to diseases of the nervous system. This, however, does not yet exceed fifteen or twenty per cent of the whole, which would be, so to speak, the natural probable percentage of deaths due to failure of one of the five great systems of the body: the digestive, the respiratory, the circulatory, the glandular, the nervous. Two elements may certainly be counted upon as contributing in very large degree to this apparent increase. One is the enormous saving of life which has been accomplished by sanitation and medical progress during the first five years of life, infant mortality having been reduced in many instances fifty to sixty per cent, thus of [Pg 410] course leaving a larger number of individuals to die later in life by the diseases especially of the blood-vessels, kidneys, and nervous system, which are most apt to occur after middle life. The other is the great increase in medical knowledge, resulting in the more accurate discovery of the

causes of death, and a more correct reporting and classifying of the same.

In short, a careful review of all the facts available to date leads us decidedly to the conclusion that the nervous system is the toughest and most resisting tissue of the body, and that its highest function, the mind, has the greatest stability of any of our bodily powers. Only one man in six dies of disease of the nervous system, as contrasted with nearly one in three from diseases of the lungs; and only one individual in four hundred becomes insane, as contrasted with from three to ten times that number whose digestive systems, whose locomotor apparatus, whose heart and blood-vessels become hopelessly deranged without actually killing them. [Pg 411]

CHAPTER XIX

MENTAL INFLUENCE IN DISEASE, OR HOW THE MIND AFFECTS THE BODY

One of the dearest delusions of man through all the ages has been that his body is under the control of his mind. Even if he didn't quite believe it in his heart of hearts, he has always wanted to. The reason is obvious. The one thing that he felt absolutely sure he could control was his own mind. If he couldn't control that, what could he control? Ergo, if man could control his mind and his mind could control his body, man is master of his fate. Unfortunately, almost in proportion as he becomes confident of one link in the chain he becomes doubtful of the other. Nowadays he has quite as many qualms of uncertainty as to whether he can control his mind as about the power of his mind over his body. By a strange paradox we are discovering that our most genuine and lasting control over our minds is to be obtained by modifying the conditions of our bodies, while the field in which we modify bodily conditions by mental influence is steadily shrinking.

For centuries we punished the sick in mind, the insane, loading them with chains, shutting them up in prison-cells, starving, yes, even flogging them. We exorcised their demons, we prayed over them, we argued with them,—without the record of a single cure. Now we treat their sick and [Pg 412] ailing bodies just as we would any other class of chronic patients, with rest, comfortable surroundings, good food, baths, and fresh air, correction of bad habits, gentleness, and kindness, leaving their minds and souls practically without treatment, excepting in so far as ordinary, decent humanity and consideration may be regarded as mental remedies,—and we cure from thirty to fifty per cent, and make all but five per cent comfortable, contented, comparatively happy.

We are still treating the inebriate, the habitual drunkard, as a minor criminal, by mental and moral means—with what hopeful results let the disgraceful records of our police courts testify. We are now treating truancy by the removal of adenoids and the fitting of glasses; juvenile crime by the establishment of playgrounds; poverty and pauperism by good food, living wages, and decent surroundings; and all for the first time with success.

In short, not only have all our substantial and permanent victories over bodily ills been won by physical means, but a large majority of our successes in mental and moral diseases as well. Yet the obsession persists, and we long to extend the realm of mental treatment in bodily disease.

That the mind does exert an influence over the body, and a powerful one, in both health and disease, is obvious. But what we are apt to forget is that the whole history of the progress of medicine has been a record of diminishing resort to this power as a means of cure. The measure of our success and of our control over disease has been, and is yet, in exact proportion to the [Pg 413] extent to which we can relegate this resource to the background and avoid resorting to it. Instead of mental influence being the newest method of treatment it is the oldest. Two-thirds of the methods of the shaman, the witch-doctor, the medicine-man, were psychic. Instead of being an untried remedy, it is the most thoroughly tested, most universal, most ubiquitous remedy listed anywhere upon the pages of history, and, it may be frankly stated, in civilized countries, as widely discredited as tested. The proportion to which it survives in the medicine of any race is the measure of that race's barbarism and backwardness. To-day two of the most significant criteria of the measure of enlightenment and of control over disease of either the medical profession of a nation or of an individual physician are the extent to which they resort to and rely upon mental influence and opium. Psychotherapy and narcotics are, and ever have been, the sheet-anchors of the charlatan and the miracle-worker.

The attitude of the medical profession toward mental influence in the treatment of disease is neither friendly nor hostile. It simply regards it as it would any other remedial agency, a given drug, for instance, a bath, or a form of electricity or light. It is opposed to it, if at all, only in so far as it has tested it and found it inferior to other remedies. Its distrust of it, so far as this exists, is simply the feeling that it has toward half a hundred ancient drugs and remedial agencies which it has dropped from its list of working remedies as obsolete, many of which still survive in [Pg 414] household and folk medicine. My purpose is neither to champion it nor to discredit it, and least of all to antagonize or throw doubt upon any of the systems of philosophy or of religion with which it has been frequently associated, but merely to attempt to present a brief outline of its advantages, its character, and its limitations, exactly as one might of, say, calomel, quinine, or belladonna.

As in the study of a drug, the chief points to be considered are: What are its actual powers? What effects can be produced with it, both in health and sickness? What are the diseases in which such effects may be useful, and how frequent are they? In what way does it produce its effects, directly or indirectly?

The first and most striking claim that is made for mental influence in disease is based upon the allegation that it has the power of producing disease and even death; the presumption, of course, being that, if able to produce these conditions, it would certainly have some influence in removing or preventing them. Upon this point the average man is surprisingly positive and confident in his convictions. Popular literature and legend are full of historic instances where individuals have not merely been made seriously ill but have even been killed by powerful impressions upon their imaginations. Most men are ready to relate to you instances that have been directly reported to them of persons who were literally frightened to death. But the moment that we come to investigate these widely quoted and universally accepted instances, we find ourselves in a curious position. On the one hand, merely a series of vague tales and stories, [Pg 415] without date, locality, name, or any earmark by which they can be identified or tested. On the other, a collection of rare and extraordinary instances of sudden death which have happened to be preceded by a powerful mental impression, many of which bear clearly upon their face the imprint of death by rupture of a blood-vessel, heart failure, or paralysis, in the course of some well-marked and clearly defined chronic disease, like valvular heart-mischief, diabetes, or Bright's disease.

Upon investigation most of these cases which have been seen by a physician previous to death have been recognized as subject to a disease likely to terminate in sudden death; and practically all in which a post-mortem examination has been made have shown a definite physical cause of death. The fright, anger, or other mental impression, was merely the last straw, which, throwing a sudden strain upon already weakened vessels, heart, or brain, precipitated the final catastrophe. In some cases, even the sense of fright and the premonition of approaching death were merely the first symptoms of impending dissolution.

The stories of death from purely imaginative impressions, such as the victims being told that they were seriously ill, that they would die on or about such and such a date, fall into two great classes. The first of these—involving death at a definite date, after it had been prophesied either by the victim or some physician or priest—may be dismissed in a few words, as they lead at once into the realm of prophecy, witchcraft, and voodoo. Most of them are little better than after-echoes of the ethnic stories of the "evil eye," and of bewitched individuals fading away and [Pg 416] dying after their wax image has been stuck full of pins or otherwise mutilated. There have occurred instances of individuals dying upon the date at which some one in whose powers of prophecy they had confidence declared they would, or even upon a date on which they had settled in their own minds, and announced accordingly; but these are so rare as readily to come within the percentage probabilities of pure coincidence. Most such prophecies fail utterly; but the failures are not recorded, only the chance successes.

The second group of these alleged instances of death by mental impression is in most singular case. Practically every one with whom you converse, every popular volume of curiosities which you pick up, is ready to relate one or more instances of such an event. But the more you listen to these relations, the more familiar do they become, until finally they practically simmer down to two stock legends, which we have all heard related in some form.

First, and most famous, is the story of a vigorous, healthy man accosted by a series of doctors at successive corners of the street down which he is walking, with the greeting:—

"Why, my dear Mr. So-and-So, what is the matter? How ill you look!"

He becomes alarmed, takes to his bed, falls into a state of collapse, and dies within a few days.

The other story is even more familiar and dramatic. Again it is a group of morbidly curious and spiteful doctors who desire to see whether a human being can be killed by the power of his [Pg 417] imagination. A condemned criminal is accordingly turned over to them. He is first allowed to see a dog bled to death, one of the physicians holding a watch and timing the process with, "Now he is growing weaker! Now his heart is failing! Now he dies!" Then, after having been informed that he is to be bled to death instead of guillotined, his eyes are bandaged and a small, insignificant vein in his arm is opened. A basin is held beneath his arm, into which is allowed to drip and gurgle water from a tube so as to imitate the sounds made by the departing life-blood. Again the death-watch is set and the stages of his decline are called off: "Now he weakens! Now his heart is failing!" until finally, with the solemn pronouncement, "Now he dies!" he falls over, gasps a few times and is dead, though the total amount of blood lost by him does not exceed a few teaspoonfuls.

A variant of the story is that the trick was played for pure mischief in the initiation ceremonies of some lodge or college fraternity, with the horrifying result that death promptly resulted.

The stories seem to be little more than pure creatures of the same force whose power they are supposed to illustrate, amusing and dramatic fairy-tales, handed down from generation to generation from Heaven knows what antiquity. Death under such circumstances as these *may* have occurred, but the proofs are totally lacking. One of our leading neurologists, who had extensively experimented in hypnotism and suggestion, declared a short time ago: "I don't believe [Pg 418] that death was ever caused solely by the imagination."

Now as to the scope of this remedy, the extent of the field in which it can reasonably be expected to prove useful. This discussion is, of course, from a purely physical point of view. But it is, I think, now generally admitted, even by most believers in mental healing, that it is only, at best, in rarest instances that mental influence can be relied upon to cure organic disease, namely, disease attended by actual destruction of tissue or loss of organs, limbs, or other portions of the body. This limits its field of probable usefulness to the so-called "functional diseases," in which—to put it crudely—the body-machine is in apparently perfect or nearly perfect condition, but will not work; and particularly that group of functional diseases which is believed to be due largely to the influence of the imagination.

Nowhere can the curious exaggeration and over-estimation of the real state of affairs in this field be better illustrated than in the popular impression as to the frequency in actual practice of "imaginary" diseases. Take the incidental testimony of literature, for instance, which is supposed to hold the mirror up to nature, to be a transcript of life. The pages of the novel are full, the scenes of the drama are crowded with imaginary invalids. Not merely are they one of the most valuable stock properties for the humorist, but whole stories and comedies have been devoted to their exploitation, like Molière's classic "Le Malade Imaginaire," and "Le Médecin Malgré Lui." Generation after generation has shaken its sides until they ached over these pompous old [Pg 419] hypochondriacs and fussy old dowagers, whose one amusement in life is to enjoy ill health and discuss their symptoms. They are as indispensable members of the *dramatis personæ* of the stock company of fiction as the wealthy uncle, the crusty old bachelor, and the unprotected orphan. Even where they are only referred to incidentally in the course of the story, you are given to understand that they and their kind furnish the principal source of income for the doctor; that if he hasn't the tact to humor or the skilled duplicity to plunder and humbug these self-made sufferers, he might as well retire from practice. In short, the entire atmosphere of the drama gives the strong impression that if people—particularly the wealthy classes—would shake themselves and go about their business, two-thirds of the illness in the world would disappear at once.

Much of this may, of course, be accounted for by the delicious and irresistible attractiveness, for literary purposes, of this type of invalid. Genuine, serious illness, inseparable from suffering and ending in death, is neither a cheerful, an interesting, nor a dramatic episode, except in very small doses, like a well-staged death-bed or a stroke of apoplexy, and does not furnish much valuable material for the novelist or the play-writer. Battle, murder, and sudden death, while horrible and repulsive, can be contemplated with vivid, gruesome interest, and hence are perfectly available as interest producers. But much as we delight to talk about our symptoms, we are never particularly interested in listening to those of others, still less in seeing them portrayed upon the [Pg 420] stage. On account of their slow course, utter absence of picturesqueness, and depressing character, the vast majority of diseases are quite unsuitable for artistic material. In fact, the literary worker is almost limited to a mere handful, at one extreme, which will produce sudden and dramatic effects, like heart failure, apoplexy, or the ghastly introduction of a "slow decline" for a particularly pathetic effect; and at the other extreme, those imaginary diseases, migraines and vapors, which furnish amusement by their sheer absurdity.

Be that as it may, such dramatic and literary tendencies have produced their effect, and the popular impression of the doctor is that of a man who spends his time between rushing at breakneck speed to save the lives of those who suddenly find themselves *in articulo mortis* and will perish unless he gets there within fifteen minutes, and dancing attendance upon a swarm of old hypochondriacs, neurotics, and nervous dyspeptics, of both sexes. As a matter of fact, these two supposed principal occupations of the doctor are the smallest and rarest elements in his experience.

A few years ago a writer of world-wide fame deliberately stated, in the course of a carefully considered and critical discussion of various forms of mental healing, that it was no wonder that these methods excited huge interest and wide attention in the community, because, if valid, they would have such an enormous field of usefulness, seeing that at least seven-tenths of all the suffering which presented itself for relief to the doctor was imaginary. [Pg 421]

This, perhaps, is an extreme case, but is not far from representing the general impression. If a poll were to be taken of five hundred intelligent men and women selected at random, as to how much of the sufferings of all invalids, or sick people who are not actually obviously "sick unto death" or ill of a fever, was real and how much imaginary, the estimate would come pretty close to an equal division. But when one comes to try to get at the actual facts, an astonishingly different state of affairs is revealed. I frankly confess that my own awakening was a matter of comparatively recent date.

A friend of mine was offered a position as consulting physician to a large and fashionable sanatorium. He hesitated because he was afraid that much of his time would be wasted in listening to the imaginary pains, and soothing the baseless terrors, of wealthy and fashionable invalids, who had nothing the matter with them except—in the language of the resort—"nervous prosperity." His experience was a surprise. At the end of two years he told me that he had had under his care between six and seven hundred invalids, a large percentage of whom were drawn from the wealthier classes; and out of this number there were *only five* whose sufferings were chiefly attributable to their imagination. Many of them, of course, had comparatively trivial ailments, and others exaggerated the degree or mistook the cause of their sufferings; but the vast majority of them were, as he naïvely expressed it, "really sick enough to be interesting."

This set me to thinking, and I began by making a list of all the "imaginary invalids" I had personally known, and to my astonishment raked up, from over twenty years' medical experience, barely a baker's dozen. Inquiries among my colleagues resulted in a surprisingly similar state of affairs. While most of them were under the general impression that at least ten to twenty per cent of the illnesses presenting themselves were without substantial physical basis and largely imaginary in character, when they came actually to cudgel their memories for well-marked cases and to consult their records, they discovered that their memories had been playing the same sort of tricks with them that the dramatists and novelists had with popular impressions. [Pg 422]

Within the past few months one of the leading neurologists of New York, a man whose practice is confined exclusively to mental and nervous diseases, stated in a public address that purely or even chiefly imaginary diseases were among the rarer conditions that the physician was called upon to treat. Shortly after, two of the leading neurologists of Philadelphia, one of them a man of international reputation, practically repeated this statement; and they put themselves on record to the effect that the vast majority of those who imagined themselves to be ill were ill, though often not to the degree or in precisely the manner that they imagined themselves to be.

Obviously, then, this possible realm of suffering in which the mind can operate is very much more limited than was at one time believed. In fact, imaginary diseases might be swept out of existence, and humanity would scarcely know the difference, so little would the total sum of its suffering be reduced. [Pg 423]

Another field in which there has been much general misunderstanding and looseness of both thought and statement, which has again led to exaggerated ideas of the direct influence of the mind over the body, is the well-known effect of emotional states, such as fright or anger, upon the ordinary processes of the body. Instances of this relation are, of course, household words,—the man whose "hair turned white in a single night" from grief or terror; the nursing mother who flew into a furious fit of passion and whose child was promptly seized with convulsions and died the next time it was put to the breast; the father who is prostrated by the death or disgrace of a favorite son, and dies within a few weeks of a broken heart. The first thing that is revealed by even a brief study of this subject is that these instances are exceedingly rare, and owe their familiarity in our minds to their striking and dramatic character and the excellent "material" which they make for the dramatist and the gossip. It is even difficult to secure clear and valid proof of the actual occurrence of that sudden blanching of the hair, which has in the minds of most of us been accepted from our earliest recollection.

More fundamental, however, and vital, is the extent to which we have overlooked the precise method in which these violent emotional impressions alter bodily activities, like the secretions. Granting, for the sake of argument, that states of mind, especially of great tension, have some direct and mysterious influence as such, and through means which defy physical recognition and study, it must be remembered that they have a perfectly definite physiological sphere of influence upon vital activities. Indeed, we are already in a position to explain at least two-thirds of these so-called "mental influences" upon purely physical and physiological grounds. [Pg 424]

First of all, we must remember that these emotions which we are pleased to term "states of mind" are also states of body. If any man were to stand up before you, for instance, either upon the stage or in private, and inform you that he was "scared within an inch of his life," without tremor in his voice, or paling of his countenance, or widening eyes, or twitching muscles, or preparations either to escape or to fight, you would simply laugh at him. You would readily conclude, either that he was making fun of you and felt no such emotion, or that he was repressing it by an act of miraculous self-control. The man who is frightened and doesn't do anything or look as if he were going to do anything, the man who is angry and makes no movement or even twitching suggesting that fact, is neither angry nor frightened.

An emotional state is, of course, a peculiarly complex affair. First, there is the reception of the sensation, sight, sound, touch, or smell, which terrifies. This terror is a secondary reaction, and in ninety-nine cases out of a hundred is conditioned upon our memory of previous similar objects and their dangerousness, or our recollection of what we have been told about their deadliness. Then instantly, irrepressibly, comes the lightning-flash of horror to our heart, to our muscles, to our lungs, to get ready to meet this emergency. Then, and not till then, do we really feel the emotion. In fact, our most pragmatic philosopher, William James, has gone so far as to declare that emotions are the after-echoes of muscular contractions. By the time an emotion has fairly got us in its grip so that we are really conscious of it, the blood-supply of half the organs in our body has been powerfully altered, and often completely reversed. [Pg 425]

To what extent muscular contractions condition emotions, as Professor James has suggested, may be easily tested by a quaint and simple little experiment upon a group of the smallest voluntary muscles in the body, those that move the eyeball. Choose some time when you are sitting quietly in your room, free from all disturbing thoughts and influences. Then stand up and, assuming an easy position, cast the eyes upward and hold them in that position for thirty seconds. Instantly and involuntarily you will be conscious of a tendency toward reverential, devotional, contemplative ideas and thoughts. Then turn the eyes sideways, glancing directly to the right or to the left, through half-closed lids. Within thirty seconds images of suspicion, of uneasiness, or of dislike, will rise unbidden in the mind. Turn the eyes to one side and slightly downward, and suggestions of jealousy or coquetry will be apt to spring unbidden. Direct your gaze downward toward the floor, and you are likely to go off into a fit of reverie or of abstraction.

In fact, as Darwin long ago remarked, quoting in part from Bain: "Most of our emotions [he [Pg 426]

should have said all] are so closely connected with their expression that they hardly exist if the body remains passive. As Louis XVI, facing a mob, exclaimed, 'Afraid? Feel my pulse!' so a man may intensely hate another, but until his bodily frame is affected he can hardly be said to be enraged."

And, a little later, from Maudsley:—

"The specific muscular action is not merely an exponent of passion, but truly an essential part of it. If we try, while the features are fixed in the expression of one passion, to call up in the mind a different one, we shall find it impossible to do so."

It will also be recollected what an important part in the production of hypnosis and the trance state, fixed and strained positions of these same ocular muscles have always been made to play. Many hypnotists can bring their subjects under their influence solely by having them gaze fixedly at some bright object like a mirror, or into a crystal sphere, for a few minutes or even seconds.

A graphic illustration of the importance of muscular action in emotional states is the art of the actor. Not only would it be impossible for an actor to make an audience believe in the genuineness of his supposed emotion if he stood glassy-eyed and wooden-limbed declaiming his lines in a monotone, without gestures or play of expression of any sort, but it would also be impossible for him to feel even the counterfeit sensation which he is supposed to represent. So definite and so well recognized is this connection, that many actors take some little time, as they [Pg 427] express it, to "warm up" to their part, and can be visibly seen working themselves up to the pitch of emotion desired for expression by twitching muscles, contractions of the countenance, and catchings of the breath. This last performance, by the way, is not by any means confined to the stage, but may be seen in operation in clashes and disagreements in real life. An individual who knows his case to be weak, or himself to be lacking in determination, can be seen working himself up to the necessary pitch of passion or of obstinacy. There is even a lovely old fairy-tale of our schoolboy days, which is still to be found in ancient works on natural history, to the effect that the King of Beasts himself was provided with a small, horny hook or spur at the end of his tail, with which he lashed himself into a fury before springing upon his enemy!

What, then, will be the physical effect of a shock or fright or furious outburst of anger upon the vital secretions? Obviously, that any processes which require a full or unusually large share of blood-supply for their carrying out will be instantly stopped by the diversion of this from their secreting cells, in the wall of the stomach, in the liver, or in the capillaries of the brain, to the great muscular masses of the body, or by some strange, atavistic reflex into the so-called "abdominal pool," the portal circulation. The familiar results are just what might have been expected. The brain is so suddenly emptied of blood that connected thought becomes impossible, and in extreme cases we stand as one paralyzed, until the terror that we would flee from crashes [Pg 428] down upon us, or we lose consciousness and swoon away. If the process of digestion happens to be going on, it is instantly stopped, leaving the food to ferment and putrefy and poison the body-tissues which it would otherwise have nourished. The cells of the liver may be so completely deprived of blood as to stop forming bile out of broken-down blood pigment, and the latter will gorge every vessel of the body and escape into the tissues, producing jaundice.

Every one knows how the hearing of bad news or the cropping up of disagreeable subjects in conversation at dinner-time will tend to promote indigestion instead of digestion. The mechanism is precisely similar. The disagreeable news, if it concern a financial or executive difficulty, will cause a rush of blood to the brain for the purpose of deciding what is to be done. But this diminishes the proper supply of blood to the stomach and to the digestive glands, just as really as the paralysis of violent fright or an explosion of furious anger. If the unpleasant subject is yet a little more irritating and personal, it will lead to a corresponding set of muscular actions, as evidenced in heightened color, loud tones, more or less violent gesticulation, with marked interruption of both mastication and the secretion of saliva and all other digestive juices. In short, fully two-thirds of the influences of emotional mental states upon the body are produced by their calling away from the normal vital processes the blood which is needed for their muscular and circulatory accompaniments. No matter how bad the news or how serious the danger, if they fail to worry us or to frighten us,—in other words, to set up this complicated train of muscular and [Pg 429] blood-supply changes,—then they have little or no effect upon our digestions or the metabolism of our liver and kidneys.

The classic "preying upon the damask cheek" of grief, and the carking effect of the Black Care that rides behind the horseman, have a perfectly similar physical mechanism. While the primary disturbance of the banking balances of the body is less, this is continued over weeks and months, and in addition introduces another factor hardly less potent, by interfering with all the healthful, normal, regular habits of the body,—appetite, meal-times, sleep, recreation. These wastings and pinings and fadings away are produced by mental influence, in the sense that they cannot be cured by medicines or relieved at once by the best of hygienic advice; but it is idle to deny that they have also a broad and substantial physical basis, in the extent to which states of emotional agony, despair, or worry interfere with appetite, sleep, and proper exercise and recreation in the open air. Just as soon as they cease to interfere with this normal regularity of bodily functions, the sufferer begins to recover his health.

We even meet with the curious paradox of individuals who, though suffering the keenest grief or anxiety over the loss or serious illness of those nearest or dearest to them, are positively mortified and ashamed because their countenances show so little of the pallid hues and the haggard lines supposed to be inseparably associated with grief. So long as the body-surplus is

abundant enough to stand the heavy overdrafts made on it by grief and mental distress, without robbing the stomach of its power to digest and the brain of its ability to sleep, the physical effects of grief, and even of remorse, will be slight. [Pg 430]

It must be remembered that loss of appetite is not in itself a cause of trouble, but a symptom of the stomach's inability to digest food; in this instance, because it finds that it can no longer draw upon the natural resources of the body in sufficient abundance to carry out its operations. The state is exactly like a tightness of the money market, when, on account of unnatural retention or hoarding in some parts of the financial field, the accumulation of sufficient amounts of floating capital at the banks for moving the crop or paying import duties cannot be carried out as usual. The vital system is, in fact, in a state of panic, so that the stomach cannot get the temporary credit or capital which it requires.

A similar condition of temporary panic, call it mental or bodily, as you will, occurs in disease and is not confined to the so-called imaginary diseases, or even to the diseases of the nervous system, but is apt to be present in a large number of acute affections, especially those attended by pain. Sudden invasion of the system by the germs of infectious diseases, with their explosions of toxin-shells all through the redoubts of the body, often induces a disturbance of the bodily balance akin to panic. This is usually accompanied and aggravated by an emotional dread and terror of corresponding intensity. The relief of the latter, by the confident assurance of an expert and trusted physician that the chances are ten to one that the disease will run its course in a few days and the patient completely recover,—especially if coupled with the administration of some drug which relieves pain or diminishes congestion in the affected organs,—will often do much toward restoring balance and putting the patient in a condition where the natural recuperative powers of the system can begin their work. The historic popularity of opium, and of late of the coal-tar products (phenacetine and acetanilide), in the beginning of an acute illness, is largely based on the power which they possess of dulling pain, relieving disturbances of the blood-balance, and soothing bodily and mental excitement. Fever-panic or pain-panic, like a banking panic, though it has a genuine and substantial basis, can be dealt with and relieved much more readily after checking excessive degrees of distrust and excitement. An opiate will relieve this physical pain-panic, just as a strong mental impression will relieve the fright-paralysis and emotional panic which often accompany it, and thus give a clearer field and a breathing space for the more slowly acting recuperative powers of nature to assert their influence and get control of the situation. [Pg 431]

But neither of them will cure. The utmost that they can do is to give a breathing spell, a lull in the storm, which the rallying powers of the body, if present, can take advantage of. If the latter, however, be not adequate to the situation, the disease will progress to serious or even fatal termination, just as certainly as if no such influence had been exerted, and often at an accelerated rate. In fact, our dependence upon opiates and mental influence have been both a characteristic and a cause of the Dark Ages of medicine. The more we depended upon these, the more content we were to remain in ignorance of the real causes of disease, whether bodily or mental. [Pg 432]

The second physical effect produced by mental influence is probably the most important of all, and that is *the extent to which it induces the patient to follow good advice*. We as physicians would be the last to underestimate the importance of the confidence of our patients. But we know perfectly well that our retention of that confidence will depend almost entirely upon the extent to which we can justify it; that its principal value to us lies in the extent to which it will insure prompt obedience to our orders, and intelligent and loyal coöperation with us in our fight against disease. The man who would depend upon the confidence of his patients as a means of healing, would soon find himself without practice. We know by the bitterest of experience that no matter how absolute and boundless the confidence of our patients may be in our ability to heal them, no matter how much they may express themselves as cheered and encouraged by our presence, ninety-nine per cent of the chance of their recovery depends upon the gravity of the disease, the vigor of their powers of resistance, and our skill and intelligence in combating the one and assisting the other.

Valuable and helpful as courage and confidence in the sick-room are, they are but a broken reed which will pierce the hand of him who leans upon it too heavily, be he patient or physician. We can all recall, as among our saddest and most heart-breaking experiences, the cases of fatal disease, which were well-nigh hopeless from the start, and yet in which the sufferers expressed, and maintained to the last moments of conscious speech, a bright and pathetically absolute confidence in our powers of healing, based upon our success in some previous case, or upon their own irrepressible hopefulness. [Pg 433]

Even the deadliest and most serious of infectious diseases, consumption, has—as is well known—as one of its prominent symptoms an irrepressible hopefulness and confidence that they will get well, on the part of a considerable percentage of its victims. This has even been formally designated in the classical medical treatises as the "*Spes Phthisica*," or "Consumptive Hope." But these hopeful consumptives die just as surely as the depressed ones; in fact, if anything, in a little larger proportion. It well illustrates the other side of the shield of hope and confidence, the danger of unwavering expectancy, in that it is chiefly those who are early alarmed and turn vigorously to fight the disease under intelligent medical direction, who make the recoveries. Too serene a courage, too profound a confidence in occult forces, is only a form of fatalism and a very dangerous one.

Broadly speaking, mental states in the sick-room are a pretty fair index—I don't mind saying,

product—of bodily states. Hopefulness and confidence are usually favorable signs, for the reason that they are most likely to be displayed by individuals who, although they may be seriously ill, are of good physique, have high resisting power, and will make a successful fight against the [Pg 434] disease. So, roughly speaking, courage and hopefulness are good omens, on purely physical grounds.

But these are only rough indications of probabilities, not reliable signs; and as a rule we are but little affected by either the hopes or the fears of our patients in making up our estimate of their chances. The only mental symptom that weighs heavily with us is indifference. This puts us on the lookout at once. So long as our patients have a sufficiently vivid and lively fear of impending death, we feel pretty sure that they are not seriously ill; but when they assure us dreamily that they "feel first-rate," forget to ask us how they are getting along, or become drowsily indifferent to the outlook for the future, then we redouble our vigilance, for we fear that we recognize the gradual approach of the Great Restbringer, the merciful drowsiness which in nine cases out of ten precedes and heralds the coming of the Long Sleep.

Lastly, the cases in which the sufferings of the patient are due chiefly to a morbid action of his or her imagination, are a small percentage of the total of the ills which come before us for relief. But, even of this small percentage, *only a very few are in perfect or even reasonably good physical health*. A large majority of even these neurasthenics, psychasthenics, imaginary invalids, and bodily or mental neurotics, have some physical disturbance, organic or functional, which is the chief cause of their troubles. And the important point is that our success in relieving these sufferers will depend upon our skill in ferreting out this physical basis, and the extent to which [Pg 435] we can succeed in correcting or relieving it. We no longer ridicule or laugh at these unfortunates. On the contrary we pity them from the bottom of our hearts, because we know that their sufferings, however polarly remote they may be from endangering their lives in any way, and however imaginary in a purely material sense, are *to them* real. Their happiness is destroyed and their efficiency is crippled just as genuinely and effectively as if they had a broken limb or a diseased heart.

We are now more and more firmly convinced that these patients, however ludicrously absurd their forebodings, are *really sick*, either bodily or mentally, and probably both. A perfectly healthy individual seldom imagines himself or herself to be ill. And as the list of so-called functional diseases—that is to say, those diseases in which no definite, objective mark of degeneration or decay in any tissue or organ can be discovered—are steadily and swiftly diminishing under the scrutiny of the microscope and the methods of the laboratory, so these purely imaginary diseases, these "depressed mental states," these "essential morbid tendencies," are also rapidly diminishing in number, as cases are more conscientiously and personally studied and worked out.

Even hysteria is no longer looked upon as sheer perversity on the part of the patient, but is patiently traced back, stage by stage, until if possible the primary "strangulated emotion" which caused it is discovered; and where this can be found the whole morbid tendency can often be [Pg 436] relieved and reversed almost as if by magic.

To sum up: My contention is, that the direct influence of emotional states upon bodily organs and functions has been greatly exaggerated; that it is exceedingly doubtful whether, for instance, any individual in a reasonable condition of health was ever killed by an imaginary or even an emotional shock; that there is surprisingly little valid evidence that the hair of any human being turned white in a single night, or was completely shed within a few hours, under the influence of fright, terror, or grief; that the effects upon bodily functions and secretions, digestion, etc., produced by emotion, are due to secondary effects of the latter, diverting the energy of the body into other channels and disturbing the general balance of its forces and blood-supply; that the actual percentage of cases in which the imagination plays the chief, or even a dominant part, is small, probably not to exceed five or ten per cent; that a very considerable share of the influence of mental impressions in the cure of disease is due to the relief of mental panic, permitting the rallying of the recuperative powers of the body, and to the extent to which they produce the reform of bad physical habits or surroundings or conditions.

The most important element in the cure of disease by mental impression is *time* plus the *vis medicatrix naturæ*. The mental impression—suggestion, scolding, securing of confidence—diverts the attention of the patient until his own recuperative power and the intelligent correction of bad physical habits remedy his defect. Pure mental impression, however vivid, which is not followed [Pg 437] up by improvement of the environment, or correction of bad physical habits, will be almost absolutely sterile. Faith without works is as dead in medicine as in religion. Mental influence is little more than an introduction committee to real treatment. Even the means used for producing mental impressions are physical,—impressions made upon some one of the five senses of the individual. In short, as Barker aptly puts it, "Every psychotherapy is also a physical therapy."

Furthermore, even mental worry, distress, or depression, in nine cases out of ten has a physical cause. To remedy conditions of mental stress by correcting the underpay, overwork, bad ventilation, or underfeeding on account of illness or death of the wage-earner of the family, is, of course, nothing but the most admirable common sense; but to call it the *mental* treatment of disease is a mere juggling with words. "Take care of the body and the mind will take care of itself," is a maxim which will prove valid in actual practice nine times out of ten. [Pg 438]

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FOOTNOTES

[1] The proportion of registered insane in civilized countries to-day ranges from two to three per 1000 of the population.

[2] What one cannot recognize he must call rheumatism.

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