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APPLETONS' POPULAR SCIENCE MONTHLY.

SEPTEMBER, 1899.

ARE WE IN DANGER FROM THE PLAGUE?

By VICTOR C. VAUGHAN,

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In an article on the plague in this journal, in May, 1897, the writer answered this question as follows: "Yes, there is danger; but this, being foreseen, may be easily avoided. Thorough inspection of persons and disinfection of things from infected districts will keep the disease out of Europe and America. Only by the most gross carelessness could the plague be permitted to enter either of these continents."

It will be of interest to take up this subject again, and study it in the light of the history of the plague since the article referred to was written. The plague first appeared in western India, at Bombay, where it still prevails. We are without any exact information concerning its introduction into that city. Before the outbreak of the disease at Bombay the mortality had increased so markedly that it was a subject of discussion for three meetings of the Grant Medical Society. The increase was attributed to the filthy condition of the streets. This society made an investigation of the increased mortality, and presented a report on the same to the municipal authorities. Instead of heeding the warning, the authorities jeered at the society, and refused to allow the report to be read.

Dr. Viegas appears to have been the first physician to recognize the existence of the plague in the city. In a paper read before the Grant Medical Society on November 24, 1896, he discussed the possible and probable avenues by which the disease had found its way into the town. He stated that sugar and dates had been mentioned as means by which the plague was imported, but, if this [Pg 578] had been the case, he thought it strange that the infection had not been conveyed from Bagdad and Bassorah, inasmuch as these articles come almost exclusively from those places. Again, it was thought possible that the clothes of the sick or of the dead from the plague in China might have been brought over to Bombay, but Dr. Viegas was unable to find any evidence in support of this theory. It had also been claimed that rats sick with the plague had come by ship from Hong Kong, and had infected the rats about the docks in Bombay. This theory, Dr. Viegas held, was not supported by any facts. In short, Dr. Viegas found some objection to every theory that had been proposed, and leaves us in doubt as to his own views concerning the avenue by which the plague

reached Bombay. He is quite confident, however, that the filthiness of the city is to blame for the rapidity with which the disease spread.

In a report by Lieutenant-Colonel Weir on the plague in Bombay a statement is made that the disease was imported from Suez. Early in September, 1896, four very suspicious deaths were reported, but, as none of these had been attended by medical men, no definite conclusion could be reached concerning them. The first case was reported by Dr. Viegas late in September, 1896. The patient was a native who had not been out of the city for months. The first case reported among Europeans occurred on November 12, 1896. During the winter of 1896 and 1897 the disease prevailed most alarmingly, and reached its highest mortality during the week ending February 9, 1897, when the deaths from all causes in Bombay numbered 1,891. During the summer of 1897 the disease declined, and led to the belief that the measures that had been put in operation would prove successful. This hope, however, was not realized, and during the winter of 1897 and 1898 there was a recrudescence of the disease. During the summer of 1898 the disease again abated, to appear with renewed strength during the winter of 1898 and 1899. During the last week in March, 1899, the total number of deaths from all causes in Bombay reached 2,408, and the deaths from plague alone numbered more than 250 a day. It will be seen from these figures that the plague still rages with undiminished virulence in the capital of western British India. The abatement of the disease during the summer months and its increased severity during the colder season are not directly due to the effects of temperature. In the warm season many of the natives sleep out of doors, while during the colder weather they crowd into small, unventilated, filthy rooms. It is the opinion of practically all observers at Bombay that the recrudescence of the disease during the winter is due to this overcrowding.

Since the plague has prevailed at Bombay for nearly three years, it may be well to inquire [Pg 579] concerning its probable continuance at that place. In making this inquiry we may learn something of the sanitary condition of the city and the habits of its inhabitants. Bombay is the metropolis of western India, and is situated on a long, narrow island running almost north and south. The city is located near the southern end of this island, with its harbor to the east and its sewage outfall to the west. Its population of about nine hundred thousand is a very mixed one, consisting of Hindoos of different castes, of Mohammedans, of Eurasians, and of Europeans. Differences in race, in religion, and in caste make it exceedingly difficult to carry out sanitary measures and to look after the sick. The mean temperature is about 79° F., and the relative humidity seventy-seven per cent. A considerable portion of the island is below high-water level, and consequently the sewage must be removed by means of pumps. The mean maximum temperature of the ground eleven feet below the surface is 84.9° F., and the mean minimum temperature is 80.9° F. It will be seen from these figures that organic matter must undergo rapid decomposition both on the surface and in the sewers. The water supply, which is said to be excellent, is so carelessly drawn upon by the natives that, although sufficiently abundant if used properly, it sometimes becomes scant. It not infrequently happens that the sewers will not carry the volume of water turned into them. For this reason, together with the tropical rains, the soil often becomes water-logged. Indeed, the surface in some sections of the city may be, not inappropriately, compared with a fermenting muck-heap. Besides the fixed population, there is a constant current of people flowing to and fro between the island and the mainland. When there is any opportunity for the employment of a large number of unskilled laborers, hundreds and thousands from the surrounding country pour into the city. These people know nothing of sanitary appliances, they lodge in the most densely crowded parts of the city, and often a dozen of them will hire a single room, not more than ten feet square, in which they eat and sleep. It is said that seventy per cent of the inhabitants of Bombay live in "chawls." These are tenement buildings of from five to seven stories high, built on the "flat" system. A narrow hall, at the end of which is a latrine, runs through each story, and from this doors open into rooms eight by twelve feet in area. In one of these houses from five hundred to eight hundred people live. These buildings are crowded together, with only narrow, dark alleys between. Into these alleys the inhabitants of the houses on both sides throw all kinds of refuse. In many parts of the city fecal matter is deposited in boxes or baskets, and these, when filled, are carried on the heads of [Pg 580] scavengers to certain designated places and the contents dumped into the sewers. It may be of interest to note, in passing, that these scavengers seem to be largely immune to the plague and all other infectious diseases.

This is a brief description of the sanitary condition of the city into which the bubonic plague found its way nearly three years ago. How long is it likely to remain? Before attempting to answer this question we might ask what means have been employed to eradicate the disease. On October 6, 1896, the municipal health commissioner issued an order to the effect that all cases of the plague were to be segregated, their houses disinfected, by force if necessary, and their sick to be taken to the hospital. Health inspectors visited all parts of the city, and carefully went through the great tenement houses looking for those sick with the plague. When such were found they were immediately sent to a hospital. Later, four camps were prepared, with facilities for accommodating about twenty thousand people. An attempt was made to transfer all the residents from a certain section of the city to these camps, and detain them there while their residences were being disinfected. After this had been done these people were allowed to return to their homes, and another twenty thousand were taken to the camps. This attempt, however, was never fully carried out. A high-caste Hindoo prefers death at any time to association with one of inferior caste. Every attempt at segregation of the sick led to more or less disturbance; and finally, in March, 1898, serious riots resulted. These were begun by Mohammedans, who followed a medical officer to the hospital and burned the building and hospital supplies. A plague inspector and three English soldiers were stoned to death. Since the riots attempts at segregation of the

sick have been practically abandoned. Numerous hospitals have been provided, in order that those differing in religion or in caste might be cared for at different places. Under certain restrictions those sick with the plague are allowed to remain in their homes. It will be seen from these statements that it is not probable that the plague will be driven by human agency out of Bombay. The Hindoos believe that when the plague finds its way into a city it will remain for six years. The probabilities are that this belief will be strengthened by the history of the present epidemic in Bombay. Nothing short of an extensive conflagration, destroying a large part of the city, can thoroughly disinfect this place, in which the plague has already dwelt for nearly three years. I think, therefore, that we must conclude that it is quite certain that for several years yet Bombay will remain an infected city.

When the plague was first announced at Bombay a large number of its inhabitants, estimated at about three hundred thousand, left the city. There can be but little doubt that with these the germs of the plague were carried into the surrounding country. From Bombay the disease has spread out in every direction, until it has found its way into nearly every part of India. To-day the three large commercial cities of British India—Bombay, Calcutta, and Madras—are all infected. The manner of the introduction of the disease into Calcutta is somewhat uncertain, several different accounts being given as authentic. Dr. Cantlie says on this point: "The first case dealt with and reported upon in Calcutta gives an interesting history. The patient, a lad seventeen years old, came from Bombay, where evidently he had been exposed to infection, as his sister, who accompanied him, had seen several cases of plague in Bombay. Fifteen days before leaving Bombay he had noticed swelling first in one groin and then in the other, but never felt ill until his arrival in Calcutta, on September 24th. He was seen and carefully examined in Calcutta by honest observers, and a diplobacterium identical with the Kitasato bacillus was found in his blood. Not only so, but the clinical symptoms of plague were most manifest." [Pg 581]

Another authority would have it that the plague was brought to Calcutta from Hong Kong by a British regiment which had been engaged in cleansing infected houses at Hong Kong. On this point Dr. Simpson makes the following statement: "In January, 1895, the regiment went to Calcutta, and this disease was first diagnosed as syphilis, then as malarial fever with bubo, and finally the cause was declared to be unknown. In June, 1896, one of the medical officers of the regiment was attacked with fever, and the glands of the neck, axilla, and groin were all enlarged. A goodly number of similar cases were met with in the town; moreover, the rats became sick, and the grain stores swarmed with diseased and dead rats. In spite of opposite evidence, it was well-nigh certain that plague in a sporadic form had been in Calcutta since 1895 or 1896."

The bacillus of the plague has undoubtedly found Calcutta quite as well prepared for its reception as Bombay. In discussing a medical report on the sanitary condition of Calcutta, the Pioneer Mail makes the following statement: "London, with its population of over 4,000,000, has about 36,000 people to the square mile. In the thirteen wards of Calcutta there are only four below this figure; the remainder have from 46,000 to 144,000 per square mile, three wards containing actually over 100,000. Colootolah is most densely populated; the houses are literally crammed with people. One case is quoted where 250 persons were living in a space that should accommodate only 50. [Pg 582] In a hut seven feet in length, breadth, and height five men were found, and several instances are given where similar conditions obtained. In our barracks 600 cubic feet per man is the minimum space allowed. In these *bastis* the space runs from 157 to 49 cubic feet. This would be bad enough if everything were clean and sweet in and about the huts, but, as the medical board puts the case, 'here we find an allowance per head going as low as practically one thirtieth of that given in barracks, and no ventilation, with filth *ad libitum* both in the room and in its surroundings, to say nothing of the filthy persons of its occupants, the sewage in the adjacent drains, and the accumulated filth in the neighboring latrines; and to this may be added the fact that the subsoil on which the huts are built is soaked through and through with sewage matters and littered with garbage and filth of all kinds.' The narrow gullies which give access to these huts are in keeping with the general character of the *bastis*, and we may well wonder that epidemic disease is not always present."

The probabilities are that the plague will continue in Bombay, Calcutta, and Madras until it dies out from want of susceptible material. It is not at all likely, with the conditions in these cities, such as have already been described, that sanitary measures sufficiently energetic to destroy the bacillus will be resorted to. For some years to come these cities are likely to harbor the infection, and will remain, as they are now, nurseries for the disease.

The plague has not confined itself to the large cities of India, but has spread all over that country. It has extended into the northwestern provinces, has crossed the frontier, and passed into Baluchistan and Afghanistan. In many of the interior cities it has proved quite as fatal, in proportion to the population, as at Bombay and Calcutta. At Poonah the mortality has during some weeks been as high as eighty per cent of the cases, and four hundred deaths a week have been reported. At Sholapore, in the Punjab, far to the northwest of Bombay, the disease has prevailed in epidemic form.

With the plague widely diffused over the Indian empire, what measures have been taken to prevent its spread to other parts of the world? There are two routes by means of which the disease may pass from India to Europe. One of these is by ship through the Red Sea, the Suez Canal, and the Mediterranean; the other is overland from the northwestern provinces of India through Afghanistan into southeastern Europe. In fact, there are three overland routes from northwestern India into Europe. One of these leads from Lahore, the capital of the Punjab, through Afghanistan into the Transcaspian Province of Russia. The Transcaspian Railway extends [Pg 583]

from Samarkand, a place of about thirty-five thousand inhabitants, through the desert to the Caspian Sea at Ouzoun Ada. The latter place is connected by steamer with Baku and the Russian railroad system. The second overland route starts from the northwestern provinces, or Afghanistan, or Baluchistan, passes through Persia, extending on up between the Caspian and Black Seas, and crosses the Caucasus Mountains in the neighborhood of Tiflis. Both of these routes are quite extensively traveled and pass through cities of considerable commercial importance. Samarkand has extensive manufactures of cotton and silk, and carries on considerable trade by means of the Transcaspian Railway with European Russia. The second route passes through Teheran, the capital of Persia, with a population of about two hundred and twenty-five thousand. This route is also largely employed by commercial travelers, especially from Russia. The third overland route passes through Persia and Turkey in Asia up to Constantinople. This route can not be called a commercial highway, but it is used to a considerable extent, especially by pilgrims, and since at no point do travelers along this route come in contact with European guards against the plague, it is most likely that the pest will find its way into Constantinople by this avenue, if at all. The first two overland routes are guarded by Russian medical inspectors. Russia has not been slow to protect itself against the introduction of this epidemic. In December, 1896, the following lines of action were determined upon, and have apparently since that time been carried out quite thoroughly: First, Russian medical men were sent to the larger cities of Persia, such as Teheran and Meshed, for the purpose of watching the approach of the plague. All Russian consular officers in Persia were requested to inform these medical men of every rumor of the epidemic. Second, points of embarkation on the Persian shore of the Caspian Sea have been watched, in order to detect suspicious cases that might pass to Russia along this route. Third, observation stations have been established along the frontiers of the Transcaspian Province. Inspection officers stationed at these places have been notified to close the frontier, with the exception of certain points where inspection stations have been established. Fourth, inspectors have also been placed to guard the region of Tiflis against the introduction of the plague from both Persia and Turkey. For the reasons above mentioned, it seems to me probable that if the plague reaches Europe, it will likely do so by way of Turkey in Asia, across the Bosporus into Constantinople. The large number of pilgrims passing along this route, with the Turk's well-known fatalistic belief, render it quite probable that infection gathered anywhere along the route may be carried into Europe. Since several places in Hedjaz, along the [Pg 584] eastern shore of the Red Sea, have already become infected with the plague, it is by no means improbable that the disease may find its way into the Balkan Peninsula. There are also several centers of infection along the shores of the Persian Gulf. It will be seen from these statements that Mohammedan pilgrims are exposed to the infection. Indeed, already the disease has been detected among these pilgrims on steamships in the Red Sea.

Certain international measures for the restriction of the plague were formulated at the Sanitary Convention of Venice in 1897. Nearly all civilized nations sent representatives to this conference, and certain general rules were adopted. Recognizing the fact that Mohammedan pilgrims from infected districts in India, coming to Mecca and other places along the eastern shore of the Red Sea, would mingle with those of like faith from Turkey and northern Africa, special rules concerning pilgrims were adopted at this conference. It should be understood, however, that these rules are likely to prove efficient safeguards only among those pilgrims who travel by sea. In the first place, the conference made certain regulations concerning the construction and sanitary arrangements of pilgrim ships. The upper deck must be kept clear for these people, and on the main covered deck every pilgrim has to have at least sixteen square feet of surface. Every one embarking on a pilgrim vessel must pass a medical inspection. No sick person or one suspected of having an infectious disease is allowed to go on board. The number which the vessel is allowed to carry is determined beforehand, and the names of all passengers and their home residences are recorded. The ship must supply wholesome water and make provision for food, proper in quality and sufficient in quantity. Every vessel carrying pilgrims must have on board a medical officer and a disinfecting stove. Details are given concerning the sanitary regulations during the voyage. All pilgrims are landed on the island of Camaran, in the Red Sea, before being allowed to disembark on the last stage of their journey. The period of detention from healthy ships at this place extends through only three days. If no disease appears during this time, the pilgrims are allowed to embark again, and go directly to Jeddah. If disease appears either before or after landing at Camaran, the pilgrims are detained at least ten days from the date of the last case. Arriving at Jeddah, they are no longer under international sanitary regulations, and any control exercised over them at that time must be administered by Turkish authorities. Just here, in my opinion, lies the greatest danger so far as pilgrims are concerned. It is true that the conference made certain recommendations and formulated certain rules concerning the return of [Pg 585] those pilgrims going to the north or into Egypt, but the fact must not be overlooked that these restrictions are applicable only to those who go by sea. No restrictions are placed upon Mohammedan pilgrims returning from Mecca to India. India is already so generally infected that such restrictions have been deemed unnecessary.

The following is a general statement of the rules applicable to vessels coming to European ports from India through the Suez Canal: All vessels that have been ten days or longer at sea after departure from an infected port are allowed to pass through the canal without question and without precaution. Suspected vessels or those which have been at sea less than ten days since departure from an infected port, and which are provided with a medical officer and a properly equipped disinfecting plant, are allowed to pass through the canal in quarantine. This means that while passing through the canal there shall be no communication between those on board the vessel and those on the land. Other suspected vessels are compelled to proceed to the Wells of

Moses for disinfection. Here the passengers and crew are disembarked, isolated for twenty-four hours, and their effects disinfected. At the same time the contents of the ship undergo disinfection. If the plague be found on board, all passengers, as well as the crew, are detained for a period not exceeding ten days. All clothing, the cargo, and the ship itself are disinfected. When a vessel passes through the Suez Canal in quarantine, notice of that fact is telegraphed to the country to which the vessel is going, and it is not allowed to land elsewhere.

Should the plague appear in any European country, the following rules were formulated to prevent its spread: (1) Whenever a case of the plague appears in any country the sanitary authorities of that country must give immediate notice to all other countries represented in the conference. This notice may pass through diplomatic or consular agencies, or it may be sent directly by telegraph. After this the sanitary authorities of the country in which the plague has appeared shall inform other countries at least once a week concerning the progress of the disease and the measures resorted to to prevent its spread.

(2) When an infected person enters a country by rail or other conveyance overland, disinfection of his person and personal effects is made obligatory. Land quarantine is condemned, and it is recommended that modern disinfection be practiced in its stead. Each country, however, may reserve the right to close its frontier against any other country in which the disease exists. It is recommended that medical inspection along the frontier be established in connection with [Pg 586] custom-house examinations, in order to prevent unnecessary delay in travel. Passenger trains and postal cars are not to be detained at any frontier, but if a car be found to contain a real or a suspected case of the plague, this car shall be detached from the train at the frontier or at the nearest station thereto and its contents disinfected.

(3) Travelers coming from infected countries may be, at the discretion of the sanitary authorities, detained under observation for a period not exceeding eight days. Individual governments are allowed to take any special measures that may be deemed wise against the importation of the disease by means of gypsies, vagrants, and immigrants.

In formulating the above-mentioned rules to prevent the importation of the plague into Europe the members of the Venice Congress seem to have been thoroughly convinced that the longest period of incubation possible in this disease is ten days. It seems to have been assumed that if a vessel had been for ten days or longer at sea after departure from an infected port, and no cases of the plague had developed up to that time, there could be no danger of this vessel carrying the infection. It appears to me that a safer course would have been to require inspection of all persons and things going on board a vessel leaving an infected port, and the thorough disinfection of certain things, at least, on such vessels arriving at uninfected ports. The disinfection of a ship and its cargo by means of steam is not at present a very costly procedure.

Since the plague, if it reaches America at all, must come to us by sea, it may be of special interest to inquire concerning outbreaks of this disease on board ship. In making this inquiry we will confine ourselves to such cases as have occurred within the past two years. In March, 1897 (I have been unable to ascertain the exact date), the transport Dilwara left Bombay, bound for Southampton, with a regiment of English soldiers, together with their wives and children. On March 18th, while the vessel was in the Red Sea, a child died of the plague and was buried at sea. On arriving at Suez the persons who had been in immediate contact with the child were transferred to the Wells of Moses and properly disinfected. After this had been done, the vessel was allowed to pass through the Suez Canal in quarantine. No fresh case occurred, and the vessel arrived at Southampton April 6th. Here all articles which might possibly contain infection were disinfected, the passengers were allowed to go to their homes, and the troops were placed in barracks. No other cases resulted.

On July 6, 1897, one of the crew of the Carthage, of the Peninsular and Oriental Company's line, was attacked with the plague. The ship was then in the Arabian Sea. Two days later the sick man, [Pg 587] with two other members of the crew detailed to attend him, was landed at Aden. Six days later a second member of the crew was attacked with slight symptoms of the plague. This fact was reported when the vessel passed Malta. The Carthage had intended to stop at Marseilles, but, on account of the plague on board, continued its course to England. Both of these patients were isolated by being placed in a large boat hung at a height at the side of the vessel so as to avoid communication with others on the ship. When the vessel arrived at Plymouth the passengers were allowed to depart to their respective homes. The only precaution that was taken consisted in ascertaining the destination of each person, and informing the health authorities of the places to which these people were going. The Carthage had on board a steam disinfector, and everything that had been exposed to the infection was thoroughly disinfected. On arrival at the port of London the second patient was isolated until he recovered. No cases developed in England.

On December 7, 1897, the Caledonia arrived at Plymouth, England, from Bombay, without touching at any Mediterranean port. While in the Red Sea two lascars developed symptoms of the plague. They were landed at Suez, and no further outbreak occurred. When the ship reached Plymouth one hundred and sixty passengers were landed, and their names and addresses forwarded to the local authorities of their respective destinations. After proper disinfection, the ship proceeded to London.

In December, 1898, a case of plague developed on the Golconda while at Marseilles, on her way from Bombay to London. The ship proceeded immediately, the patient was landed at Plymouth, proper disinfection was carried out, and no other cases developed. This is a proof that the

assumption that a vessel is safe from infection after ten days have passed since leaving an infected port is fallacious, as this time was exceeded between Bombay and Marseilles.

The report that the Nippu Maru recently arrived at San Francisco with the plague on board has proved to be erroneous.

In September, 1896, a Portuguese-Indian steward died at the Seamen's Hospital, at Greenwich, England, very suddenly. This man was in the hospital for only forty-eight hours, and no one suspected the plague at that time. On the last day of October of the same year another patient in the same hospital was taken ill and died with symptoms of the plague. Bacteriological examinations of the glands of the body of the second man were made, and a bacillus which presented the well-known characters of the plague bacillus was found. The vessel on which the Portuguese steward came to England left Bombay about the end of August, 1896. There was at [Pg 588] that time no official knowledge of the existence of the plague in Bombay, but it probably existed there. This is another evidence of the fallacy of the belief in the ten days' period of incubation. It seems quite evident to me that the English authorities lay too much stress upon the period of incubation. A man leaving Bombay or any other infected port may carry the bacillus under his finger nails, elsewhere on his person, or in his clothing, and may not become infected until many days after leaving the infected place. Careful inspection and thorough disinfection of all vessels coming from infected ports should be insisted upon. It has been abundantly demonstrated by the history of the plague, as well as that of other infectious diseases, that the old plan of detention in quarantine is a relic of bygone times. Detention is cruel, dangerous, and inefficient; inspection and disinfection are rational and efficacious.

The modes of infection with the bacillus of the plague are as follows: (1) By inoculation. The history of the present epidemic in Asia recounts several instances of inoculation with the plague bacillus. On June 22 or 23, 1896, while making a post-mortem examination, Professor Ayoama, of Tokio, one of the Japanese commissioners sent to Hong Kong to study the plague, scratched the third finger on his left hand; on June 27th he again scratched himself on the end of the right thumb; on the evening of June 28th he felt ill, and had a temperature of 101.6° F.; he slept well during that night, but during the afternoon of June 29th he had a temperature of 105° F. At that time a bubo was found in the left axilla, and there was well-marked lymphangitis of the right arm. Professor Ayoama has described his own case as follows: "On June 28th, after having finished a dissection, I took my meal about half past two and did not enjoy it. After the meal I went upstairs, when at certain movements of the arm I felt a slight pain in the left armpit, and on feeling with my finger I found some slightly enlarged glands present. In the evening I felt very ill, depressed, and languid, burning hot along the whole of the back, while the thermometer showed normal temperature. As Mr. Kitasato and I had invited guests that evening, I was present at supper. I had no appetite, and felt so languid that I often wished to withdraw. At half past eleven I hurried to my room, when I found my temperature was 39° C. I took one gramme of quinine, and slept well. Next morning I awoke and noticed, on the under side of the left ring finger, a small, whitish-yellow blister, and then, along the back of the hand, a red line. From this time I remembered nothing for more than two weeks."

Dr. Ishigami, another of the Japanese commission in Hong Kong, also inoculated himself with the [Pg 589] plague while making a post-mortem examination.

A patient, while delirious with the pneumonic form of the plague, expectorated into the face of an English nurse caring for him. Within a few hours the eye on that side of the face became inflamed; later the parotid and cervical glands became involved, and the nurse died. Other illustrations of inoculation with the bacillus of the plague might be given. Dr. Wyssokowitch and Dr. Jobobat believe that the bacillus can penetrate the unbroken skin. In support of this belief they report some experiments made by them upon macaque monkeys. They found that when a needle was dipped in the culture of the plague bacillus and drawn across the palm of the hand of one of these monkeys, without making any visible scratch, the animal speedily developed the disease. However, this does not prove that the bacillus will penetrate the unbroken skin of man.

(2) By inhalation. That the pneumonic form of the plague results from inhalation of the bacillus can not be doubted. Monkeys caused to inhale the bacillus develop this form of the disease.

(3) By deglutition. That the disease may be acquired by taking the bacillus into the alimentary canal has been demonstrated by experiments upon animals of various kinds.

The sputum of patients suffering from the pneumonic form of the disease is filled with the bacilli. The germs are also found, sometimes at least, in the discharges from the bowels and kidneys. That the infection may be transported in clothing and rags has been long known. The following extract from a memoir by Sir John Hay, then minister from England to Morocco, indicates that the plague was introduced into Morocco in 1826 by means of infected articles of clothing: "The danger from plague by contagion can not, however, to my mind be called in question. That dire disease was introduced into Morocco about the year 1826 by an English frigate, which our Government had dispatched to Alexandria, where the plague was then raging, to convey from that port to Tangier two sons of the Sultan, returning from a pilgrimage to Mecca. No case of plague or other illness had occurred on board the frigate during the voyage, and the Sultan's sons and other passengers were allowed to land at Tangier.

"The customs officers, being suspicious that, in the numerous boxes brought by the pilgrims who had been permitted to embark with the Moorish princes, contraband goods were being smuggled, caused some of the cases to be opened. One contained Egyptian wearing apparel, which the

owner said he had bought second hand, and subsequently confessed had belonged to a person who had died of the plague in Alexandria. The two Moorish officials who opened the boxes were attacked with the plague that night and died in a few hours. The disease spread rapidly throughout Morocco, carrying off eighty per cent of those who were attacked." [Pg 590]

I mention these facts in order to emphasize the desirability of disinfecting all articles liable to carry the infection coming from infected places.

Professor Haffkine's preventive inoculation against the plague is still being largely employed in India. This consists in injecting hypodermically sterilized cultures of the bacillus. No curative action is claimed for this treatment, but it is believed to be protective against the disease. It is stated that more than eighty thousand people in India have undergone this form of vaccination, and that the death rate among these has been exceedingly low. However, it is well to be careful in accepting statistical statements on a matter of this nature. In the first place, it is probable that only the more intelligent will submit to vaccination, and these will also employ other means of protecting themselves against the disease. In the second place, there are many thousands of people exposed to the infection, or at least live in infected districts, who have never been vaccinated and who do not acquire the disease.

Three kinds of serum have been used as curative agents in the plague. In 1896 M. Yersin began the use of a specially prepared serum in China. The first cases treated with this preparation did unusually well, and it was hoped that most valuable results would follow from its more extended use. This serum is prepared after the manner of the antitoxine used in the treatment of diphtheria. That used most largely in India is made at the Imperial Institute of Experimental Medicine in St. Petersburg. Numerous physicians in India have reported upon the action of this serum, and none of them favorably. Very recently Dr. Clemow treated fifty cases with this serum, and compared them with fifty other cases treated without the serum. Every other case was selected for the serum treatment. The mortality was exactly the same in each group, forty patients out of fifty dying.

The second serum is that prepared by M. Roux, of the Pasteur Institute in Paris. This is practically the same as the preparation made by M. Yersin, and the results obtained are equally unsatisfactory. In 1897 the writer had the privilege of observing, both at Paris and at St. Petersburg, the preparation of these agents, from which at that time great results were expected. A third preparation is made by Professor Lustig, of Florence. I have been unable, so far, to find any detailed account of the method followed by Professor Lustig in preparing his serum. From all that I can learn, however, it is not a serum, but a sterilized bacterial culture; at any rate, Lustig's preparation has proved probably least valuable of all. [Pg 591]

At present (July, 1899) the plague prevails throughout India, and has appeared at various places in Baluchistan and Afghanistan, at Samarkand in the Transcaspian Province of Russia; in Persia, at Bassorah and other points along the Persian Gulf; at several places along the western shore of the Red Sea; at Suez and Alexandria; at Tamatave, in Madagascar; at Port Lewis, Mauritius; at Penang, in the Straits Settlements; at Amoy and Hong Kong, China; and at numerous places in Formosa. For reasons already given, it will not be at all surprising should the recent report that the plague had appeared in Constantinople prove to be true. If it once reaches that place, it is more than likely that it will become scattered throughout the Balkan Peninsula. The sad death of Professor Müller and his laboratory servant, at Vienna, from the plague bacillus which Professor Müller brought from Bombay, shows the necessity for caution in handling the germ of this disease.

Are we in America in danger of the plague? I will have to answer this question very much as I did two years ago: "Yes, we are in danger; but this danger, being foreseen, may be easily avoided." In my opinion, our most vulnerable point is along the Pacific coast. With the plague at Hong Kong, it is possible that it may be transferred to Manila, and the transports bringing soldiers to this country may also bring the infection. However, I think the chances of this happening are small. The length of time required to make the voyage from Manila to San Francisco is so great that, with the infection on board, it would be almost certain to manifest itself before reaching our shores, and, knowing its presence on board a ship reaching San Francisco or any other point on the western coast, thorough inspection and disinfection will keep the disease out of this country. The probabilities are that for several years to come the larger cities of India, at least, will remain infected, and our sanitary authorities must be vigilant. The fact that, if the plague reaches us at all, it must come by sea, that a long voyage must be made before it can reach us, and that the disease will most probably appear on board ship before arrival at any American port—all these conditions are in our favor. The General Government should take upon itself the control of all measures to prevent the introduction of infectious diseases from without. Quarantine detention is a relic of ignorance of the true nature of infectious diseases. All transports and other vessels between Manila and this country should be provided with proper disinfecting apparatus. The Government should supply the Marine-Hospital Service with every needed equipment, and if this be done the plague can enter America only through incompetency in that service. There is another source of danger on our Western coast that must not be overlooked. The plague is now widely distributed in Formosa, which is under the control of Japan, and our intercourse with the last-mentioned country should be most carefully watched. [Pg 592]

TUSKEGEE INSTITUTE AND ITS PRESIDENT.

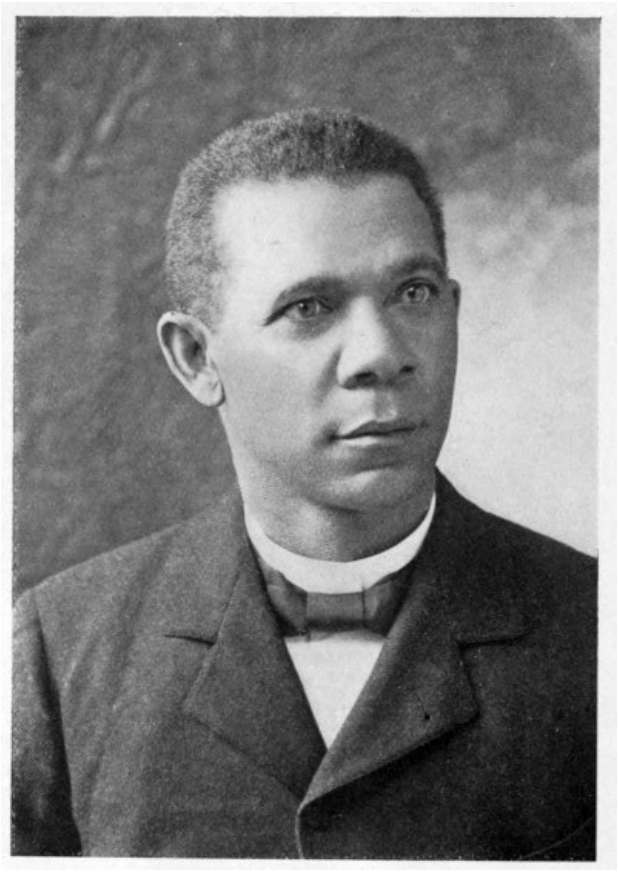
By M. B. THRASHER.

Tuskegee is a county town in the State of Alabama, not far from Montgomery. It is near the center of that part of the South commonly spoken of as the "black belt," because the negro inhabitants there greatly outnumber the whites. The town is one of the oldest in the South. It is said, in fact, that when De Soto made his famous journey across that part of the newly discovered continent he found an Indian village of the same name on the site of the present town. Tuskegee is five miles from the main line of the Southern Railroad, with which it is connected at Chehaw by means of a narrow-gauge road.

The Faculty of the Tuskegee Normal and Industrial Institute.

Tuskegee, as the word is oftenest used now, means the Normal and Industrial Institute, situated a mile out from the town and forming a little settlement in itself. This is the great school for young negro men and women which Booker T. Washington has built up, and of which he is the principal. The pupils who attend number a thousand each year. It is the largest school for colored people, managed by colored people, in the United States. There is no one connected with the school, except some of the members of the board of trustees, who is not of the race which the institute is designed to help.

Tuskegee Institute is so entirely the result of Booker T. Washington's labors, and his life has been so interwoven with the development of the school, that a brief account of his boyhood and youth is almost indispensable to a complete description of the institute, particularly as the conditions with which he struggled were so generally those which confronted all of the negroes at that time.



President Booker T. Washington.

Booker T. Washington was born a slave in Virginia, not long before the breaking out of the war. It seems strange that a man who is so widely known to-day and is so universally respected as Mr. Washington, when asked how old he is should be obliged to reply that he does not know, yet such is the case. The birth of one more black babies on a large plantation at that time was a matter of too little moment to have sufficient notice taken of it to accurately fix the date. He was a boy old [Pg 593] enough during the war, though, to know something of the struggle going on around him, for, [Pg 594] speaking in public of Lincoln once, I heard him say: "My first acquaintance with our hero was this: Night after night, before the dawn of day, on an old slave plantation in Virginia, I recall the form of my sainted mother bending over the bundle of rags that enveloped my body, on a dirt floor, breathing a fervent prayer to Heaven that 'Massa Lincoln' might succeed, and that some day she and I might be free."

Mrs. Booker T. Washington.

Another incident of those days I have heard him tell of in these words: "Word was sent over the plantation for all 'the hands' to come up to the 'big house.' We went, and to us men, women, and children gathered in the yard some one standing on the veranda read a paper. I was too young to understand why the men and women around me should have begun to shout, 'Hallelujah! Praise [Pg 595] de Lawd!' when the reading was finished, but my mother, bending down to where I was clinging

to her dress, whispered to me that we were free."

Not long after the close of the war the Washingtons left the plantation and went to West Virginia, where, in the coal mines, work could be had which would pay money wages. At first Booker worked in the mines with his brothers, but he soon became dissatisfied with the chance for improvement which that work afforded. "The first thing that led me to study," he has said, "was seeing a young colored man slowly reading a newspaper to a group of colored people who surrounded him with open mouths and gaping eyes. He was almost a god to them." The chance to study was soon found. An energetic woman of kindly nature hired the young colored boy to work about her house as a general chore-boy. Finding that he was anxious to learn, she offered to teach him to read in the spare minutes of his work, and did so. One day he overheard a man talking about Hampton, where General Armstrong had already begun his noble work. This, the man said, was a place where black boys could go to school, and at the same time work to pay their way. "As soon as I heard that," Mr. Washington has said, "I made up my mind that Hampton was just the place for me, and that I would go there. I started, although I had no money and did not even know where Hampton was. I felt sure I could inquire the way as I went, and work my passage. I walked a good share of the way, begged some rides, and when I had earned any money [Pg 596] which I could spare, paid my fare to ride on the trains. I reached Richmond, Virginia, one night too late to get any work, and I was entirely out of money. While I was walking about wondering where I would get a lodging, I happened to see a nice dry place under a stretch of plank sidewalk. Watching my chance when no one was looking, I crawled in and curled up to sleep. The next day I was so fortunate as to get work helping to unload a vessel, and, as the job lasted several days, I came back each night to my lodging under the sidewalk, thus saving all my wages except the little required for food. In this way I was able to get money enough to carry me the rest of the way to Hampton, and leave me fifty cents when I got there."

In these days of entrance examinations to various institutions of learning, it is interesting to read of the examination which young Washington was required to pass before he could enter Hampton. He tells us of it thus: "Of course," says he, "they knew nothing of me, and, after my long tramp, days of hard labor and nights of sleeping in barns and under sidewalks, I suppose I could not have presented a very prepossessing appearance. After looking me over in a not very encouraging manner, they gave me a broom and took me into a room, which they told me to sweep. I suppose I swept that room over three or four times before I was satisfied to call it done, when a teacher came in and took her handkerchief and wiped the walls to see if she could find any dust on them. After that they said I could come to the school. So you see I passed my examination.

"At Hampton I found the opportunity, in the way of buildings, teachers, and industries provided by the generous, to get training in the class room, and by practical touch with industrial life to learn thrift, economy, and push. I was surrounded by an atmosphere of business, Christian influence, and a spirit of self-help that seemed to have awakened every faculty within me, and caused me for the first time to realize what it meant to be a man instead of a piece of property.

"While there I resolved that, when I had finished my course of training, I would go into the far [Pg 597] South, into the 'black belt' of the South, and give my life to providing the same kind of opportunity for self-reliance and self-awakening that I had found provided for me at Hampton. My work began at Tuskegee, Alabama, in 1881, in a small shanty and church, with one teacher and thirty students, without a dollar's worth of property. The spirit of work and of industrial thrift, with aid from the State and generosity from the North, has enabled us to develop an institution of a thousand students, gathered from twenty-six States, with eighty-one instructors and thirty-eight buildings.

"I am sometimes asked what is the object of all this outlay of energy and money. To that I would answer that the needs of the ten million colored people in the South may be roughly said to be food, clothing, shelter, education, proper habits, and a settlement of race relations. These ten million people can not be reached by any direct agency, but they can be reached by sending out among them strong selected young men and women, with the proper training of the head and hand and heart, who will live among these masses and show them how to lift themselves up. The problem that Tuskegee Institute keeps before itself is how to prepare these leaders."

The first time I went to Tuskegee I happened to ride for half a day through the State of Georgia in the same seat in the car with a man whose conversation showed him to be one of the class to [Pg 598] whom the designation "unreconstructed" has sometimes been applied. An officer in the Confederate army, he had accepted the situation at the close of the war, but now, after thirty years, although he spoke of existing conditions without bitterness, he spoke of them with little or no sympathy. I had some doubt how he would comment on my errand, when I told him that I was on my way to attend the Negro Conference at Tuskegee. Imagine my surprise when he exclaimed: "Going to Tuskegee, are you, to see Booker Washington? Just let me tell you there's a man that's got the right idea of things. He's teaching the negroes to work. I wish the South had a thousand Booker Washingtons." This man, I learned afterward, when I was in Atlanta, was one of the most prominent and successful business men of that city.

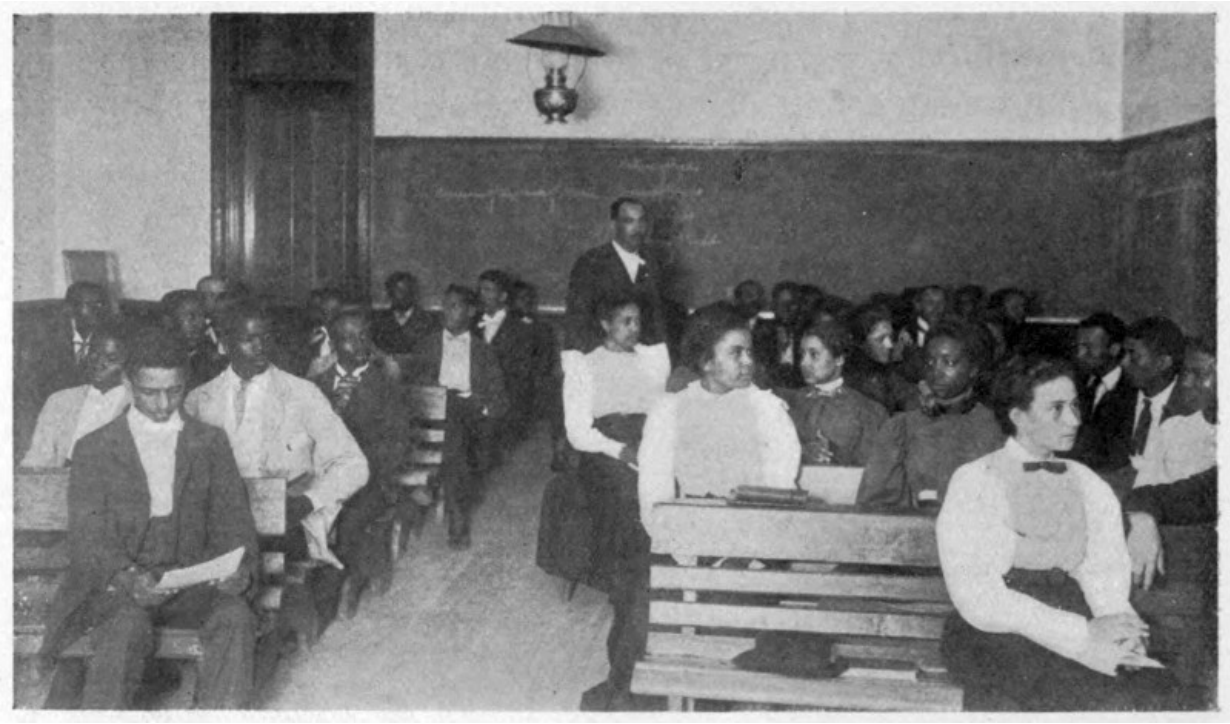
The second day of my stay at Tuskegee, as I came out of the rude buildings where the conference had been held, a young colored man waiting at the door accosted me. "Is not this Mr. ——," he said, "and at the World's Fair were you not in charge of such an exhibit?" naming one of the educational exhibits. I said I was the man. "Don't you remember me?" he added, telling me where he had been working at the time. I did remember him perfectly, and asked how he happened to

be so far removed from Chicago.

"It was like this," he said. "Next year I went to the Atlanta Exposition. While there I heard Mr. Washington speak, and learned about his school where negro boys could learn a trade. I had always been at a disadvantage because I did not know how to do any kind of work really well. So I came here and began to learn carpentering. I have the trade nearly learned now, and when I graduate from here I shall know how to really work." [Pg 599]

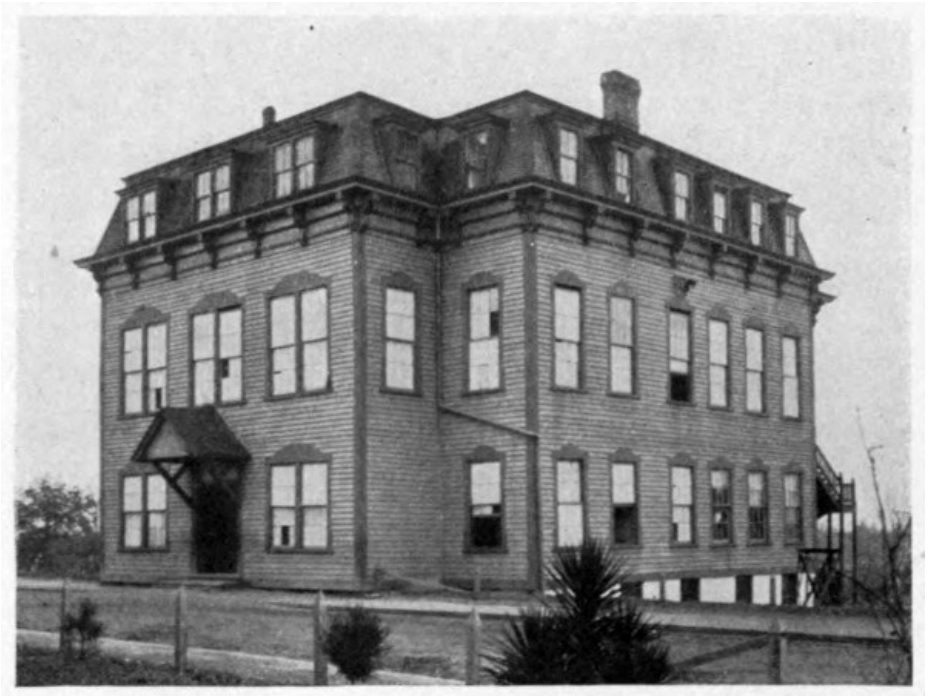
Soon after beginning my long car ride from Tuskegee back to the North I stepped into the mail car on the train to post some letters. The envelopes I had used bore the imprint of Tuskegee Institute in the corner. As I handed them to the postal clerk, he glanced at the printing in the corner and exclaimed: "I say, that Booker Washington is a wonderful man, isn't he? I never saw him, but he's teaching those people there to work." Then he went on to tell me about a young colored man whom he had known who had gone to Tuskegee and learned harness-making, and then come home to set up business for himself. This man told me later that he had never been farther north than Louisville.

It seemed to me as if here was an interesting coincidence of unsought testimony, and all tending to show how consistently Tuskegee teaches a gospel of work. Industrial training goes hand in hand there, with mental and moral teaching, in earnest effort to help the thousand young negro men and women there and make their lives count for the most possible for themselves and their race.



A Class in Mental Philosophy.

Any one who has heard Mr. Washington speak at any length to audiences of his own race knows how earnestly he advocates industrial education for the negro. As might be expected, then, we find at Tuskegee practical hand training. The advantage is twofold. The students not only learn to work, but in doing so many are enabled to work out all or a part of the expenses which otherwise in many cases would have prevented them from remaining at the school. [Pg 600]



Armstrong Hall. One of the oldest buildings at Tuskegee.

Of the thirty-eight buildings at Tuskegee, all but the first three, and these are among the smallest ones, have been built by the students. Several of the largest of these buildings are of brick, and the educational process begins in the institute's own brickyard, where a class of muscular young men are making bricks under the direction of a capable instructor, and in making them learn the trade which they expect to follow in after life. This yard not only makes all the bricks the institute uses, but many thousand more to be sold each year for use in the surrounding country.

Alabama Hall. One of the first buildings erected by the students.

I heard Mr. Washington tell to an audience of fifteen hundred negroes, in Charleston, South Carolina, a characteristic story of the beginning of this brickyard. "After I had been teaching a while at Tuskegee," he said, "I began to feel that I was partly throwing away my time teaching the students only books, without getting hold of them in their home life and without teaching them how to care for their bodies and how to work. I looked about for some land, and found a [Pg 601] farm near Tuskegee which could be bought. I had no money, but a good friend had confidence enough in our prospects to loan me five hundred dollars to pay down toward the land so as to secure it. After that it was not long before I had the school moved. Then I would teach the boys for a part of the day, and then for the rest of the time take them out of doors with me to help clear up the land. In that way we did all the work we possibly could. When it came to making bricks for a building, though, we were stuck. We could make the bricks, and did, but none of us knew how to burn them. For that it was necessary to have a skilled man, who must be paid. I was out of money by that time, but I owned a gold watch. This I took to a pawnshop and raised all I could on it. The money I got was enough to pay a man to burn the bricks and teach us so that we could do the next ones ourselves. That watch is in pawn yet, but we have got thirty-eight

buildings."

Students at Work on New Trades-School Building.

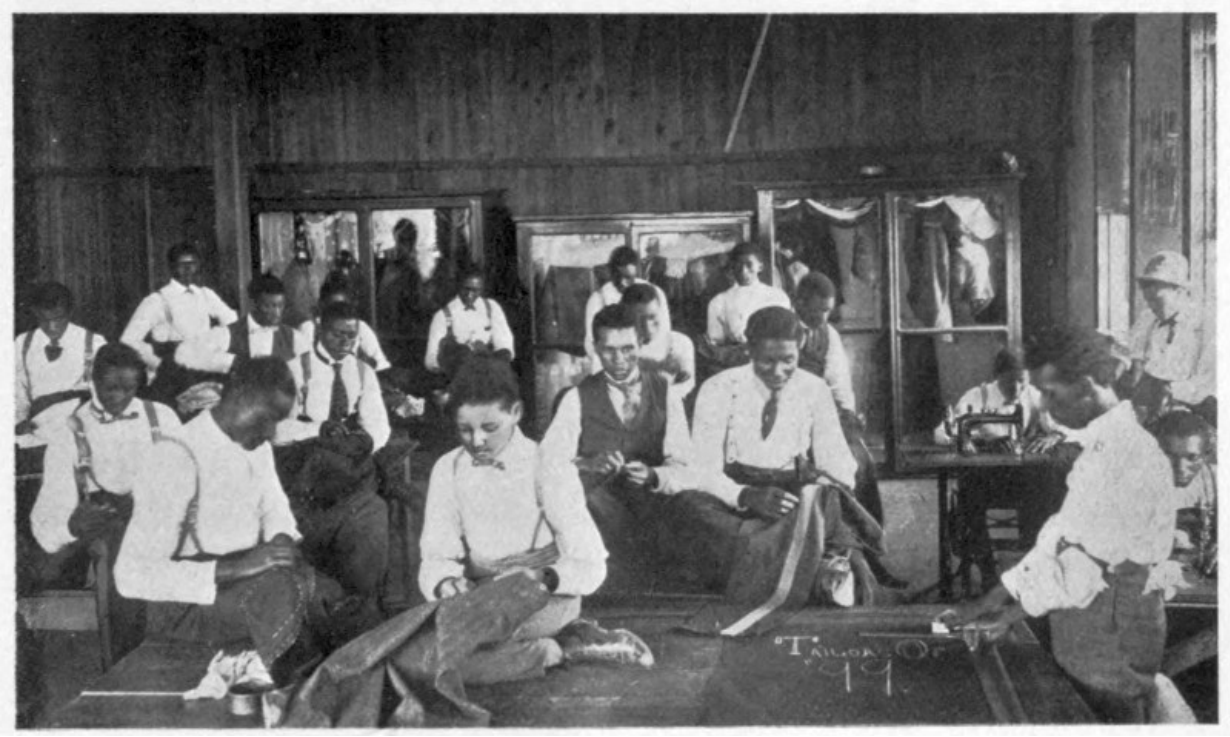
Another class of young men are learning bricklaying. They take the bricks as they come from the yard and put up the walls of the buildings, while the carpenters do the woodwork. The classes in woodworking are among the most important at the school. The institute now owns a large tract of valuable timber land, while among the industrial buildings on the grounds is a good sawmill, [Pg 602] equipped with the necessary machinery. Whatever lumber is needed in the erection of the buildings is cut on the timber lot, drawn to the mill, and sawed. In this way one class learns to saw and handle lumber. Besides the regular carpentry classes, joiner work and carriage-making are carried on. A large part of the furniture in the buildings, including the beds, tables, and chairs in the dormitories and dining rooms, was built in this way. All the carts, wagons, and carriages which are used about the place were built in the carriage shop, and the hickory lumber wagons turned out there have so good a reputation that all not needed on the place are sold readily to be used on the near-by farms. The carriages are painted, ironed, and trimmed by the young men, and no better proof of the workmanship can be asked than some of the rides I have had in them about Tuskegee.

One End of the Dining Hall at Tuskegee.

The management at Tuskegee tries to have a building always in course of construction for the benefit of the building classes. This year they are erecting a trades-school building. Last year they built a handsome brick church, which will seat two thousand persons. The building of this church shows well what the school's building classes can do. The designs were drawn by Mr. R. R. Taylor, the young colored man who is the instructor in mechanical and architectural drawing. One of his pupils designed the cornices with which the building is finished, and another designed the pews which furnish it. These pews were built in the school's joiner shop. The bricks were all

made in the school's brickyard, and laid by the students. Men learning slating and tinsmithing covered the roof, and the steam-heating and electrical apparatus were also put in by the students, although this is one of the first of the buildings where the students have been sufficiently advanced in those trades to do the last-named work.

As it was determined to employ only negroes as instructors at Tuskegee, it was at first difficult to find enough men and women of that race skilled in the arts and trades which it was wished to have taught there, and teachers were brought to the institute from all over the country. Now, however, as each year sees the industrial classes better under way, the tide is setting out, and [Pg 603] Tuskegee yearly turns out teachers of trades, both men and women, who are eagerly sought by other institutions which are coming to see the value of industrial training. In many cases these teachers go to such positions at lower wages than they might hope to earn if they went to work at their trades, but they do this because they feel they have a duty to the institute and to the friends who have sustained it, to help extend its influence as widely as lies within their power. The question is often asked if a negro having learned a trade can find work at it. I do not think that the Tuskegee students who have thoroughly fitted themselves feel any anxiety about this. I remember speaking on this subject to the teacher in the harness-making and saddlery department, a good workman and a superb physical specimen of a man. He told me that during the long summer vacations he had left Tuskegee, and had never had any trouble in getting work and keeping it in shops in Montgomery and other towns of the State.



A Class of Tailors.

Among the buildings at Tuskegee is a foundry and machine shop, which is always full of work, especially in the way of repairs upon agricultural machinery for the farmers about Tuskegee, because there is no other shop of the kind within thirty miles at least which has facilities for doing such heavy work as this. Printing, tailoring, blacksmithing, and painting are taught. Since a large proportion of the students at Tuskegee are young women, arrangements are made to furnish opportunities for them also to learn to work. They do all the work of taking care of the dormitories and dining rooms, learn plain and fancy cooking, candy-making, millinery, [Pg 604] dressmaking, and all the most modern methods of laundry work. One class learns nursing, under the direction of a capable trained nurse.

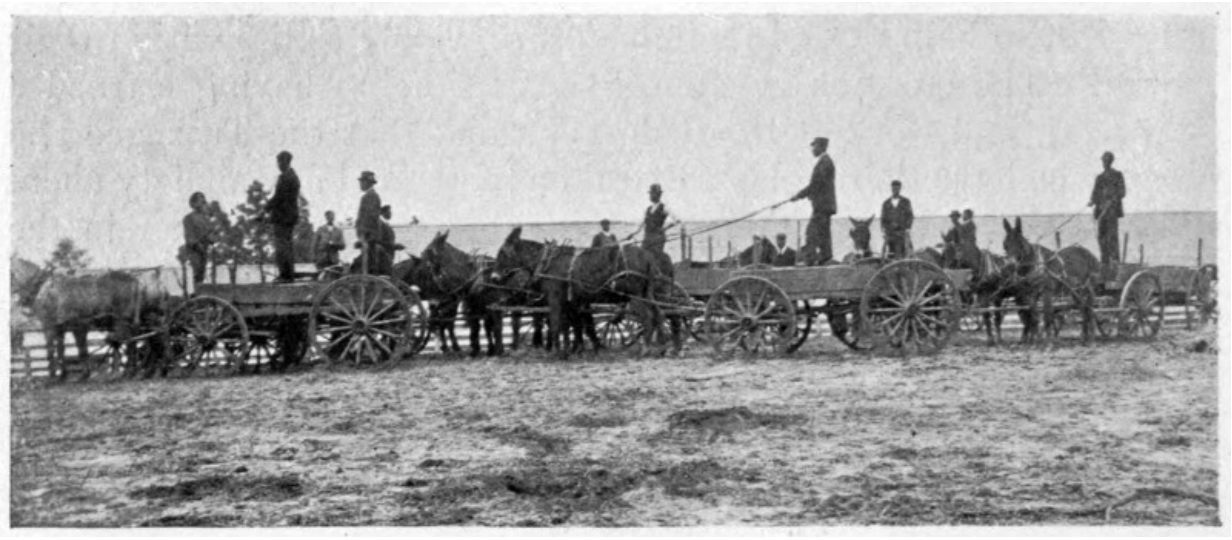
In speaking of the trades taught at Tuskegee, it should be remembered that agriculture is reckoned among them, and one of the most important. A very large percentage of the negroes of the South must continue to live upon the plantations and gain a living by tilling the soil. As a general thing their knowledge of how to best do this is lamentably deficient, and they labor under great disadvantages. They do not own their land, but rent it at ruinous rates. They mortgage their crops and eat them up before they are harvested. They plant nothing but cotton, because that is about the only crop that can be mortgaged, and are therefore obliged to buy food at any exorbitant prices which the dealers may demand. Tuskegee tries to remedy these evils by teaching the young men who come there the best methods of modern farming. If the farmers' sons can remain only a short time they carry back to the home plantations some new ideas to put in practice there; if they can remain for the full term of three or four years, they are fitted to take full charge of the work on any large plantation. The institute has a farm on which are raised the crops best adapted to the soil and climate of that part of the South. The men who have charge of this work are among the most able in the entire force of instructors. Mr. C. W. Green, the farm superintendent, has no superior in the South as a practical farmer. Mr. George W. Carver, the head of the agricultural department, is a graduate of the Iowa State College. To my mind, no more valuable text-book for Southern scholars could be furnished than a little pamphlet which this man has recently issued, telling how he raised [Pg 605]

between two hundred and three hundred bushels of sweet potatoes from an acre of ground, whereas the average yield of that crop in the same part of the country is less than fifty bushels to the acre.

"Building a Hat"; Millinery Department.

An Institute Cabbage Field.

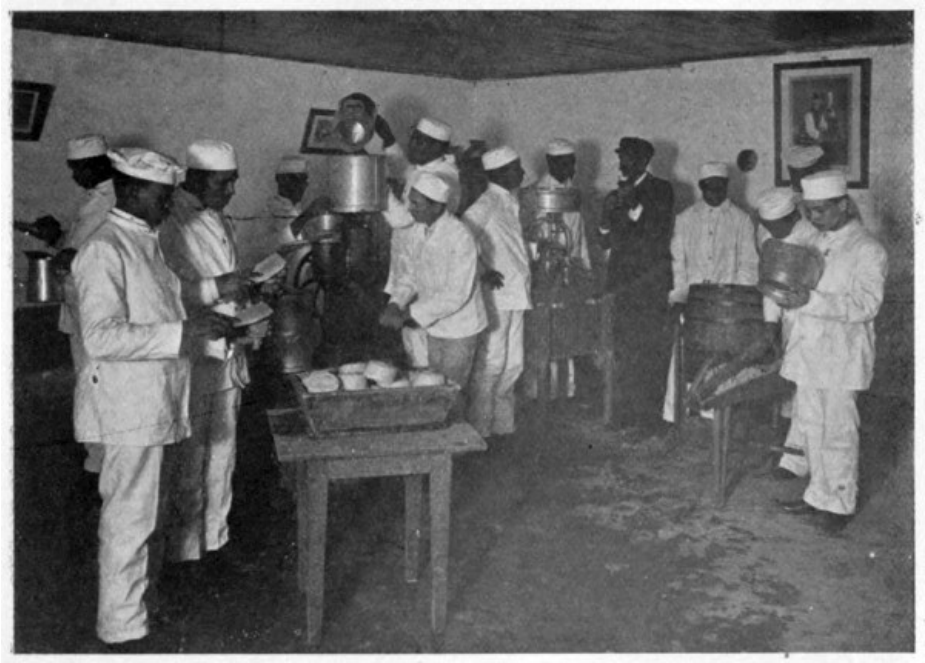
Tuskegee has a large herd of cows and a good dairy and creamery, in which a class of men receive instruction in dairy work. An incident which occurred in connection with this dairy furnishes a story which Mr. Washington likes to tell, because it illustrates a point which he constantly impresses upon his colored audiences. One of the surest ways to abolish the color line, he tells his hearers, is to learn to do some kind of work so well that your services will be really needed.



The Start from the Barn. "Farm Students."

"There came to my knowledge," says Mr. Washington, "the fact that the owners of a certain creamery were in search of an able superintendent. We had just graduated a man who was thoroughly capable in every way, but he was just about as black as it is possible for a man to be. Nevertheless, I sent him on to apply for the place. When he made his errand known to the owners they looked at him and said:

"'A colored man? Oh, that would never do, you know.'



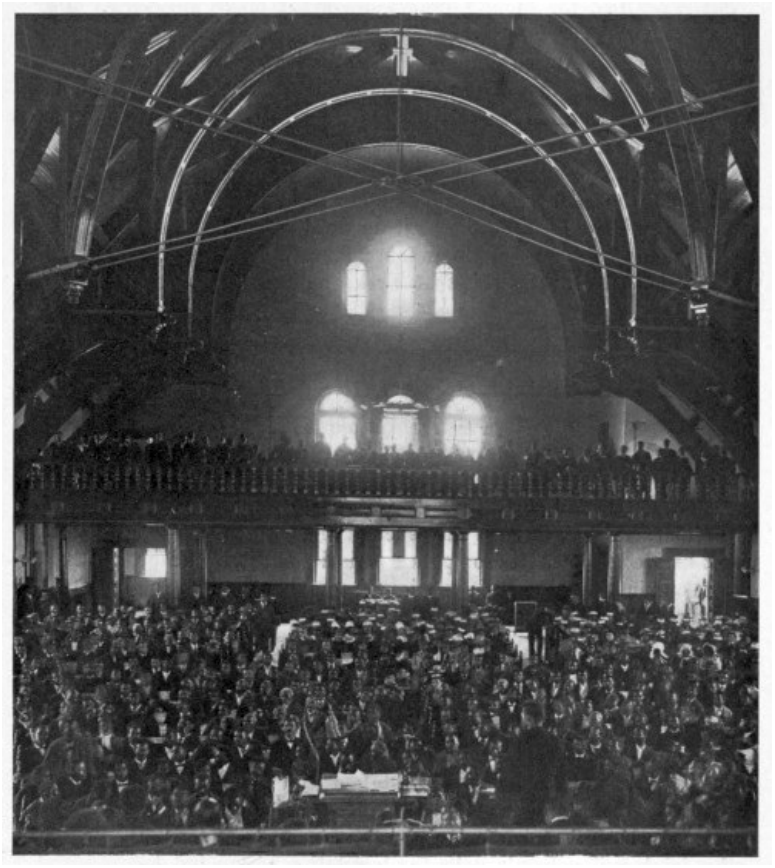
Dairying Division; making Butter.

"The applicant for work said very politely that he had not come there to talk about his color, but about the making of butter. Still, they said he would not do.

"Finally, however, something the man said attracted the attention of the owners of the creamery, and they told him he might stay two weeks on trial, although they still assured him that there was no possibility whatever of their hiring a colored man. He went to work, and when the report for [Pg 606] the first week's shipment of butter came back—would you believe it?—that butter had sold for two cents a pound more than any butter ever before made at that creamery! The owners of the establishment said to each other, 'Why, now, this is very singular!' and waited for the second week. When the returns for that week came back—a cent a pound more than for the week previous, three cents a pound more than the creamery's best record before our man had taken charge of it—they didn't say anything. They just pocketed the extra dividend, as welcome as it was unexpected, and hired the man for a term of years. That extra three cents a pound on the price of the butter he could make had knocked every bit of black out of the color of his skin so far as they were concerned."

Delegates to the Tuskegee Negro Conference.

Out of the desire of Mr. Washington to help the struggling negro farmers has grown one of Tuskegee's greatest institutions—the annual Negro Conference which assembles there each year. About ten years ago Mr. Washington invited a few of the negro farmers who lived near Tuskegee to meet at the institute on a stated day "to talk over things." Perhaps twenty men accepted the invitation. These men, gathered in one of the smaller rooms of the institute, under Mr. Washington's leadership discussed the problems with which they had to contend, and different ones among them told how they had succeeded or failed. The meeting was felt to be so helpful that another was planned for the next year. From that small beginning has developed a conference which now brings to Tuskegee, in February of each year, two thousand persons, from a dozen States, and representing many occupations besides that of farming. These men and [Pg 607] women are the parents of the generation which is at school at Tuskegee and similar institutions. These fathers and mothers lived "too soon" to be able to profit by such advantages. Few of them can read or write, and nearly all of them know by experience what slavery was. They see their children learning so much which was unattainable for them that they ask, "Is there no chance for us?" The conference is Tuskegee's attempt to answer that cry. As one grizzled old negro preacher, whom I heard make the opening prayer one year, said, "O Lawd, we wants ter tank de for dis, our one day ob schoolin' in de whole year."



Negro Conference in Session in Tuskegee Institute Church.

Beginning with this year the conferences will be held in the new church, which will comfortably seat all the delegates. Until this church was completed, though, there was no audience room at the institute which would begin to accommodate all who came, and the sessions were held in a rude temporary building, which was also utilized for chapel and graduation exercises. Convenient as the new church is in every way, I shall always miss the unique gathering in that old pavilion. Imagine a broad, low building of unplaned boards, its floor the earth, and its seats backless benches made by spiking planks on to posts driven into the ground. From its rafters hang masses [Pg 608] of Spanish moss, amid which streamers of red, white, and blue bunting are woven. On the walls are many American flags, looped back with the spiked leaves of the palmetto tree. Booker Washington stands on a low platform at one end of the room, and all around him, packed just as closely as they can be, are the people, while hundreds of late comers cluster around the doors and open windows like bees around the opening of a hive. No matter if the benches are backless and hard. No opera audience in five-dollar chairs ever sat half so interested for an hour as do these men and women through all the day, which, long as it is, proves far too short for what they have to say. This is the one day of the year for them, and not a minute must be wasted. The speakers are the men and women themselves. Mr. Washington simply starts the discussions and steers them so as to make all the time count. He is a genius as a presiding officer, and gets more out of the limited time than any one else could do. The subjects which they discuss are the practical ones which concern them most vitally. Some I have mentioned—non-ownership of land, crop-mortgaging, and the evil of raising only cotton. Others are the need of a longer school year and how to get it, the foolish extravagances of buying showy clocks, sewing machines, and organs before a house is owned to put them in, and similar subjects. The time is never long enough for all there is to be said. The effort is to make this a center from which some helpful thought will be carried out to take root during the year.

"Plain-Sewing" Room.

I saw a striking example of the influence which the conference may exert at one of the sessions. A tall young mulatto woman had finally succeeded in getting a chance to speak, for there are always twice as many to talk as can find time. "Last year brother Washington told us," said she, "that three acres of land, properly carried on, would support a person, and told us how, and said that a woman as well as a man could carry on the land. I made up my mind I'd try it. I did, and it's so. I hired three acres of land and had it plowed. I had it plowed deep, too. No lazy nigger half done the job, for I sat on the ground myself to see it done." She then went on to tell what her seed and fertilizer had cost, what she planted and raised, and what her profits were, showing them to be quite enough, as she had said, to support her for a year.

Loud applause greeted this report, and cries of "Dat's good!" and "Go ahead, sister!" but through it all the woman was seen to be still standing where she had spoken, waiting for a chance to go on, and with no sign of satisfaction in her face at the approval shown her. Raising one yellow hand high above her head, as soon as she could be heard, she cried in a strangely thrilling voice, [Pg 609] which echoed through the dusky room: "How can you waste the one day of the year for us in such foolishness, when the life of a race is in jeopardy? Get to work! We must learn first to help ourselves, if we want God to help us!"

Hardly had this woman finished speaking when it was seen that another woman had risen and was waiting for a chance to make herself heard. I think I never saw a more pitiful figure. Very black, old, with a gaunt form on which a shabby dress hung loosely, her face was that of a person for whom life had been so hard that hope was for her a word unknown. Two or three men in the audience said, "Oh, sit down!" as if they wondered what such a person could have to say which [Pg 610] would not be a waste of the meeting's time, but she would not sit down. Standing there until the noise had hushed, she began:

"I wants ter tank Gawd I'se come here ter day an' heard what dat sister had ter say. I don' know what made me come. I'se nebber been here before, but I'se so glad I come ter-day! I'se been de mother ob sixteen chillen. I hain't nebber had a home nor a mule nor eben a dress dat wa'n't morgiged. My chillen's gone an' lef' me as soon as dey's growed up, an' now my ole man is gone too. I tought dere wasn't nuffin lef' for me ter do but jes' die, but now I'se goin' home an' get some lan' an' do for myself an' my littles' chillens what nobody has ebber done for me. I kin do it, an' I tank Gawd I'se been here ter git de word."

It seems to me as if this was missionary work of the best kind, and it is such work as this that Tuskegee is doing constantly.

RECENT LEGISLATION AGAINST THE DRINK EVIL.

By APPLETON MORGAN.

[*Concluded.*]

X. Quality Inspection.—In my paper in these pages, in 1894, I remarked, "If there is any such thing as a salutary liquor law, not derived from excise or police jurisdiction, it would be, perhaps, a statute insuring the purity of liquor; reviving that old English functionary, the 'ale-taster,' with his care over all drinkables exposed for sale." And surely this would be a legitimate and a constitutional law, as providing for the public safety (which is, after all is said, the origin and

summit of all law). To kill a rattlesnake the rattlesnake must first be recognized as alive, and the old cry of the Podsnap that nothing improper exists is fast disappearing. It seems to me that at present, and in view of the fact that Mr. Reed's plan would involve a social and economical plant which could only be accumulated by long and deliberate legislative action, and admitting that the drink evil not only calls for legislative action but has received it for sixty-two years, and so accustomed our communities to expect it; admitting also Mr. Bellamy's and Mr. Reed's basic proposition that there is no reason why any human being should starve, and that it is not public policy that any creature of the State (even if a criminal confined for crime in a State penitentiary) should starve—admitting all these, it seems as if this plan really might be the best and most immediately practicable plan yet. Every State, without any criticism or clamor of [Pg 611] constitutionalists against paternal government, appoints its official tester of illuminating fluids, that conflagration may not ensue and the public safety be imperiled by the destruction of the citizens' homes. Why not a State "tester" of the stimulant which may inflame the vital forces of the citizen himself, and so imperil the public peace, which, by all laws, is the public safety? Municipal corporations appoint inspectors of meat, of milk, of fruits, of confectionery, precisely under this constitutional duty of preserving the public health, upon which, most largely of all, the public safety depends. Why not, then, inspectors of the potables which the public drink?

By having liquors examined, and only pure liquors sold, and condemned liquors destroyed, precisely as in the case of unclean or impure meats, milk, fruit, and confectionery; much could be practicably, and in a minimum lapse of time, accomplished to the decrease of the liquor evil. The prohibitionists themselves, by placing and replacing and abolishing and experimenting with all sorts of statutes upon the statute-book, have accustomed us to State regulation of the sale of intoxicants, and, least of all, can complain of yet one more experiment toward the decrease of drunkenness.

Let the national or State government have liquors examined, and those not up to the standard emptied into the sewers, precisely as in the case of milk found filthy, dangerous, or questionable. The Government might also supervise the distilleries and forbid the manufacture of what are called "quick-aging" goods, or "continuous distillation," precisely as it controls the manufacture of oleomargarine. It is not improbable that a commission appointed to this good work might, by just, equitable, and easily-to-be-borne statutes, prescribe a time limit or period after which no spirituous liquors should be sold less than, say, five years old (the age of liquor being said to regulate its irritant and insanitary and to conserve its really salutary and sanitary qualities). I believe (not without consultation and a deliberate exchange of opinion with experts) that the good effects of such legislation would be almost instant; I believe that from pure motives of self-interest alone the distillers and rectifiers of liquors, instead of fighting such a law, would be eager to compete to furnish pure brands of liquor for the State censors, in the certainty that the State must adopt the best and the purest. To-day the public is served with precisely what the publican finds it most to his profit to sell. It may be only dirty water which he sells at a price at which he could (to his own immense profit) sell pure liquor. In every drinking place in the land, to which the public resorts, there are two prices—one price for what you order, and the other for the same "good." I believe that one of these days the world will remember, as curiously as it now [Pg 612] remembers the days of the stagecoach or the tallow-dip, a time when a man desiring a dram of liquor was obliged to drink whatever the dram-seller found it profitable to sell him.

We have tried about everything else. Why not try this? We have conceded to our legislators the right and the jurisdiction. Since we can not adopt Mr. Reed's proposition to feed everybody, why not enter the wedge right here and do the next best or a next best thing—see that the people not only eat proper meats and fruits, but that they drink, if drink they will, pure liquors? And it need be added (however it may appear to be a sop to Cerberus) that it would not antagonize that most powerful class, whose organized and capitalized opposition every other liquor-regulating law which has ever been suggested has at once antagonized, and been obliged in the end to if not conciliate, at least to recognize in the adjustment of equities. Fortunately, we have not to begin our experiments out of whole cloth. Illinois, Michigan, Ohio, Massachusetts, New York, and Washington have led the way, and made the adulteration of liquor a misdemeanor. (New York, however, has probably negatived the best results of the prohibition by adding that the prohibited adulteration must only be "with any deleterious drug, substance, or liquor which is poisonous or injurious to the health," which is shutting one door and opening another, and relegating to the lawyers and their experts a tedious inquisition as to what the word "poisonous" or the term "injurious to health" may mean, in the course of which the offender would walk free.) The question as to whether it would conserve the public peace as well as the public safety by decreasing drunkenness can only be favorably conjectured. Experience of such a law only can show. To begin with, it would increase the cost of a dram. A glass of true whisky, for example, might be twenty cents instead of ten, and (the law forbidding adulteration) this would probably in itself lessen dram-drinking. In England, many years ago, a similar law was found to eventuate in compelling that only the highest grades of ale should be sold at a certain price. This led to the offering of a second, and then of a third grade, and finally of what was claimed to be a blending of all three grades or an "entire" (which was the origin of the term ENTIRE, that later began to be the name of an alehouse—a legend still seen on English alehouse signs). But the law we now suggest, by preventing the blending of three grades of spirits, might, while lessening the sales, increase the excise revenues, and perhaps accomplish whatever may be left to be accomplished in conserving at once the health, the peace, and the income of the State.

That a system by which only pure liquors can be exposed for sale as beverages is feasible, seems already assured, the States of Ohio, Illinois, Michigan, Massachusetts, and Washington having [Pg 613]

already long since adopted a partial statutory policy of the sort, and the State of New York, in 1896, having followed. In order to demonstrate what these have accomplished, and what improvements can be suggested, there were addressed to the proper officers of each of these States the following questions, viz.:

1. In your State what officer is charged with enforcement of the provisions of its liquor statutes, forbidding adulteration of liquors exposed for sale as beverages? And must such officer be examined as to his experience or as to his competency only?

2. Is his standard of unadulterated liquors established by law, and if so, what is it? Or is the officer's judgment as to what liquor may or may not be sold discretionary according to the circumstances of each case?

3. Is the examination to be conducted by taste or tasting (sampling), the old English method, or by chemical analysis?

4. Is adulteration so defined as to include the mixing of liquor with water, or only with substances or liquids in themselves toxicants?

5. Is the effect of this clause thought to be beneficial? Has it, for example, decreased drunkenness?

To the first question Mr. Samuel P. Sharpless, State Assayer of Massachusetts, reports as follows: "An assayer of liquor is appointed under our public statutes, who is charged with performing such duties as are referred to him. No particular examination prior to appointment is laid down. The presumption is that an analytical chemist will receive the appointment, as in the twenty years in which the law has existed only analytical chemists have received the same."

As to Ohio, Mr. Joseph E. Blackburn, Dairy and Food Commissioner, says: "The office of Dairy and Food Commissioner is charged with the enforcement of all laws governing the sale of food, drink, and drugs. He is not required to stand any examination, and his experience and qualifications are not considered except as to his eligibility as a candidate. It is distinctly a political position, and all the parties nominate candidates for the place."

As to Michigan, Mr. Elliot O. Grosvenor, Dairy and Food Commissioner, says, "The Dairy and Food Commissioner of the State is charged with enforcement of the law relating to adulteration of liquors."

As to Illinois, Hon. E. C. Akin, Attorney-General, writes: "It is the duty of the several State's attorneys to prosecute for violations of this section, on complaint of any one, or by indictment. There is no officer charged with the duty of making examinations or tests of liquors."

As to New York, Hon. Henry H. Lyman, Commissioner of Excise, replies: "The district attorneys of [Pg 614] the several counties in this State have direct and exclusive control of all criminal prosecutions against violators of the liquor-tax law, but indirectly the matter of enforcing this section devolves upon the State Board of Health. By the provisions of section 42, chapter 661, laws of 1893, the State Board of Health shall take cognizance of the interests of the public health as affected by the sale or use of foods and adulterations thereof, and make all necessary inquiries and investigations relating thereto. It shall appoint such public analysts, chemists, and inspectors as it may deem necessary for that purpose, etc. Upon discovering any violations of the provisions of the act relating to the adulteration of foods or drugs, the State Board of Health shall immediately communicate the facts to the district attorney of the county where the violation occurred, who shall thereupon forthwith commence proceedings for the indictment of the persons charged with such violations."

To the second question, as to what is held to be adulteration, in Massachusetts the only standard fixed by law is that of the United States Pharmacopœia. Chapter 272, Acts of 1896, undertakes to provide certain standards. But so far not a single case has been brought under this act, since it has not been made the duty of any one in particular to enforce it. The assayer and inspector can only examine such liquors as are brought to him by the proper officers. He has no authority to institute proceedings even if he finds the liquor to be badly adulterated. Such action must be taken by the officers making the seizure. But Mr. Sharpless writes that, in his opinion, the law (section 31 of chapter 100 of the public statutes) providing for taking samples of liquors for analysis contains in its last sentence a clause which renders it inoperative: it requires such samples to be paid for if they are found to be of good quality. Mr. Sharpless adds: "Under this section I have received perhaps on an average twenty samples a year for the past fifteen years. These samples have generally been whisky, gin, brandy, and rum. The Legislature has been repeatedly requested to give the assayer authority to take samples in the same manner as they are taken by the milk inspector, but has as uniformly refused to give him that power."

Ohio reports that the legal standard for liquors is the requirements of the United States Pharmacopœia.

In Michigan the law does not define any standard for adulteration or unadulteration. Nor is it left to the mere judgment of any officer. "In case of prosecution the fact of adulteration would have to be proved to the satisfaction of the jury by any competent evidence." This is the language of Mr. Samuel A. Kennedy, Deputy Secretary of State. Mr. Elliot O. Grosvenor, the Dairy and Food Commissioner, indicates the nature of the evidence, however, as follows: "If the word 'standard' [Pg 615] can be used in connection with the word 'adulteration,' our law does regulate this standard. We

send you under another cover a copy of the law concerning liquors, so far as within the jurisdiction of this department, from which you will see we have little or no discretion in the matter." The clause marked by Mr. Grosvenor is as follows: "The law relating to liquors seems to be meant only to prohibit the sale of spirituous or fermented or malt liquors containing drugs or poisons or substances or ingredients deleterious or unhealthful; and provides that each barrel, cask, keg, bottle, or other vessel containing the same shall be branded or labeled with the words 'Pure and without drugs or poison,' together with the name of the person or firm preparing the package. This applies to every package of whatever size—it matters not whether they are put up for immediate delivery or for stock purpose. This includes all bottled ale, beer, rum, wine, or other malt or spirituous liquors, also the bottles used for dispensing over the bar. The State has no standard of proof, but liquors in packages where proof is indicated must test to that proof. Compounds containing nothing deleterious or unhealthful may be sold as cordials. The blending of liquors will be permitted, if spirits or other ingredients are not added. Dealers purchasing and receiving goods not properly branded or labeled are not relieved from any responsibility, if they sell the same without branding or labeling."

In Illinois the standard is not mentioned, but the articles forbidden are plainly set forth by the criminal code of the State, which provides that "whoever adulterates, for the purpose of sale, any liquor used for drink, with cocculus indicus, vitriol, grains of paradise, opium, alum, capsicum, copperas, laurel water, logwood, Brazilwood, cochineal, sugar of lead, or any other substance which is poisonous or injurious to health; and whoever sells or offers, or keeps for sale any such liquor so adulterated, shall be confined in the county jail not exceeding one year, or fined not exceeding one thousand dollars, or both."

In New York there is a standard fixed for wines, and sections 46, 47, and 48 of the laws of 1893 are devoted to the definition of pure wine, half wine, made wine, and the adulteration of wines generally. But there is no standard of purity enacted for spirituous or malt liquors, and it is left to the discretion of the inspecting officers whether any liquors inspected and analyzed by them contain any deleterious substances.

As to question third, all the States seem to agree that chemical analysis is the safer, but adulteration seems to be considered by them all as a fact, to be proved by any competent process, even the taster not being barred, as he certainly is not by the clause as to inspection in [Pg 616] the State of New York. Mr. Grosvenor, Food Commissioner of Michigan, however, says that the only test recognized by his department would be that made in its own laboratory by its own two chemists.

As to whether the adulteration could be by water only, all our courteous informants refer us to their answer to the question as to standards but Ohio, whose Food Commissioner (Blackburn) replies, "Yes, if the proofage is reduced to less than one hundred degrees." In Massachusetts, Mr. Sharpless says, "In a case brought a number of years ago the court refused to consider water as an adulteration; no recent case has been brought."

As to the fifth and vital question, whether the clause against adulteration tends to decrease drunkenness, Mr. Sharpless adds the following valuable record of his experiences as State assayer in a State which, in thirty years, has experimented with about every known form of liquor statute: "So far as I have observed, the quality of the liquor has but little to do with the question of drunkenness. In some localities where prohibition has been strictly enforced we find that the class who will have liquor is obtaining it in other than the well-known commercial forms. Frequently we find that large quantities of extract of ginger are being consumed. A number of cases have been brought against the venders of this article, as an alcoholic beverage containing more than one per cent of alcohol. These cases have generally proved successful in stopping its sale. Essence of peppermint and of checkerberry, for example, are favorite tipples. During the past summer a case was found in which 'So-and-so's Drops,' a nostrum, a mixture of ether and alcohol, was being used as an intoxicant. The so-called 'native wines' have given us some trouble. These are essentially a fermented solution of sugar and water, with sufficient juice of some fruit for flavoring and color. When made without the addition of spirits they contain about fourteen per cent of alcohol. They are generally pretty poor stuff. About two years ago we had an epidemic of so-called 'malt extracts.' These, with very few exceptions, were found to be essentially porter. The alcohol in them averaged about six per cent, and they were quite palatable beverages. They contained about seven or eight per cent of solid extract.

"It has been several times proposed here that no liquors should be sold unless their purity was certified to by the State assayer. This I have uniformly opposed, for the reason that, while the State may well prohibit the sale of adulterated liquors, it is no part of its business to certify to the purity of any man's goods; and, unless the State becomes the sole vender of liquors, it has no means of keeping track of them.

"It has been my practice during my term of office never to give a certificate in regard to a liquor [Pg 617] to any one but the officers authorized to ask such a certificate. In other words, the only way a private person can get an analysis of liquor made by the State assayer is to take it to the chief of police of his town or city and make a complaint in regard to it; as the assayer is paid by the State for his work, it would obviously be wrong for him to do work which he might, have to revise in his official capacity.... I may perhaps be allowed to add a few words as to what is defined in this State as an intoxicating liquor. When the State assayer of liquors was first appointed he soon became convinced that some limit must be fixed to the allowable amount of alcohol contained in a liquor. After consultation this amount was fixed at three per cent by volume at 60° F. This law

remained in force several years. Soon after it was found that a large amount of beer was being made which contained about 3.5 per cent of alcohol. This was a palatable beer, and the venders gave the officers much trouble. The regular trade, who were selling lager beer and ale, and paying for the privilege, were also much opposed to its sale, and the Legislature was asked to reduce the limit to one per cent by volume. This at one stroke destroyed a large amount of illegitimate trade. The Massachusetts law, as it now stands, is that ale, porter, strong beer, lager beer, cider, all wines, and any beverage containing more than one per cent of alcohol, by volume, at 60° F., as well as distilled spirits, shall be deemed to be intoxicating liquor, within the meaning of the license provisions, and this section of the law has been decided by the Supreme Court of the Commonwealth to be constitutional.[A] The question is never raised now in the court as to whether a liquor is actually intoxicating; the only question being, Does it contain more than one per cent of alcohol? If it does (and as a matter of fact cases are very rarely brought in which the sample does not contain at least two per cent of alcohol), the court has no power except to convict, if it be proved that the article was kept for sale. The result of this law has been that the sale of beer, with the idea that it is possible to convince the court that it is not intoxicating, has entirely stopped. Some few attempts are made to produce a beverage that shall contain less than one per cent of alcohol. And several brands are on the market which, when cold, taste very well, but which contain only about 0.85 per cent of alcohol. Generally the only test made in regard to liquors is as to the amount of alcohol that they contain; or, rather, whether the amount of alcohol exceeds one per cent, that being the maximum amount that can be sold without a license. Such examination is generally made by distilling the liquor and determining the alcohol in the distillate. [Pg 618]

"The whiskies examined have in Massachusetts, as a rule, been free from any substance more injurious than the alcohol they contain. They have generally (as well as the other distilled liquors examined) been of standard strength—that is, they have contained about fifty per cent of alcohol, and as a rule have not given much over the amount of residue allowed by the Pharmacopœia. As you will see by the foregoing remarks, the provisions of the Massachusetts liquor law, so far as adulteration is concerned, are practically a dead letter. I have been repeatedly before the Legislature asking for such modifications of the law as would enable me to make an intelligent study of the subject; but it seems satisfied to allow the matter to stand as it now is. Several difficulties arise in regard to any enforcement of the law. One of these—that samples must be paid for, and there is no appropriation to pay for them—I have already pointed out. In the second place, the State Board of Health (which has full power to inspect liquors under the food act) has discovered that the chief adulteration is water in distilled liquors, and that this, together with a little burned sugar and sirup, is practically the only adulteration. Large amounts of rectified spirits are used in the preparation of whiskies for the market, where the whisky is used only as a flavoring material. But such manufactured whiskies meet the requirements of the Pharmacopœia better than the genuine article, being more free from the higher alcohols and ethers than a pure whisky. The only point in which they do not agree is that they are not three years old. But the only method for determining the age of a liquor that I am acquainted with, is the brand on the barrel. It certainly can not be determined by any chemical means."

But, with the exception of Massachusetts, where Mr. Sharpless points out clearly the reason why the law against adulteration is a dead letter, all the reports speak encouragingly. Michigan, Illinois, and Ohio believe that the operation of the provision will do genuine good. Says Food Commissioner Blackburn, of Michigan, "It is my opinion that this law has and will decrease drunkenness, for the reason that pure liquor will not create the unnatural appetite that compounded, adulterated, or artificially prepared liquors do."

The State of Washington sends no report. There is a provision in the South Carolina law providing that liquors shall be "pure"; but, as the State is the dispenser of liquors, the operation of this clause has not been considered exemplary for the purposes of this article. Mr. Lyman, in New York, thinks that sufficient time has not elapsed to fully pronounce as to the benefits of the law.

XI and XII. High License and Local Option.—Certainly the examination of these statutes and reports of their results in forty-nine States and Territories leaves it beyond question that so far the very best results have accompanied the combination of these two provisions. Perhaps the best example is in the largest of the communities to be affected—viz., in the State and city of New York. Here, by separating the plebiscitum or referendum into four local options—viz., (1) selling liquor to be drunk upon the premises where sold, (2) selling liquor not to be drunk upon the premises where sold, (3) selling liquor by apothecaries only on physician's prescription, (4) selling liquor by license granted to "hotel keepers" only—the result obtained has been, I think, precisely what I contended for in the paper of five years age, namely, the value of liquor has been recognized, and its sale provided for without denying its dangers as a temptation, or the disastrous effects of drunkenness. To use the exact words of the commissioner's report: "The tendency is to recognize the propriety of the sale of liquors by hotels and pharmacists in many communities where they will not, by their votes, approve the sale by saloons and groceries; and while there are now twenty less absolutely 'no-license' towns than when the law took effect, there are very many less saloons and groceries where liquors are dispensed." And this while not in any way compromising or dallying with the proposition which the prohibitionists and temperance societies insist upon (and which is all they have as a basis for their claims), viz., the consequences of intoxication and the public policy of its prevention. To show that, as a fact, an equivalent result has been reached in every State in the Union where high license and local option are united, would unduly tax these pages. But one or two prominent examples are of the [Pg 619]

paradoxical results—as gratifying as they are paradoxical—that the fewer the places where liquor is sold the larger the revenue to the State, and the less the drunkenness, may be cited. In the State of New York in two years of high license the reduction in selling places was 5,484; the increase of revenue to the State was $9,094,646.01; the decrease in the number of arrests was 22,689. In the city of New York alone the reduction in places was 1,204; the increase of revenue was $3,549,851.90; the decrease in the arrests for drunkenness was 3,044. Similar results are reported invariably as the fruit of high license elsewhere in the United States. In the city of Chicago, under an exceedingly high license, the reduction in one year was 200 in the number of saloons, while the increase of revenue was $1,250,000; and yet the decrease in the number of arrests was 1,217. Contrast this result with the condition of affairs in the triple-steel-barred prohibition State of Maine! Says an ex-Mayor of Portland: "I went into office perfectly free; I think I enforced the law impartially with all the vigor I could control.... I looked it all over to see [Pg 620] what I had accomplished; I found that I had driven out of the business one set of men, and another had come in worse than the first. I found that the young men were establishing club rooms. Not only did they become drinking places, but they brought in gambling and other vice. While I was driving liquor out of the ordinary shops I was driving it into houses and kitchens, where even children dealt in it.... I am sorry to say it, but the law makes perjury alarmingly common; it opens up ... an avenue for bribes.[B]

"The local authorities could not be trusted to enforce the law. The price of liquors has been lessened and the quality is worse.... To those who shunned the open bars the apothecary shops supplied liquor by the bottle as often as desired.... Then arose pocket peddlers, young men who loiter about the street supplying customers from the bottle with a drink known as splits—a concoction of the cheapest alcohol mixed with a dash of rum and coloring matter, which produces a dangerous form of intoxication.... At the city agency the question 'Medicine?' and the answer 'Yes,' was quite sufficient, and throngs of people were constantly waiting with flasks to be filled.... 'Bars,' 'Eating Houses' (so called because protected by the police), 'Kitchen Bars,' 'Pocket Peddlers,' 'Hotel Bars,' 'Apothecary Shops,' 'Bottling Houses,' 'Express Companies,' 'Clubs,' and the 'City Agency.'"

But all these, under the very eye of the late Hon. Neal Dow, were powerless to convince the Hon. Neal Dow that his policy was not a massive and monumental success, and to the end of his days the good old man delivered glowing eulogiums upon its exalted benefits to a suffering and liquor-ridden world!

Among the novel devices among the statutes of States classed as licensing sales of liquor (or which have rejected prohibition) may be mentioned the following: Apothecaries may sell without a license if they keep records of sales. Purchasers of liquor must make affidavit of the purpose for which they require the liquor. Physicians prescribing liquors must make affidavit that they are required by the case they are attending. Public officers who tolerate or refuse to prosecute are fined. Name of owner of premises where liquors are sold must be painted in large letters on outside window with the word "owner" added. A provision that any one may sell liquor, but that the Legislature may provide in any way it sees fit against "the evils resulting therefrom." No barmaids, or dancing, gambling, or oil paintings on premises where liquor is sold. The provisions [Pg 621] that eatables must or must not be sold where liquor is retailed are about numerically even. (It will be remembered that the New York ["Raines"] law at first abolished free lunches, but insisted that while one must not have food with his liquor on week days, he could not on Sundays have it without—the last provision still being enforced). Similarly, in some States, liquor dealers must not keep lodging houses, while in others they must. West Virginia says that a tavern or hotel must not be used as a liquor-selling establishment only, and that a refusal to give diet or lodging to any one demanding it will forfeit its license to sell liquor. One State (Colorado) recognizes the so-called "gold-cure," and authorizes "the person most interested," or the county, to send habitual drunkards at county expense to "any respectable gold-cure institute." In Illinois a drunkard is by law a vagrant, and drunkenness is a cause for divorce. In Louisiana the excise man who makes an erroneous estimate of the amount of business done (Louisiana regulates the liquor business according to sales only, disclaiming any preventive or reformatory object) is removable from office. In Tennessee applicants for license must state the amount of business they intend to do. Kentucky regulates the price of liquors sold, being the only American State so doing (except that South Carolina says that the price of a potion shall not be "more than fifty per cent above," or if used as a medicine "more than ten per cent above," the cost thereof to the seller—rather a difficult matter to approximate). Arkansas prohibits sales within three miles of a church, schoolhouse, or academy. The sales of liquor to Indians is prohibited, and the exclusive right of army officers to purchase it is conserved, at the proper frontiers. Texas inserts in her statutes a fine for keeping a "blind tiger" (defined to be a place "where intoxicating liquors are sold by any device whereby the party selling or delivering the same is concealed from the person buying or to whom the same is delivered"). And, in Kansas, twenty-five reputable women must unite with twenty-five reputable men in applying for a license to sell liquor. No State or Territory mentions the size or quantity of liquor to be sold at any price, as is the European custom.

It would seem, therefore, that, with the exception of the State of Maine alone, all the American Commonwealths are gradually harking back to the standpoint of the earliest liquor laws. Moderation (temperance) in drinking was the public policy. Leaving out the act of the British Parliament, in the year 1735 (which gave Governor Oglethorpe the right to prohibit the importation of ardent spirits into Georgia, which was not a measure to prevent intoxication, but to give a monopoly to Governor Oglethorpe), the first temperance association was that founded by Dr. Rush; and it is related that the venerable president, upon being elected, rose with a glass [Pg 622]

of brandy in his hand and gave the toast: "Gentlemen, fill your glasses. Let us show the world that we know how to drink in moderation."

To sum it all up. Why, since we can not set out with a club or a headsman's axe to reform mankind; since there are substantial rights to adjust and innocent parties to protect, why is not the proposition to prevent by law the exposure of adulterated liquors for sale as beverages the best so far suggested? Is there another which at the same time is constitutional, equitable, peaceable, and so conservative of the public safety, which creates no law-breaking class out of honest citizens, sheds no blood (as blood was shed in South Carolina in 1875 because men of Anglo-Saxon breed could not be readily made to concede that a man's house was not his castle), and which imports no new doctrine into American policy?

I, for one, believe that, with it, the solution of the drink problem would be in sight. High license and personal damage laws are two thirds of it. If a man desires to sell liquor let him pay one or two thousand dollars, or other substantial sum of money, to the school or the police or the poor fund of his neighborhood. Let him be liable in damages, as are common carriers or any others who deal in conveniences or commodities in which there is possible risk to the community, for what is injured by his operations. As to the remaining third of the remedy: the sole objections to local option (viz., that it may be abused at the polls, where the total-abstinence interest might be as capable of a wrong use of money or of other undue influence as the liquor interest, or that it might be inconvenient to the public) are fully met by making adulteration impossible and providing for a compulsory, rigid, and universal inspection of liquors exposed for sale as beverages. And then, besides, it will be unnecessary to burn down our village to roast our pig.

A curious experiment, at Carnot, in the Congo, is described in the journal *Le Chasseur Français* in the shape of the collection and raising of the animals which the natives bring in from the bush. Large numbers have been taken in. Some of the animals die, some escape. Among those that have stayed are two wild hogs, which roam at liberty, eat from the hand, and follow like dogs. There are a jackal, mangoustes, small rodents, a company of monkeys, and a young tiger cat, "which is the lawgiver to the others." None of the animals is confined, except that the jackal is tied, though he follows; but it has been necessary to separate the guinea-pigs from the rest. A large monkey has assumed the office of shepherd's dog, and takes care of the sheep. There are also dogs —"good company, but not of much value"—eight horses, with a colt that will eat at the table if allowed to; forty horned cattle, which are multiplying; and asses, which are also increasing.

HAWK LURES.

[Pg 623]

By W. E. CRAM.

It is a pretty well known fact among hunters and students of Nature generally that most flesh-eating animals, whether in fur or feathers, can be more readily called by imitating the squeaking of mice than in any other way, and proves conclusively enough that these creatures depend largely on the sense of hearing in their struggle for a livelihood.

My first practical illustration of this fact occurred so long ago that it seems almost like ancient history.

For some reason or other one summer's vacation began some six hours earlier than was expected, and although apparently insignificant enough when compared with the entire three months that were to follow, that extra half holiday was probably valued out of all due proportion by the pupils, owing to its unexpectedness, and for that reason, perhaps, more than any other, is still recalled by one at least as distinctly as ever.

One of the boys had a contrivance known as a bird-call—a simple instrument of wood and some soft metal—that, on being turned, produced noises that bore not the slightest resemblance to the cries of any bird, but were not entirely unlike the squeaking of a mouse in distress.

Some of us were more or less skeptical as to its powers of attracting birds, and decided to put it to the test. So we loafed about under the apple trees working the thing for all it was worth, but no birds came about us, and the bird-call was in danger of being thrown away in disgrace, when a small brown beast appeared from under a pile of boards and came running toward us, till suddenly scenting danger it disappeared. There was some discussion at the time whether it was a rat, chipmunk, or red squirrel; none had seen it very clearly or could give any very definite description of it, but in all probability it was a weasel attracted by what it supposed to be the voice of its accustomed prey.

About halfway between that time and the present a young long-eared owl became an important member of our family, a most original and amusing bird, without the slightest fear of any of us. [Pg 624]
He was christened Mephistopheles.

MEPHISTOPHELES.

As he was learning to fly, it seemed advisable that he should be taught to come at our call to be fed; and accordingly one day, by way of experiment, I held out a piece of meat to him and squeaked like a mouse. There was a rush of downy pinions, and his talons were neatly arranged about my lips. He was evidently a good deal excited, but was careful not to hurt me any more than was absolutely necessary in order to secure the mouse which he fancied he had cornered in my mouth. I was just reckless enough to try it again on the following day as he perched on the low branch of an apple tree. His power of detecting the direction whence the sound came proved fully equal to the occasion, and the result was the same as in the first instance. The end of Mephisto was tragic in the extreme. He was sometimes fastened by a linen cord six or eight feet long and as large as a lead pencil, which when not in use was hung across the perch where he slept. Evidently he felt that the food furnished him was too effeminate, for the powerful stomachs of all birds of prey require a certain amount of such indigestible matter as hair, feathers, or bone to keep them in good condition. So one ill-fated night, in looking about for something that would answer that purpose, he unfortunately hit upon the cord as a substitute, and proceeded to swallow one end of it. The first few feet must have fully satisfied his cravings, but there was the rest to be disposed of, and the most feasible method that presented itself naturally was to go on swallowing. The thing must have grown extremely dry and distasteful as inch after inch disappeared, still there was nothing for it but to go on, which he did. In the morning he was strangely silent and gloomy, with hardly a foot of cord protruding from his beak. Any attempt on our part to remove the cord proved not only fruitless but painful, so it was cut off close to his [Pg 625] beak, whereupon he swallowed what remained in his mouth and looked relieved. His meal proved too much for him, however, and he only lived a few days after it.

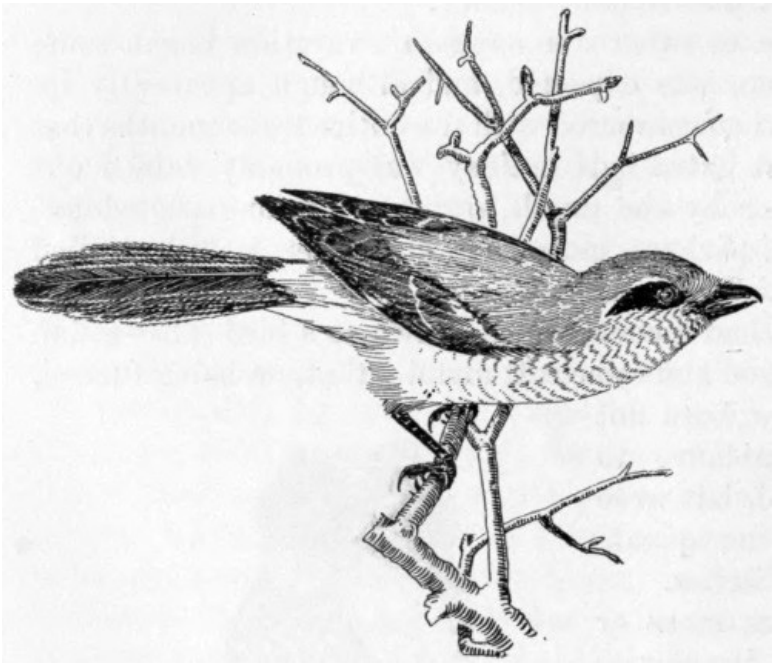
The different species of hawks vary greatly as regards the readiness with which they may be called—most of them, in fact, absolutely refusing to be lured in any way. As might be expected from its habits, the marsh hawk is the most susceptible, and in still weather may be brought from a distance of one hundred yards or more. At the first squeak he wheels about in the air and comes directly toward you with most unexpected impetuosity and swiftness. His discomposure on discovering the fraud is usually most amusing, as he stops short in mid air, with wings and legs asprawl, and turning his back on you, hurries off in feverish haste.

The red-tailed and red-shouldered hawks are also easily attracted in this manner, but the rough-legged hawks, although they live almost entirely on mice, are not so readily deceived, though this is undoubtedly owing more to their extreme wariness than to any dullness of hearing on their part.

None of the falcons or short-winged hawks pay the slightest attention to the most lifelike squeaking, so that evidently when they do deign to attack such ignoble quarry as a field mouse they depend more on their eyesight than on the sense of hearing. One still October day the red-tailed hawks were soaring and screaming above the pines beneath which I was hidden; by mimicking their cries I enticed one of them nearer and nearer, till at last he closed his wings and alighted bolt upright on a dead stump not fifty feet away. Changing my tactics, I endeavored to convince the hawk that a family quarrel was in progress among the mice in the thick clump of pines below him, and was rewarded by seeing him turn first one keen eye and then the other on my place of concealment; then he leaned forward and crouched catlike on his perch, half opening his broad wings and shifting his feet about in his impatience. But he evidently desired more positive evidence than his ears could give him before making the final dash for his breakfast. There was a slender dead branch beside me, and cautiously taking this, I shoved it slowly along under the carpet of pine needles out into the opening, as one sometimes amuses a kitten with a

pencil beneath the tablecloth. The instant the hawk's eye caught the movement of the pine needles he descended with a whir almost to the point of seizing the stick in his claws; then, catching sight for the first time of the author of his disappointment, he rose flapping into the air, shrieking out his anger to the skies. If we had been more evenly matched in weight, I fear I should have suffered the most extreme punishment for my deceit.

The northern shrike is generally given the credit of living to a certain extent on mice, but the only evidence pointing in that direction that I have ever seen is that, like the mouse-eating hawks and owls, he comes quickly enough to the call; nor is there any need of concealment when dealing with this bird. He will come fearlessly within a few yards of you, hopping and flying from twig to twig, with his long tail continually moving up and down in his excitement, apparently impelled more by motives of curiosity than hunger. [Pg 626]



Northern Shrike.

But when it comes to calling up to you such shy creatures as the mink or fox the utmost caution is necessary, for although lacking the keenness of eyesight possessed by birds, the acuteness of their sense of smell and hearing is something marvelous; yet when conditions are favorable they may sometimes be brought quite close and studied to advantage.

Standing one day beside an old tumble-down rail fence that ran along between the woods and salt marshes, half hidden in the brambles and tall grass, I caught the merest glimpse of a mink slipping along between the bottom rails. As he was evidently unaware of my presence, I determined to see more of him, and squeaked in as mouselike a manner as possible, and quickly had the satisfaction of seeing him make his appearance on a projecting stake much nearer than when I had first seen him. Stretching himself along the stake, he appeared to listen and look in my direction, but although I was standing in plain sight on the edge of the marsh hardly a rod away, the fact that he was obliged to look directly into the sun made it quite impossible for him to clearly distinguish what he saw. At the end of a few moments he dropped into the grass and started in my direction, the trembling grass blades clearly indicating his progress as he approached nearer and nearer, until almost at my feet he vanished, and, in spite of the most patient waiting on my part, absolutely refused to show himself again.

The last instance of the kind that has come under my notice happened on a clear moonlight night as I was wheeling along a lonely road between old apple orchards. Some part of the machine squeaked at intervals in a way that might possibly have been mistaken for a mouse. At all events, an owl appeared to have been deceived thereby, for he came flapping out of the orchard and flew alongside, at times coming quite close and again swinging off into the shadow, till at last, convinced that his supper lay not in that direction, he put on fresh speed and left me far behind. Perhaps he would have done as he did if the bicycle had not squeaked, but, judging from his behavior, I am inclined to think otherwise.

THE MILK SUPPLY OF CITIES. [Pg 627]

By Prof. H. W. CONN.

The ever-growing needs of civilized communities constantly demand new methods. At the time when the streets of Boston may have been the actual cow paths which we are sometimes told they represent, the milk problem did not exist. Every farmer owned his cows, and if some of the people in the small communities did not happen to own a cow there were plenty of these animals in their neighborhood to furnish them with milk. But as our cities have grown the farmer has

been pushed back farther and farther into the country, while the demand for milk in the cities has been constantly increasing. The man of the city can no longer call upon his neighbor for milk, but must depend upon some unknown farmer living perhaps many miles away. In England the farmer still lives somewhat close to the city, and as soon as one passes the city limits he begins to find the fields and meadows covered with cows. London and Berlin draw their immense milk supply chiefly from a radius of seventy-five miles. In the United States, however, the farmer does not live so close to the cities, and the demand for milk is even greater than in Europe. Our cities must therefore depend upon a wider range of territory. New York draws its milk from a radius of some three hundred miles. It is easy to see that with such conditions many new problems have arisen. These problems, so far as they concern the obtaining of a sufficient quantity and the transportation and preservation of the milk, have, from a business standpoint, been pretty satisfactorily solved. The milk-supply companies succeed in obtaining a sufficient supply at all seasons of the year, and get it into the city in such a manner that when delivered to the consumer, even though it be forty-eight hours old, it is in tolerably good condition. But it is beginning to appear that the problem, as concerns the consumer, is a somewhat serious one, and that this problem has not yet been solved, nor is it likely to be solved unless the consumer himself takes a direct interest in it.

The problem of the milk supply in the smaller cities is quite different from that of our larger cities. In the smaller cities, even those with populations of one hundred thousand, there may be commonly found a number of milkmen who bring into the city the milk from their own farms and personally distribute it. Such a business is a small one, and the dealer and the producer may be held directly responsible for the quality of the milk. In large cities, however, the business is very different. The individual milk dealer who brings in milk from his own farm has almost disappeared, and his place is supplied by the milk-supply companies that control the product [Pg 628] from hundreds of farms and regulate the large part of the milk which the city consumes. These companies send milk trains into the country in all directions, and collect milk from thousands of farms. The milk is brought into the city in cars in which it is cooled by ice. It may be already many hours old when it reaches the city. It is taken from the cars, and the milk from many different sources is mixed in large mixers to insure greater uniformity. It is again packed in ice, and remains thus until the individual dealer is ready to put it into his cart and distribute it through the city to the customer.

As a result of this the customer no longer knows whence his milk comes. If he is a citizen of New York, he may receive milk from his own State, or Connecticut, or Pennsylvania, or New Jersey. It may come from a thrifty farmer, or from a slovenly, filthy farm, or, for all that the consumer knows, it may come in part from a farm where there is a contagious epidemic. There is no method of tracing responsibility, no method of even knowing the source of any lot of milk. One morning we may receive milk from northern New York, and the next from New Jersey. One morning, for all he knows, it may come from a model dairy farm, and the next from the most unhygienic surroundings imaginable.

But this is to a certain extent true of other foods. We can not tell where our flour or meat comes from, or our apples or sugar. Why should we be more disturbed over milk than other foods? Indeed, until recently we have had no especial interest in the milk problem, and have taken milk as it has been offered without question, except as to its being pure milk unadulterated with water. But the rapid discoveries of bacteriology, which have shown milk to be such a good locality for bacterial growth, have been raising some very significant questions. We have been told of the countless millions of bacteria which we have been drinking daily. This has somewhat disturbed us, and no sooner have we become reconciled to this idea than we are told of the great amount of filth that finds its way into milk—two hundred pounds of cow dung being the daily ration of New York city, some one tells us. The matter appears more serious still when we are told by the public press that there are more bacteria in city milk than in city sewage, and are informed of the epidemics of typhoid which are distributed by milk, or of the prevalence of tubercle bacteria in this food product. We become suspicious of the milk supply and hesitate to use this food product or to give it to our children.

Naturally, the people in small communities feel somewhat more at ease in the matter since they know their milk producer and can hold him responsible. But it is questionable whether the milk [Pg 629] supply of the large city is not more reliable. The milk supply in the city is handled by organizations, and these, on the whole, are rather more likely to exercise care in the treatment of the milk than are the small dealers. The advantage of handling the matter through companies is well shown in many European cities. In the large cities of England and the continent the milk business is commonly handled by concerns that distribute great quantities daily. Now, many of these companies deal with the subject in a very intelligent manner. They exercise a very considerable control over the individual dairy farms. Some of them keep inspectors traveling constantly among the farms, spending $10,000 to $15,000 yearly in such inspections. They will receive no milk from a farm until after an inspector has visited it and looked into the hygienic conditions of the dairy, even sometimes going so far as to make an analysis of the water used in the dairy. Only after such inspection has been declared favorable is the milk received in the city. These inspections are repeated monthly. The appearance of a contagious disease on the farm is noted at once and the milk no longer received, although still paid for. These companies employ chemists and bacteriologists to study the character of the milk received. They educate their men into their business, and consequently employ more intelligent help than small concerns can. They can furnish a more uniform product than can be expected of smaller dealers. They soon acquire a reputation for their milk, which they are very careful to preserve. Such firms can exercise a much

more satisfactory control over the individual farmer than can even public statute, since, with their systems of inspection, it is possible to have an accurate knowledge of the actual conditions under which the milk is produced. It is plainly within the power of firms dealing in large quantities to control the character of its milk more accurately than can small dealers.

Results, too, appear on the whole in favor of the large dealers. In the cities where there is a system of rigid milk inspection it is comparatively seldom that the milk furnished by such companies is found below the standard. This milk is kept up to the standard, and the companies having a chemical laboratory and having milk from many sources can keep the quality of the milk much more uniform than can a dealer whose supply comes from a single farm. The milk inspectors usually find that it is the small dealers that fail to meet the standard. Moreover, it is a fact that where epidemics have been traced to milk it has always been in communities where individual milkmen bring in milk from one or two dairies and distribute it personally. All the epidemics of typhoid that have been definitely traced to milk have been in small communities, [Pg 630] and none traced to the milk of large dealers. It is true that it would be difficult or impossible to trace to the milk a typhoid epidemic which might occur in a large city. No one is likely to receive the milk from the same source for two days in succession, and the mixing which the milk receives in the receiving station entirely obliterates the individual source. If there should be some milk brought to the city which contained typhoid bacteria it would be impossible to determine the fact, for such milk, after mixing, would be thoroughly scattered beyond any possibility of following it. We may, then, question somewhat the significance of the fact, but it certainly is true that while serious epidemics have been caused by milk in smaller cities no such instance has occurred in the large cities, or been traced to the milk furnished by companies that handle it in considerable amounts. It would seem that if milk has ever been the cause of such diseases in large cities there ought to have been some evidence of the fact obtained.

It is probable, therefore, that the small community can hardly feel itself any better off in regard to the milk supply than the larger city. It is, of course, easier to trace responsibility for bad milk if we know where it comes from, but it is less likely to be very bad if it comes from a large number of sources and is thoroughly mixed. The milk in the large city is perhaps forty-eight hours old when it is received by the consumer. But it has been kept on ice, has perhaps been filtered, and many of its bacteria may have been killed by the long-continued cold temperature. So far as concerns the bacteria question, our milk which is thus two days old, appears to be actually superior to milk delivered in European cities, which is only a few hours old. The free use of ice in our milk car produces a more favorable result than the more rapid handling which the milk receives in Europe. The milk company controlling a large territory, with great resources at its command, can put into practice rules which even public statute can not enforce, and which the individual farmer will rarely do by himself. One who is acquainted with the methods of handling milk in our cities finds that the companies are each year improving their methods, and that the milk is in most places becoming more reliable. The proper solution of the milk supply for our communities is in the formation of large companies, provided they are managed partly for the benefit of the public and not wholly for money-making.

There is little question that the public has become somewhat suspicious of milk, and that many hesitate to drink it as freely as in earlier years. This suspicion is more pronounced in Europe than in the United States. Upon the continent of Europe the amount of milk which is used raw is really [Pg 631] very small, and apparently its use in this condition is destined to cease. The younger generation of physicians are now being taught that raw milk is a dangerous food, and in some countries even the children in the schools are being taught that it is not safe to drink raw milk. Such teaching can have only one result, and that is the reduction in the amount of milk consumed. Much less milk is used in Europe than in this country. It is used for tea or coffee or for cooking, and of course for infant feeding, but for any one to drink milk as we do in this country is certainly a rarity. The suspicion under which milk has been placed has decreased its use.

The dangers which are feared in milk are of course connected with the distribution of disease. Most persons who thus hesitate to use milk have simply a vague fear, without knowing just what is to be feared. When we put together all the facts in our possession we find that there is good reason for believing that milk is sometimes concerned in the distribution of the following well-known diseases and some obscure ones: The first is *tuberculosis*, which is a disease attacking the cow, and, if located in the mammary gland, may infect the milk with tubercle bacilli, and may subsequently produce the disease in the person who drinks the milk. It should be stated, however, that there is good reason for believing that the danger from this source has been overrated. Second, we have *diphtheria*, which apparently may also attack the cow. The diphtheria germs may get into the milk from the cow, and they certainly do get into the milk occasionally from secondary sources. *Scarlet fever* apparently is distributed by milk, though whether this disease may come from the cow or only by secondary contamination of the milk is not yet positively settled. *Typhoid fever* has in a large number of cases been traced to the milk supply. This disease, however, does not occur in the cow, and the germs always get into the milk from a secondary source, such as water or contact with a person who has the disease. *Cholera* may be distributed by milk, but this is of course of little importance. Of these disease bacteria, the tubercle bacillus probably never grows in milk, while the typhoid and diphtheria germs do. The most common of all troubles attributed to milk are those somewhat obscure *intestinal diseases* which attack people especially in the summer months, and are particularly common among children. Prominent among these stands *cholera infantum*. These latter troubles, according to our present knowledge, are not produced by distinct species of bacteria finding entrance into the body and growing there, as are the other diseases mentioned. They appear to be produced by

bacterial poisons which are in the milk. The bacteria—probably several different varieties—grow in the milk and there give rise to certain poisonous products, and these, when taken into the stomach, produce the diarrhœal diseases referred to. [Pg 632]

The question of more importance is, however, as to the extent of the danger from such causes. This question is much like the famous one of how large is a piece of chalk. There is danger in everything, even in drinking water and breathing air. Is the danger from milk so great as to suggest that we should give up our habit of drinking milk as they have largely done in Europe, or is this danger so slight that we can well afford to neglect it? We can not avoid all sources of disease even if we would. To do this we should need to shut ourselves up in a box, breathe nothing but sterilized air, drink nothing but sterilized water, and come in contact with no other person, to say nothing of wearing sterilized clothes. Such a method will produce physical weakness rather than vigor. We have learned in the last few years that the proper way of avoiding disease is rather by preparing ourselves to resist it rather than try to avoid all contact with possible disease germs. The question is significant, then, whether the danger from milk is so great that we should use every means of avoiding it; or is it one of the slight dangers which we may best class with the everyday incidents against which our proper guard should be simply vigorous health?

It is impossible to say how great is the liability of contracting disease from milk. Sometimes the subject looms up before us in gigantic proportions. When our papers are describing the occurrence of hundreds of cases of typhoid fever in a city, all traced to a milk supply, the seriousness of the problem is very apparent, and very likely we stop drinking milk for a season. But when, on the other hand, we remember the millions of people that are drinking milk daily without injury, and remember that our forefathers have done the same, we grow graver and begin again our old custom. No one can, indeed, pretend to say how great the danger is. That it is greater than that from drinking water is pretty clear. That it is less than that of riding in the cars is probably equally true. That it is greater in a small community than a large one seems probable, and that there is a greater likelihood of its being serious where the milk comes from a single source than where it passes through the hands of a milk-supply company appears to the author to be quite sure.

In his relation to this problem each person must decide for himself. We do not cease to ride in the cars because there is danger here, nor do the innumerable accidents from bicycling deter us from this pleasure. Ought we to give up milk because of an occasional instance of disease? It might be possible to give advice to use milk freely, looking upon the danger as a slight one and one of the unavoidable dangers of living, but if such advice is given some one will instantly declare it bad advice. It might be possible to advise boiling all milk before drinking, and again some authority would say that this is unnecessary and bad. Personally, the author, though living in a small community, uses raw milk with perfect freedom, but would regard it as unwise to allow young children, especially infants, to use it in this way. [Pg 633]

As already stated, the agitation over the milk supply is greater in Europe than in this country. While in England milk is used much as in this country, on the continent really little milk is drunk raw, and there is a growing demand for some means which shall deprive milk of the suspicions attached to it. This demand has been rapidly growing in recent years, and has resulted in the appearance of two new industries. These are the preparation of *sterilized* and *Pasteurized* milk. Neither of these industries has as yet developed much in the United States, although in our larger cities beginnings are being made along similar lines.

Sterilized milk has been used for many years. Long ago our doctors learned to recommend, for invalids, that milk should be boiled before drinking. This was done before the matter of its relation to bacteria was understood, and when physicians simply conceived that the boiling rendered the milk more digestible. From being used by invalids it came to be suggested in feeding infants, and then, after the relation of milk to possible disease germs had been understood, the general sterilization of milk was widely recommended. The process of sterilization of milk has not taken much of a hold upon the people of this country as yet, nor has it in England. In continental Europe, especially in northern countries, where the amount of tuberculosis is very large, it has made rapid headway, and now in most of the cities sterilized milk can be bought on the streets just as easily as ordinary milk.

In sterilizing milk as it is done in Europe the destruction of the disease germs is not the only purpose. An object of perhaps equal weight is to produce a milk that will keep. There are many circumstances where it is desirable to carry milk for long distances, and to lay in a supply to last many days or even weeks. Under these circumstances sterilization is resorted to, since it preserves the milk.

There are various methods of sterilizing milk. The simplest, and doubtless the most common, is simply the boiling of the milk. This can easily be done by any one at home, and is, beyond question, very widely resorted to. But where the sterilization is to be performed by a public-supply company, boiling is not satisfactory, since the milk, although it will keep some time, is not indefinitely preserved. The common method used is heating with superheated steam. The milk is placed in bottles of special device, holding about a pint or a quart, and are placed, hundreds at a time, in a large chamber which can be hermetically sealed and then filled with steam under pressure. Here the temperature rises to 102° to 106° C. (216° to 220° F.), and is retained here for some little time. This high heat is supposed to kill all the living bacteria that may be in the milk, even the resisting spores being commonly destroyed. While the milk is still in this [Pg 634]

apparatus, and before the chamber is opened, the bottles are sealed by a mechanical contrivance and then allowed to cool. After this they are taken out of the sterilizer, and are ready for distribution. The milk thus treated is sometimes pure white, although frequently it has acquired a brownish color, which is not enticing to one accustomed to ordinary milk. Moreover, it has a taste of cooked milk, which is to some people very unpleasant. But when the method is successful the milk contains no living bacteria, and may now be kept indefinitely without further change. It may be shipped to all parts of the world, and whenever opened it will be found still sweet. The process is evidently equivalent to the canning of fruit or meat, only more difficult because the milk commonly contains many resisting spores.

Such sterilized milk can be bought almost anywhere in Europe, and there is undoubtedly a growing demand for it. Where this or other sterilized milk is used it is claimed that very favorable results follow. Careful statistics have been collected as to the number of deaths among infants from diarrhœal diseases, and it is found that in some cities the deaths from infants fed upon raw milk are nearly three times as great as among those fed upon sterilized milk. Of course, no typhoid epidemics can ever be traced to such milk, and in general its use seems to meet with decided favor.

There are, however, some serious objections to this method of treating milk, which have been and probably will continue to be sufficient to prevent its wide extension. The first is that such milk appears to be slightly less digestible than raw milk. Over this matter, however, there has been and still is a great diversity of opinion, and many claim that there is really no difference in the digestibility. It is a matter of comparatively little importance, however, at least for adults and healthy children, for the sterilized milk can be digested, and the slight difference in ease of digestion probably has little significance unless it be for weakly individuals. Secondly, the taste of the sterilized milk is that of boiled milk, and this is rather unpleasant to most people. Probably a majority of our people, if called upon to drink sterilized milk or none at all, would prefer to give it [Pg 635] up entirely. This is really an almost insurmountable obstacle to the wide extension of the use of sterilized milk, at least for the present generation. Those who have accustomed themselves to the taste of raw milk will not drink sterilized milk, and, if they do not dare to drink it raw, will not drink it at all. If infants are brought up on sterilized milk the next generation may look upon the matter differently, since the taste can be cultivated.

The third objection to sterilized milk is its cost, which pretty effectually prevents its wide use. Here is probably the real reason why the sterilized-milk industry has not extended more rapidly than it has. The cost of the milk that has been subjected to the treatment above described is considerably above that of ordinary milk, and the size of the pocketbook is commonly a matter outweighing, with most people, even matters of health. When raw milk can be purchased at half the price of sterilized milk, or even for a cent or two less, it will be purchased almost uniformly by the bulk of people, rather than the more expensive sterilized milk. Thus it happens that, in spite of the fact that sterilized milk can be purchased easily in most European cities, the business is not a large one. Probably not one quart of sterilized milk is sold to a hundred quarts of raw milk, even in cities where the business is best developed.

There are some who think that this method of treating milk is soon to be recognized as a necessity, and that it will be shortly regarded as improper to drink raw milk as it is to eat raw pork. But the business has grown rather slowly. Most people prefer to purchase their milk raw at a cheaper price and then boil it themselves, if they do not forget it. There is, moreover, one rather serious criticism that is made against this sterilized milk. Even with the high temperature that is used, it is impossible to be sure that all bacteria spores are destroyed. In most cases they are killed, but occasionally, and indeed not infrequently, a lot of milk will contain resisting spores that the heat does not destroy. These few spores that are left may become serious, far more so than the bacteria in raw milk. After sterilization they begin to grow, and, since this milk is very commonly kept for many days before it is used, these germs have a chance to become very abundant in the milk and to produce profound chemical changes therein, in some cases actually developing poisons. The changes that thus occur may be such as to escape notice with the eye, since they do not curdle the milk, and they may even fail to affect the taste of the milk. Such milk is to all appearances good, and would be given to infants without hesitation. If it did contain the injurious products thus referred to the results would be serious. Some bacteriologists are [Pg 636] convinced that not a few cases of serious sickness have been produced in this way. When the milk is used shortly after the sterilization this matter is of no importance, since the bacteria spores grow slowly. But sterilized milk is supposed to keep indefinitely, and is therefore likely to be preserved some time before using, giving abundant opportunity for these spores to grow.

For these several reasons there is developing a different method of dealing with the problem. It is the well-known process of *Pasteurization*. But although the process has been known for several years, its application to the milk business on a large scale is quite new. Pasteurization consists in heating the milk to a temperature of only about 68° to 85° C. (165° to 185° F.), leaving it at this temperature for a short time, and then rapidly cooling. The length of time required depends upon the temperature used, being, of course, shortest for the higher temperature, but it varies from some two minutes to half an hour. This moderate heat does not necessarily produce the cooked taste nor, as we shall see, does it involve an expense which need raise the price. The temperature, however, is not sufficient to destroy all bacteria, and for this reason is looked upon with disfavor by those who feel that what is needed is an absolute destruction of all bacteria. The Germans, who like to do things thoroughly, do not take readily to Pasteurization, and there are others besides Germans who insist that this treatment does not make the milk safe. But if one is

looking for practical possibilities rather than theoretical success, there is perhaps at present more to be said in favor of Pasteurization than sterilization.

Pasteurization is found to be sufficient to destroy all the strictly pathogenic bacteria that are likely to be in milk. The germs of diphtheria and typhoid are killed, and even the tubercle bacillus is rendered innocuous by a few moments at a temperature of 75° C. The resisting spores above mentioned are of course not destroyed, and many other bacteria are left uninjured. But the bacteria which escape the heat are not strictly pathogenic, and do not grow in the body. If they produce any injury to the drinker it is because they grow in the milk and produce injurious chemical products there. They are only dangerous, therefore, after they have had an opportunity to grow in the milk for some time. This opportunity they do have, as we have seen, in sterilized milk, but they do not have the opportunity in Pasteurized milk. Pasteurized milk is not designed for keeping, and those who use it know that while the strictly pathogenic bacteria are killed the milk will not keep. It will remain sweet a little longer than raw milk, but it must be used at once. It must be treated just like fresh milk. Under these conditions the bacteria do not commonly have [Pg 637] an opportunity of growing sufficiently to produce their poisonous products before the milk is consumed. Practically, then, these bacteria that resist the moderate heat of Pasteurization are of no serious importance in connection with the healthfulness of milk. Pasteurized milk has been deprived of all its strictly pathogenic bacteria, and the germs still left will commonly have no opportunity to grow very much before the milk is consumed. It is therefore the confident belief of many that Pasteurization is actually a safer method of treating milk than sterilization. Moreover, the results appear to be equally favorable, for Pasteurization is claimed to produce an effect upon diarrhœal diseases equal to that of sterilization.

But the most important argument for Pasteurization seems to be that it is really practical, and can be introduced upon a scale vastly more extended than can sterilized milk. The practice of Pasteurizing milk has doubtless been followed not a little by private families, but from the very outset it has appeared that the proper method of dealing with the matter is to treat the milk at a general distributing center, rather than to depend upon the consumer to do it. Not a few devices have been suggested for accomplishing the purpose satisfactorily and rapidly. The machines invented are planned upon two different principles. In one plan the milk is placed in some large vessel holding many gallons and is here heated, commonly by steam coils. It is allowed to remain here at the desired temperature for twenty minutes to half an hour, and is then cooled. This method is necessarily slow—so slow, indeed, that it is impractical for use where large amounts of milk must be treated rapidly for general distribution. It probably could not be used for the milk supply of a city. The other method is called that of continuous flow. Here the milk is allowed to flow continuously over a heated surface, which brings it quickly to the desired temperature. It is kept hot for only a short time, however, and it then flows over a cooled surface, where the temperature is brought down again and the milk is finally delivered from the machine in a continuous stream of cooled milk. Great objections have been urged against this process, from the fact that it is not thorough. The milk is retained at the high temperature for such a short time that many of the bacteria are not killed. The Pasteurization is decidedly less thorough than by the other method. But here, again, before condemning the process it is necessary to consider its purpose. If it is to destroy all the bacteria, or as large a number of them as is possible, it is of course unsatisfactory. If, however, the purpose is to treat the milk cheaply and rapidly in such a manner as to remove the danger of disease distribution through, the milk supply, it would appear [Pg 638] that such a method is perhaps satisfactory.

So far as can be determined, this method is efficient in destroying pathogenic bacteria. Its efficiency is of course dependent upon the length of time that the milk is retained at the high temperature, and this can be regulated by the rate of the flow of the milk through the machine. All evidence we have seems to point to the conclusion that a temperature of 75° C., continued for a few minutes only, so far destroys or weakens the pathogenic bacteria which are liable to be found in milk that they need not subsequently be feared as producing disease. Of course, there are pathogenic bacteria that are not destroyed by this temperature, but they are not likely to occur in milk. The germs of typhoid, diphtheria, and tuberculosis are probably rendered harmless by such treatment, and these are the chief pathogenic bacteria of milk. Moreover, the other bacteria are very greatly decreased in numbers, so that the dangers of intestinal troubles are at least much reduced. In hospitals where Pasteurization has been adopted the results are as favorable as with sterilization.

The great value of this plan is, however, that it is practical on a large scale. In Copenhagen it has been in practice for some three years very extensively. In Denmark the amount of tuberculosis among cows is very great, somewhat more than half the animals suffering from this disease. As a result the public milk supply is regarded with more suspicion than in countries where the disease is less. It is everywhere recommended that the milk be always boiled before using, but the bother of treating the milk thus daily makes people unwilling to do it, and it is doubtful whether the practice is as common as the physicians think necessary. Some three years ago a company was organized to meet the public demand for safe milk, and it has adopted plans by which it furnishes Pasteurized milk on a scale as extensive as that of the ordinary milk-supply companies. The company has devised and manufactured two large machines which receive the milk, Pasteurize it, and cool it in a constant stream, and are capable of treating two thousand quarts an hour. The milk received by the company is tested chemically and filtered, and then allowed to pass through one of these large machines. After this it is placed in glass bottles and sealed with the company's seal. The heating is done by steam, and the cooling by brine cooled by an ammonia cooling machine. The greatest care is taken in cleaning and sterilizing the bottles, an enormous chamber

some twenty feet long and six feet in diameter being used for a sterilizer. Into this the washed bottles are placed, the chamber hermetically closed, and then superheated steam is turned in upon them. Everything connected with the establishment is conducted with the greatest attention to cleanliness, and upon a very large scale. The bottled milk is subsequently distributed in ordinary milk carts. A bacteriologist is constantly testing the efficiency of the machines by bacteriological examinations of the Pasteurized milk. [Pg 639]

The most important feature in this undertaking is that the company furnishes the city with milk at the same price as that furnished by the other companies without Pasteurization. It seems strange that this can be done, for the Pasteurization of course costs something. But the explanation is essentially that heat is cheaper than cold. Because of the subsequent Pasteurization this company does not feel it necessary to demand that the milk should reach them in as cool a condition as is required by the other companies. While their business rivals insist that they shall receive milk not warmer than 4° C., this Pasteurizing company receives it as warm as 10° C., and this saving in the cooling largely pays for the Pasteurization. The mechanical bottling enables them to employ a cheaper grade of help than is necessary when the milk is peddled in carts.

The results of this endeavor to furnish safe milk are in quite decided contrast to those connected with sterilized milk. Sterilized milk has now been on the market for quite a number of years, but, in spite of the fact that it can be readily bought in most cities, the actual business is small. The largest milk-supply company in Europe has a demand for only a few hundred quarts per day. This company in Copenhagen offers to the public a milk which has the taste of fresh milk and which has been so treated as to have all pathogenic bacteria within it destroyed, and at the same time the other bacteria greatly reduced in number. This milk it sells at the same price as ordinary milk. As a result its business has rapidly grown, and instead of supplying a few hundred quarts it sells some thirty thousand daily, and the amount of milk handled is increasing with great rapidity. It probably sells more Pasteurized milk than all the sterilized milk sold in Europe.

It would thus seem that we have here actually a practical method of dealing with the new problem of the milk supply. That it is practical is manifest from the actual results in this institution in Copenhagen. Whether it is regarded as satisfactory will of course depend upon our standpoint. Those that insist that the milk must be freed from all danger, and hence deprived of all bacteria, will not regard this method as satisfactory. But probably every one will recognize that milk thus treated is very much safer than raw milk, and that dangers from typhoid epidemics and tuberculosis are removed, even if they do not admit that intestinal troubles are thus avoided. [Pg 640]

There can be little doubt that the method would be successful in our own cities, but its success would depend upon the price at which the milk is sold. If the Pasteurized milk is sold for a price much higher than ordinary milk it will not be a commercial success, for the vast majority of people prefer to save the one or two cents per quart, and run the rather slight risk of trouble from the milk. If it can be sold in our cities, as in Copenhagen, for the same price or a price only slightly higher than that of ordinary milk, it is hardly doubtful that it would soon come into favor, for who would not prefer milk that is safe from disease germs if the price is the same? Already there are a few attempts in this direction in some of our cities, but as yet they are only in the beginning stage. Whether they will develop to a wide extent depends probably almost wholly upon the price at which the milk can be sold.

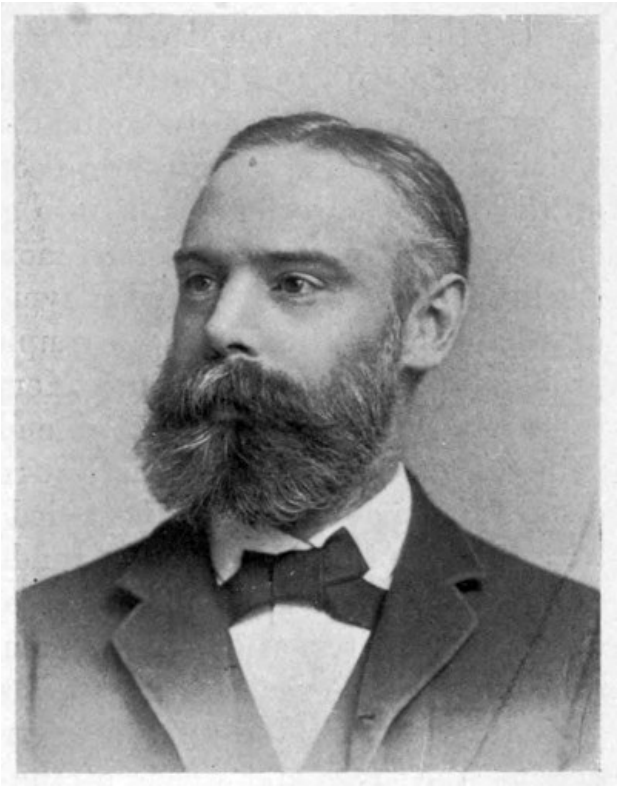
It would appear, then, that this method of Pasteurization by a central company offers the most hopeful solution of this feature of the problem which is growing with the growth of cities. The milk companies could probably arrange, without great expense, such a plan of Pasteurizing large amounts of milk. This only emphasizes the conclusion, already reached, that the most hopeful method of dealing with the problem in our cities is through properly organized companies that can handle milk on a large scale, and will do it conscientiously, and not wholly from the standpoint of money-making.

TEACHERS' SCHOOL OF SCIENCE.

By FRANCES ZIRNGIEBEL.

[*Concluded.*]

Parallel in time with the course in historical geology or paleontology was that in botany, under the leadership of Dr. Robert W. Greenleaf, a Boston physician, who in his student days had assisted Dr. Goodale and was at the time of giving these lessons Professor of Botany and Materia Medica at the Massachusetts College of Pharmacy. A growing interest in the study of botany in the schools, and Dr. Greenleaf's exceptional ability as a teacher, made the attendance at this class very large. After an hour's lecture the instructor and two assistants directed the observation of the specimens by the students, who were required to make sketches of the objects studied. The first set of lessons was similar to that given in the school by Dr. Goodale several years before, and was of a preparatory nature, including morphological, structural, and physiological botany. [Pg 641]



Robert W. Greenleaf.

The introductory lesson dealt with the relation of botany to its various subdivisions and to other studies. The meaning of morphology was illustrated by comparing the four plant members—root, stem, leaf, and plant hair—with the different plant organs, and a practical exercise, with specimens whose parts were sketched and labeled, was given to show that the position and mode of development of a part determine its rank as a member or structural division, while its function may give it quite a different rank as an organ.

A preliminary view of vegetable histology, considering the shape, wall, markings in the wall, and contents of cells, was next given. This was followed by lessons on vegetable physiology, in which the absorption of liquids and gases for the making of food, assimilation, transfer and storage of food, the growth of cells and tissues, the excretion of waste products, special kinds of work, as climbing, catching of insects, etc., reproduction, and the process of metabolism as illustrated in cells, were treated of first in a general way and then elaborated upon in the succeeding lessons. Much time was devoted to the anatomy, histology, and germination of seeds and to the structure and function of root, stem, and leaf. The morphology of fruits and their anatomical classification (profusely illustrated from the fruits of the market and neighboring fields), with a discussion of the contrivances for dissemination of fruits and seeds, furnished subject-matter for both a profitable and interesting lesson.

The last lessons of this set were devoted to the study of the flower and its parts, particularly stamens and pistils, and ended with an explanation of the processes of pollination and fertilization. The work of making vertical and horizontal plans of the flower served as an introduction for the second year's course on Systematic Botany, wherein the relations between the common families of flowering plants were shown. This course was illustrated by numerous [Pg 642] hothouse flowers and also by dried specimens, of which one hundred kinds were given to each teacher. This course was given to teachers, many of whom could by means of a key analyze any common flower, but who knew nothing of the principles of plant relationship. The theories of special creation and of evolution were explained, and the theory of descent with variation was taken as a hypothesis.

Starting with this theory of evolution as a basis, the structure of certain families was studied and they were taken as types with which other related families were compared. After a classification of all known flowering plants into gymnosperms and angiosperms, and subdividing the latter into monocotyledons and dicotyledons, the lily family was considered as typical of monocotyledons. It and its related families afforded a simple means of demonstrating the problems under consideration. Members of this family were found to be characterized by having an endogenous stem, usually parallel veined leaves, six-parted perianth free from a three-celled superior ovary, and six stamens. The allied families were shown to agree with the type in the internal or fundamental characters, such as the number of carpels and cells of the ovary, but were found to differ in the more external or environmental characters, such as the arrangement of the parts of the perianth.

After studying the relations between the various groups of endogens, the trees and weeds of the apetalous division of exogens were next considered, and through *Ranunculaceæ* connected with polypetalous dicotyledons. These latter were classified according to whether the parts of the flower were hypogenous, perigynous, or epigynous. These terms signify, respectively, under the pistil, around the pistil, and on the pistil. In this group the rose family presented several

modifications of the pistil, according to which it was divided into tribes.

When the group of *Gamopetalæ* was studied, *Solanaceæ*, the nightshade family, with its regular flower, and *Labiatæ*, or mint family, with irregular flower, were taken as types with superior ovaries. Various modifications from these types were found in several families.

Ericaceæ, the heath family, presented, in its suborders of *Ericineæ*, *Pyroleæ*, and *Monotropeæ*, which had superior ovaries, and *Vacciniæ*, which had inferior ovaries, an intermediate order between the preceding *superæ* and following *inferæ*, of which latter group *Campanulaceæ* was considered a type.

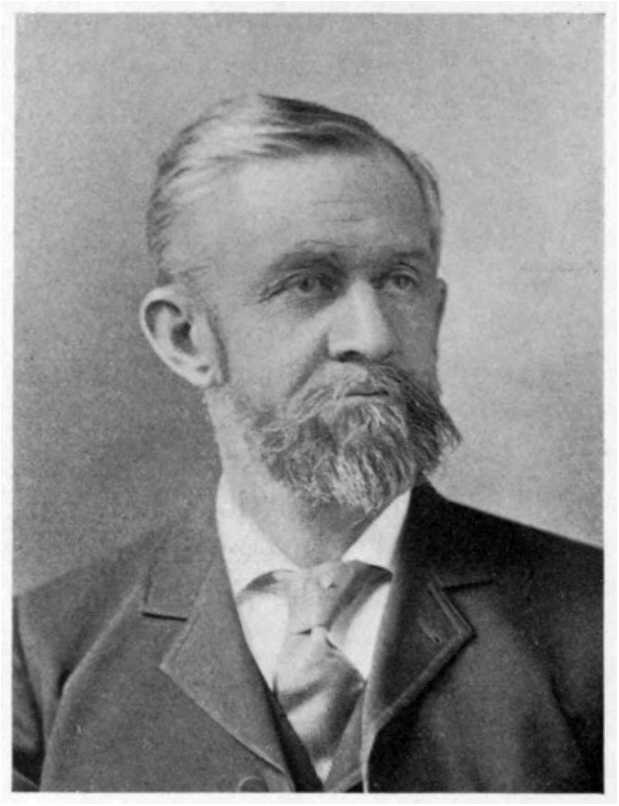
The relations between many families were traced, and the *Compositæ* were lastly considered, this family showing the greatest differentiation with its coalescence of circles, adnation of different circles, reduction in parts, and number of individuals brought together. The greatest [Pg 643] deviation from a simple flower and a complexity of structure were here presented. Through the co-operation of parts these flowers were of high physiological efficiency.

Throughout the course, families of medicinal or other economic value, or such as presented evidences of adaptation for cross-fertilization, dissemination of seed, life in desert regions, or contained examples of parasiticism or many poisonous genera, were incidentally considered.

Carefully made illustrated notebooks, collections of dried specimens, and other evidences of interest in the course were shown by the teachers, who gained great facility in placing an unknown flower in its proper family without the use of a key or botany.

The next set of lessons in the botanical series consisted of the usual number (fifteen) on cryptogamic botany. This was perhaps the course which was the most difficult of presentation; but, notwithstanding, much dried and fresh material, representing chiefly the higher cryptogams, was distributed among the pupils and examined by them.

The fourth and last year of the series was spent on paleobotany. This was a somewhat novel and valuable course, which was particularly appreciated by those who had studied geology and paleontology in other classes of the school. A large amount of laboratory material was provided from the museum. The duplicate fossil specimens of the society were used by the class, and ninety determined species were figured by many members. Since the close of these lessons persons who have shown throughout the four years a satisfactory knowledge of botany and have passed the examinations, in the most exhaustive course ever given in the subject for teachers, have received certificates stating their qualifications.

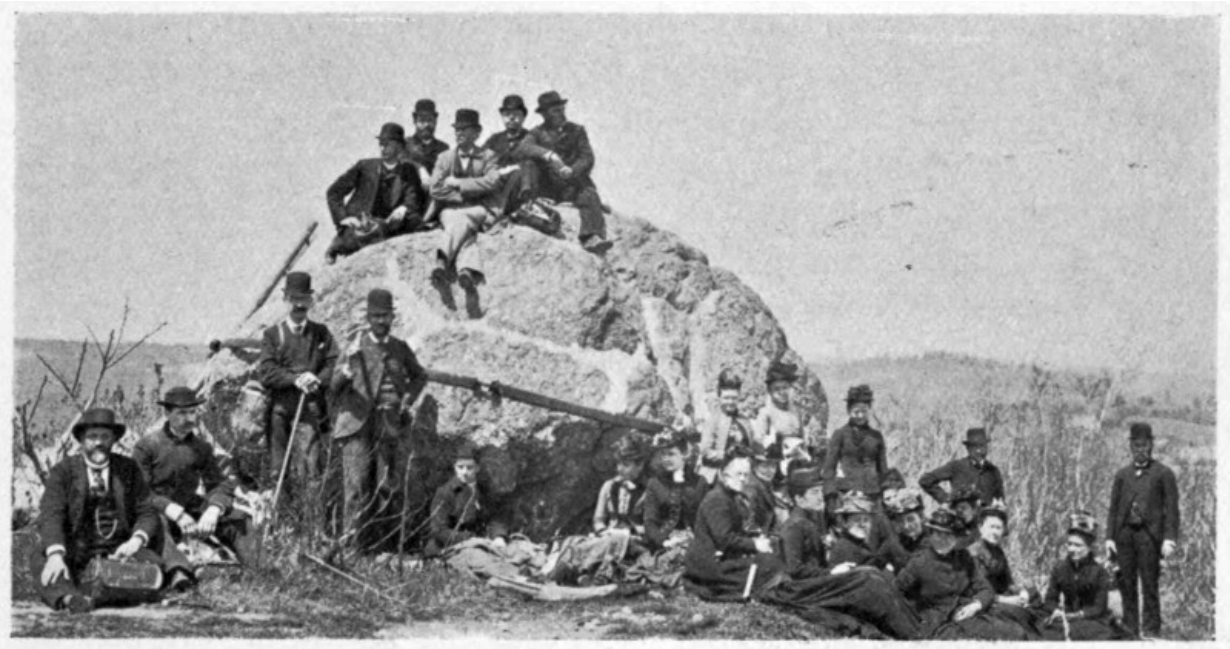


George H. Barton.

In the spring of 1887, owing to a suggestion made by Professor W. O. Crosby and to assistance furnished by him, a private course of instruction was arranged by Prof. G. H. Barton, of the Institute of Technology, for a series of lessons in field geology. Twenty-one persons, nearly all of whom had attended Professor Crosby's course in The Teachers' School of Science, took these lessons with great enthusiasm. The series of lessons was continued in the autumn, with the addition of twelve new members to the class. From this beginning has grown the systematic course of field instruction in geology now carried on as one of the regular courses. As at present conducted, it consists of a series of lessons in the autumn and spring of each year, so arranged as to give detailed instruction in methods of observation covering a range through all portions of the

subject, embracing mineralogy, lithology, structural geology, historical geology, and physiography.

[Pg 644]



Teachers' School of Science. Field Class in Geology. Prof. George H. Barton, Instructor.

The method pursued is as follows: The class is taken to a typical place for illustrating the subject in hand. The area to be studied is pointed out, and then for a half hour or so the class is asked to make observations unassisted by the instructor and with as little communication among themselves as possible. Then they are called together and questions are asked to draw out the results of their observations, free discussion being invited at this time, and questions from the class answered by the instructor. Then the instructor explains the phenomena studied, and finally gives a general lecture upon the particular subject involved. Notes, taken in the field, are carried home and rewritten and then handed in at the next lesson, to be corrected and returned later. A printed synopsis is furnished each member of the class at every lesson, for which payment is made sufficient to cover the cost of the printing. Each member is also required to be provided with a hammer, chisel, and compass.

The course of instruction begins with a discussion of the general principles of erosion, and one lesson each is given at places illustrating an excess of chemical and mechanical action. At Medford a very broad dike of coarsely crystalline diabase, penetrated by numerous cracks, furnishes an exceptionally good opportunity for the observation of rapid chemical decomposition, an almost complete gradual transition being shown from the fresh unaltered rock through all degrees of decomposition to the formation of soil. The cause of the decomposition is explained, with the resulting products, and the history of the latter is traced till they form parts or the whole of a new rock. A drumlin is seen, at Great Head, Winthrop, being undermined and worn away by the waves. By comparison with other drumlins in the neighborhood, the original form of Great Head can be easily restored mentally and the effect of waves and currents upon a coast can be readily appreciated. In an excursion to North Adams and rides over the Hoosac Mountains and to the summit of Greylock, rivers are seen in their various stages of action, the cutting backward by the cascade action, the cutting downward of torrent action, and the more quiet transportation and final deposition of the streams passing through the lower levels and approaching the sea. From the sides of Hoosac and Greylock the surface of the Massachusetts plateau is seen, with its dissection by the Berkshire and Deerfield Valleys, illustrating the broad effects of erosion over the surface of the continent.

[Pg 645]

Passing next to a discussion of the disposition of the material that is derived by erosion from the land, a lecture upon the sorting action of water is given, and the resultant beds of gravel, sand, and clay are studied in a section cut by the Fitchburg Railroad through the sand plateau at Lake Walden, in Concord.

The next step is to study these products of deposition in their consolidated forms. At Parker Hill, Roxbury, a large quarry furnishes opportunity for the study of conglomerate, special attention being paid to the means of determination of stratification in a nearly homogeneous, coarse material. Here also is a large section in a drumlin left in a nearly vertical face by excavation about twenty years ago, and now illustrating finely the action of rain during the years. This forms an instructive contrast with the marine erosion of Great Head, Winthrop. Any one of the numerous slate quarries at Somerville serves the purpose of studying stratification in a fine, homogeneous material. In each of these three last-named places the various phenomena of stratified rocks are studied, such as unconformity, cross-bedding, ripple-marks, strike, and dip, but attention is confined more especially to the original structures, subsequent structures being left for later lessons.

Eruptive rocks are then taken up and studied in respect to their origin and original structures. The quarries near Winter Hill, in Somerville, furnish an admirable opportunity to study dikes.

Here a small hill of slate is intersected by three series of dikes of different character and intersecting each other at various angles, enabling a determination of their relative ages. An intrusive bed, now separated from its parent dike by erosion, affords the means of comparing the characteristics of the two forms and of tracing out the relation between them. The inclined positions of the dike and bed and the numerous quarries furnish several sections in varying relations to the two. The various dikes and the inclined position of the inclosing slate give an excellent chance for the first instruction in the making of geological maps and sections. Notes are taken for this purpose, and both maps and sections are constructed and handed in at a later date.

At Marblehead Neck various other eruptive structures, such as flow structure, ancient ash-beds, etc., are seen in the felsite, of which many varieties occur there. Attention is especially called to [Pg 646] the liability of mistaking flow structure for stratification, the similarities and differences being explained. At Marblehead Neck, also, a careful study is made of the formation of pebbles, all stages being shown from the dislodging of fragments from the cliffs by frost action, the dropping into reach of the waves, the first rounding of the sharp angles to the subangular outline, and finally the rounding of the fragment into a complete pebble form.

At Newton Centre a study of contemporaneous beds is made, including their relations to the inclosing rocks and a comparison of their characteristics with those of intrusive beds.

Eruptive masses, metamorphic rocks, and vein phenomena are all well shown at Fitchburg, where Rollstone Hill is an eruptive mass of granite cutting through the metamorphic mica schists and gneisses, and the granite in turn is cut by very numerous veins of pegmatite, abundantly rich in tourmaline crystals and occasionally having beryl.

Glacial structures are next taken up. At Newtonville is studied the esker and sand plateau, rendered famous by the work of Prof. W. M. Davis and others; at Clinton an exceptionally fine set of terraces, and the best example of *roches moutonnées* near Boston, where a class can be taught in a very few minutes to recognize that the movement of the ice sheet must have been from the north toward the south; and at Stow and Haverhill are studied drumlins.

After this, special attention is devoted to the subsequent structures of rocks, such as folds, faults, cleavage, joints, etc. Typical places, as before, are selected for each, and the work carried on in the same manner. When this course has been entirely accomplished, then places of greater complexity and where the problems are not quite so plain are visited, and opportunity is given to exercise the skill or knowledge already gained.

Following this, a series of lessons is devoted to the study of typical places illustrating the various historical strata occurring in Massachusetts; among others, Nahant and Braintree for the Cambrian, Attleboro for the Carboniferous, Mount Holyoke for the Triassic, Gay Head for the Cretaceous and Tertiary, Rockport, Martha's Vineyard, and claypits of Cambridge for the Glacial Champlain.

The work in this course has been marked by enthusiasm, and the attendance has been very large, reaching a maximum of two hundred and ten, with an average attendance of seventy-one in the autumn of 1896. As a direct outcome of this work, and connected with it, several excursions to distant points have been made by parties under the charge of Professor Barton during the summer vacations. The most important of these were the following: A five-days' trip through [Pg 647] western Massachusetts; a seven-weeks' trip to the Pacific coast, including visits to the Lake Superior copper regions, the Yellowstone Park, Butte, Montana, Great Shoshone Falls in Idaho, Columbia River, Mount Hood, Frazer Cañon in British Columbia, the Great Glacier of the Selkirks, and the Hot Springs at Banff; and two trips through Nova Scotia, one in 1894 and another in 1898. In each of the latter trips special attention has been paid to the various kinds of mining coal, iron, and gold, to the famous mineral localities like Cape Blomidon, and to the general geology.

Also, connected with this work, a special course of lessons has been given by Professor Barton each spring to a class from the Boston Normal School, and many occasional lectures and field lessons to the classes of the State Normal School at Framingham, and at other schools, teachers' clubs, etc. During the Boston exhibition of the cyclorama of the volcano of Kilauea, Hawaii, over three hundred teachers and a large number of schools visited that exhibition and listened to personal lectures by Professor Barton in direct connection with the work of The Teachers' School of Science.

Owing to the request of members of the field class, a private class was organized in the winter for a course of twelve lessons in mineralogy. This proving successful, and a demand for laboratory work being shown, this work was incorporated as a distinct course in the school. It was during the early part of this work that Professor Barton introduced for the first time in The Teachers' School of Science the system of daily and final examinations—a system since followed [Pg 648] as the general practice of the school and now considered as one of its most fundamental features.

This course, after various experiments, has finally developed into a definite four-years' course of instruction, at the end of which those members who have met all the requirements receive the diploma of the school. The full four-years' course is designed to give a thorough training in the fundamental principles of geological science. Each year is given a series of fifteen lessons of two hours each, partly laboratory, partly lecture, and fully illustrated with specimens and diagrams. The first year's work is devoted to mineralogy. One introductory lecture is given on the principles of chemistry as the basis of understanding the composition of minerals, and the four following

lessons are devoted to a study of the physical properties, mainly crystallography. During the remaining lessons, about one hundred and fifty of the commonest mineral species are studied, the class being required to learn to recognize each species and be able to tell its composition.

The second year's work with lithology is carried on largely in the same way as with mineralogy. At first a brief review is made of the most important rock-forming minerals. Then all the commoner species of rocks are taken up and studied, so as to learn to recognize each species at sight and to tell its composition. Besides this, lectures are given upon the origin of the rocks and the derivation of their component materials, involving a large amount of dynamical geology.

During the third and fourth years are taken up, respectively, structural and historical geology. Both these subjects are taught largely by lectures, illustrated by charts and diagrams, a select set of specimens for the table, and a few such specimens as can be passed around the room. In the historical geology special care is taken to furnish for class use as many specimens as possible of the typical rocks and fossils of the various ages. It is nearly impossible to provide so abundantly, however, as for mineralogy and lithology. As regards examinations, the methods used are as follows: The first half hour of each exercise is taken up with answering questions or identifying specimens, the examinations in all cases being written. The ground covered by each examination includes all that has been gone over during that year previous to the examination. After the examination is finished, the instructor briefly answers and explains the questions. The papers so handed in are marked by the instructor and returned the following week. All of this serves to enable the class to keep a comprehensive grasp of the subject constantly in hand. At the end of each year's work a final examination of three hours in length is given, covering the complete subject. The final rank given each member is made up equally from an average of the term's work [Pg 649] and the final examination. This course has proved decidedly popular. The instruction was originally given in the Geological Department of the Institute of Technology, in a room adapted to seating thirty-six persons. This was gradually crowded to accommodate fifty-six persons. At the beginning of the last four-years' course the number of the applications was so large that each applicant was required to sign a printed statement promising to be present at all exercises for the four years, except for good and sufficient reasons. One hundred and seventeen persons gave the required promise. In order to meet this demand, two divisions were formed, and on each Saturday afternoon the same lesson was repeated. In order to defray the additional expense of the second division the members of the class voluntarily contributed three dollars each. The labor of repeating the lessons on the same afternoon proving too great, provision was made the second year to transfer the instruction to the large lecture hall of the Natural History building, where accommodations were made for one hundred and twelve students. The work has since been carried on there, and a complete new set of specimens, diagrams, etc., is gradually being obtained.

The membership of the class is, of course, principally made up from Boston and the towns immediately surrounding, but a few come from places as far distant as towns in Connecticut and Rhode Island, from Bridgewater, Scituate, Framingham, Fitchburg, Lowell, Lawrence, and Beverly.

One member of the class has made an exhaustive study of the granites of eastern Massachusetts, and others are teaching geology in secondary schools outside of Boston.

An important and influential outcome of the first lessons of Mr. Barton was the formation, in the fall of 1888, of the Barton Chapter of the Agassiz Association, by seven ladies who had been fellow-students in mineralogy. Later, men and other ladies who had attended Mr. Barton's field lessons were invited to join. For ten years this club has flourished, and held weekly evening meetings for nine months of the year, at which the members have done much systematic work in the study of geology, mineralogy, chemistry, botany, entomology, and zoölogy. At some of the sessions the individual members have taken their share of the work by the preparing of exhaustive papers which have been read to and discussed by the class, and sometimes a series of lessons has been given by specialists in the several departments. Many of the first scientists of Boston have aided this association by the giving of lectures and advice regarding courses of lessons and opportunities for study, while the club has in return been a great benefactor to many [Pg 650] who sought its instruction and the association of those with like tastes. In arranging regular Saturday outings for the study of field geology and botany, this club was the pioneer in this vicinity of the kind of study which happily now seems to be fast becoming popular. A number of persons who were members of this association in their younger years are now holding positions in the United States Geological Survey or other departments of the Government, or in the capacity of curator or instructor are connected with large museums, colleges, or schools in different parts of the country, thereby having opportunities to continue their favorite lines of work, to spread a knowledge of the things about them, and to induce in others tastes such as were fostered in them while connected with the Barton Chapter of the Agassiz Association.

Field Class in Zoölogy. Looking for Shore Life among the Bowlders at Woods Hole.

Since closing the four-years' course in botany Dr. Greenleaf has repeated the lessons on vegetable morphology and physiology and those on systematic botany. Finding the class not so well prepared as in former years, instead of continuing the third course of the series, he has given a set of fifteen lessons on the elementary structure and function of flowering plants, as he believed that course to be a necessary foundation for further botanical study. [Pg 651]

Another feature of The Teachers' School of Science should not remain unnoticed. It consists of effective work in zoölogy and geology by Mr. A. W. Grabau, the official guide in the museum and a graduate student of geology. A course of lessons on The Shore Animals of New England was begun by him in April, 1897. Directly connected with these field lessons was held a class in laboratory work, which was attended by about twenty persons.

The next year Mr. Grabau endeavored to give his audience a comprehensive view of the action of cold and heat, of winds and waves, rain and rivers, and of the chemical effect of the atmosphere in the production of the natural features of the earth's surface, by giving eight lectures on The Surface of the Earth, its Rocks, Soils, and Scenery. Special attention was given to the scenery of New England, and this awakened an interest in local scenery, which interest led to Mr. Grabau giving several lectures in surrounding towns, under local auspices. One of these lectures called the attention of the people of Arlington, Massachusetts, to the fact that they had in their midst a valuable geological monument, and led them to start a movement for the preservation of a terminal bowlder moraine on Arlington Heights, which is the only good accessible example of such moraine near Boston.

Under the same instruction ten lessons were given on the use of the microscope and the preparation of specimens of hydroids.

The work begun at the winter lectures was continued during the spring by excursions to the seashore. The beaches of Revere, Swampscott, Marblehead; the cliffs and tide pools of Nahant, Marblehead Neck, and Nantasket, and the mud flats and piles of Beverly, were explored. One excursion was made to the outer shore of Cape Cod and Buzzards Bay. The party spent four days on this excursion.

During the early part of the summer an outing was made to Bayville, Maine, where a laboratory was furnished, with microscopes and other accessories, and fourteen persons (mostly teachers) devoted ten days to the study of marine fauna, special attention being given to hydroids. Some geology was studied during this excursion, and a small island mapped. Those who attended this expedition were delighted with an experience new to most of them, as many of them had not before studied zoölogy and knew not what a field could be opened by the study of natural history. One of the party afterward remarked, "I feel as if I had been born into a new world, so different are these things in their homes from their representations in books."

In the autumn and following spring field lessons were given on marine zoölogy, the object being to study animals in their natural habitats. Another excursion was made to Woods Hole, Buzzards Bay, and a summer laboratory established for ten days at Goldsborough, Maine, where work similar to that done the previous summer was here carried out. Among the field lessons of the spring of 1899 was an excursion of four days' duration to Cuttyhunk, one of the Elizabeth Islands, where there was an opportunity to study a marine fauna southern in character and different from that found on the Maine coast. On the afternoon of Agassiz's birthday a sail was taken to another of this group of islands—Penikese, the site of the famous summer school. In the evening the class [Pg 652]

of seventeen persons listened to the reading of selections from the life of Agassiz, poems regarding him, and magazine articles describing events connected with the great meeting in the summer of 1873. The next day an excursion was made to Gay Head, Martha's Vineyard, where the afternoon was spent in studying the wonderfully colored clay cliffs and in searching for fossils. As an outcome of Mr. Grabau's field lessons the Hale House Natural History Club was formed. This club consists of teachers and other persons who have banded together for the study of natural history. Meetings are held twice a month, and similar classes have been formed for children of the neighborhood.

The Teachers' School of Science has been of great assistance to the Boston Normal School by furnishing certain of its pupils with instruction in geology and zoölogy.

In 1893 The Teachers' School of Science took part in the exhibition of elementary science teaching made by certain teachers of the schools of the eastern part of Massachusetts. The school was enabled to take part in this public exhibit through the generosity of Mr. T. A. Watson, a pupil in the school, who paid the necessary expenses.

A collection of articles obtained by the Baron de Baye in a scientific expedition last year to Siberia and the Russian Caucasus contains specimens from very ancient times down. Among them are mammoth bones and chipped flints, like those of the Mousterian period in France, from the Yenisei; arrowheads, like the European and American, from the same region; bronze weapons from the Caucasus; iron arrowheads like those of the Congo; skulls, weapons and ornaments, necklaces of hard, polished, pierced stones, from the Kurgans of the steppes, dating from antiquity down to the beginning of the middle ages; Caucasian jewels, and ceramic ware ancient and modern. A very curious object is one of the statues, called Kamenaia Baba, of a kind supposed to have been set up by the Scythians and always held in veneration, of which the present specimen is the only one yet allowed to go out of Russia.

INFLUENCE OF THE WEATHER UPON CRIME.

[Pg 653]

BY EDWIN G. DEXTER.

The relation between general climatic conditions and the prevalence of suicide has been somewhat exhaustively studied by students of criminology, the result being a considerable accumulation of data and the formulation of a number of more or less tenable theories. From these studies we may safely conclude that the homicidal tendency, as shown by self-destruction (suicide) and the destruction of others (murder), is stronger in the temperate climatic zones than in the torrid or frigid, and that in the late spring and early summer months more of these offenses have been recorded than for any other period of the year. To these few facts the seeming effects of cosmical forces upon such tendencies has apparently been limited.

In fact, it was the oft-repeated statement that nothing was known of the exact relations of the more definite meteorological conditions with the prevalence of suicide—a statement to be found in most treatises upon the subject—that has given rise to this paper. Realizing that the science of climatology must include, and in fact be based upon, a study of the meteorological conditions prevalent, and that the study of these definite conditions for the exact times when suicides or murders occurred might throw some light upon the question, this problem was undertaken.

In the preparation of the accompanying charts, from the study of which the conclusions herein stated were deduced, the record of crime for Denver, Colorado, for the fourteen years ending with June, 1897, was made use of. Superintendent Howe, chief of the city detective service, has kept such a record with the greatest care, and we wish here to acknowledge the many courtesies of his office.

No attempt has been made in this paper to compare the conditions for Denver, either meteorological or social—and each is somewhat unique—with such conditions elsewhere. In fact, such a comparative study is at present impossible since data are wanting.

In the actual preparation of the charts each murder, suicide, or attempt at suicide—which, for our purpose, is equally important—was set down chronologically in the left-hand columns of large sheets of paper ruled for the purpose. These sheets were then taken to the office of the United States Weather Bureau, F. H. Brandenburg, director, where were recorded in the proper columns the maximum and minimum barometer readings, maximum and minimum temperature, maximum and minimum humidity, maximum velocity of the wind, precipitation, and character of the day for [Pg 654] each day during the fourteen years on which a crime of either class occurred. When several took place upon the same day the fact was taken into consideration. From the sheets thus filled out, the curves on the accompanying charts were plotted by computing the per cent of crimes of each class committed under the definite meteorological condition indicated.

The curves marked "normal" were constructed by tabulating in a similar manner the conditions for every day in a sufficient number of days to secure a fair average. Five years were so tabulated

for Figs. 2, 3, 4, and 5, and the records for nineteen years used in Figs. 1 and 6.

The whole number of suicides recorded is two hundred and sixty; murders, one hundred and eighty. It may be noted that this number of suicides, for a city averaging hardly one hundred thousand inhabitants for the fourteen years, is largely in excess of the rate recorded for American cities, but it must be remembered that some of these were unsuccessful attempts, and also that the social conditions of Denver tend to swell the number—containing, as it does, so many disappointed in the last struggle for health. [Pg 655]

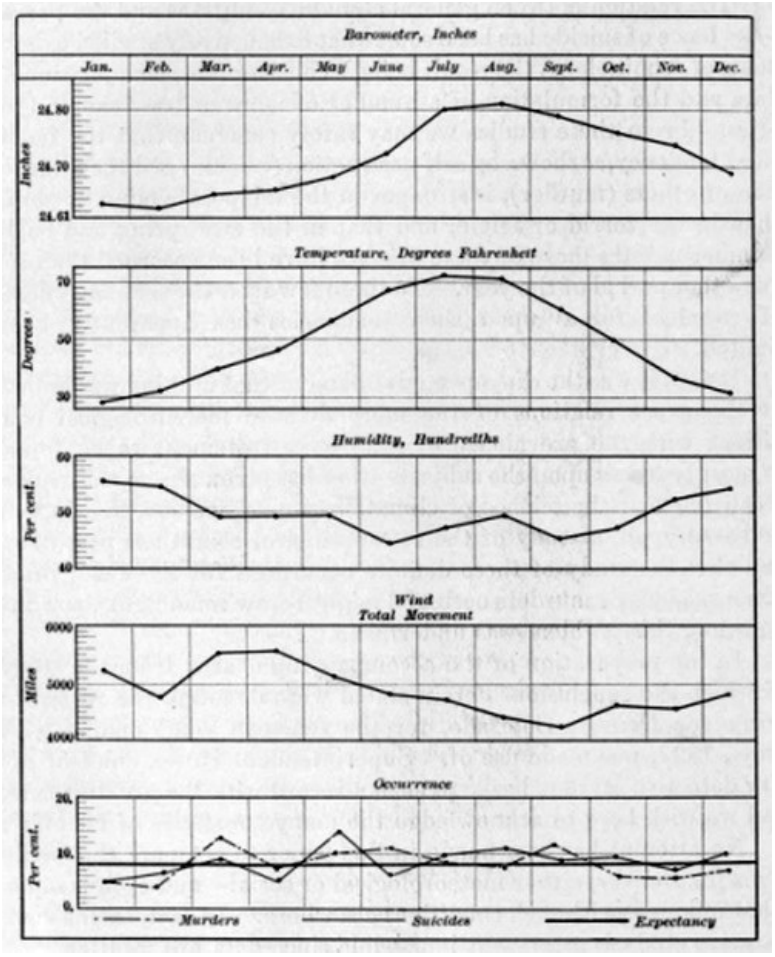


Fig. 1.

Fig. 1 shows the occurrence, in per cent, of crimes of both the classes considered for each month of the year, together with the monthly meteorological means, computed from the records for nineteen years. The expectancy curve in the occurrence table is based upon the supposition that the months of the year are all of the same length, and that the numerical expectancy would be one twelfth, or eight and a third per cent for each. It will be seen that the crime curves are for the most part below the expectancy for the winter months, and above it for the summer (except for April, and suicides for June), showing the maximum for the latter class in May and for murders in March. Morselli shows[C] that for most European countries suicides are at the maximum in June, though a considerable number show that condition for the later spring months. A study of the general meteorological means, shown upon the same plate as the occurrence table, fails to indicate any good reason for irregularity of the crime curves. The "month" columns read from the top to the bottom of the chart, and by following that for May, for instance, which month shows the maximum for suicide, we find that the meteorological condition for each class of data is about halfway between the extremes for that class for the year, while for January (minimum suicides) each class is by far more divergent. Yet a mean, like those considered in this table, is but the average of the extremes, and those months which show great per cents of crime also present great extremes of condition, which fact, interpreted in the light of those disclosed by the charts yet to be considered, make the occurrence curve more explicable.

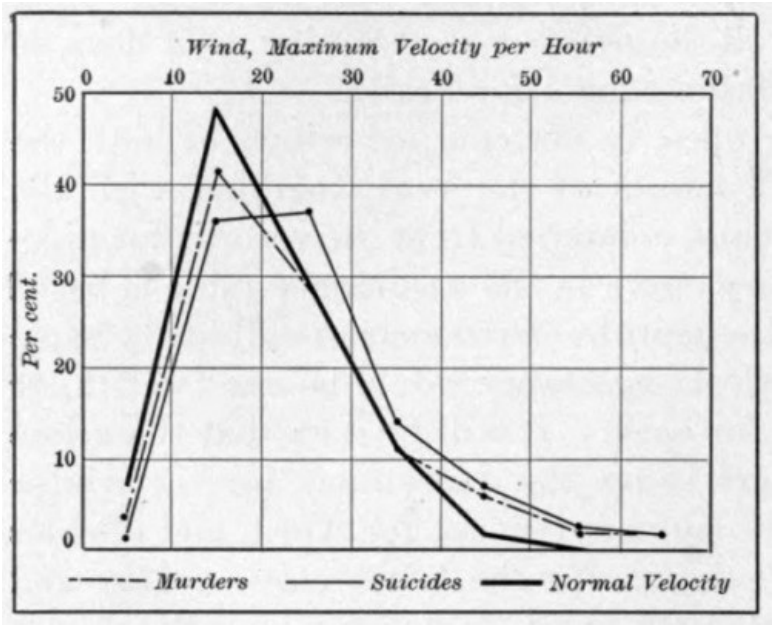


Fig. 2.

Wind.—An explanation of the various curves in Fig. 2 may serve for the series following, so I give it somewhat in detail. The vertical distances from the base line indicate per cents, and the distances from left to right, divided into columns, the maximum velocity of the wind per hour for the days tabulated. In the "normal" curve every day for five years was considered, and it was found that seven per cent of the days for that period showed a maximum velocity of between one and ten miles (first column), forty-eight per cent a maximum velocity of between ten and twenty miles (second column), nineteen per cent a maximum velocity of between twenty and thirty miles, [Pg 656] and so on, as indicated by the curve. Now, it can readily be seen that this normal curve may also be considered the expectancy curve—*if the wind has no effect*. That is, if forty-eight per cent of the days of the year show a maximum velocity of the wind, between ten and twenty miles an hour, the law of probability would give us the same per cent of the crime for the year on such days if this meteorological condition were not effective.

What we do find, however, is indicated by the other curves, and any increase of crime over expectancy may in this case be ascribed to the wind. We notice that for slight velocities (one to twenty miles an hour) the crime curves are below that of expectancy, but we can see that if the sum of all the per cents for any one curve is one hundred, and one is forced above the other at any part, there must be a corresponding deficiency at some other part. So we may, perhaps, with justice suppose that these mild velocities do not exert a positively quieting effect emotionally, but simply a less stimulating effect than the higher ones. For velocities of between twenty and thirty miles a marked effect is noticeable, and under those conditions the proportion of suicides to that expected is 37:29; velocities of from thirty to forty miles, 14:11; of forty to fifty miles, 7:2; of fifty to sixty miles, 0.4:2.6; of fifty to sixty miles, 0.2:2. The curve for murders shows the increase to be slightly less than for suicides, but the same general relation is preserved throughout. The value of such curves is, of course, somewhat proportional to the number of observations made and recorded, and we must confess that two hundred and sixty (suicides) and one hundred and eighty (murders) is a hardly sufficient number from which to deduce a definite law, but we can hardly doubt, even considering this somewhat limited number, that the wind is, in our problem, a factor of no mean importance.

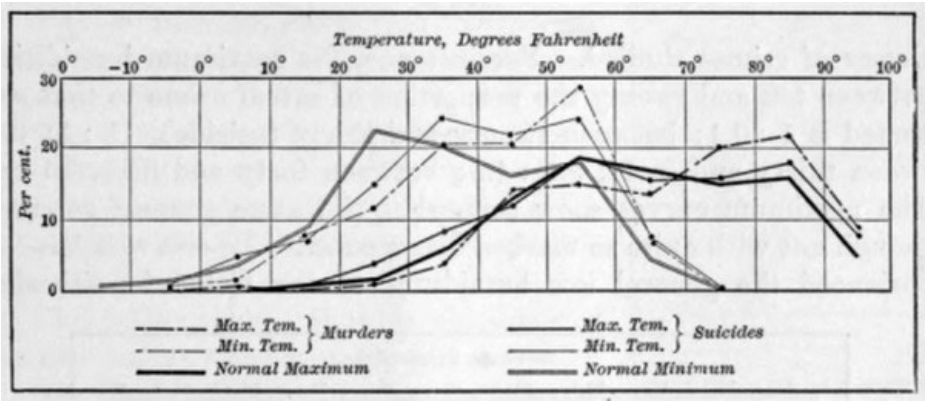


Fig. 3.

Temperature.—Fig. 3 is intended to show, in a similar manner, the relation between expectancy curves, based upon conditions of temperature, and the actual occurrence of the crimes in question. With this class of data, as well as that for the barometric readings and humidity (Figs. 4 [Pg 657] and 5), both the maximum and minimum readings are considered. This was done instead of taking the mean of both for the day, since in many cases the latter might be quite normal, while one or possibly both the former might exhibit marked peculiarities. All the curves were constructed precisely as in the chart just considered, and those marked "normal" are again the

expectancy curves. An inspection of the chart shows no marked discrepancies till we reach the higher temperatures. For the lower the coincidence for all the maximum and all the minimum curves is not exact, but somewhat similar. When, however, we reach for the minimum curves, temperatures of from 40° to 50° and from 50° to 60°, which means that for the per cent of days indicated, the temperature did not go below those points, the per cent of crime exceeds that expected under the conditions in the proportions of 22:16.5 and 24:18 (suicides), and 21:16.5 and 29:18 (murders).

The same general relation exists between the maximum curves, where it is shown that for temperatures between 80° and 100° the actual crime is about thirty-three per cent in excess of the expected.

These facts have their bearing upon the already noted statement that the summer months show a preponderance of homicide.

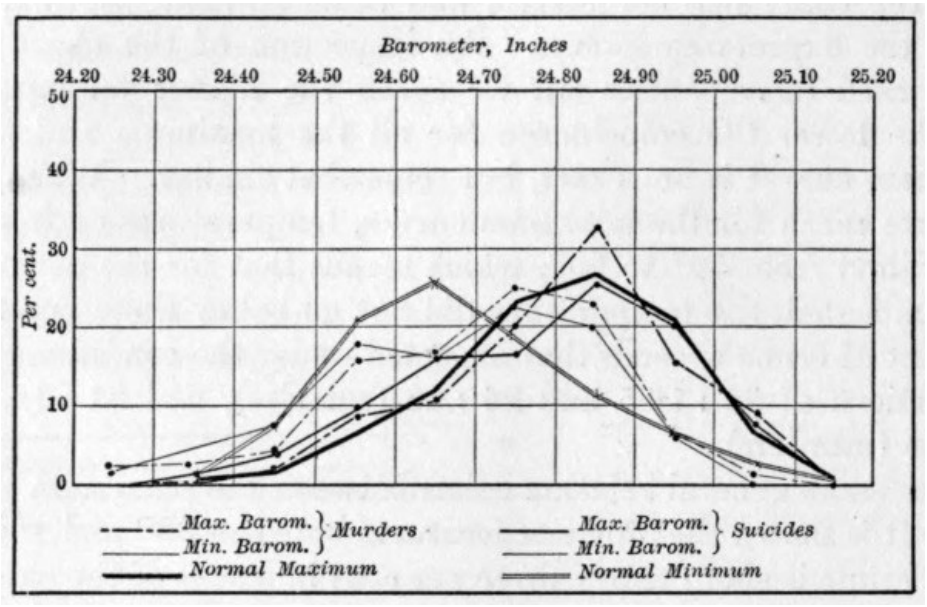


Fig. 4.

Barometer.—Fig. 4, disassociated from the others, shows but little. Naturally we should not look for very marked effects from variations of an inch or less in the barometric readings, when in the course of a journey from the sea level to Denver a change of six inches is brought about, and in going from the same point to the summit of Pike's Peak one of nearly twelve inches without producing any marked emotional abnormities, but we must take into consideration the fact that sudden barometric variations generally accompany or more frequently precede other important meteorological changes. In the latter case, though they might be the primary cause of factors considered in this study, they themselves would fail to show upon the tables. [Pg 658]

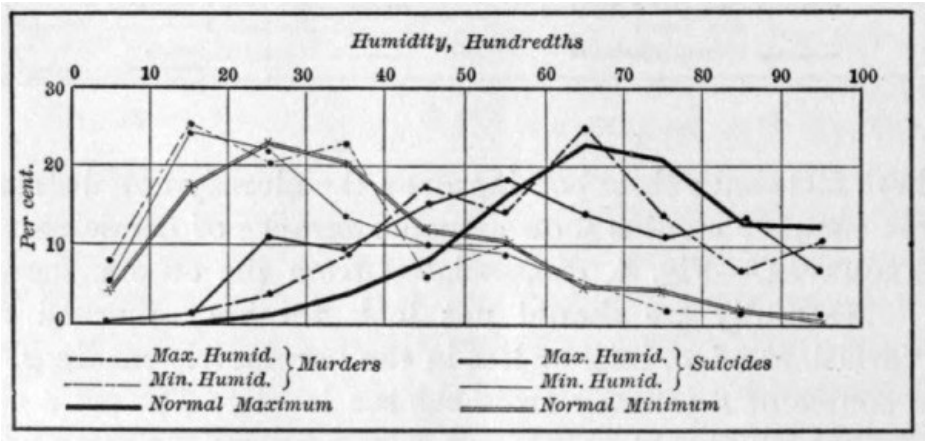


Fig. 5.

Humidity.—This figure (Fig. 5) indicates in a very decisive manner that states of low relative humidity, as shown by both maximum and minimum readings, are conducive to excesses in both the classes of crimes studied. For instance, for maximum humidities between ten and twenty the proportion of actual crime to that expected is 1:0.1; between twenty and thirty (suicide), 11:1; between thirty and forty, 9.5:4.5; between forty and fifty, 15:8. The maximum curves show somewhat the same general relation though not with quite so marked divergences. To one who has experienced the general low humidities of our Colorado altitudes (Denver is one mile above the sea level) this result is not surprising. There is no doubt that a nervous tension much in excess of that common in the lower altitudes exists, due in part, perhaps, to the deficiency in barometric pressure and a consequent effect upon the respiratory processes, but probably, as shown by these curves, more largely to the dryness of the atmosphere, as indicated by low humidity. I hope at some future time to verify or disprove this supposition by a comparative study made at some lower altitude. [Pg 659]

Character of the Day.[D]—Fig. 6 shows the relation between the expectancy of crime, based upon the actual per cents of cloudy, partly cloudy, and clear days (records of nineteen years), and its actual occurrence. The disagreements are very slight, although a slight excess of murders is shown for cloudy days.

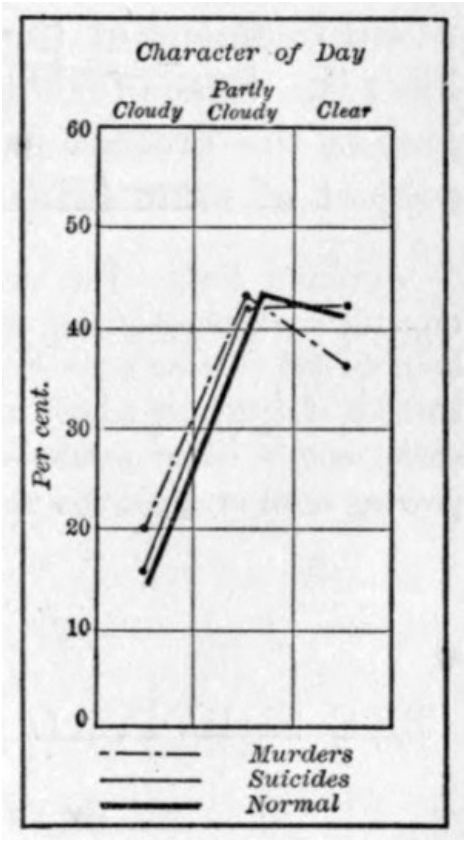


Fig. 6.

Summary.—Fig. 1 shows at a glance no generally prevailing meteorological conditions to which can be ascribed, with any degree of certainty, the monthly variations of crime.

Fig. 2 shows that high velocities of wind seem to increase to a marked extent the tendency to crime. For the highest velocities increasing the probability twenty times (two thousand per cent).

Fig. 3 shows that high temperatures seem to have the same effect, that of between 90° and 100° increasing the probability one hundred per cent.

Fig. 4 fails to show that barometric changes are accompanied by any marked excesses in crime.

Fig. 5 shows that low conditions of relative humidity are attended with very marked excesses, those below thirty increasing the probability of suicides eleven times (eleven hundred per cent).

Fig. 6 fails to show that the character of the day has any considerable effect.

Considering briefly, in conclusion, the results of the foregoing study, and comparing them with a somewhat similar one for children,[E] we may safely conclude that the tendency to homicide varies with those meteorological conditions which bring about an emotional state necessitating a considerable discharge of motor stimulus. The same conditions which bring about irritability and unruliness on the part of the child accompany suicidal tendencies.

This supposition is upheld by the fact that suicide is less common in the colder climates, where the metabolic processes are slow, and in the torrid zone, where the heat produces a general depletion of energy for motor discharge, than in the temperate regions, where the climate is exhilarating. The study, from the social standpoint, too, leads us to the same conclusion. The excess of crime in the social whirlpools of our great cities is convincing, and especially the careful study made by Morselli of the prevalence of suicide in the different countries of Europe, interpreted in the light of what we know of their social conditions. [Pg 660]

Yet, in considering the facts disclosed by the present paper, we must not dogmatically assert that each is of the importance that the figures indicate. In fact, it seems evident from a careful study of the sheets, which show all the conditions together for the same day—a thing impossible with the charts illustrating this paper—that the various conditions for the day mutually react and interact upon one another, certain combinations seemingly resulting in a re-enforcement of the tendency to crime, while certain others inhibit it. Space forbids any full discussion of this phase of the problem in the present paper, but it very probably will be made the subject of some future study.

> Author's Note.—The above paper was written more than a year ago. Since that time the work of comparing the prevalence of crime with the meteorological conditions has been carried on upon a much larger scale in the city of New York. An immensely greater number of data have served to corroborate the earlier conclusions arrived at in this Denver study, only in minor points—and those directly traceable to the very different climates—proving at all in opposition to them.—New York, *July, 1899*.

THE SURVIVAL OF AFRICAN MUSIC IN AMERICA.

By JEANNETTE ROBINSON MURPHY.

Fifty years from now, when every vestige of slavery has disappeared, and even its existence has become a fading memory, America, and probably Europe, will suddenly awake to the sad fact that we have irrevocably lost a veritable mine of wealth through our failure to appreciate and study from a musician's standpoint the beautiful African music, whose rich stores will then have gone forever from our grasp.

During my childhood my observations were centered upon a few very old negroes who came directly from Africa, and upon many others whose parents were African born, and I early came to

the conclusion, based upon negro authority, that the greater part of their music, their methods, their scale, their type of thought, their dancing, their patting of feet, their clapping of hands, their grimaces and pantomime, and their gross superstitions came straight from Africa. [Pg 661]

Some of their later songs, it is true, we must technically call "modified African," but how far the original African song elements have been altered (and usually not for the better) by contact with American life is a question of fact, and can only be settled by a careful comparison of the songs as sung among the natives of Africa and the changed forms in which their modified ones are found today in the South. It must be determined in each case, and can not be settled by any general theory or formula.

This question of the classification of African music has given rise to more or less discussion. It seems hardly just to call the genuine negro songs "the folk songs of America." We are a conglomerate people, and no one race can claim a monopoly in this matter. English, Scotch, German, French, Italians, and others have brought their own music and their own folklore, and in each case it must be considered distinctly belonging to the nationality that imported it. Why should not the same be true of the genuine negro music? The stock is African, the ideas are African, the patting and dancing are all African. The veneer of civilization and religious fervor and Bible truth is entirely superficial. The African is under it all, and those who study him and his weird music at short range have no difficulty in recalling the savage conditions that gave it birth.

Were I to begin now the study of all the intonations and tortuous quavers of this beautiful music, I fear I should be able to do little toward imitating it; for it was only possible to catch the spirit of it and the reason of it all while my voice had the flexibility of childhood, and the influences of slavery were still potent factors in the daily life of the negroes. I followed these old ex-slaves, who have passed away, in their tasks, listened to their crooning in their cabins, in the fields, and especially in their meeting houses, and again and again they assured me the tunes they sang came from Africa.

Possibly I have an unusual predilection for this imported African music, but to me some of the strange, weird, untamable, barbaric melodies have a rude beauty and a charm beside which, as Cowper says—

> "Italian trills are tame."

It is indeed hard to account for the strange misconceptions which prevail as to what really constitutes genuine African music. The "coon songs" which are so generally sung are base imitations. The white man does not live who can write a genuine negro song. At home there used to be a rare old singer, an old Kentucky mammy, whom everybody loved. She once said: "Us ole [Pg 662] heads use ter make 'em up on de spurn of de moment, arter we wrassle wid de Sperit and come thoo. But the tunes was brung from Africa by our granddaddies. Dey was jis 'miliar songs. Dese days dey calls 'em ballots, but in de ole days dey call 'em spirituals, case de Holy Spirit done revealed 'em to 'em. Some say Moss Jesus taught 'em, and I's seed 'em start in meetin'. We'd all be at the 'prayer house' de Lord's Day, and de white preacher he'd splain de word and read whar Ezekial done say—

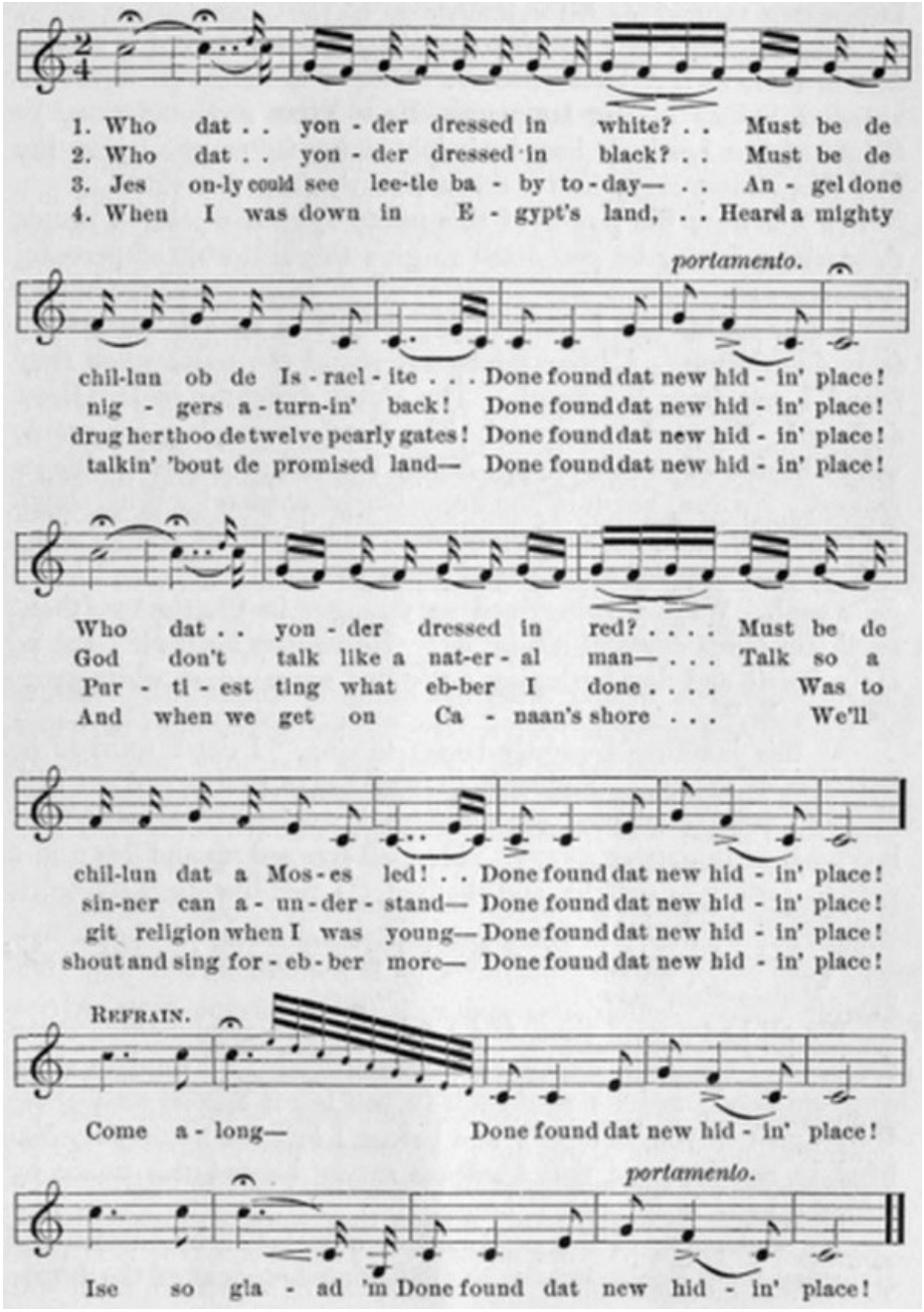
> "'Dry bones gwine ter lib ergin.'

And, honey, de Lord would come a-shinin' thoo dem pages and revive dis ole nigger's heart, and I'd jump up dar and den and holler and shout and sing and pat, and dey would all cotch de words and I'd sing it to some ole shout song I'd heard 'em sing from Africa, and dey'd all take it up and keep at it, and keep a-addin' to it, and den it would be a spiritual. Dese spirituals am de best moanin' music in de world, case dey is de whole Bible sung out and out. Notes is good enough for you people, but us likes a mixtery. Dese young heads ain't wuth killin', fur dey don't keer bout de Bible nor de ole hymns. Dey's completely spiled wid too much white blood in 'em, and de big organ and de eddication has done took all de Holy Spirit out en 'em, till dey ain't no better wid der dances and cuttin' up dan de white folks."

The negro usually sang religious music at his work. He was often turned out of church for crossing his feet or singing a "fiddle sing," which is a secular song, but he could steal all the chickens he wanted and never fall from grace. One of the most persistent fancies that the old slaves cherished was that they were the oppressed Israelites, that the Southerners were the cruel Egyptians, and that Canaan was freedom. Bondage was of course their slavery. They believed that some day the Red Sea would come in a sea of blood, which was verified in the civil war. In many of their songs they appropriate Bible prophecies and ideas to themselves. The song given on the opposite page is a characteristic one, illustrating many peculiarities; and if it did not come from Africa, where did it come from?

It is often asserted at the North that, as a rule, the negro was punished if he prayed or received religious instruction. On the contrary, many fine plantations had their "prayer houses," where a white minister was employed to hold services and to instruct them in the Bible. In nearly every section they were permitted and encouraged to hold their own meetings. That this is true is attested by these same thousands of "spirituals," all of which are filled with Bible texts. Some of [Pg 663] the most devout Christians were, and are yet, the old "mammies" and "uncles" who lived all the closer to the heavenly Father because of their simplicity and lack of learning. The deeply religious and better class of old negroes maintain that the reason that this music is so fascinating to whites and blacks is because it is God's own music inspired by the Holy Spirit.

DONE FOUND DAT NEW HIDIN' PLACE.



[Listen]

Lyrics:

1. Who dat .. yonder dressed in white?.. Must be de
2. Who dat .. yonder dressed in black?.. Must be de
3. Jes only could see leetle baby today— .. Angel don
4. When I was down in Egypt's land, .. Heard a mighty

chillun ob de Israelite... Done found dat new hidin' place!
niggers a-turnin' back! Done found dat new hidin' place!
drug her thoo de twelve pearly gates! Done found dat new hidin' place!
talkin' 'bout de promised land— Done found dat new hidin' place!

Who dat .. yonder dressed in red?.... Must be de
God don't talk like a nateral man— ... Talk so a
Purtiest ting what ebber I done.... Was to
And when we get on Canaan's shore... We'll

chillun dat a Moses led!.. Done found dat new hidin' place!
sinner can a-understand— Done found dat new hidin' place!
git religion when I was young— Done found dat new hidin' place!
shout and sing forebber more— Done found dat new hidin' place!

REFRAIN.

Come along— Done found dat new hidin' place!
Ise so glaad 'm Done found dat new hidin' place!

There is indeed a wonderful power in some of these songs, and the charm undoubtedly lies in the fact that they are founded on Bible texts. [Pg 664]

No one questions the remarkable hold the genuine negro music has upon the Anglo-Saxon race, as is evidenced by the success of the Jubilee singers years ago and of the Hampton students now. The negroes have simply used the weird African melodies as a fascinating vehicle for Bible truths.

Most students of English hymnology have observed a similar fact in their own religious poetry. One of the most powerful devotional hymns in the language—How Firm a Foundation, ye Saints of the Lord—is largely indebted for its perpetuity to the fact that almost every line is taken directly from the Bible.

To illustrate the power of this music upon the colored people themselves, I may be permitted to give this little bit of personal experience:

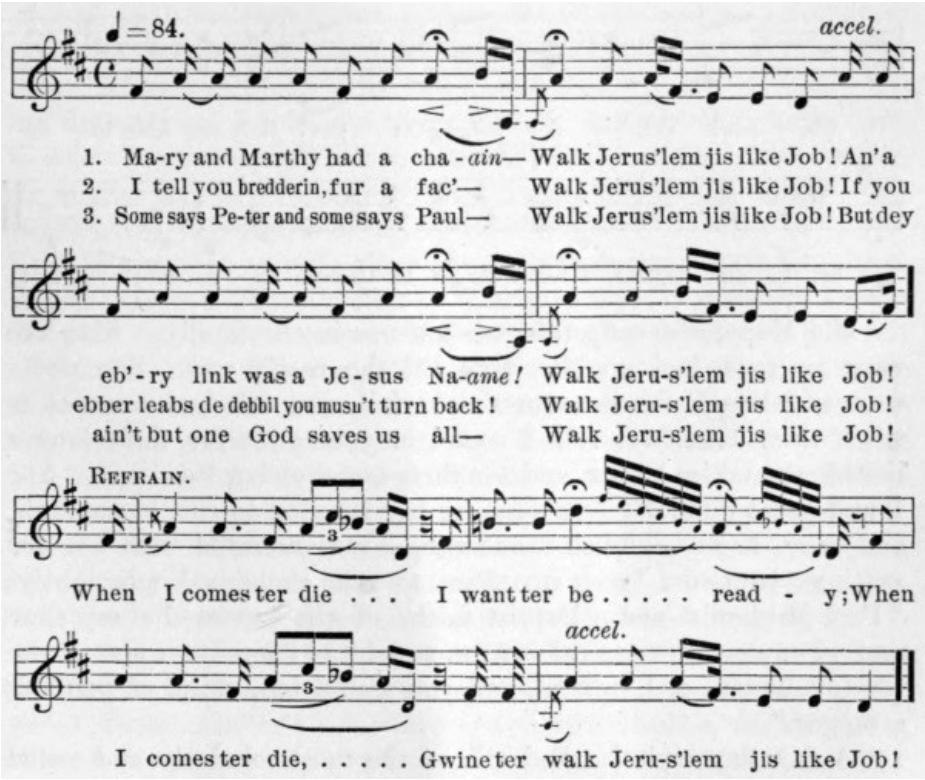
A few nights ago I went to pay a visit to an old "mammy" from Charleston. All her family sat round the room when they found I was from the South. The eldest daughter said: "Bress de Lord! I'm glad to see you! The Norf am no place for people what's been used to eberyting. Nuffin but wuk, wuk, wuk; all's jes money. No fun, nor lub, nor Jesus Christ nowhar! Why, dey'll jes meet you and pass de time ob day, and dey'll let you go away widout eber stoppin' to ax yer ef you's prepared to die, and how's your soul. Why, I neber seed no stranger in Charleston 'thout axin' 'em how's der soul comin' on? De niggers heah ain't got no Holy Spirit and dey is singing no 'count songs—dese white songs from books."

At this juncture I quietly began to sing, "I don't want to be buried in de Storm." Suddenly they all began to sing and pat with me, and quickly adapted their different versions to mine. They lost no time in getting happy. They all jumped up and down in a perfect ecstasy of delight, and shouted, "I feel like de Holy Spirit is right on my hade!"

Another one exclaimed: "People! dem songs makes de har rise up. Mine a-risin' now."

We all had a good time, and I felt greatly complimented when the head of the house explained enthusiastically: "You does shore sing 'em good; and for a white lady you is got a good deal ob de Holy Spirit in you, honey"; and before I left the house they had tried to convince me that God has surely blessed this music by taking a hand in forming it himself.

We find many of the genuine negro melodies in Jubilee and Hampton Song Books, but for the uninitiated student of the future there is little or no instruction given, and the white singer in [Pg 665] attempting to learn them will make poor work at their mastery; for how is he, poor fellow, to know that it is bad form not to break every law of musical phrasing and notation? What is there to show him that he must make his voice exceedingly nasal and undulating; that around every prominent note he must place a variety of small notes, called "trimmings," and he must sing tones not found in our scale; that he must on no account leave one note until he has the next one well under control? He might be tempted, in the *ignorance* of his twentieth-century education, to take breath whenever he came to the end of a line or verse! But this he should never do. By some mysterious power, to be learned only from the negro, he should carry over his breath from line to line and from verse to verse, even at the risk of bursting a blood-vessel. He must often drop from a high note to a very low one; he must be very careful to divide many of his monosyllabic words in two syllables, placing a forcible accent on the last one, so that "dead" will be "da—*ade*," "back" becomes "ba—*ack*," "chain" becomes "cha—*ain*."



[Listen]

Lyrics:

1. Mary and Marthy had a cha-*ain*— Walk Jerus'lem jis like
   Job! An' a
2. I tell you bredderin, fur a fac'— Walk Jerus'lem jis like
   Job! If you
3. Some says Peter and some says Paul— Walk Jerus'lem
   jis like Job! But dey

eb'ry link was a Jesus Na-*ame*! Walk Jerus'lem jis like Job!
ebber leabs de debbil you musn't turn back! Walk
   Jerus'lem jis like Job!
ain't but one God saves us all— Walk Jerus'lem jis like Job!

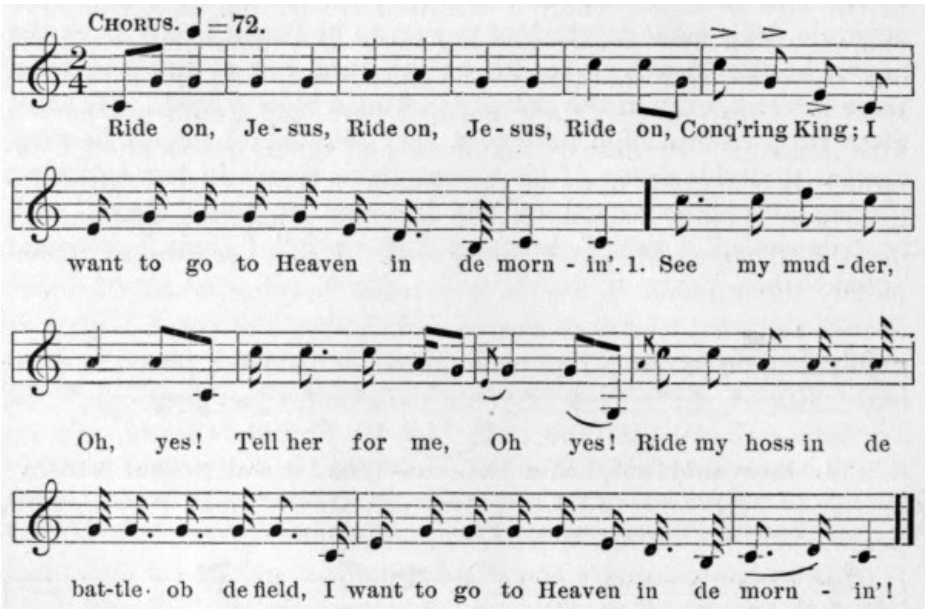
REFRAIN.

When I comes ter die ... I want ter be ..... ready; When
I comes ter die, ... Gwine ter walk Jerus'lem jis like Job!

He must also intersperse his singing with peculiar humming sounds—"hum-m-m-m." He will have to learn that the negro never neglects his family relations in his songs, and seldom considers his "spirityul" finished until he has mentioned his father and mother and sister and brother, and his preacher. [Pg 666]

A beautiful custom prevails among them of sending messages by the dying to friends gone before into heaven. When a woman dies some friend or relative will kneel down and sing to the soul as it takes its flight. This song contains endless verses, conveying love and kisses to Aunt Fannie and Uncle Cæsar and "Moss Jesus." With omissions it is used upon other occasions with fine effect.

RIDE ON, JESUS.



[Listen]

Lyrics:

Chorus.

Ride on, Jesus, Ride on, Jesus, Ride on, Conq'ring King; I
want to go to Heaven in de mornin'. 1. See my mudder,
Oh, yes! Tell her for me, Oh yes! Ride my hoss in de
battle ob de field, I want to go to Heaven in de mornin'!

Old Mary, who sang this, was a nurse in our family. She, like most negroes, had no idea how old she really was. She never worried, though the heavens should fall, and this ignorance as to when their birthdays rolled round may account for their longer lives here and in Africa, and for their not showing their age. She found great difficulty in arranging her religion to suit her morals, and once, in my childish innocence, I remonstrated with her for getting "baptisted" so many times, and she exclaimed indignantly: "I's a Methodist wid a Baptist faith. I gits baptisted ebery summer when de water am rale warm, and I gits turned out ebery winter fur dancin' and stealin', and you would too, child, ef you was a nigger."

A few days ago I asked one of the most scholarly and noted ministers of the colored race, who was visiting in New York, about the negro music. He is very black, and his parents were pure Africans. He said that undoubtedly the tunes came directly from Africa, that his father said he [Pg 667] had sung them at home in Africa, and that the tunes were almost supernatural in their hold upon the people. He continued: "Upon condition that you will never tell my name, I'll give you an incident which will prove to you that many of our race are still under the influences of voodooism, and that although I am, as you see, a professed Christian, all the African practices hold a powerful charm for me which I can't shake off." Knowing well his reputation and position, I was startled. He went on and said: "And this may serve you some time, as it is a true story of my own weakness. Once the bishop ordered me to the city of ——, where I was to have charge of a run-down church. The first prayer-meeting night the members locked me out, and came with shotguns to the church steps and said they were tired of ministers, that they had had four, and would not have a fifth minister. By dint of eloquence and superior education I obtained their consent to enter the church. Well, I tried faithfully to attract them. I never had more than a handful, and for six months all seemed dead set against me. I could not draw. Completely discouraged, I was in my study praying when the door opened and a little conjure man came in and said softly: 'You don't understand de people. You must get you a hand as a friend to draw 'em. Ef you will let me fix you a luck charm you'll git 'em.' In my desperation, I told him to fix it. He brought the charm back in a few days, and said, 'Now, you must feed it wid alcohol, whisky, or spirits, and never let it git dry, and always wear it nex' your heart when you enters or leaves de church.'

"It was only an ugly piece of red flannel, and I hate to confess it, but I obeyed his instructions. I always felt for it before I went down on my knees to pray. The next Sunday the church was full of people. The following Sabbath there was not standing room. For four years the aisles were crowded every Sunday. I knew it was not the gospel's power, but that wretched 'luck ball.' When the bishop sent me to another church he wrote and said: 'When you came they tried to drive you away with shotguns; here, now, twenty men write me begging to have you stay. Now you draw beyond any minister in the city! How is this?' I was ashamed to tell him. I opened the charm, and found these things in it. It was a large piece of red flannel, with a horseshoe magnet fastened flat to it. In the center of the space in the magnet was a bright silver dime. On one side were sewed two needles, on the other side of the money one needle. Below it were two more needles. The whole was covered with what looked and tasted like gunpowder. I tore it up and threw it away, and have never been able to draw an audience since.—You want one? Well, I'll try to get one for you."

"Indeed I want one! What lecturer would not?" [Pg 668]

I give this as an instance of the peculiar persistency of African ideas even in enlightened, civilized, Christian minds.

There is a Mrs. R—— in a side street in a Northern town whom I lately visited. She was the most prominent member in the Baptist colored church. She was the leading singer. Another singer got jealous of her power to holler the loudest; besides, she wanted to get her washing away from her as well as her husband, and, worst of all, *conjured* her. At last the first singer fell sick, and the doctor could do nothing to relieve her. A conjure woman called, and for twenty-five dollars undertook the case. She came in and moaned a few incantations in an unknown tongue. She carried a satchel, and took from it a glass, poured some gin into it and drank a little, and then, holding her hand over it, said:

"Mrs. R——, look inside yourself and tell me what you see."

Mrs. R—— was hypnotized, I suppose, and said, "I see pizen, and snakes a-crawlin'."

"That's right! It's the lady across the way has put the spell on you, and she has cut your shape out in red flannel and stuck it full of pins and needles and biled it. She's trickin' you, and killin' you. But I'll throw it back on her—scatter your spell to the four winds. She has killed a snake and taken the blood and mixed it with wine, and in twenty-four hours it turned into snakes and you drank it and you were going crazy, and your home would have been gone." It is needless to say the sick woman recovered.

She showed the caul she was born with tied up in a bundle in her stocking. The neighbors were always trying to touch the lump so they could put spells on people and be healed from diseases. The conjure woman also makes luck balls for sale. She tells her customers they must always wear them next their skin on the right side, and keep them wet with "feedin' medicine."

I was so fortunate as to discover the contents of one of her balls. Corn, twine, pepper, a piece of hair from under a black cat's foot, a piece of rabbit's right foot, and whisky—all put into a red flannel bag. This was all inclosed in a buckeye biscuit. She puts loadstones in some of them to draw away a lover from a girl. She also takes roots of several different herbs and flowers and makes them into love powders, and gives them to a darkey lassie to throw upon her truant lover to bring him back to her waiting heart.

It is not to be disputed that Africa has touched in many ways and in divers places the highest civilization of the Old World. I am fully persuaded that in the near future scientific researches will discover among native African tribes traditions which disclose the real parentage of many of the weird stories concerning the Creation and the Flood which are now current among their [Pg 669] descendants in this country. The same may be said of "Brer Rabbit" and the "Tar baby," "Brer Fox," "Brer Dog," "Brer Wolf," and all that other wonderful fraternization with animal nature which simple savage life and unbridled childish imagination suggest. In many instances they will be found absolutely identical with those that are now told in the wilds of Africa.

To show the existence of this belief among the negroes themselves, I will quote from an old negress, whom I know well, named "Aunt Lucinda":

"Dis is an ole tale. Hit done come down since de Flood. Why, chile, de Bible didn't git eberyting by a good deal—cose it didn't! Us niggers done tole dis in Africk, and Moss John done say de Bible say ef it got all de words Jesus say hit couldn't holt 'em. And dere's lots of tales de Bible didn't git. Dis one now be 'bout de hammer and de ark:

"One time God done tole Moss Nora to build him a ark, case de people fo de Flood was a singin' and a cuttin' up and a givin' entertainments, and God wanted to raise up a better people to a sarve him, and so Moss Nora had to build de ark tight, so de few people wouldn't drown. God tole him to take a he and a she of every kind and fix de jistes tight so de ark wouldn't leak water when de Flood came. De people sat around on de benches a-pokin' fun at him, and dey say, 'Moss Nora, what you doin'?'

"He say, 'I's a-hammerin' de jistes tight.'

"And de people say, 'What dat you doin'?'

"And Moss Nora say, 'I got this ark to build, and I gwine to build it.'

"And de people kep' a-pokin' fun. Dey say, 'Moss Nora, what dat hammer say?'

"And he say, 'What it sound to you like it say, humph?'

"And de people laugh and say it soun' like it say nuffin but 'Tim—tam! tim—tam!'

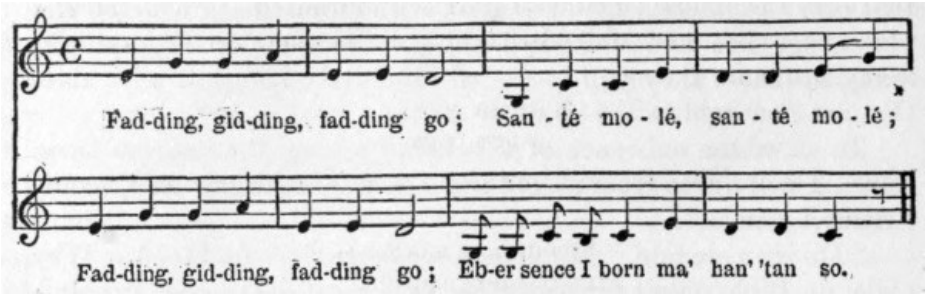
"And Moss Nora say: 'Dot's whar you fotch up wrong. I got ter build this ark so tight de water won't leak thoo, and de people won't fall out, and dat hammer don't say "Tim—tam," no sich ting. Hit say ebery time I hits de jistes, "Repent! repent!"'

"Dere's a spiritual what goes long wid it too, honey, 'bout de hammer an' de nails, but I don't know it. Hit's a ole, ole story dat we been singin' since de Flood—jes come down from mouf to mouf. Hist de Window is a ole tune, but not ole like dis one. Hit done come jis like I tole you."

In regard to one song, at least, I have irrefragable proof of its African origin. Mrs. Jefferson Davis

tells me her old nurse was a full-blooded African named Aunt Dinah. She would lovingly put her little charge to sleep with this doggerel: [Pg 670]

FADDING, GIDDING.



[Listen]

Lyrics:

Fadding, gidding, fadding go; Santé molé, santé molé;
Fadding, gidding, fadding go; Eber sence I born ma' han'
'tan so.

Aunt Dinah would also sing it pleadingly when begging for a present. She would begin the supplication with hands clinched tight, and open them quickly at the last line. She declared that she always sang it in this exact manner in her old African home whenever she was asking a favor, but she was never able to tell the meaning of any part of it except the last line, the African of which she had forgotten, but which meant that all black races are born with wide-open palms ready and waiting for other peoples to pour rich gifts into them. This she translated in her apt, crude way: "Eber sence I born, my hand stand so!"

She had a relative named Moses, I think, who had three deep gashes radiating from each eye. Of these he was very proud, as he said they indicated that he was of the king's blood.

Ten days have elapsed since the above was written. I feel like crying, "Eureka!" I have found my proof! After a diligent search for a real live African, I have found an educated convert to Christianity, who has been absent only two years from the wilds of the west coast of Africa. In broken English he sang for me several songs sung by the savages of the native Mendi tribe. The tunes sounded much like songs I know, but I could not take them down during this interview. All the songs I sang he said seemed very familiar—in certain portions especially so.

I was especially interested in the description he gave of a peculiar ceremony common among the wildest Bushmen and the Yolloff tribe. My informant grew up and played with them a great deal when a child. He says the death of a young boy they consider an affront to the living—an affront which they never forgive. It is singular that among some of our Indian tribes a similar notion prevails. The friends meet around the corpse and exclaim, while they chant and sing and dance, in a high-pitched voice: "Why did you die? Were you too proud to stay with us? You thought yourself too good to stay with us. To whom do you leave all your things? We don't want them! [Pg 671] Take them with you if you are so stuck up; we'll bury them with you!"

They work themselves into a perfect fury, and one gets a whip and flogs the corpse until it is horribly mutilated. Then the few who have really been friends to the child in their crude way draw near and begin to sing:

"Anasa yi.
Anasa papa,"

which this native African assured me meant, as nearly as he could translate it—

"Find out how mother is.
Find out how papa is."

The curious identity of the name for father in this African dialect and our own he could not explain.

Even while the relatives were thus speaking kindly to the departed child, others would come up with whips, and with blows spitefully exclaim: "Tell my father's sister I am happy. Speak to her for me." This they said, mocking the relatives for sending messages.

What better proof is required of the origin of the peculiar custom of the negroes in our own Southland of sending communications by the dead? He also gave me new stories of Brother Conch, and a tale of a rabbit and a pitch-man.

He says he has heard a savage tribe often sing to the beat of a peculiar drum, as they started to pillage and destroy a neighboring tribe, these words, which he could not translate:

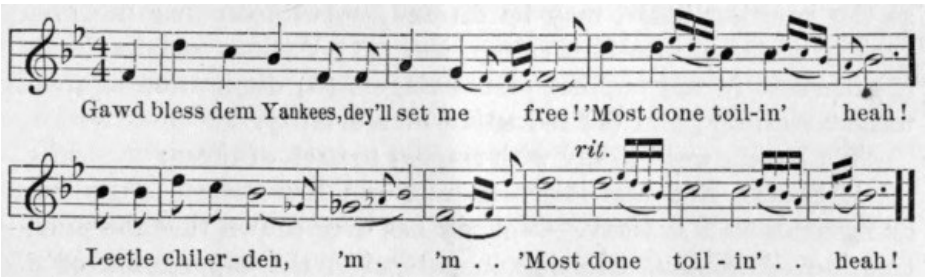
"Zo, whine, whine,
Zo, bottom balleh.
Zo, whine, whine,

Zo, bottom balleh."

Some of the tribes are followers of Mohammed. After they have broken their fast, they sing this hymn to their God:

"Li li, e li li,
Moo moo dooroo, soo moo li."

I then sang for him a part of "Gawd bless dem Yankees, dey'll set me free,"



[Listen]

Lyrics:

Gawd bless dem Yankees, dey'll set me free! 'Most done
toilin' heah!
Leetle chilerden, 'm .. 'm .. 'Most done toilin' .. heah!

and when I came to the humming, which we all know is the marked peculiarity of the negro singing, he stopped me and said, "Whenever you hum that way it means 'Hush!' and among the tribes I have known it always comes in baby songs." He then sang this one, which a heathen woman used to sing to his little sister "Amber": [Pg 672]

"Amber in a wa,
Keen yah feenyah ma,
Amber in a bamboo carri,
Amber eeka walloo.
Um, um, um."

A rough translation of this means: "Amber, be quiet and I'll give you something. I'm not going to flog you. You are quiet, so I thank you. Hush, hush, hush!"

REMEDIES FOR THE DEPOPULATION OF FRANCE.

By M. JACQUES BERTILLON.

France is on the way to become a country of the third rank. It is perishing for lack of births. Its population remains stationary, while that of all the other great countries has largely increased since the beginning of the century. This points ultimately to a certain growing inferiority in military strength, economical prosperity, literary prestige, and scientific repute; and finally to a progressive diminution of French influence upon the march of civilization. This depreciation of France comes partly from political causes and partly from its low birth rate.

In the examination of the remedies which have been proposed to antagonize this evil, we shall begin with a rapid review of those which appear to be least efficacious. Then we shall present those which figure on the programme of the *Alliance Nationale pour l'accroissement de la population française*, a society which should include all French people who care for the future of their country.

The reforms for which the depopulation of France has served as the vaulting board may be divided, notwithstanding the great variety of them, into four categories: (1) Various social reforms; (2) increase in the number of marriages; (3) diminution of involuntary sterility; and (4) reduction of mortality.

We have a word to say with respect to each of these:

I. Social Reforms proposed for the Hypothetical Purpose of increasing Natality.—Nobody has ever shown that the emancipation of woman, selection in paternity, the suppression of divorce, or, the contrary, laws facilitating divorce, would augment natality. Nobody has ever given a proof, or the beginning of a proof, in support of these fancies. [Pg 673]

Would socialistic reforms leading to a diminution of the share of capital, and a corresponding increase of the share of labor, have any effect upon natality? I can not pronounce upon this question, because I have not sufficient data; nevertheless, the remuneration of capital has not ceased to diminish since the beginning of the century—we may even estimate that it has diminished nearly one half, for the nominal interest on money has fallen from five to three per

cent. This has not prevented natality from decreasing in our country. Would it be augmented if capital should come to have no remuneration at all? I have not examined this difficult and very hypothetical question, for, if such a thing should happen, it could be only in an extremely remote future. But the supreme struggle of which our country has always to think will have taken place long before that.

The revival of religious ideas, if it should come about, might have some effect on natality. Demographic studies have shown how great an influence religion has on habits and on phenomena of moral pathology (on the frequency of suicides, for example), and prove that men put the prescriptions of their religion into practice more than one would believe. All religions direct man, more or less imperatively, to have as numerous a posterity as possible. There may therefore exist a relation between natality and the degree of sincerity of religious convictions. But it is manifest that, whatever we may do, we can not change our age nor prevent its growing more and more incredulous.

II. Summary Examination of Measures having in View the Increase of the Number of Marriages.—Nuptiality is nearly the same in France as it has been. It has, however, diminished during the last twenty years, falling gradually from eight marriages to seven marriages a year per thousand inhabitants. For seven years past it has gained a little, and is now 7.6—a fairly satisfactory rate. It is not here that the saddle galls us.

It has been proposed, as a measure for increasing the number of marriages, to simplify the required formulas. I believe that these formulas are indeed too long, too many, and too expensive. The countries which have been so foolish as to copy our civil code have taken pains to strike out this chapter, and they have done well. But he is greatly mistaken who believes that the number of marriages could be perceptibly increased by suppressing unpleasant formulas. When one wants to marry, he generally does so in spite of the obstacles which maladroit legislation may have piled up. In case of need, the matter is settled by an irregular affiance, and natality loses little. [Pg 674]

The violent suppression of convents has also been proposed as a measure for promoting the increase of marriages. A person who has reflected much could not speak of such a thing. To what extent does any one suppose that might augment natality? The convents at this time contain about sixty thousand women. Suppose they were all as ready as other women to marry—which is not the case, for the fact that they have retired to a cloister proves that family life has few attractions for them—a simple calculation shows that they would afford forty-five hundred births a year. So France needs six hundred thousand infants every year, and a plan is advanced to give it four or five thousand at most—and that by means of a violent measure, unworthy of an age of freedom!

Next are the *measures proposed for diminishing involuntary sterility*. Is involuntary sterility as frequent as it is supposed to be? Our respected master, Jules Rochard, was surprised to find two million sterile families recorded in the census reports. But the number does not appear excessive. We can not compare it with similar returns abroad, for France is the only country, except in the case of a few cities abroad, in which items of this kind are inquired into by the census takers. But, according to different gynæcologists—chiefly German—cited in the Academy of Medicine, the number of sterile families should be sixteen per cent. Now, this is the exact proportion found in France in the enumeration of 1896. The really surprising thing about the matter is not the number of sterile families, but the limited fecundity of the fertile families. There are other figures to show that absolute sterility is not the cause of the low rate of French natality. An inquiry respecting sterile families was made in 1856, at a time when French natality was a little higher than it is now, a comparison of the results of which with those of the enumeration of 1886 shows that the number of fruitful families had not diminished (83.6 per cent of the families having one or more children then, to 83.3 in 1886). The factor that has diminished is the fertility of the families. It is only necessary to cite the measures that have been suggested to counteract this supposed excessive sterility to make their inanity apparent. Among them are reform of the abuse of tobacco and alcohol and war upon syphilis. Do not these scourges exist among other nations than us? Nothing could be more salutary than to war upon them, but to connect their existence with the depopulation of France is a singular exaggeration of their importance. More than this, the physician of a benevolent institution in Paris has told me that the large families who resort to his dispensary nearly all have a drunkard at their head. The families that issue from such parents are not necessarily degenerate. This curious observation ought not certainly to make us partisans of drunkenness, but it demonstrates to us that the suppression of alcoholism is not what will restore French natality. Rather the contrary. [Pg 675]

III. Examination of Measures proposed for diminishing Mortality.—As the question of the population of France has been more especially discussed by the doctors, it has done great service as a vaulting board for medical theories. Doctors are very ready to reason as if they could dispose of human life at their will. It is very hard to keep a man from dying. The most skillful doctors have not reached that point; but it is very easy to have a man born, and is within the reach of the latest-made young practitioner. It is very doubtful whether the proposed measures will be efficacious or practical. See how much trouble we have had, after a century of experiments, in realizing the benefit of vaccination, the only nearly infallible remedy we have against disease. Surely a country ought to guard itself as much as possible against sickness and death, and should do everything that will conduce to that end, as we do all that is possible to cure a man ill with pneumonia or any other disease. But we should not delude ourselves with illusions, and we have to confess that the efficacy of the measures which we take to satisfy our conscience is very

doubtful. The failures of hygiene are almost as numerous as those of medicine.

Mortality has not increased in France. It is rather less there than in other countries in the same latitude, and even less than that of some of the countries situated farther north. So we can hardly hope to diminish it very much.

The effect of mortality on the whole is, moreover, not to diminish natality, but rather to favor it. The death of an adult leaves some position vacant, and makes room for the institution of a new household and the birth of other children. So when a rich old man dies, the money he leaves helps set up his children in life; and when a poor old man dies, a burden is taken away from his descendants, who had to support him and who can now marry and have children. Some of the parallelisms in the movements of population which statisticians have observed may be explained thus. We might compare a human society to a tank so arranged as to be always full of water. It has a supply pipe (natality and immigration) which opens and operates only when the discharge pipe (mortality and emigration) is also open; or to a forest of definite extent, in which, when a clearing is opened, a new growth appears in the cleared space, unless some cause exists to prevent it, which cause it will be the forester's business to find and remove. He would not think, [Pg 676] however, of stopping the cutting of the old trees, for that would be to prevent the essential condition of the new growth's getting a headway. The law of all living societies, in forests and in nations, is the perpetual renewal of the stock.

IV. Of Measures that will be Effective.—The evil must be fought in its causes. These causes are detestable family customs, dictated by pecuniary considerations. These being the things to be reformed, and money being the cause of them, the beginning should be made with money. We have a right to demand energetic measures, severe if necessary, against the evil that is eating France. Those which we shall ask for here are only equitable. They shall fully respect individual liberty, and in some cases augment it. Their purpose is to teach the French people who do not know it the immense wrong which their mistaken selfishness is inflicting upon the country. They aim especially to modify customs, and to invoke for reasonably numerous families the profound respect and protection that are due them. And they seek to harmonize general with particular interests, a thing to which the present laws have precisely the contrary effect.

It is just as much every man's duty to contribute to the perpetuity of his country as it is to defend it. This is a moral truth which the French have forgotten, and it will have to be inculcated in them. The case is beyond the reach of the most eloquent sermons, and will have to be met, if the mass of men are to be convinced, by palpable facts that will touch all personally. This leads to the principle, which seems, moreover, self-evident, that the fact of bringing up a child should be considered a form of tax payment. The payment of a tax is, in fact, the imposition of a pecuniary sacrifice for the profit of the whole nation. This is what the father accepts who rears a child.

A family, to be acquitted of the tax, should rear at least three children. It takes two children to fill the place of the parents, and there should be a third in addition, for one in three families, on an average, will have no children. Hence the family which does not rear three children will fail of imposing sufficient sacrifices upon itself for the future of the nation. It is free to do this, but should pay damages for it. He, on the other hand, who rears more than three children imposes supplementary burdens upon himself, for which he should be recompensed every time occasion offers. The principle of a reduction of taxes proportioned to the number of children was applied in June, 1898, at the instance of the *Alliance Nationale*, by the city of Lyons. It has been adopted, very timidly at first, and then a little more broadly, by the Minister of Finance.[F] But it would be [Pg 677] easy, and even necessary, to go considerably further in this direction.

To accomplish this reduction without the treasury losing anything, it is only necessary to charge the less prolific families with one fifth additional tax. The demographic condition of France is, in fact, so deplorable that families of more than three children form only one sixth part of the whole number, or are 2,122,210 out of 12,127,023; hence, in order to clear fully from liability for taxes these two million families, it is enough to charge the other ten million families with supplementary taxes of twenty per cent—a thing that is entirely practicable. It may, however, seem more expedient to scale the supplementary impost, so that it shall fall in inverse proportion to the number of children. Thus, let bachelors more than thirty years old pay fifty per cent; households without children, forty per cent; families with one child, thirty per cent; families with two children, ten per cent; families with three children, the present tax without addition; while families with more than three children should be wholly exempt. A simple calculation will show that the treasury would gain by such an adjustment. It would lose 2,122,210 contributors of taxes, and would gain, against these, 2,456,112. Furthermore, families with more than four children are usually poor and hardly able to pay even light assessments, while those we propose to tax supplementarily are mostly wealthy, whence the tax against them would be generally productive.

These scalings and exemptions might be applied to all the various kinds of direct taxes, so that the state should say, in effect, to the infertile families: "You have done a wrong to your country. We have no thought of punishing you for it, but it is not right that you profit by it. You must pay damages for it."

The plan actually followed by the state, instead of making lighter the meritorious burden which the head of a numerous family assumes, does everything to make it harder. All the direct and indirect taxes seem to fall higher upon families having many children. It would not be exact to say that the law is indifferent to natality. It would be more just to say that it does all it can to

discourage it, and that every Frenchman is officially invited, in his own interest and that of his posterity, to limit it as much as possible. The contrary is what should be done.

There are wealthy families which are in a position to contribute most liberally to the perpetuity of the nation, and yet, strangely, they are the most abstemious. It would not be fair to tax them according to the number of servants they have, for this must increase as children multiply; but the tax might be adjusted to the excess of servants over children. [Pg 678]

As an objection to our plan, it may be asked if we really believe that those "neo-Malthusian" families who have only one or two children will decide to have four in order to save themselves from some taxes? We do not cherish this illusion; but the sordidness of the family customs of the country should not be exaggerated. Most of the families sin through selfishness, while they do not realize that their selfishness is culpable, harmful, and ignoble. This must be made clear to them, and no method of publishing the fact is as imposing and effective as the tax-collector's schedule. The reform in direct taxes which we propose will therefore have an educational influence.

The same principle might be applied in the military service by expediting the discharge of soldiers who are married. A bill to this effect has been introduced in the French Senate, and an amendment has been proposed extending the favor to the eldest son of a family of five children.

The inheritance tax is a particularly fitting form of impost in which insufficiently fruitful families might pay the indemnity which they justly owe the state on account of their sterility; for the prime object of the neo-Malthusians is to forestall the necessity of dividing their fortunes among too many children. The laws of succession are so framed now that *only* sons pay less than others; not only are the expenses of notarial acts less for them than for families with several children, but the latter are liable to pay the tax several times, for when one of the heirs dies his brothers and sisters will have to pay new succession taxes. In all cases of this order the treasury burdens numerous families, and spares neo-Malthusian ones. The institution of heritage stimulates industry, and is one of the chief reasons for it. A great many men, we are sure, would work less and would certainly save less except for the prospect of leaving the fruit of their labor and economy to their children—or, too often, to their only child. But as the institution of heritage becomes under these conditions one of the prime factors of depopulation, it will have to be modified.

The state is as much interested in the fecundity of families as it is in their industry and thrift. To stimulate the latter virtues it guarantees them the right of inheritance. It might withdraw it or diminish it to its own profit, if their fertility was not judged sufficient for it. For such a measure to be effective its application should be severe enough to touch sensibly the fortunes of families which have given the country only one or two children. The state, for instance, might reserve to itself the disposable part of the inheritance—half, for instance, in the case of families having only one child; a third, of families where there are two children; and waiver of the extra tax where there are three children. The principle might be approximately expressed as that of treating single children as to their inheritance portions as if they had brothers. But as a proposition so worded would have but little chance of immediate adoption, we should have to be satisfied with a less radical reform. If it is objected that such measures would be too revolutionary and too much opposed to existing ideas and habits, the answer is that anodynes would be without effect upon so profound and inveterate an evil. French families must cease to have an evident interest in limiting the number of their children, and something more than half measures will be needed to achieve such a result. [Pg 679]

Our principle is equality of burdens. We say to the French: "You have three chief duties toward your country: to contribute to its perpetuity, to its defense, and to its pecuniary burdens. We affirm that you have failed in the first of these duties. This being true, you must accept the other two with a supplement. With this principle severely applied, and with some other reforms, we hope to bring back to the country the idea of the respect that is due to numerous families and of aversion against the detestable habits that are destroying France."

The sums derived from the increased succession taxes which we have proposed to assess upon families that have given the country only one or two children might be reserved for the education of poor children or for the realization of some such plan as has been proposed by M. Raoul de la Grasserie for the pensioning of a retreat in old age for the parents of large families.

Another means of encouraging parentage may be found in instituting special honors and marks of esteem for the fathers and mothers of numerous children. Thus the General Council of the Drôme gives a gold medal on the 14th of July to each of the two women in the department who excel in this respect. A fund has been created at Nantes for providing rewards to those who have the most children under fifteen years of age. A system of rewards also exists at Meaux for those who have contributed most to the population.

The French law requiring the equal division of estates among all the children operates as a deterrent to parentage. A father who has built up a large business or accumulated a handsome domain is exceedingly averse to the prospect of having it cut up and dispersed, and is therefore careful to have but one child, so that it may descend unimpaired to him. The coincidence that France is the only country where this system prevails, and is, at the same time, the only one where the population is decreasing, is striking enough to suggest a connection between the two phenomena. The law works mischievously in this respect, and requires modification in the direction of giving the parent larger privileges of testamentary disposition. [Pg 680]

Thus, the state should in every way and in every department of law and administration manifest its profound respect for large families; it should set the example on this point, for it is the party most largely interested.—*Translated for the Popular Science Monthly from the Revue Scientifique.*

WEST INDIAN POISONOUS FISHES.

By JAMES MACDONALD ROGERS, F. R. C. S.,

STAFF SURGEON, R. N.

At a time when so much attention is being paid to the West Indian Islands as regards their politics, social condition, and natural history it may not be out of place to briefly consider the subject of the poisonous fishes to be found in the neighboring seas. Considering the number of unwholesome fish abounding in these waters and the numerous cases of illness caused by them, I was surprised on investigation to find that so little appeared to be known or written on the subject. During my three-years' cruise in the West Indies the study of those fishes reputed to be poisonous was forced upon me by reason of the numerous cases of illness among the sailors of my own ship. When it is asserted that there are no less than sixty varieties of noxious fishes to be found in Cuban waters alone, it seems desirable that those who are about to settle in these parts should have some general idea as to what fish to choose and what to avoid.

Colored fishermen are not too particular about hawking unwholesome fish in the streets, even when its sale is forbidden in the market, and numerous cases have come under my notice where the unwary purchaser has paid the penalty by a sharp and painful illness. One of the great delights of our sailors is to land on some sandy beach, provided with a large seining net, in order to catch fish, the consumption of which varies the monotony of salt beef and pork. On examining the hauls they made I invariably found some unwholesome specimens, which I advised them to [Pg 681] reject, and by so doing every time they went seining had no more cases of fish poisoning on board.

In tropical seas some fish are found to be always poisonous wherever and whenever caught, but there are numerous instances where wholesome fish become noxious when found in certain localities, especially on coral reefs and shoals. Fish when feeding on decomposing coral polyps, medusæ, and poisonous mollusks found on these reefs often become noxious, as the following instance will prove: Midway between Cuba, Hayti, and Jamaica lie the extensive reefs and shoals of the Formigas, which are several miles in extent and covered by a small depth of water. These shoals present a concentration of all the incidents to be found in West Indian fringing shore reefs. Arborescent corals and spreading millepores stretch on walls and ledges, interspersed with huge meandrinas and brainstones, among which lodge a profusion of *Holothurias*, starfishes, and a variety of sponges. This great mass of reefs, called from their clustering swarm the Ants' Nest, or the Formigas, abound with all sorts of fishes. As you approach the great submarine plateau, the odor of the slime and of the spermatic substances that find a resting place in the crevices and shallow pools spread through it is very remarkable—the pleasant blandness of the sea breeze suddenly changing to the nauseating smell of a fish market. Those who have waded on tropical shore reefs know not only the strong scent given out by the polyps that build there, but feel how sensibly the hands are affected, and how the skin of the thighs is susceptible of a stinging irritation from the slightest contact with the slime of corals. It has been found by invariable experience that all the fishes taken on the Formigas are pernicious; that the barracudas especially are always poisonous. Similar stretches of shoals among the Bahamas produce fishes deleterious as food.

The low-spreading ledges and banks of the Virgin Islands, called the Anegadas, or the Drowned Islands, afford a similar unfavorable ground for fishing. In this way we may account for the remark of Dr. Grainger that fishes are poisonous at one end of St. Christopher while they are harmless at another. We get over, by these several incidents of those fishing grounds, the adventitious occurrence of poisonous among wholesome fishes, which become deleterious from the food on which they subsist at certain seasons on certain banks and coasts.

Again, in the tropics wholesome fish soon become virulently poisonous if kept too long, as the fierce heat favors rapid decomposition. In this short article I have only space for a description of the most common and injurious fishes met with in the West Indies. One of the commonest fish in [Pg 682] these seas is the barracuda (*Sphyræna barracuda*), which can be easily recognized by its elongated body, covered with cycloid scales. The color is dark olive-green on the back, fading to a lighter green on the sides, while its under surface is silvery white. The mouth is wide and curved, with long and sharp teeth. These fishes are large and voracious, often attaining the length of six feet; and as they are usually found close inshore, amid the heaviest surf, they are as much feared by fishermen and bathers as the shark. Indeed, they are more to be feared, for the shark as a rule is timid, and unless extremely hungry is cautious in its voracity. The barracuda, on the contrary, is very bold. The shark flees from a splashing in the water, but the barracuda goes there to see what he may find, as he is only attracted by live bait. The wounds inflicted by the barracuda are exceedingly severe and sometimes fatal.

When young this fish is generally used as food, but having attained a certain size the flesh

becomes exceedingly noxious, at least at certain seasons of the year. This change is said to be due to the poisonous fish on which they feed. When caught on certain banks, as the Formigas, their flesh is always extremely unwholesome, and, as Kingsley says, they have this advantage, that while they can always eat you, you can not often eat them with impunity. The Cubans, as a rule, will not touch this fish, and at Santa Cruz it is the custom never to eat it till the next day, and then not till after salting it; but that is apparently no safeguard, as four persons living in Kingston, Jamaica, suffered severely after eating "corned barracuda."

It is stated that when unwholesome, its teeth will be found of a blackened color at the base, and on inserting a silver coin into its flesh this will also turn black. The poisonous symptoms caused by this fish are peculiar, and were strongly marked in the case of a friend of mine who was a solicitor living in Barbados. He and several others who had partaken of the same fish suffered from severe gastro-intestinal disorder, with intense nausea and vomiting. His face swelled up and became tubercular like a leper; afterward, general muscular tremblings and acute pain about the body, particularly in the joints of his hands and arms, came on. The nails of his feet and hands became black and fell off without any pain, and his hair also fell out. For years after he suffered from debility and tubercular skin eruptions. Death sometimes follows, but those who do not die suffer for a long time from its effects, which in some cases last for twenty-five years.

The "yellow-tailed sprat" (*Clupea thrissa*) is common in the West Indies, and may be recognized by having its last dorsal ray prolonged into a filament. A black spot behind the gill cover is said to [Pg 683] distinguish it from a somewhat similar fish, the "red-eared pilchard," which has a yellow spot behind its gill cover. Schomburgk gives testimony to the poisonous properties of the "yellow-tailed sprat" when found at certain periods of the year among the Leeward and Virgin Islands.

The eating of this poisonous "sprat" is said to be followed by most violent symptoms and rapid death. The common saying in the West Indies—that if you begin at the head you never have time to finish the tail—is almost literally true.

The eating of the roe of this "sprat" caused in Japan, in the year 1884, twenty-three deaths. The victims suffered from severe inflammation of the mouth and throat, strong abdominal pain, formication in the arms and legs, disorders of vision, paralysis, convulsions, and loss of consciousness. Nausea, vomiting, and diarrhœa often occurred. Death followed in some cases in a quarter of an hour, but mostly in from two to three hours.

Lacroix describes a case of poisoning through eating the "sprat" which occurred on board a French man-of-war. Out of a crew of fifty men, thirty were dangerously ill and five died. The men experienced strong muscular cramps in the arms and legs, nausea, vomiting, and diarrhœa. Afterward congestion of the brain, delirium, and coma supervened.

Most of the cases of fish poisoning which I have met with in the West Indies have been due to eating various kinds of "snappers," especially the "gray snapper." The tropical species are very numerous and difficult to differentiate, owing to their frequent change of color according to age and surroundings. In 1897, at St. Georges, Grenada, twelve persons who partook of a large gray snapper were attacked with severe symptoms of fish poisoning. A few hours after the meal all these were suffering from pain and fullness in the stomach, followed by persistent vomiting, severe cramps, watery evacuations, weak, thready pulse, and labored respirations. One of the victims was examined by me four months afterward, and he stated that, owing to intense weakness, he had been forced to keep his bed for several months, during which period he suffered from various nervous disorders. He had shooting pains and tingling of the limbs, dimness of vision, and quick, thready pulse.

In 1893 seventeen persons living in Bridgetown, Barbados, were attacked by similar symptoms to those mentioned above. All these had eaten of a fish which had been hawked about by a fisherman, and which was subsequently identified as a "gray snapper," though sold under a more innocent name.

A Spanish naval surgeon, Don Anton Jurado, while serving on board the gunboat Magallanes had [Pg 684] an opportunity of proving Poey's statement that the fishes caught on the coast of Cuba are often very poisonous. No less than twenty-seven of the officers and men were taken ill, most of them with gastro-intestinal disturbance of a more or less severe nature; the others suffered from nervous symptoms.

The horse mackerel, green cavalla, and the jack are often found most unwholesome when caught in West Indian waters.

In Barbados a whole family were seized with symptoms simulating cholera from eating "green cavalla."

The editor of The Barbadian writes: "We think it right to caution people against the fish called 'green cavalla' from being purchased by their cooks. Some years ago we know that several individuals were extremely ill from eating this fish, which is frequently very poisonous. The night before last a whole family in Bridgetown, except the master, who fortunately had dined out, were seized with violent cholera after having partaken of cavalla."

The "jack" (*Caran plumieri*) is found to be poisonous in some seasons of the year, and it is said that at such times two small red lumps appear in its gills. When they are suspected of being in a poisonous condition an experiment is tried upon a duck by giving her one of them to swallow, and if at that season it is poisonous the duck dies in about two hours. The "rock hind," or "smoky

hind," after attaining a certain size becomes most unwholesome, and often infested with parasites. Numerous instances of severe symptoms attacking persons after eating this fish are recorded.

Toadfish, or *Tetrodons*, are occasionally met with, and are to be avoided as being extremely poisonous, especially if the roe or liver be eaten. A family of coolies in Trinidad, in spite of being warned, ate one of these fishes, with a fatal result. The symptoms were blunted sensibility, trembling, general muscular weakness, difficulty of breathing, vomiting of blood, convulsions, and death.

The *Diodonts*, "trunkfishes," are not nearly so poisonous as the *Tetrodonts*, but they are found to be very noxious at certain times or in certain localities, more especially if the gall bladder, liver, and intestines are not removed before cooking. It is reported that those persons who had eaten them suffered from loss of sensibility, cold sweat over the whole body, and stiffened limbs. Death followed in some cases.

The "prickly bottle fish" (*Diodon orbicularis*), met with in the Gulf of Mexico, is said to be injurious when eaten.

The *Ostracion triqueter*, called in the West Indies "fair maid," "plate fish," "trunkfish," is often eaten with no ill effects by the negroes, who, after cleaning it, bake it in its hard shell-like covering. There is, however, a gelatinous matter near the tail which is called "the jelly," and a similar substance is found near the head. When only part of this jelly has been eaten its effects are a peculiar vertigo, nausea, vomiting, pains all over the body, more especially in the limbs. The feeling of vertigo is similar to that of intoxication, hence the fish has been called "drunken fish." [Pg 685]

The "filefishes," or "trigger fishes," when found in the tropics, where they feed on coral polypi, have the reputation of being most unwholesome.

In the West Indies "sea eels," or murenas, are only eaten by the negroes. The blood of eels is said by Mosso to contain a poison like that of vipers. It is related that a man drank some eel's blood mixed with wine, and was in consequence seized with severe diarrhœa, disturbance of vision, foaming at the mouth, and stertorous breathing. He ultimately recovered after vigorous treatment.

Dr. Gordon, of Montego Bay, Jamaica, records a case of death from eating the flesh and liver of a species of coast conger (*Gymnothorax restratus*). In spite of treatment, the man died after a lingering illness.

Space will not permit me to dwell in this article on the remaining noxious fishes, but it is to be hoped that enough has been written to teach people to be cautious in their selection of fish when in the West Indies.

THE COLORS OF NORTHERN FLOWERS.

By JOHN H. LOVELL.

For profusion of bloom and brilliancy of coloring, the land of the tropics, with all its luxuriance of vegetation, can offer nothing to compare with a New England meadow in June. Along the great rivers of the South or in the islands of the East strange and beautiful flowers occur individually or in small groups, but the traveler looks in vain for myriads of blossoms giving a distinctive coloring to the landscape itself. It was long the popular notion that the colors of flowers were of no importance except as they gave human pleasure. This idea has been made familiar by a well-known line of Gray's Elegy. It was a German pastor, Christian Conrad Sprengel, at the close of the last century, who first pointed out their true significance. So enthusiastically did he pursue his botanical studies that he neglected the duties of his office, and finally even omitted the Sunday sermon. The natural result followed, that he was deprived of his parish. In straitened circumstances he then sought unsuccessfully to maintain himself at Berlin by giving lessons in botany and Sunday excursions in search of plants. His book, now a botanical classic, attracted but little attention; his publisher did not even send him a copy of it, and in disgust he turned from the study of plants to that of languages. The title of the work, The Secret of Nature in the Form and Fertilization of Flowers Discovered, affords us the pleasure of knowing that he rightly estimated the importance of his observations. Sprengel clearly states that the bright hues of flowers, as is now well established, serve as signals to attract the attention of nectar-loving insects flying near by. He was led to this conclusion very fitly by the study of *Myosotis*, the "forget-me-not." He has not been forgotten. His name and theory were rescued from obscurity by Darwin; his book a few years ago was reprinted at Leipsic, and is now universally recognized, says H. Müller, as having "struck out a new path in botanical science." [Pg 686]

A day's stroll through the fields and woodlands is sufficient to show that yellow and white blossoms are in Nature more common than red or blue. From an examination of 741 New England and Eastern species belonging to 48 families (see table) it appears that 164 are yellow, 283 white, 71 red, 136 blue and purple, and 87 green. Greenish flowers occur in 25 families, yellow in 29, white in 32, red in 16, purple and blue in 22.

The Predominant Colors of the Flowers of Ranunculaceæ to Cornaceæ in the Northern States.

	Yellow.	White.	Red.	Blue.	Green.	Total.
Ranunculaceæ	19	19	2	14	6	60
Magnoliaceæ	1	4	..	..	1	6
Anonaceæ	..	..	..	1	..	1
Menispermaceæ	..	2	..	..	1	3
Berberaceæ	2	3	..	..	1	6
Nympbæaceæ	3	2	..	1	..	6
Sarraceniaceæ	1	..	..	1	..	2
Papaveraceæ	4	2	2	..	..	8
Fumariaceæ	2	3	2	1	..	8
Cruciferæ	17	37	2	5	4	65
Capparidaceæ	..	1	..	..	..	1
Resedaceæ	1	..	..	..	..	1
Violaceæ	4	6	..	8	..	18
Cistaceæ	4	..	..	..	4	8
Droseraceæ	..	3	1	..	..	4
Hyperaceæ	18	..	2	..	..	20
Elatinaceæ	..	..	..	..	1	1
Caryophyllaceæ	..	32	15	..	6	53
Portulaceæ	1	..	3	1	..	5
Malvaceæ	5	4	10	3	..	22
Tiliaceæ	..	2	..	..	..	2
Camilliaceæ	..	2	..	..	..	2
Linaceæ	3	..	..	1	..	4
Geraniaceæ	3	2	2	6	..	13
Rutaceæ	..	2	..	..	1	3
Anarcardiaceæ	1	..	..	..	5	6
Vitaceæ	..	..	..	..	7	7
Rhamnaceæ	..	3	..	..	4	7
Celastraceæ	..	..	..	2	1	3
Sapindaceæ	2	2	2	..	5	11
Polygalaceæ	2	3	4	5	..	14
Leguminosæ	19	28	6	61	2	116
Rosaceæ	19	44	13	2	2	80
Calycanthaceæ	..	..	..	3	..	3
Saxifragaceæ	2	20	..	1	13	36
Crassulaceæ	2	3	1	2	1	9
Hammelaceæ	1	1	..	..	1	3
Halorageæ	..	..	..	..	9	9
Onagraceæ	15	2	4	5	4	30
Melastomaceæ	..	..	..	3	..	3
Lythraceæ	..	1	..	8	..	9
Loasaceæ	1	..	..	..	..	1
Cactaceæ	3	1	..	..	..	2
Cucurbitaceæ	..	2	..	..	1	3
Umbelliferæ	8	33	..	2	2	45
Araliaceæ	..	3	..	..	3	6
Cornaceæ	..	11	..	..	2	13
Total	164	283	71	136	87	741

Yellow appears to have been the first color developed, and flowers with this coloration are usually simple and regular in structure, as the buttercups and five-fingers. But why, it will be asked, should yellow have been the primitive color? The spores and spore-cases of the club mosses, and the pollen of all cone-bearing trees, and, in fact, of most plants, are yellow, and the yellow coloration of the first petals is doubtless correlated with this fact. Flowers of this tint are peculiarly attractive to yellow-banded flies, and when dull are avoided by beetles. Yellow flowers vary greatly in size, but pale yellow flowers are usually small, and bright or orange-yellow are large. *Ranunculus abortivus* and *R. sceleratus*, which grow in wet places, are small and pale, while *R. bulbosus* and *R. acris*, the familiar buttercups of our meadows, are an inch broad. An apparent exception to the above rule is offered by the globe-flower (*Trollius laxus*), found in dense swamps, which has solitary, very large, pale greenish-yellow flowers. As the cultivated European and Asiatic species have bright yellow flowers, the coloring of the sepals of *T. laxus*, for the petals are wanting, has probably retrograded from growing in dense shade.

Yellow flowers in their natural state exhibit but little variation of color. They change most readily to white, and less often to red or blue. Under cultivation sudden variations from yellow to white have been observed. A double yellow hollyhock, according to Darwin, suddenly turned one year [Pg 687] into a single white kind, and a chrysanthemum has been seen to bear both yellow and white flowers. It will be observed in the accompanying table that in all families in which yellow flowers are common, white are also common, except in the *Hyperaceæ*, which contain no white-flowered

species. Some species of mustard regularly fade to white, while many white flowers show that they are descended from ancestral yellow forms by retaining vestiges of this color on the base of the petals, as in the water-crowfoot. The pale yellow flowers of *Œnothera laciniata*, of the cultivated *Ribes aureum*, and of *Diervilla trifida* in fading change to rose or red, exhibiting a tendency to develop red coloration. *Aquilegia canadensis* produces scarlet flowers, which are yellow inside and rarely all over. There are two other species in the Northern flora which exhibit similar coloring, *Lonicera sempervirens* and *Spigelia marylandica*, and the former is sometimes yellow throughout. *Myosotis* is at first pale yellow, and changes to sky-blue. But the best illustration of the transition from yellow to blue is exhibited by the violet family; the smallest and simplest species is yellow, the most highly specialized is blue, and all the intermediate stages are presented by *Viola tricolor*.

Honey-guides are exceedingly rare among yellow flowers. *Cassia chamæcrista*, which has nearly [Pg 688]
regular, showy yellow flowers, has two or three petals with a purple spot at base, while four of the anthers are yellow and six purple. It is interesting to compare with this flower the change of color presented by *Arnebia*. When the flower opens, each lobe of the yellow corolla is marked by a dark purple spot, which soon begins to fade, and by the next day has entirely disappeared. *Saxifraga aizoides* has golden flowers spotted with orange, and attracts a large number of insect visitors, and the yellow violets have their petals marked with dark-brown lines leading to the honey glands. Sulphur-yellow flowers are visited chiefly by bumblebees, and their coloration seems to have been developed by their selective influence from red or purple-flowered ancestors. Müller observed that the sulphur-yellow flowers of *Sempervivum Wulfenii*, which are unlike the primitive yellow of the *Crassulaceæ*, are purple at base. This purple coloring he believed to be a remnant inherited from an earlier purple-flowered form. *Hibiscus trionum*, which is sulphur-yellow with a blackish eye, has perhaps been derived from a red-flowered ancestor, for the three other species of the genus are rose or flesh colored.

White flowers, in the opinion of the writer, are due to retrogression, and are derived from yellow, red, or blue, and in some instances from the primitive green, as in the involucre of *Cornus*. As a whole they present no advance in specialization over yellow flowers, and are often smaller and less conspicuous. When the petals of blossoms containing yellow, red, or blue pigments are placed in concentrated alcohol they turn to white. To produce these pigments is evidently more or less a tax upon the energies of the plant, which, whenever possible, is avoided. They are not present in the embryonic buds, and may not develop until they are well advanced in size. In [Pg 689]
Gentiana crinita the yellowish-white bud is nearly an inch long before the purple coloring appears, and the corolla always remains white at base. A stimulus to the growth of the plant makes itself apparent in the increased brilliancy of the flowers, as when they are exposed to clear sunlight or are treated with nitrate of soda, and may also be observed in the flushing of tulips, by which they lose their variegated colors when treated with strong manure. On the other hand, a check in nutrition and growth will cause a diminution of the perianth in size, accompanied by retrogression in color. When double red poppies are transplanted the whole plant is dwarfed, while the flowers are much smaller and pure white. This view of the origin of white flowers explains why they are the commonest in Nature, accounts for their being most numerous in families in which yellow flowers are likewise numerous, and why they are most true to name under cultivation. Many white flowers also exhibit other evidences of degeneration in their structure. Numerous species of *Cruciferæ* and *Caryophyllaceæ* have small white flowers, which regularly fertilize themselves; and in *Lepidium*, *Stellaria*, and *Sagina* the petals are sometimes present and in other instances are wanting.

White flowers often develop red or blue coloration. It is interesting to note that the red and white varieties of the hyacinth were derived from the wild blue form earlier than the yellow. Darwin gives an instance of a white and red rose produced on the same root, also of white and pink flowers on a single plant of *Antirrhinum majus*. *Cratægus oxyacantha*, a dark pink hawthorn, has been known to throw out a tuft of pure white blossoms. Every stage of the transition from white to red is placed before us by the rose family. The thorns are white, rarely tinged with rose; in the pear and apple the flowers are white, regularly shaded with red; and one of the *Spiræas* is rose, rarely white, while in the roses proper the six species are rose-colored, but the prairie rose changes to white. Under cultivation the wild geranium has been seen to produce upon the same plant both white and blue flowers. Good examples of the transition from white to blue and from blue to white may be met with in the *Ranunculaceæ* and *Leguminosæ*. *Delphinium tricorne* is bright blue, sometimes white, *Viola canadensis* has the petals white inside but the upper ones tinged with violet beneath, *Astragalus* has a part of the species white and a part purple, while it is common to find blue and white varieties of *Hepatica* growing on the same grassy bank. White flowers pass more readily into red, blue, or yellow than any one of these colors can be converted into any other, since it is easier to develop a new pigment than to transform one already existing. This is confirmed by the experience of florists, who always seek to obtain a white variety from [Pg 690]
which to develop the desired hue.

Red flowers are much rarer than blue, and both are seldom common in the same family. For instance, in the pink family red and white blossoms prevail, and there are no blue shades. The pinks are crimson and scarlet, often with elegant markings and a strong aromatic odor. The honey is deeply concealed, and they are visited almost exclusively by butterflies and millers. Twenty-eight species of diurnal *Lepidoptera* have been collected upon a single variety of *Saponaria*. Of the eighty species of *Rosaceæ*, thirteen are red and two purple, but the forty-four white flowers are very generally tinged or tipped with red. The two purplish-flowered species, *Geum rivale* and *Potentilla palustris*, belong to genera in which yellow predominates, and this

primitive color is still evident in both their calyx and corolla. There are no blue or violet flowers. This family exhibits a marked tendency both in stem, leaf, bud, flower, and fruit to develop reddish coloration, a tendency which is probably due to the chemical constitution of the sap. There are no flowers in this family adapted to *Lepidoptera*, but they are visited by a mixed company of flies, beetles, and *Hymenoptera*. The smaller and less specialized *Rosaceæ* are yellow and white and are visited by a variety of short-lipped insects. With the increase of the flower in size and conspicuousness the number of insect visitors greatly increases, and the enlargement of the flower is attended by red coloration. Owing to the chemical constitution of the nutritive fluid, probably to its acidity (for when the petals of a rose are treated with ammonia they become blue), there has been no opportunity for the development of blue coloration by insects. With the enlargement of the perianth and the increased flow of sap, red tints have tended to appear by process of oxidation.

The correlation of red coloring with an increased flow of sap is well illustrated by the galls of the wild-rose tree, which are often "as rosy as the rosiest apple." An abnormal flow of sap is caused to the part stung by the insect, and red coloration is due to the action of light, for it is of no service to the plant. Again, when the flowers of *Cratægus coccinea* are stung by the gall-fly the different organs all become bright red, and the change in coloring is accompanied by an increase in size. In some instances red colors, according to Darwin, indicate greater vigor on the part of the plant, and I have also observed that the dwarfing of red flowers under cultivation may cause them to revert to white.

It was long, indeed, believed that the same species could not produce yellow, red, and blue flowers. But this doctrine, to use the words of Dr. Lindley, "must now be laid up in the limbo of pleasant dreams." This supposed law is contradicted by the hyacinth, pansy, *Delphinium cardinale*, and many other plants. Though red and blue coloring never occurs among the roses, a hyacinth has been seen to produce a perfectly pink and a perfectly blue blossom on the same truss, and the *Borraginaceæ* afford examples of flowers turning from red to blue in even a short space of time. [Pg 691]

Blue is the highest color of the floral world, and is preferred by bees. Blue flowers are, as a rule, highly specialized both in form and color, and often possess marvelous mechanisms which aid in disseminating the pollen. This coloring is very common in the mint and pulse families, and in this district there are in the former forty-nine and in the latter sixty-one species of blue flowers. Their structure is such that few insects besides the long-tongued bees can gain access to the honey, and in some instances a single species of flower is visited by a single kind of bee, as one of the larkspurs by one of the bumblebees. While this high specialization of the flower may insure intercrossing, it is yet open to many objections, such as scarcity of proper guests, mechanical imperfections, perforation of the flowers by bees, and development of the perianth at the expense of the essential organs.

It is noteworthy that when genera occur containing three or more species they are seldom all blue or purple; one species at least, and frequently more than one, is yellow, white, or red. In *Trifolium*, *T. pratense* is rose-purple, *T. repens* white, and *T. agrarium* yellow. In the genus *Astragalus* a part of the species are violet or blue and a part white, and the same is true of *Lespedeza* and *Vicia*; in *Lathyrus* three species are blue-purple, one yellow, and one yellowish white. It is probably more advantageous in these genera for a part of the species to be of one color and a part of another than for all to be blue. When species are closely allied bees tend to visit them indiscriminately, as has been observed to be true of the buttercups, *Spiræas*, and golden-rods. During an afternoon the writer carefully collected the insect visitors to *Solidago bicolor*, our only cream-colored golden-rod. Both the number of species and of individuals taken was much larger than upon the yellow-flowered and more abundant varieties of this genus growing near by. There could be no doubt that the whitish coloration was beneficial in enabling insects to distinguish it more readily. Many purplish flowers are regular, often showing indications of degeneration, are devoid of honey, and are self-fertilized or adapted to *Diptera*, or, as in *Hepatica*, which is visited by bees for the pollen, open to a wide circle of visitors. In the sea purslane (*Sesuvium maritimum*), a prostrate maritime herb, there are no petals, but the five-parted calyx is purplish inside. The genus *Ammannia* of the *Lythraceæ* has the petals small, purplish, and in one species they are wanting; the axillary flowers of *Bracenia purpurea* are small and dull purple; in the common papaw the lurid purple flowers are large and adapted to *Diptera*, as are probably the lurid purple flowers of *Calycanthus*. Blue flowers may revert to red, white, or yellow. The fringed *Polygala* of Britain is usually bright blue, but often reverts to pink and white; there is a pure white variety of the blue-eyed grass; *Mertensia virginica* is purple-blue, rarely white; the larkspur is bright blue, sometimes white, and a white variety of the purple *Trillium* frequently occurs; there is, indeed, no improbability of a white-flowered form of every species being discovered. *Viola calcarata* is normally blue, but sometimes changes to the ancestral yellow. [Pg 692]

The possession of a strong scent may, however, in many instances more than compensate for the absence of color. This is well illustrated in *Lepidium sativum*. The flowers are small and inconspicuous and in rainy weather do not fully open, yet, as it is odoriferous, Müller found it more abundantly visited by insects than any other crucifer. It is their strong odor, rather than their color, that renders so many umbellifers so attractive to a great variety of insects. Nocturnal flowers, which are visited by moths, are usually white and sweet-scented, though the evening primrose is yellow and *Saponaria officinalis* is rose-colored. Kohler and Schübeler have shown that a larger proportion of white flowers are fragrant than of any other color. Of 1,193 white

flowers examined by them, 187 were odoriferous; of 951 yellow, 75; of 923 red, 85; of 594 blue, 31. But neither color nor odor will long alone serve to insure the visits of insects. The common elderberry exhibits the disadvantages which may attend the want of honey when there is but a limited supply of pollen. There are great masses of odoriferous flowers which convert the shrub into a huge bouquet, but it blooms at midsummer, when it must contend with many nectar-yielding plants. As a result, it is almost wholly deserted by insects. Only four species of flies have been taken upon it, and repeatedly the blossoms were examined without discovering a single visitor, and yet upon the jewel-weed and the red-osier cornel, a few yards away, scores were at work.

Among the more recent applications of electricity is one for the desiccation of wood, by the Nadon Bretonneau method, by which wood is made as fit for use for certain exact processes in as many months as it has formerly taken years. It is also proposed by Mr. Shaw, an English mining engineer, to substitute water and steam for gunpowder in mine blasts, a cartridge of water being placed instead of the powder cartridge, and vaporized by passing the electrical current through it.

SKETCH OF OSCAR SCHMIDT.

[Pg 693]

Oscar Schmidt was characterized by Ludwig von Graff, his successor at Grätz, as a real naturalist who, keeping up with the advances of science and philosophy all his life, as a zoölogist spanned the whole domain of that science, giving equal interest to every part and branch of it. The animal as a whole, as a living being in the series of organisms, was the object of his concern, and all the parts of the animal and all the processes that go on within it were alike interesting and important to him; and the ultimate purpose of his study of that object was to gain from the facts disclosed a philosophic view of Nature.

Eduard Oscar Schmidt was born at Torgau, Prussia, February 24, 1823, the son of a military chaplain who was descended from an old family of clergymen—"a man of fine Saxon culture, with no very great taste for theology, and open-minded to a ripe old age," and who died in 1875. His mother was of French and German (Hamburg) descent, and counted the great Aristotelian Petrus Ramus among her ancestors. The father was a gentle instructor to the son; and the latter, attending in the intervals of study to duties of the household and the farm and making good use of his opportunities for relaxation, enjoyed a young life that was invigorating to mind and body. He thus acquired tastes that led him frequently in his later life to leave the city and his study and go into the country to build and plant, whereby he endeared himself to the Badenese farmers. On rainy days and winter evenings, as he gleefully told of himself in 1858, the boy of eleven or twelve years of age entertained himself and had his fancy stimulated by reading Campe's old accounts of his travels. He thus became interested in geography, and acquired a thirst for travel that was never quenched.

Having finished his elementary schooling at Weissenfels, on the Saale, where his grandfather had served as superintendent, he went in 1836 to the celebrated Royal School at Pforta, of which his father was an alumnus, and whither he himself took his son thirty years later. He was much impressed by the teaching of Koberstein, the historian of literature, who unlocked for him the world of Goethe and of romance; and he went out from Pforta into life with a full conviction that the soundness of our culture depends upon its humanistic foundation. He went to Halle in the fall of 1842 to fulfill his military obligations and study mathematics and natural science, and became interested in other branches. At the Berlin Hochschule, whither he went next, he further broadened the scope of his culture, pursued philosophical studies, and finally settled upon the [Pg 694] organic sciences. His interest was gradually diverted from mathematics, and he took up zoölogy with enthusiasm. Johann Müller—whose portrait, his son Erich Schmidt says, in the memorial address from which we draw most of the facts of his life, always adorned his room—permitted him, in 1845, after a summer term in comparative anatomy at Heligoland, to take part in a research upon sea animals, and impressed a stamp on the young investigator's view of Nature that lasted till the Darwinian revolution. Christian Gottfried Ehrenberg interested him in the investigation of the minute life of the infusoria, and, besides being his teacher, had a fatherly affection for him.

In 1846 Schmidt obtained a promotion to Doctor of Philosophy at Halle, the subject of his still unprinted dissertation being the sacred *Scarabæus*. He passed the higher teachers' examination in Berlin, and thereby avoided a year of probation at a realgymnasium. In August, 1847, he habilitated himself at Jena. He presented, on the occasion, a paper entitled Morphological Fragments, in which, while the name of Oken was mentioned appreciatively in the introduction, the gap between his philosophy and the current zoölogy was insisted upon. He became Professor Extraordinary of Natural History in this university in 1849, and Director of the Grand Ducal Zoölogical Museum in 1854. While at Jena he published the Handbook of Comparative Anatomy (1849), the Hand Atlas of Comparative Anatomy (1852), and a historical study on the Development of Comparative Anatomy (1855). Some results of a journey to the North in the course of his studies of the *Turbellaria* were embodied in a lecture on the Faroe Islands (1848),

and Pictures from the North, collected during a Journey to the North Cape (1854), a versatile work, in which his sharp powers of observation were well illustrated. A work of somewhat different character was a lecture on Goethe's Relation to the Organic Natural Sciences, which was delivered in the Berlin Singakademie and was printed in 1853.

Having occupied the professorship at Jena for seven years on a salary never exceeding one hundred thalers, and after declining an invitation to Prague, Schmidt in 1855 accepted the appointment of Professor of Zoölogy in the University of Cracow. The conditions at this institution were quite different from those which had surrounded him at Jena. He received more liberal allowances than had been granted him there; but political affairs were disturbed, and he withdrew in 1857 to become Professor of Zoölogy and Comparative Anatomy, and eventually rector, at Grätz. Here he spent the fifteen most enjoyable and most fruitful years of his life, of [Pg 695] which his son, Erich Schmidt, has given, in his memorial address, a most pleasant picture. "In the magnificent scenery," he says, "among which he often wandered with his growing children, with warm-hearted men around him, sure of the increasing affection and capacity of his students, he reached his culmination as a naturalist and as a man. He was active in every direction. The university was in a very promising period of its career. A medical faculty was required, and that magnified his function. He also represented his department in the Johanneum, and presided over the museum. He went every year to Dalmatia while he was composing his monograph on the sponges, and made experiments in their artificial cultivation, being given one year a small war steamer at his disposal. These journeys were doubly enjoyed when Franz Unger went with him to Lesina or to the Ionian Islands. He and the great botanist had a close community of interests, and it was an inestimable privilege, during the great scientific crisis, to stand shoulder to shoulder with an older man, who to power of following philosophical intricacies united the habit of the most exact research with finely trained effort and suggestive intuition. Together the two devoted themselves to the study of Darwinism, at first opposed to it, as is shown by one of Schmidt's printed essays, but soon becoming impressed with the conviction that all scientific progress was connected with that revolution, and finally Schmidt gave all his energy to the advancement of it. As Rector Magnificus—the first Protestant to wear the golden chain at an Austrian university—he declared himself, in his inaugural address, for Darwinism with a resoluteness peculiar to him, and neither the silly demonstrations of the theological students nor the wrath of Cardinal Rauscher could intimidate him from the vindication of free investigation.... The rectoral year 1865-'66 was also the year of the Austro-Prussian War, and he now proved that the rashly progressive man to whom the whole clash of opinions was a bath of steel also possessed a considerable measure of self-control. He bore himself correctly in every sense in his difficult position, and, without turning his back upon his native Prussia, he so completely devoted himself to the care of the wounded as to receive a note of thanks from the General Archduke Albrecht. Having been chosen a deputy to the Landtag, his voice was always heard in favor of the Liberal side. He served indefatigably in the communal council and the school board. The Protestant communes depended upon him as one of their most effective champions, even to the end of the partisan contest. Besides all this many-sided scientific and public-spirited activity, Schmidt had time to describe the lower animals for Brehm's *Thierleben*, and to write a number of popular [Pg 696] treatises. A lively social disposition bound him to numerous colleagues, and on the whole he felt so much at home in Grätz, especially after he had a new institute and a share in the direction of a zoölogical station at Trieste in prospect, that he had no thought of a change. He declined invitations to Marburg and Dorpat. He was always favored by the Government, and kept the marks of its consideration faithfully in memory."

Ludwig von Graff describes three plainly marked periods in Schmidt's scientific career. The first, the beginning of which coincided with his entrance into his scientific professorship, was characterized by his labors on the *Turbellaria*, from which he was only occasionally diverted during his residence at Jena and Cracow. "The observations on infusoria, radiates, and tapeworms, the structure of the annelids and the development of the mollusks, the descriptions of new amphibia, and the important discovery of the crustacean nature of the peltogasters, were, we might say, only rests in the uninterrupted course of the *Turbellaria* studies; and that Schmidt was constantly returning to them was not merely because particular interest had been devoted to them in Germany at that time only by M. Schultze and R. Leuckart, for other animal groups had fared no better among the then small number of scientifically working zoölogists, but Schmidt had won his earliest scientific fame with his little book on the fresh-water *Rhabdocœlas* (1848), and had by means of it entered the circle of recognized investigators. He gave in this book the first connected presentation of the whole organization of a group of animals, the diversity and great abundance of which in fresh water were hardly suspected, and the anatomy of which consisted of few and imperfectly understood isolated data; described new systems of organs in them, and based an improved classification on their remarkably complicated and variously graded structure, with new families, genera, and species. The little book was therefore received with much interest. A journey to the Faroe Islands in 1848, and his first excursion to Lesina in 1852, followed in 1856 by a journey from Cracow to Nice and Naples, enabled him to increase the number of new species, and permitted an insight into the great diversity of forms, without, however, giving him time for accurate anatomical investigations, for the nature of the objects promised a considerable advance in this direction only at the cost of tenacious patience and untiring industry. His subsequent labors on the *Rhabdocœlas* of the vicinity of Cracow, the *Dendrocœlas* of the vicinity of Grätz, and his researches on the *Turbellaria* of Corfu and Cephalonia, which (in 1861) closed this period of his career as worthily as it had begun, proved that Schmidt possessed both these requirements. These labors, if he had accomplished no more, [Pg 697] would have been sufficient to give him an honorable position in science for all time.

"The second period begins in Grätz. Some contributions to the knowledge of the prehistoric vertebrate fauna of Steiermarck resulted from Schmidt's keen observations of Nature during an excursion in the Alps. But the Adriatic, so near, enticed him into new paths, and offered an inexhaustible field for work in the sponges. Aside from his contributions to the theory of the *Bathybius* and to the systematics of the *Gephyrea*, the sea sponges constituted the object of his studies during the whole period of his residence in Grätz, and were the occasion of yearly journeys to the Adriatic coasts. The results reached by Schmidt in this field placed him in the foremost rank of contemporary investigators, while his occupation with the sponges marked the completion of a revolution in his view of Nature by converting him to Darwinism. After his work the characteristic fluid form of the sponges became a classic subject in the study of the transmutation theory.

"At the time of the appearance of Schmidt's first work on the sponges of the Adriatic (in 1862), just enough of their anatomy and physiology had been made known through individual labors, especially those of Lieberkühn, to prove their animal nature; and then, also, the sponges first found a place in the fifth edition of Schmidt's Handbook of Comparative Anatomy. But any one who undertook either in the Adriatic or the Mediterranean to make his way through the immense wealth of the forms would have found himself without help of any kind. It was therefore Schmidt's purpose to lay the basis, through exact description and definition of the forms, for continued investigation through which the study might be further advanced. He carried out this purpose, recognizing in the skeleton parts what survived amid the changes, clearly defining the species and genera, nineteen of which were new, and brilliantly demonstrating his talent in systematization. While in the first supplement, in 1864, which brought up the histology of the sponges, he still acknowledged himself an adherent of the old school, he expressed the hope in the second supplement that science might some time come upon the track of the genealogical relations of species; and, in the memorable rector's address of November 15, 1865, he openly signalized his passage to the new theory, and proclaimed it, with all the youthful enthusiasm and carelessness as to consequences characteristic of his nature, as the gospel of the research of the future.

"The idea of utilizing the great reproductiveness of the sponges for artificial cultivation was suggested to Schmidt during his studies of the Dalmatian fauna, and his experiments in this direction made his name well known in the Austrian coast land and far beyond. After the [Pg 698] publication of an article on the subject in the *Wiener Zeitung* he was requested, by the Imperial-Royal Ministry of Trade and National Economy, to make a special presentation of his views respecting the possibility and methods of cultivating sponges artificially in Dalmatia. He first asked for means for experimenting, as furnishing the prime and most essential method of determining where and how a sponge culture could be instituted with the best prospect of success. The request was not granted, but Schmidt was requested to furnish data respecting the provisions and measures within reach which might be employed with advantage till further information could be obtained concerning the adaptability of sponges to propagation from such local experiments as might be carried on through the industrial and commercial chambers of Dalmatia. The Notes on Sponges in the Adriatic Sea and an article of similar import in the *Triester Zeitung* of March 12, 1862, were the answer to this request, and they were followed by Schmidt's having placed at his disposal, by the exchanges of Trieste, in the next season, money and the control of the war steamer Hentzis for use in scientific and practical investigations on the Dalmatian coast. With the assistance of his brother, Eugen, he carried his experiments to a successful issue at Sebenico, Zlarin Valle Socolizza on Lesina, Curzola, Lagosta, Meleda, and Ragusa, but especially in the more favored stations of Zlarin and Lesina, and demonstrated the possibility of artificial propagation. In order to test the practical value of the experiments, propagating stations were established on the island of Lesina and visited by Schmidt every spring. The results of the experiments were presented in a report to the Imperial-Royal Ministry of Commerce and National Economy, in which the possibility of artificial propagation was emphatically affirmed."

Unfortunately, the Dalmatines have not been quick enough to take advantage of the opportunity thus offered to them to establish a new industry on their not very busy coast. Bucchich continued Schmidt's experiments till 1872, but no capitalists have been found to establish the cultivation of sponges on an extensive and permanent scale.

Another enterprise, however—the Zoölogical Station at Trieste, to which Schmidt for a time devoted all his energy—has had a more fortunate realization. The plan of it was developed by Carl Vogt, but it would never have been erected if Schmidt's practical sense had not adapted the plan to the actual needs of the case and the financial conditions imposed by the state, and if he had not given the weight of his personality to the accomplishment of it.

The erection of a German Empire at the conclusion of the Franco-Prussian War was an occasion [Pg 699] of proud and exultant joy to Schmidt; and when, in the spring of 1872, he was elected, at the instance of his friend Haeckel, a professor in the newly instituted university at Strasburg, he deemed it a patriotic duty to accept.

With his removal to Strasburg, what both Erich Schmidt and Professor von Graff call the third period of Schmidt's scientific career began. It was a period of undisturbed ease in his home life, and was devoted chiefly to the continuation of the studies of the sponges, with a few special researches, the results of which appeared in books, on the theory of descent, fossil animals, on Hartman's theories, and on social democracy. His systematic and anatomical labors on the sponges—the provisional conclusions of which, in 1870, constituted the *Grundzüge einer*

Spongienfauna des Atlantischen Gebietes (Outlines of a Sponge Fauna of the Atlantic Region)—were carried on, Professor von Graff says, from the point of view of the development theory. Besides several smaller contributions to the building up of the theory of descent, the most important of all his works of this time is his book on the Theory of Descent and Darwinism (Appletons' International Scientific Series)—"one of the best presentations of all the questions pertaining to that subject, and distinguished from other similar works both by the philosophical spirit with which the whole discussion is carried on, and by the even consideration it gives to all the various fundamental points of the principle of descent. The prominent features of Schmidt's presentation appear most especially in the final chapter, the subject of which is the Application of the Theory of Descent to Man, which he had also previously discussed in a public address. Shortly after this he reduced to absurdity, in a very forcible attack on Hartman's Philosophy of the Unconscious, the idea of the Social Democrats that they could use Darwinism to the advantage of their Utopia, and treated the subject of the Mammalia in their Relation to Primeval Times (Appletons' International Scientific Series) most vigorously from the point of view of the development theory." He also found time for special researches on the Structure and Development of Loxosema, the Eyes of Arthropods, and, still keeping up his studies of the sponges, closed his more than twenty years' labors on this group with his Sponges of the Gulf of Mexico, and his last scientific work—Derivation of New Species through the Decay and Atrophy of Older Characteristics. The preface to the former work, Professor von Graff says, shows plainly how Schmidt, in contrast to so many fellow-laborers in the field of the theory of descent, was always circumspect in a high degree, and never suffered himself to be carried so far in his zeal as [Pg 700] to leave the ground of facts. Although a champion of monophyletic derivation, he did not overlook the facts that might be brought to bear in favor of a polyphiletic origin.

During the later years of his life Schmidt visited Heligoland, and enjoyed the sea air, which seemed to have become necessary to him, during two winters at Dohrn's Institute at Naples, in southern France, and at Grado, and attended the meetings of naturalists at Leipsic, Wiesbaden, Salzburg, Baden-Baden, Munich, Cassel, and Freiburg, where he was a welcome guest and a prominent speaker. In September, 1885, as president of the Zoölogical Section he entertained his fellow-specialists at his house. A slight stroke of apoplexy, which he suffered in the summer of 1882, passed away without seeming to leave any trace. He spent the Easter season of 1885 with his son's family in Vienna and with Graff in Grätz. He intended to speak on Easter of 1886 in Weimar and to visit Jena, "whither he expected to return in his sixty-fifth year so as to attach a good end to a good beginning." But on the morning of January 9, 1886, after he had spent the previous evening in pleasant social intercourse, there came another stroke. He never recovered consciousness, but died on January 16th.

Professor von Graff describes Schmidt's method of teaching as one encouraging the students to pursue their own ways of thinking. He did not expect formal theses from them, but, having indicated the theme, left them to work it out according to their own logical processes, and as often let them choose their own subjects. Having found a pupil's bent, he sought to turn him into a corresponding course, "and never tried to make a poor naturalist out of one who might become a good doctor or teacher." In his lectures he was earnest and enthusiastic, not as good a speaker as writer, and sometimes betraying his trouble to find the right word; "but he knew how to win the love of his pupils for his subject, and, while trying to make the comprehension of the matter not too difficult, to keep interest alive by occasional glances at the theoretical significance of the facts. It was very far from his purpose to make pastime for his hearers, and, when he was polemical, every one had to be made sensible of the purely technical bearing."

Professor Schmidt's literary work covered a field of extraordinary breadth. Besides numerous works and text-books in systematic and anatomical zoölogy and life histories, he published popular lectures and essays in many different periodicals, recensions, reviews of books, translations, and even political articles. It would be impossible to give a complete bibliography of his works, because he left no notes respecting them. A list of his publications in zoölogy, by Professor von Graff, includes ninety-nine titles.

Correspondence. [Pg 701]

SCIENTIFIC METHOD AND THE BIBLE.

Editor Popular Science Monthly:

SIR: I have read with great interest an article in the July number of your Monthly entitled Scientific Method and its Application to the Bible. So far as I am able to understand the writer's views, I must certainly decline to accept some of his conclusions. The vital teaching of his paper appears to me to be this: it is proper to apply scientific methods to the study of the Bible so far as to inquire into its structure, the date of its composition, its composite authorship and the sources from which it was compiled, and the names of its authors; but certain truths are distinctly taught in it of a supernatural character which must be accepted because they are a revelation of God's will, and not because they are found to be true by intellectual apprehension and logical reasoning. Indeed, to think of understanding them by intellectual processes is "unscientific beyond hope of pardon."

It is conceded that "the stifling of thought and of investigation into what might lead men away from the truth and the faith once delivered to the saints" was instrumental in causing the barrenness in scientific work for twelve hundred years of the middle ages, between Hipparchus and Copernicus, and that "the same causes are more or less at work at all times to hinder the growth of science and the extension of scientific method." He still, however, insists that there is limitation to human inquiry and ecclesiastical bounds beyond which thought must not go. There are still revelations of truths which the intellect can not perceive, and which can only be understood by "an exercise of faith." It is no longer the Mosaic line which scientists are forbidden to cross, but the "spiritual verities" must not be questioned. There are some revelations which, in the language of Huxley, "they are to hold for the certainest of truths, to be doubted only at the peril of their salvation."

Was it not Martin Luther who called Copernicus a "fool" for trying "to reverse the entire science of astronomy" in the face of revealed truths? "To accept the truth as revealed by God and to acquiesce in it is the part of a good mind," said Melanchthon in condemning Copernicus. "Who will venture to place the authority of Copernicus above that of the Holy Spirit?" said Calvin. Verily, his unpardonable sin was "investigating the truths which are distinctly taught in the Bible," which required an "exercise of faith" and were not to be "apprehended intellectually."

The question seems a reasonable one to ask, To what authority shall we look for knowledge and interpretation of these spiritual truths which are not accessible by scientific study? How shall we know that they are truths at all? I am aware that here the testimony of Christian conscientiousness is sometimes held to be the court of last resort, which I interpret to mean that if one intuitively reaches the conclusion that something is true it is true, the most positive evidence to the contrary notwithstanding. Certainly, no other fact is better established in all human history than the truth of witchcraft, if we admit the potency of this authority. If we reject this, must we not then fall back upon ecclesiastical infallibility as the final interpreter of truth? And this the essayist, in his paper, declines to argue.

Now, can there be any such thing as scientific investigation within such prescribed limitations? Or scientific study of the Bible itself which excludes from its province the so-called spiritual revelations which it contains? One might naturally think that the primary purpose of all the critical study of the books, authors, and structure of the Bible was to learn just what these distinct truths it teaches are. But what bearing can this study have upon the question, being but an intellectual process with which the essential truths are disconnected, which only come by revelation?

Higher criticism can not hold permanently such an untenable position. It must either go backward to an infallible book, or an infallible interpretation of it by authority, or it must go forward to the consideration of the Bible as a collection of books of ancient literature, to be examined without restrictions. The truths which it contains are to be ascertained by "apprehending intellectually" and "reasoning logically," in the same manner as with other books written by religious leaders in ancient times. Any halting between these two positions is only for temporary rest. No permanent foothold can ever be gained on such a foundation of quicksand. An impassable dead line in biblical study is indicative of the theological and not the scientific method. [Pg 702]

LEWIS DAYTON BURDICK.

MCDONOUGH, N. Y.

A CORRECTION.

Editor Popular Science Monthly:

SIR: A correspondent, Mr. C. Wood Davis, of Peotone, Kansas, appears to think it his duty to prove that we can not produce wheat enough in this country to meet our own future demands, and apparently regards it as a personal matter when any one contests this position. He also thinks he has found a small error in long division in the last article which you printed from me on this question which I can not find, but which if found and corrected would have no influence on the general argument.

He also rebukes me in a most earnest manner for the alleged misuse of the chemical term "phosphate of potash," which crept into my article in connection with the right use of the term "phosphate of lime," when I referred to the mineral phosphates of Kentucky, Tennessee, and Florida. Technically he is apparently right. There is no permanent form or no natural mineral form of phosphate of potash which can be removed from place to place. Yet my article was revised by an experienced geologist, thoroughly familiar with the chemistry of the soil, before I sent it to you, and he failed to correct this technical error. My own knowledge of chemistry is very limited.

It might be inferred, as my irascible correspondent points out, from the manner in which I have called attention to the deposits of mineral phosphates in Kentucky and Tennessee, that I thought these deposits would yield phosphates of lime and phosphates of potash each in a separate movable form, which could not be a fact. Yet my critic will doubtless admit that the soils of many parts of this country are stocked with potash sufficient for a very long period.

Many years ago, when I began the study of the cotton plant and its growth, under the leadership

of the late Prof. William B. Rogers, I made reference to the existence of the vast supplies of phosphate of lime and potash, which are necessary to the growth of the cotton plant, in the Southern soils. I derived my conception of their origin in the lowlands and plateaus in marine formations from Professor Rogers, and also from the works of Professor Shaler. One may also impute the large amount of potash that is found in the valleys and mountain lands to the disintegration of the gneiss and other rocks of the Appalachian chain, which have never been washed out by glacial action or by glacial streams. If any one has been misled by this slight misuse of chemical terms it may be well to state that phosphate of potash does not exist, and I am told that it can not exist, in a separate removable form.

We have not as yet discovered any large deposit or mine like that of Stassfurt, in Prussia, yielding potash in a commercial form in which it can be widely distributed. We import annually thousands of tons of potash from Stassfurt. This deposit was discovered, as I am informed, by accident, and it may be hoped that a similar accident may occur in this country. These mines were originally opened for the production of salt. In boring for salt the product of a stratum above or below the salt, I know not which, was brought up, which was thrown aside as worthless until an inquisitive visiting chemist examined it and thus discovered this great source of potash. We possess enormous beds of salt, of soda, and of alkalies, scattered throughout the area of this country, in connection with which it may be hoped that we may hereafter discover a deposit of mineral potash, or of the mineral from which potash may be derived cheaply and in large quantities.

These two exceptions which have been taken to my article have no real connection with the substance of the argument, which stands independently either of the undiscoverable error in long division or of the technical fault in the use of the term "phosphate of potash." Yours very truly,

EDWARD ATKINSON.

BOSTON, *June 7, 1899*.

Editor's Table.

[Pg 703]

AN OLD-FASHIONED MORAL.

Voltaire's Candide is not a book that can be recommended for general reading; yet it contains perhaps as good a moral as could easily be found in a wide range of books aiming more distinctly at edification. The hero, after many vicissitudes and copious experience of the deceitfulness of riches and the miseries of an ill-regulated life, made the blessed discovery that peace and health and independence were to be obtained by the industrious cultivation of a small piece of ground. He had a friend called Martin who associated himself with him in his agricultural labors, but who had rather a fine talent for discussing abstract questions. Candide would listen to him for a while, but never allowed him to get very far without breaking in with the observation, "Mais surtout il faut cultiver notre jardin" ("But above everything else we must cultivate our garden"). Here was safety, here was balm for painful recollections, here was about the best that the world had it in its power to give; and Candide, chastised by misfortune, wanted to stick to that.

This is an age of copious and unending discussion of social and political problems. Discussion is well in its way; but perhaps the problems would not be so acute if there was less discussion and more cultivating of gardens. It may indeed be said, with no small degree of plausibility, that the greed to be rich, the unwillingness, so to speak, to cultivate a garden which only promises a moderate reward, is at the bottom of a large part of our troubles. Wisdom cries aloud and tells the world that happiness is not to be found in riches; but the cry is little heeded. The whole lesson of higher education is that happiness springs from within and not from without; but thousands take what they can of the higher education while declining the lesson. Science unlocks a world of beauty and wonder, and offers to the mind a constant succession of interesting subjects of contemplation; but thousands again ask nothing of science except to show them the way to wealth. Precisely similar in a multitude of cases is the demand made of art and literature. It is well-nigh a century since Wordsworth lamented the decay of "plain living and high thinking." Have the succeeding years brought any improvement in this respect? It is much to be feared they have not. Wealth is, if possible, more than ever the ideal of society, and plain living is terribly at a discount.

We believe, however, that in the deliberate choice of plain living by an influential portion of society there lies a greater potency of social reform than in all the schemes of socialistic reconstruction. The most hurtful thing in the world to-day is the false glamour of wealth. It is against this evil influence that we want an insurrection, not against capital as such. Weaken the fascination of wealth, and, in the same degree that you do so, you increase the moral responsibility of those who are its possessors. The luxury of the present age has run to a dangerous extreme. Advice in such a matter may seem idle, but the discovery that Candide made is one that the world at large must make some day. True happiness is the natural accompaniment of honest industry and moderate living. Such conditions make high thinking possible, and give a savor to all enjoyments. There have been times when men, to save their souls, would go forth into [Pg 704] the wilderness or the desert. Such sacrifices are not needed in the present day; there is a very respectable measure of salvation to be won in cultivating a garden.

THE TROUBLES OF ORTHODOXY.

The thought of the age has now reached a point of development at which it has become almost impossible for any man of trained intellect to say that he receives on authority pure and simple any statement which admits or should admit of direct verification—for example, any statement dealing with matters of a historical or scientific character. This, if we mistake not, is the true secret of the troubles over doctrinal questions which have lately broken out in more than one division of the Christian Church. It is not so much that there has been a revolt against doctrines as such, as that a need is felt by thinking and cultivated men to seek for higher grounds of belief than those hitherto deemed sufficient. This has led to a certain generalization of belief, if we may so call it, which to less cultivated minds looks almost like an abandonment of the most essential doctrines of the Christian faith. Such a view of the matter, however, we hold to be entirely erroneous. The men we are thinking of—and Dr. Briggs and Bishop Potter may be taken as conspicuous examples—have the interests of religion and of their fellow-men at heart. They do not wish to force upon others a mode of looking at religious questions for which they are not prepared; but, for their own part, they find it necessary to restate the articles of their religious faith in terms which do not absolutely conflict with the principles of reason. This rectification of terms is imposed in part by the conditions of thought in the modern world, but to an equal extent at least by what may be called an inward expansion of the doctrines themselves. Who that holds any truth, scientific or other, does not feel impelled to seek for it continually a wider interpretation and application? Not otherwise is it, we hold, with religious doctrines; they have their own law of growth and development, and he who would arrest the process condemns them to atrophy and decay.

It is charged against both the scholars we have mentioned that they speak of the Bible as literature, and say that in determining its meaning we must keep in view the same class of considerations which would guide us in dealing with other literary monuments. There is nothing in this which need alarm any thoughtful person. It would be doing less than justice to the Bible to deny that many parts of it are literature of a very high order; and it would be doing less than justice to our own intellects to deny that the conception of the Bible as literature is a great help to its correct interpretation. Religion, in the view of such men as we have mentioned, does not depend upon the meaning given to a text or the acceptance or rejection of any specific statement of fact. There is nothing specially "religious" in believing that the Epistle to the Hebrews was written by St. Paul, or that the adventures of Jonah were precisely as described in the book that bears his name. Grant that the organ of religious apprehension is faith, yet each age must settle for itself the question as to what is the proper scope of faith and what of reason. In the present day reason can deal with many things which at one time were thought to be entirely within the domain of faith, and it would be rash to say that the frontier has even yet received its final rectification. If we rightly understand the position of Dr. Briggs and Bishop Potter, they hold that [Pg 705] religion is essentially an attitude of mind and heart, a seeing of the invisible, an instinctive recognition of a supreme moral authority, a sense that every human being is called to nothing less than holiness of life. They reverence the Scriptures because in them, as in no other body of writings in the world, the realities of religion are both expressed and implied. They do not demand of the Bible perfect agreement with either scientific or historic truth; they are content if they find in it the spiritual basis of human life, a scheme of thought that links the individual human being with an infinite origin and an infinite destiny. From their standpoint the value of the Bible for the highest moral purposes would in no way be increased if every word in it which touches on scientific or historical questions had the seal of all the academies in the Old World and the New.

It is not a difficult thing, nor does it require much wisdom, to harry a man whose independent thinking and moral earnestness have forced him to take a different attitude toward some great question from that which is adopted by the multitude. It is easy to present his views in an invidious light, but a more useful task would be to show that all that is essential and precious in religious belief can exist as well in a philosophical as in a popular form. With such a thesis it may not be quite so easy to "score," but it is a pity when the standards of the reporters' room invade the desk of the literary or theological editor. It is upon such men as we have mentioned, men of competent scholarship and earnest spirit, that the task is laid of purifying and liberating the religious consciousness of the age; and we do not hesitate to say that when, from the vantage height of modern knowledge, they affirm with deep conviction the indestructibleness of the religious sentiment and the everlasting reality of its object, they render a service which, from a religious point of view, can not be overestimated.

Scientific Literature.

SPECIAL BOOKS.

In a stout volume[G] of nearly a thousand pages Mr. *Jackson*, the leader of the Jackson-Harmsworth Polar Expedition of 1894-'97, puts into permanent form the record of three years' observations made in Franz-Josef Land, a region beyond the eightieth parallel of latitude, which was accidentally made known to the world twenty years before by the drift of the Tegethoff, the ill-fated vessel of the Austrian expedition of Payer and Weyprecht. As such it is a substantial

contribution to arctic literature, and from it much important detail will be obtained by those seeking further adventure in the quest for the pole, and a mass of material, geographic and otherwise, pertaining to the region which forms the subject of the work before us. The meteorological data, covering as they do a longer continuous period of observation in the extreme North than has heretofore been possible, and fittingly supplementing those recorded by Nansen for an almost equal period, will be specially prized by the scientist, even if the facts of the air are not considered to be the main object of arctic research. It is interesting to note, from [Pg 706] the observations on temperature, that the lowest record was only -46° F., the extreme rigor, consequently, being only that of Dakota or Manitoba, and marking nearly fifty degrees above what has been observed a thousand miles farther to the south at Verkhoyansk, in Siberia. Nothing approaching the extreme cold (-72°) noted by Kane and by the Nares British Expedition of 1875-'76 has thus been recorded by Nansen, Peary, or Jackson.

Mr. Jackson's claims to discovery lie mainly in the field of geography; for, while the observations on zoölogy, botany, and geology are by no means meager or lacking in originality, the results obtained have been largely anticipated by other investigators—notably Payer, Leigh Smith, and Nansen. In the domain of geography, however, there is a distinct contribution, and the author has missed no opportunity to add to the catalogue of geographical names by "rounding up," as it were, the numerous points which appeared new to him or were thought worthy of designation. This diligence in applying names, at times to points or places which are wholly insignificant and which could be followed with equal advantage or disadvantage on most of the known coast lines of either Europe or North America, can hardly be said to detract from the value of the discoveries actually made, although their publication, from advance letters received by Mr. Harmsworth's representative in London, has caused hostile comment and bitter controversy, even on the part of British geographers and scientists. Much of Mr. Jackson's work, it was contended, was directed to demolishing the work of Lieutenant Payer in the same region, and toward substituting names for those given, whether with a correct placing or not, by the Austrian commander—in itself a legitimate undertaking, but heralded out, it was claimed, to mask Mr. Jackson's own failure to accomplish the real task of his expedition—the finding of the north pole. Mr. Jackson has certainly very largely remodeled Payer's map of the archipelago, but the new map in no way discredits the attainments of his predecessor, even though showing up many and even glaring inaccuracies in the cartographical details published by him, for allowance must be made for the limitations under which the Austrian commander made his work. The vital points which have to be eliminated from the geography of Payer are: That Franz-Josef Land is a congeries of no very large islands, without continental extent northward, and that much that has been represented to be land is, in fact, water or ice, the appearance of land in the frozen North being frequently suggested by the vast gray and ill-defined ice masses which loom up in fog and mist, both as flat sheets and mountain buttresses.

It was the failure to find a northward continental extension to Franz-Josef Land, such as had been thought to possibly exist by Payer, which led Jackson to abandon all effort to advance upon the pole—a condition which appears, at this time, the more surprising seeing that two expeditions, those of Walter Wellmann and the Duke of Abruzzi, with all of Mr. Jackson's facts before them, have elected this same route as the one most calculated to bring about a successful issue, and certainly much can be said in favor of it. While the Franz-Josef Land route may not commend itself as the one best to be followed—and surely the open highway which from time to time appears north of Spitzbergen offers marked advantages for one without a land following—it still has its advantages in the point of high northern departure, and arctic authorities will fail to be impressed by the negative conditions which were obtained from it by the Harmsworth Expedition. Manifestly, Mr. Jackson had prepared himself for one form of journey only—that of [Pg 707] following the land, a singularly blind limitation, considered in the light of the little that was positively known of such land extension as the expedition had counted upon, and one that is disagreeably emphasized by the lavish expenditure of money that had been put to the expedition, and the personal confidence that had in some quarters been expressed in its success. Without wishing in any way to disparage or minimize the importance of Mr. Jackson's work, or to underestimate the hardships of any form of arctic exploration, one can not but feel surprised and in a measure disappointed that an expedition designed primarily for an advance upon the pole, which passed the better part of three years beyond the eightieth parallel of latitude, and whose members during this time did not know a single day of sickness—an almost unprecedented performance in arctic methods—should have found itself in a condition unable even to make an effort upon the "open." The recollection of Parry's performance in the frozen sea north of Spitzbergen in 1827, of Markham's advance in 1876, and of Peary's "treck" across the north of Greenland in 1892, emphasizes only more deeply this feeling of disappointment.

Mr. Jackson has made a very careful study of Franz-Josef Land, and has brought that region into a condition of knowledge similar to that which the different Peary expeditions have brought to the north of Greenland. His narrative is simple and direct, virtually a transcript of notebook and diary, without embellishment of any kind, and with a statement of facts and conditions such as they appeared almost at the instant of time of their occurrence. While indisputably impressing a truthfulness and reality, it can not be said that this method adds to the readableness of the book, which is overburdened with repetitions, frequently in identical words and sentences, to a useless and, one is tempted to say, most distressing extent. It is to be regretted that an explorer of the marked energy, routine, and persistence which are Mr. Jackson's qualities should have faltered in what by some travelers has been considered the most arduous part of their task—the proper preparation of a report—for surely it can not be conceived that a good purpose was subserved, either in a popular or scientific aspect, in the publication of wholly unimportant matter, over and

over repeated, merely because it formed part of an official diary. The work is abundantly illustrated throughout with half-tone reproductions from photographs, taken by Jackson and his companions, that give a vivid reality to the journey which no amount of word-painting, even when so skillfully handled as by the present author, could prove a substitute for. Scientists will be gratified to know that supplemental reports, prepared by specialists in different departments, may be expected before long to fill out the full scientific aspects of the exploration.

On one point in connection with Mr. Jackson's discoveries the geographer, not less than the lay public, has the right to break straws with the author—that is, the method of naming the new points of land, water, and ice. Zoölogists and botanists have long been guilty of an absurd levity in the discharge of their obligations as namers of new species, and have burdened the vocabulary of animal and vegetable names with thousands of *personalia* which in no way called for perpetuation, and many of which were suggested only by way of ridicule or jest. So long, however, as these were dressed in Latin or Greek form and remained merely the possession of the scientific world there was little to complain of, and even the objections of the extreme sentimentalists might have been met by an appeal to the difficulty of obtaining or coining judicious or otherwise appropriate names. The case is different with the naming of places on the earth's surface, which at this day can be done with direct reference to euphony, to a certain appropriateness of dedication or appeal, and the intelligence of the student. A map of the world is intended for everybody, and not for a class of specialists, and its symbols are devised for readers of all classes. Maps of America have particularly suffered from irrelevant and commonplace designations, and only during recent years has the money value of names suggested radical changes, as in the case of many of the seaside resorts of the middle Atlantic coast. But, with all our indifferences and extravagances of even a half century ago—the period of Hog Hollows and Yuba Dams—a no cruder infraction of the logic of nomenclature can be found than in the coining of such names as "Cape Mary Harmsworth," "Cape Cecil Harmsworth," "Alfred Harmsworth Island," "Harold Harmsworth Straits," "Cape William Bruce," "Bruce Island," "Mabel [Bruce] Islands," "Mabel Bruce Fjord," "Albert Armitage Island," "Cape Alice Armitage," "Ceceil Rhodes Straits," "H. M. S. Worcester Glacier," etc. These have not even the advantage of an old-time arctic "ring" about them. Courting popularity by the bestowal of all manner of personal names, irrespective of direct relation to the expedition or to geographical exploration, is hardly commendable, and is only less objectionable than the plan suggested a few years ago by an American would-be arctic explorer to "sell" the names of places to be discovered to the highest bidder—i. e., according to a graded schedule of contributions to the expedition funds.

[Pg 708]

GENERAL NOTICES.

On the South African Frontier[H] is a narrative of the experiences and observations of the author, Mr. *William Harvey Brown*, partly as naturalist of the United States Government Eclipse-observing Expedition of 1889 to the west coast of Africa, and partly as a resident in various occupations for seven years in Rhodesia. The principal object in composing it was to give American readers a clearer idea of English operations in conquest and colonization on the South African frontier than it is possible to glean from current fragmentary accounts. The author served his apprenticeship at natural history collecting under Prof. L. L. Dyche, of the University of Kansas, and Mr. W. T. Hornady, of the New York Zoölogical Gardens, and was recommended by Mr. Hornady to the Government for the Eclipse Expedition. He sailed first to Freetown, then to St. Paul de Loanda, where he spent a few weeks collecting, establishing his headquarters at Bishop Taylor's American Methodist Self-supporting Mission. Thence, after a short attack of African fever, he proceeded to Cape Town, where he was attacked by the other sort of African fever—"an irresistible longing to penetrate the Dark Continent for purposes of exploration and of observing both man and Nature." He made the journey overland to Mafeting and to the Mashona country, in the region of which he spent seven years as "game-hunter, gold-seeker, landowner, citizen, and soldier," observing and participating in the settlement and early development of the new state of Rhodesia. The larger part of the book is devoted to his adventures and observations, "travel, collecting, hunting, prospecting, farming, scouting, fighting," and seeing pioneer life. Two chapters are devoted to ethnology. The race problems which arise during the stage of transition from barbarism, the agricultural and mineral resources of Rhodesia, and its prospects and possibilities, are discussed.

A very handsome book, in what to many are the most graceful and interesting forms of vegetable life, is Mrs. *Parsons's How to Know the Ferns*.[I] The name of the author is new, but the author herself is a familiar friend to all lovers of American field and wild-wood life, for she is none other than Mrs. William Starr Dana, who had already given us How to Know the Wild Flowers and According to Season. In this book she does as she did with regard to the wild flowers—takes her readers to the haunts of the ferns and into their company, introduces us to them, and before she is done makes us well acquainted with them. "It seems strange," she says, "that the abundance of ferns everywhere has not aroused more curiosity as to their names, haunts, and habits." Possibly it is because they are so common that we are not at pains to seek greater intimacy with them. Then, they depend on the beauty of graceful proportion, which is less obvious to careless eyes than that of color. First, Mrs. Parsons discourses of Ferns as a Hobby, and the pleasure we may derive from them; then she tells when and where to find them, defines the terms used in speaking of them, explains their fertilization, development, and fructification, gives a list of notable fern families and descriptions of the American ferns classified into eight groups according to the arrangement of their spores, and completes the work with indexes of Latin and of English names and of technical terms.

[Pg 709]

The Microscopy of Drinking Water[J] is intended by Mr. *Whipple* primarily to serve as a guide to the water analyst and the water-works engineer by describing the methods of microscopic examination, assisting in the identification of the common microscopic organisms found in drinking water, and interpreting the results in the light of environmental studies. A second purpose is to stimulate a greater interest in the study of microscopic aquatic life and general limnology (the lessons of lakes and ponds) from the practical and economic point of view. The work is elementary in character. Principles are stated and illustrated, but the last ten years' accumulations of data are not otherwise attacked. The illustrations have been largely drawn from Massachusetts cases, from which there may be differences elsewhere, but not very great as to microscopic organisms. The latter half of the book is devoted to descriptions of a limited number of organisms, chosen for the most part from those commonest to the water supplies of New England, and those that have best illustrated the more important groups of microscopic animals and plants. Most of the illustrations have been drawn from living specimens or photomicrographs of such, but some are reproduced from other sources.

It is evidence of appreciation of Dr. *Wetterstrand's Hypnotism and its Application to Medicine*[K] that, written in Swedish, it has been translated into German and Russian, and now into English. The German work, from which the present translation is made, was enlarged from the original, and embodied the results of additional experience. The author disavows the intention of writing a manual or text-book, and modestly assumes only to have given "unpretentious notes by a physician who, under the pressure of a fatiguing and engrossing practice, has not been able to develop his rich material into a more complete form." The book is characterized by the translator as more practical than theoretical, and as offering the results of conscientious and able observation. Hypnosis is defined by Dr. Wetterstrand as embracing a number of various conditions of the nervous system, which can be produced in different ways. "We recognize phases of the greatest variety, from a slight heaviness in the limbs, the most superficial somnolence enabling the hypnotized subject to hear and perceive the least noise, to the deepest sleep, from which the greatest disturbance can not awake him, and wherein every sensation disappears and permits the most serious surgical operation without pain." The author believes that the majority of people can be brought into any of these conditions, but the methods and degrees of difficulty [Pg 710] of the process are various. "Liébeault distinguishes five degrees in hypnotic sleep, Bernheim nine; but Wetterstrand thinks they may all be grouped under three. Suggestive therapeutics is regarded as by no means a panacea, but it succeeds in cases where other methods have failed," and, as Bernheim says, "often it produces miracles." After an outline of the general principles of the subject the author passes on to describe some diseases and morbid conditions in which he has employed hypnotism with the greatest results, culling from his notes, as impartially as possible, both successful attempts and failures. The cases include insomnia, the list of nervous diseases, drug diseases, consumption, rheumatic, heart, and other organic diseases, and functional affections; with the use of suggestive therapeutics in operations, obstetrics, and on some other occasions. Dr. Petersen's medical letters on hypno-suggestion, etc., added to Dr. Wetterstrand's work, are intended to give a succinct idea of the present status of practical psychic therapeutics, as based on the observation of clinical facts. They relate to suggestive treatment in reform work, post-hypnotic responsibility, and music in hospitals.

The original object of Mr. *Henry Rutgers Marshall's* essay on *Instinct and Reason*[L] was to present a conception of religion. In attempting to make his argument convincing he found it necessary to deal with questions which did not at first appear to relate to this subject, whereby the study of religion, though still the most important and interesting matter considered, is made to appear subsidiary to the treatment of instinct and reason. Believing that activities so universal in man as those which express his religious life must be significant in relation to his biological development, the author has attempted to outline a theory that will account for their existence and explain their biological import. In order to present this clearly he has made a special study of instinct and the relation of its activities with religious activities in general. This has naturally led to the study of impulse, and thus to a consideration of moral standards. The study of reason, too, has been found appropriate in connection with the consideration of the nature of religion. The genesis of religious customs and beliefs is touched upon only so far as seems necessary for the elucidation of other parts of the treatise. Concerning the relation of religion and morals, the author finds that religion teaches us to listen to the past, and gives enthusiasm to do the work commended by the "voice" of that past; it gives us the basis for the perfection of our moral code, but it does not give us this perfect moral code itself. When reason and the religious instinct are opposed we should, after reverent and full consideration, act in accord with reason, but should be cautious in guiding others that way, for the chances are decidedly that we are wrong, and "the rule of action which will best satisfy conscience, which will produce the closest correspondence between our action as viewed in retrospect and our most permanently efficient impulse series, is one which is based upon the religious instinct, and which involves the presence in mind of the sense of duty."

Mr. *Arthur Berry* has undertaken, in his *Short History of Astronomy*,[M] to give an outline of the history of the science from the earliest times in a form intelligible to readers who have no special knowledge of astronomy or mathematics. Some compression having been necessary, it has been found possible to omit a considerable number of details which might receive treatment, and indeed would often require it in a treatise on the science. The author has deliberately abstained from giving any connected account of the astronomy of the Egyptians, Chaldeans, Chinese, and other peoples who are usually supposed to have had a share in the early development of star-lore. Accounts of scientific instruments, except in a few simple and important cases, are omitted. But

little is said of scientific discoveries that have to be described in technical mathematical language, and of speculative theories that have not been established or refuted. On the other [Pg 711] hand, whatever pertains to the real history of astronomy has been given with sufficient fullness to make it plain; the principles which are illustrated by enormous masses of observations that there is no room to record; short biographical sketches of leading astronomers other than living ones; a considerable number of dates, such as those of the births and deaths of astronomers; and even descriptions of such obsolete theories as appear to form an integral part of astronomical progress. Among the illustrations are portraits of a few of the eminent astronomers of the past.

The special articles in the *Bulletin of the Department of Labor*, Nos. 18 and 19, are Wages in the United States and Europe, 1870 to 1898, in the September number, and Mr. Dunham's paper on The Alaskan Gold Fields and the Opportunities they offer for Capital and Labor, and Mutual Relief and Benefit Associations in the Printing Trade, by W. S. Wandly, in the number for November.

The Rev. Dr. *Adam Miller* is a retired minister who has devoted his leisure hours to the study of sunshine, in which he has included all that properly belongs to the sun. He has read the standard works on astronomy, and some, but apparently not all, the later results for comparison, it seems, rather than information, and he has performed some original and ingenious experiments with the sunlight. His views, therefore, as expressed in *The Sun an Electric Light* (Chicago), are his own. He has come to the conclusion that the material theories of the origin of the sun's light and heat do not account for the facts, and are therefore insufficient if not wrong; postulates a theory that the phenomena are matters of electric action made perceptible to us by refraction through the atmosphere, and makes an unnecessary and inconsequent attack on the theory of the conservation of forces. When Dr. Miller assumes that his views of the insufficiency of present theories and of the electrical nature of the sun's action are new, he shows that he is not fully read up in the current literature on the subject. The insufficiency of present views is confessed, and the discussions of the subject with the various suppositions which he criticises are efforts to find better explanations. The causal identity of electricity, heat, and certain other forces is accepted. But, given that electrical action is the basis of it all, what then? Philosophers know of no way of maintaining electric action except through material processes, and the way they are replenished to keep it up is as hard to find out as would be the way fuel is supplied to keep up a solar fire.

A pamphlet entitled *The Story of the Rise of the Oral Method in America* (of Instructing the Deaf and Dumb) *as told in the Writings of the late Hon. Gardner G. Hubbard*, compiled by Mrs. *M. Gardner Bell*, reveals a seeming indolence in the early instructors of the old method that is hardly creditable to their energy in investigation. When deaf-mute instruction was first projected here, a teacher was sent over to Europe to learn the best methods. Denied access to schools in London and Edinburgh, where articulation systems were taught, he went to Paris, found the Abbé de l'Epée's sign language there and brought it over. This and the finger language held sway in our schools for many years, while the possibility of teaching articulation to the deaf was denied. It required long-persistent effort on the part of a few men who refused to have their deaf children taught these systems and consequently isolated from their fellow-men to secure a recognized place for oral schools. The story of the struggle is told in Mrs. Bell's pamphlet.

The widespread ignorance and superstition with which even to-day the practicing physician has to contend are hardly conceivable by an outsider. The conditions under which a doctor knows his patients are just those calculated to bring out the weak spots in their mental organization, and the absurd notions which still have a foothold in many minds are a constant source of wonder to the speculative doctor. These superstitions are so widespread and so frequently dangerous to the whole community, as well as the individual himself, that anything which is calculated to improve matters, however so little, should be welcomed with open arms. *Dr. Therne*, by *H. Rider Haggard*, is aimed at the antivaccinators, and by means of a not uninteresting story points out the serious consequences which a general belief in this absurd crusade brought to an English city. The [Pg 712] author labels his story as an attempt to forecast the "almost certain issue of the recent surrender of the English Government leaders to the clamor of the antivaccinationists."

The annual number of the *Cumulative Index* for 1898, constituting the third annual volume, is a book of seven hundred and ninety-two pages, and includes one hundred periodicals. It indexes—by authors, titles, and subjects, including reviews and portraits—what is important in the monthly and part of that in the weekly publications of the year. Special attention is given to portraits, reviews, and necrology. The Index is a very useful publication to writers and students of every sort, recording the articles as they appear month by month in a form that makes the knowledge of them easily accessible to one who seeks it. The numbers succeeding the first number of the volume include, besides their own fresh matter, that which has appeared in two or three previous numbers, saving the necessity of hunting up scattered editions. The annual volume contains all for the year. The Index is edited in the Public Library of Cleveland, Ohio, and is published by the Holman-Taylor Company in the same city.

Two papers bearing upon instruction of the deaf, published by the Volta Bureau, Washington, are statistics, by Alexander G. Bell, of the relative use in the United States of the several methods, and a collection of *International Reports of Schools for the Deaf*. The latter paper contains reports from sixteen countries.

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Fragments of Science.

Death of Dr. Brinton.—By the death of Dr. Daniel G. Brinton, at Atlantic City, N. J., July 31st, America loses one of the most industrious and intelligent students of its ethnology, languages, and antiquities. We think we may safely say of him that he did as much as any other single man among us to organize and systematize these studies and put them on a stable foundation and a broad basis. To them he devoted his time, his heart, and his fortune. Dr. Brinton was born in West Chester, Pa., in 1837; was a graduate of Yale College and of Jefferson Medical College; served in medical departments in the United States Volunteer Army during the civil war; was for several years editor of the Medical and Surgical Reporter and of the Quarterly Compendium of Medical Science; and was finally drawn predominantly to the study of American ethnology and languages, to which he contributed a long list of books, special articles, and paragraphs, a large proportion of them fruits of his own investigations. For his work in this department he received, in 1866, the medal of the Société Américaine de France. He was Professor of Ethnology and Archæology in the Academy of Natural Sciences of Philadelphia, and of American Linguistics and Archæology in the University of Pennsylvania, and was President of the Antiquarian and Numismatic Society of Philadelphia. He was President of the American Association for the Advancement of Science in 1894. He established a library and publishing house of aboriginal [Pg 714] American literature, and one of his most noteworthy works was the publication in this library of a series of original texts in the languages of North and South American tribes, with commentaries and translations, in the preparation of which he called in other Americanists to assist him. In this way he contributed much to save a literature and a history that were fast disappearing. A few months ago, as was mentioned in the Monthly at the time, he presented his entire collection of books, pamphlets, and manuscripts, many original and some unique, relating to the aboriginal languages of North and South America, to the University of Pennsylvania.

Nebraska as a Home for Birds.—Mr. Lawrence Bruner introduces his Notes on Nebraska Birds with the expression of a belief, founded on his own observations for twenty-five years, together with those of about fifty other persons to whose notes he has had access, that Nebraska, although a prairie State, has an unusually large bird fauna. The notes show 415 species and subspecies as visiting the State, while there are records of 227 species breeding within its borders, and of more than 700 winter residents. "When we learn that only about 780 species are recorded for the whole of North America north of the Mexican boundary, it certainly seems astonishing that from among them we should receive so large a percentage. If, however, we take into consideration the variations in altitude above sea level, the differences in surface configuration, climate, etc., that pertain to our State, its location, and the relation which it bears to the country at large, perhaps the wonderment will become less." The southeastern corner of Nebraska is only eight hundred feet, the western border almost six thousand feet, above tide water. The State is divided into timber, prairie, and plain regions. It lies in the middle of the United States, with a high mountain chain to the west and a giant water way along its eastern boundary. In fact, eastern, western, northern, and southern fauna meet in Nebraska, and it also has a fauna of its own. Forms are found there that belong to low and high altitudes, to wet and dry climates, to prairie and timbered countries, and to semi-desert and alkali regions.

The Power of the Imagination.—The following interesting experiment is described in the Psychological Review for July by E. E. Slosson, of the University of Wyoming: "I had prepared a bottle, filled with distilled water, carefully wrapped in cotton and packed in a box. After some other experiments in the course of a popular lecture I stated that I wished to see how rapidly an odor would be diffused through the air, and requested that as soon as any one perceived the odor he should raise his hand. I then unpacked the bottle in the front of the hall, poured the water over the cotton, holding my head away during the operation, and started a stop-watch while awaiting results. I explained that I was quite sure no one in the audience had ever smelled the chemical compound which I had poured out, and expressed the hope that while they might find the odor strong and peculiar it would not be disagreeable to any one. In fifteen seconds most of those in the front row had raised their hands, and in forty seconds the 'odor' had spread to the back of the hall, keeping a pretty regular 'wave front' as it passed on. About three quarters of the audience claimed to perceive the smell, the obstinate minority including more men than the average of the whole. More would probably have succumbed to the suggestion, but at the end of a minute I was obliged to stop the experiment, for some on the front seats were being unpleasantly affected, and were about to leave the room."

Government Scientific Work.—Mr. Charles W. Dabney, Jr., of Knoxville, Tenn., while having a very high opinion of the scientific work of the Government, finds it greatly scattered and confused, and often multiplied, among the departments. There are three distinct and separate agencies for measuring the land of the country, four hydrographic offices in as many departments, and five separate and distinct Government chemical laboratories. The Coast Survey, the Naval Observatory, and the Weather Bureau are all engaged in studying the magnetism of the earth. Three distinct branches of the Interior Department are engaged in [Pg 715] irrigation work, and the census has published a report on the subject, while the report of a board appointed to examine into the matter shows that eight bureaus of the Interior and Agriculture Departments must co-operate in order to accomplish any thorough work on the great problem of irrigation. The statistics of the natural resources and the products of the country, of exports and imports, of populations, schools, etc., are collected and compiled by eight or ten different agencies in five or six different departments. Mr. Dabney's remedy for this condition is the consolidation of all the scientific work under a single department, to constitute a National Department of Science. This seems hardly necessary. The scientific work of the departments has grown under the pressure of their necessities, relating chiefly to the examination of an unsettled and unexplored country. So long and so far as such work is essential to the legitimate work of the department it will have to be done within it. All work beyond this can be left to the Smithsonian Institution, the universities and scientific academies, and individual effort. The Government of the United States is not a scientific body.

American Indians and Mongolians.—In answer to Major Powell's theory, recently expressed anew, that while there may be a unity of species in the ancient physical man, the civilization, arts, industries, institutions, languages, and opinions of the American tribes were autochthonous, and owed nothing to Old-World influences; Mr. James Wickersham, of Tacoma, Washington, maintains that our Indians are connected in blood with the Mongolian stock of East Asia and none other, and that their arts, etc., were derived thence in comparatively recent times. In the comparison he makes, for argument, between the two races he finds a considerable number of features that were common and peculiar to both. Of both, the Chino-Japanese and the Americans, he says: "The most civilized tribes spoke a monosyllabic language, others spoke an agglutinative tongue; their writing was ideographic and written from right to left, from top to bottom; their systems of numeration were based upon the digital count, and their old numerals up to nineteen were practically identical; their calendar systems were alike in principle, and nearly so in details; both divided time into cycles and quarters thereof; the solar year in both regions began at the winter solstice, and the solstices were celebrated in both lands on the same day by the same national festivals; both prepared almanacs on paper of national manufacture; the good or evil power of every day was fixed by the priest-astronomer, and each almanac also contained medical receipts and astrological formulæ and a table of religious festivals; the same elements, colors, viscera, birds, seasons, and planets were assigned in the same general scheme to the cardinal points." Like similarities are traced in constitutions, laws, ecclesiastical institutions, monastic orders, and physical aspects.

The Teaching of Bows and Arrows.—What the study of so simple a subject as bows and arrows may reveal is illustrated by Mr. Herman Meyer's paper in the Smithsonian Report for 1896 on Bows and Arrows in Central Brazil; an introduction giving a general outline of a contemplated larger work which intended to set forth for the circumscribed region of the Matto-Grosso, how, through the harmonizing of different tribal groups, ethnographic types arise; what share the several associated tribes have had in this creation of groups; and, on the other hand, what ethnographic development within the group each tribe has undergone. While the South American Indian tribes have different special methods of capturing wild animals, they all have as the chief weapon the bow and arrow, which even the gun can not supplant. The tribes that are now sedentary, which practice hunting along with agriculture only for amusement, exercise still the greatest care upon the preparation of this weapon, and know how to use it with skill. In their sagas the bow and arrow still play an important part. They are regarded almost as sacred, and are frequently used as cult objects. When bows and arrows are exchanged for other weapons the children keep up the old reminiscences, and hold on to the bow and arrow as playthings. The South American Indian is accustomed to recognize the tribe by its arrow. A grouping by these [Pg 716] weapons, a separation of forms according to specific marks of structure, is possible for the study

of the tribes. The feathering, which seems to be capable of unlimited variation, is of great importance. A great deal of care may be bestowed on the fastening of the feather, on the wrapping of the shaft with thread, or upon the manner of fitting the feather. The wrapping of the feathered end or shaftment offers excellent opportunity to preserve certain textile patterns, perhaps the one remaining survival of the old tribal peculiarity. The fastening of the point to the shaft or to the foreshaft also affords a safe datum for discriminating, and the shape of the point furnishes a guide for differentiations.

An Aztec Pictorial Record.—The forty-four paintings of the *Mapa de Cuauhtlantzinco* were executed in oil colors on European paper by an artist named Tepozetecatl, and are of high importance in the history of the conquest of Mexico. The Pueblo of San Juan de Cuauhtlantzinco, to which they belong, is situated between the cities of Pueblo and Cholula, and is inhabited by about fifteen hundred people, who still speak the Aztec language. The pictures, each about sixteen by twelve inches in size, were discovered about thirty years ago by Padre D. José Vicente Campos, who, to save them from decay, had them pasted on cotton sheeting and mounted in two frames. They contain scenes from the conquest—not badly executed—and portraits of aborigines. Each bears a text in Nahuatl, which Padre Campos translated into Spanish and appended the translation to the original. Another series of ancient paintings somewhat like these was preserved for a long time at Tlaxcala, but, according to Prof. Frederick Starr, they were less personal and less local. They are called the *Lienzo de Tlaxcala*, and picture all the important events of conquest from the time when Cortes came into contact with the Tlascalans till the city of Mexico was captured. The Mapa de Cuauhtlantzinco deals with but little space; perhaps Texculco and Chalco and Quimistlan describe its limits. The pictures and the texts in Spanish and English have been copied by Professor Starr, who publishes them for their ethnological interest, in that they illustrate a practice, common at the time of the conquest, of painting representations of important matters; that they in many cases present successful portraits; that they are, in conception and execution, truly native works of art; that they give considerable information relative to daily life and customs; and that they are psychically interesting in showing the feelings of the natives shortly after the conquest toward their conquerors and toward the newly introduced religion. The town of Cuauhtlantzinco appears to have been settled between 1519 and 1528 by refugees from Cholula, who were driven away because they had gone to Tlaxcala to visit Cortes and invite him to come to their pueblo.

Permanence of the Fish Supply.—A Scottish fish commission has been for fifteen years conducting an experimental research on the capacity of the sea to bear the drain upon its resources made by the growing industry of trawl fishing along shore. Some first-class fishing grounds along the coast were closed for several years, in the anticipation that the fish, freed from molestation, would breed and multiply in them. The conclusion reached from examination of the results has been that fishing or no fishing makes no difference whatever. "On the preserved grounds there are no more fish, and no less, than when the trawls were daily dragged across the bottoms of the bays. For the rest of the areas frequented by trawlers beyond the three-mile limit the happy conclusion is that there are as many fish in the sea as ever, and that the supply does not diminish, in spite of the increased and increasing number of ships engaged in the fisheries and their fine equipment." The equipment of steam trawlers for the North Sea and the open ocean has become an immense industry in the east of England. Never have so much capital and labor been spent in harrying the fish since the fishing began. "Yet the take steadily increases as the boats increase. 'The great labor and expenditure of the last ten years prove that the balance of Nature in the neighboring seas is steadily maintained, and that there is no need for anxiety concerning the continuance of every species of good fish.' ... It is now clear that life in the sea is not dependent on what takes place near the shore. In other words, it is difficult to destroy marine [Pg 717] life, so far as fish are concerned, by mischief done near the coast. Their area of propagation and reproduction is too large for land creatures like us, who can only invade the sea in boats, seriously to injure it." Yet the experiments and experience of the United States Fish Commission show that we are able to increase the supply immensely.

Relative Power of Fungicides.—Mr. F. L. Stevens has published, in the Botanical Gazette, an account of experiments made for the purpose of establishing with some degree of accuracy the strengths of various solutions which are necessary to prevent the growth of fungous spores. The bearing of this question upon the relation of a fungicide to its efficiency is apparent. As among the general results the author finds that mercuric chloride is the strongest chemical used in its toxic effect upon the fungi, while potassium cyanide is remarkably weak considering its great toxic action on animals. Alcohol and sodium chloride have a stimulating effect. Various fungi offer different resistance to poisons, and the limits of resistance will vary in the same species. The spores of fungi are less susceptible than the roots of seedlings. A chemical may be twice as powerful as another against one fungus, while in acting upon another fungus an entirely different ratio may be sustained. An occasional spore may germinate and grow quite normally in a solution that prevents hundreds of normal spores around it from germinating. Penicillium as a nutrient medium offered greater resistance to poisons than did any of the other fungi worked upon. Uromyces did not diminish in vigor of growth with the increased strength of the poison, but the percentage of spores that germinated was diminished. In general, the results of the action of the chemicals were in accord with the theory of hydrolytic association. Incidentally new evidence bearing upon the theory of the hydrolytic dissociation of the molecule was adduced, together with facts that may throw some light upon the structure of the cell wall.

National Forest Reserves.—The report of the Secretary of the Interior for the year ending June 30, 1898, mentions thirty forest reservations (exclusive of the Afognac Forest and Fish-Culture

Reserve in Alaska) as existing by presidential proclamation under the act of March 3, 1891, embracing an estimated area of 40,719,474 acres. The patrolling of the reserves has shown that fire is the paramount danger to which they are exposed. Next to fire, sheep-raising is the most serious difficulty to be considered in administering the reserves. Yet, as it is not considered expedient to prohibit so important an industry throughout the reserves, special efforts have been directed toward ascertaining the particular regions in which the conditions demand the exclusion of sheep, and toward learning what restrictions may be necessary in other regions. The institution of a national system of timber cutting to be economical in all directions is under consideration, but it is acknowledged that the work will require a certain degree of experience and training on the part of forest officers. A forest system inaugurated by the department in August, 1898, in which the reserves are placed under the control of a graded force of officers, has already shown good results; the reports received from the forest officers indicate that the patrolling has limited both the number and extent of fires. During the eighteen months previous to the preparation of the report in November, 1898, a great advance was made toward a comprehensive administration of the public forests. A marked change in public sentiment toward forest policy is noticed, with a subsidence of the opposition to the reserves and a tendency among the people in the localities directly interested to take a deep and approving interest in the matter.

Sloyd as an Educational Factor.—Mr. Gustaf Larsson, of the Sloyd Training School, Boston, represents, in his Bulletin, that Sloyd is steadily gaining ground, and has been introduced, during the past year, into city schools, colleges, and charitable institutions, and that many clubs and social organizations are becoming interested in it as an educational factor. The Sloyd principles seem to meet a cordial welcome wherever they are adequately presented. Mr. Larsson insists that in Sloyd instruction the teacher should enter into the child's point of view, and must never [Pg 718] forget, he says, that it is the real work which appeals to him, and not the particular exercise or the typical use of the tool. As Dr. Henderson says, it is not necessary to be forever suggesting to him that he is being educated. "We must see, feel, and think with the worker, and so introduce our disciplinary exercises that he practices them correctly while still carrying out his own dearest desire. In this way only can he get the greatest benefit from any exercise. We must constantly bear in mind that we are aiming at a well-developed producer rather than a perfect product.... Whenever a piece of work, however poor in itself, stands for a child's best effort, it is a highly satisfactory production from the true teacher's point of view. He must remember also to keep constantly before us the fact that independence and self-reliance are to be cultivated from the outset." Sloyd claims to be peculiar in aiming at ethical rather than technical results, and at general organic development rather than special skill; in employing only pedagogically trained teachers; in using rationally progressive courses of exercises applied on objects of good form which are also of special use to the worker; in striving after gymnastically correct working positions in encouraging the use of both the left and right sides of the body; and in giving to each individual opportunity to progress according to his peculiar ability. These points have been emphasized in Sloyd from its beginning in Sweden more than twenty-five years ago.

Hawaiian Reptiles.—It is shown, in a paper on the subject by Dr. Leonhard Stejneger, published by the United States National Museum, that there are no true land reptiles in the Hawaiian archipelago other than a few species of lizards, all belonging to the cosmopolitan families—the geckoes (four species) and the skinks (three species). All of these, except one of the geckoes, belong to species widely distributed over the Indo-Polynesian island world, while the gecko excepted has close relatives in New Caledonia, Java, Sumatra, and Ceylon. This distribution is regarded by the author as not sustaining the theory of a once continuous land connection between the various island groups, but rather, by the limited number of species, as indicating that at the time of the immigration of the lizards the islands were separated from other lands. Yet these land creatures could not have been distributed over thousands of miles of ocean by ordinary means, and the agency of man has to be invoked. From various considerations it is permissible to conclude that they came to the islands with the ancestors of the Hawaiians. No records are known of any of the marine snakes having been taken at the Sandwich Islands. Marine turtles live in the seas surrounding the archipelago and breed upon some of its outlying islands, but little is known of them. There are no indigenous batrachians in the group, but frogs and toads are said to have been brought, intentionally, from China, Japan, and America to assist in the fight against mosquitoes.

MINOR PARAGRAPHS.

Miss Kingsley defines one of the fundamental doctrines of African fetich as being that the connection of a certain spirit with a certain mass of matter, a material object, is not permanent. "The African will point out to you a lightning-stricken tree and tell you that its spirit has been killed; he will tell you when the cooking pot has gone to bits that it has lost its spirit; if his weapon fails, it is because some one has stolen or made sick its spirit by means of witchcraft. In every action of his daily life he shows you how he lives with a great, powerful spirit world around him. You will see him, before starting out to hunt or fight, rubbing medicine into his weapons to strengthen the spirit within them, talking the while, telling them what care he has taken of them, reminding them of the gifts he has given them, though those gifts were hard to give, and begging them in the hour of his dire necessity not to fail him. You will see him bending over the face of a river, talking to its spirit with proper incantations, asking it when it meets a man who is an enemy of his to upset his canoe or drown him, or asking it to carry down with it some curse to the village below which has angered him, and in a thousand other ways he shows you what he believes if you will watch him patiently. It is a very important point in the study of pure fetich to [Pg 719]

gain a clear conception of this arrangement of things in grades. As far as I have gone I think I may say fourteen classes of spirits exist in fetich. Dr. Nassau, of Gaboon, thinks that the spirits affecting human affairs can be classified completely into six classes."

At a recent meeting of the Institute of Mining Engineers (England), reported by Industries and Iron, Mr. J. A. Longden, who delivered the opening address, discussed the problem presented by the rapid exhaustion of the English coal fields. During the last twenty-five years, he said, the output of coal had increased from 120,000,000 to 200,000,000 tons, the ratio of increase being two and a half per cent per annum. Assuming that the increase for the next twenty-five years will only be one and a half per cent, the coal output in 1925 would reach 280,000,000 tons. At such an increasing annual output the commercially workable coal would be practically used up. Mr. Longden suggested the propriety of putting an export duty of sixpence per ton on all coal exported, and finally said: The evidence before them all pointed to one thing—namely, that in fifty years they would practically be dependent on the United States of America for cheap coal, iron, and steel, and when this came about "we or our sons will find out that an alliance with the United States for coaling our navy was imperative." In conclusion, he insisted upon the necessity of taking measures to avoid waste in the coal industry.

The following note is from Nature of May 11th: "At the last meeting of the Anatomical Society of Great Britain and Ireland Dr. Elliot Smith settled a point in the comparative morphology of the brain which at one time was the subject of a heated controversy between Huxley and Owen. In 1861, it may be remembered, Owen maintained that the *calcar avis* and the calcarine fissure which causes it were characters peculiar to the brain of man, a statement which Huxley showed to be untrue, the formation being well marked in all primate brains. Dr. Elliot Smith has reached the further generalization that the *calcar avis* is a character shown by all mammalian brains, with the possible exception of the prototherian. He identifies—and the reasons for this identification do not seem capable of refutation—the calcarine fissure of the primate brain with the splenial fissure of the brain of other mammals. This generalization will materially assist in homologizing the primate and unguiculate *pallium*."

The influence of wind on the speed of steamers is of considerably more importance than is generally believed. In the *Annalen der Hydrographie* for January, 1899, L. E. Dinklage describes some observations recently made on two of the North German Lloyd steamers of about five thousand tons and fifteen or sixteen knots. The results show that when the wind was favorable no difference whatever could be detected in the speed of the vessels during a light breeze or a heavy gale. But with a beam (cross-wind) or head wind a reduction of from three to five knots and a half was produced. The obvious conclusion is that the wind when favorable never helps a fast steamer, but always hinders it when unfavorable. Probably with vessels steaming ten knots or less a favoring gale might increase the speed.

NOTES.

The burden of the president's address of J. B. Johnson before the Society for the Promotion of Engineering Education is the necessity for our future material prosperity for a specific scientific training for the directors of each and every kind of manufacturing and commercial activity. Germany "has worked out this problem to a most fruitful issue," but its imperial and paternal method can not be imitated here, or probably anywhere else. The problem is a very difficult one with us, and it will be of no use to look to municipalities or Legislatures for its solution. There exist a few special high-grade industrial, commercial, mechanical, electrical, and mining schools, but they are entirely inadequate to answer the demands of the occasion. The author looks to organized commercial bodies like the one he is addressing as furnishing the best means for establishing the schools desired.

Prof. F. L. Washburn, of the University of Oregon, describes in the American Naturalist a curious specimen of the toad (*Bufo columbiensis*), which has an extra arm projecting from the left side just in front of the normal left arm. The extra arm has seven digits, and is without an elbow joint, but is slightly movable at the proximal joint next to the body. Its radius and ulna are separate [Pg 720] bones, not fused as they are normally. The dissection shows other peculiarities of structure, such as might be expected from a consideration of the exterior. The species, normal, is common in parts of Oregon.

It is related of Charcot, the distinguished alienist, late of the Salpêtrière, Paris, that he had marked artistic ability, and when he was seventeen years old his family had some hesitation whether to make him a doctor or a painter. He chose the medical profession. He was fond of drawing sketches of his patients, and of landscapes he saw in his travels, and was not above making an occasional caricature. Several albums are filled with designs of this kind. A study of his work as an artist was prepared by Dr. Henri Meige in connection with the erection of his monument, and is deposited in the Salpêtrière.

The Russian decree nullifying the constitutional privileges of Finland, notwithstanding treaty guarantees, is producing an effect that was probably not intended or anticipated. Realizing the futility of resistance and holding the people true to their reputation of being the most peaceable, enlightened, and orderly of the Czar's subjects, the representatives of the Finns are said to be quietly making inquiries about the prospects of settlement in the Canadian Northwest and other free regions.

Despite the growing use of motor traction, the raising of horses gives no sign of diminishing.

Against 212,827 horses in 1888, the Argentine Republic has, by the census of 1895, 4,234,032. That country now ranks third in horse-rearing nations, being excelled only by Russia and the United States.

M. André Broca has found, concerning the use of India-rubber supports for isolating physical apparatus from earth tremors, that when apparatus having movable parts are supported in this way the vibrations, instead of being reduced, may in some cases be increased tenfold. But when the apparatus consists entirely of rigid material there is no better way of insuring steadiness than by resting it on India rubber.

The Pennsylvania Society for the Prevention of Tuberculosis works for the single end of educating the community in a knowledge of the true nature of consumption and of the means of controlling or conquering it. For this it diffuses literature, seeks the aid of persons in influential positions, and strives to obtain the requisite conditions for restoring those early afflicted and for preventing the communication of infection to others from those far advanced. Its main effort is directed toward the establishment of a municipal hospital for tuberculous patients, and for a sanatorium in the high regions of the State. For the last purpose it is offered a most desirable location in Luzerne County.

The list of recent deaths among men known in science includes the names of W. W. Norman, Professor of Biology in the University of Texas; John Whitehead, who died while on a scientific mission to the island of Hainan, for which he left England in the autumn of 1898; Naval Lieutenant Charles William Baillie, Marine Superintendent of the English Meteorological Office, inventor of the hydra sounding machine, late Director of Nautical Studies at the Imperial Naval College, Tokio, and author of important meteorological investigations, at Broadstairs, June 2th, aged fifty-five years; Henry Wollaston Blake, an original member of the Institution of Civil Engineers, of the Institution of Mechanical Engineers, and of the British Association, and a Fellow of the Royal Society, eighty-four years of age; Edward Jannetaz, a French mineralogist, an assistant in the Museum of Paris, and Lecturer on Mineralogy for forty years, Master of Conferences in the Faculty of Sciences, author of *Les Roches* and other books, aged sixty-seven years; Dr. Eugen Ritter von Lommell, of the University of Munich, distinguished in mathematics, physics, and optics, and author of several books on those subjects, including The Nature of Light in the International Scientific Series, June 19th, in his sixty-third year; Sir Alexander Armstrong, arctic navigator and discoverer of the Northwest passage, late Director-General of the Medical Department of the British Museum, and author of a narrative of his great discovery and of a work on Naval Hygiene; Dr. Hugo Weidel, Professor of Chemistry in the University of Vienna; Sir William Henry Flower, late Director of the British Museum of Natural History, Past President of the British Association, at the time of his death President of the Zoölogical Society of London, and author of several excellent books on zoölogy, natural history, museums, and kindred subjects, aged sixty-eight years; and Dr. Daniel G. Brinton, the distinguished American ethnologist and linguist, of whom we give a fuller notice elsewhere.

FOOTNOTES.

[A] *Vide* Commonwealth *vs.* Brelsford, 161 Mass., 61.

[B] Annual Report of the New York State Commissioner of Excise, 1897-1898, p. 716, Id.

[C] Suicide, International Science Series.

[D] By the United States Weather Bureau days are characterized as "cloudy" when for 0.8 or more of the possible hours of sunshine the sun is obscured; "partly cloudy" when from 0.4 to 0.7 inclusive is obscured; and "clear" when 0.3 or less.

[E] See The Child and the Weather, Pedagogical Seminary, April, 1898.

[F] France is not the first country that has started on this course. The spirit of justice has suggested similar reforms in countries which have no questions of depopulation to deal with. Reductions of taxes proportioned to the number of children have been granted in Prussia, Saxony, most of the secondary states of Germany, Servia, Norway, Sweden, several Swiss cantons, and Austria.

[G] A Thousand Days in the Arctic. By Frederick G. Jackson, Knight, First Class, of the Royal Order of St. Olaf, etc. New York and London: Harper & Brothers, 1899.

[H] On the South African Frontier. The Adventures and Observations of an American in Mashonaland and Matabeleland. New York: Charles Scribner's Sons. Pp. 430, with map. Price, $3.

[I] How to Know the Ferns. A Guide to the Names, Haunts, and Habits of our Common Ferns. By Prances Theodora Parsons. New York: Charles Scribner's Sons. Pp. 215. Price, $1.50.

[J] The Microscopy of Drinking Water. By George Chandler Whipple. New York: John Wiley & Sons. Pp. 300, with nineteen plates.

[K] Hypnotism and its Application to Medicine. By Otto Georg Wetterstrand, M. D. Authorized translation (from the German edition), by Henrik G. Petersen, M. D. Together

with Medical Letters on Hypno-Suggestion, etc. By Henrik G. Petersen, M. D. New York: G. P. Putnam's Sons. Pp. 166.

[L] Instinct and Reason. An Essay concerning the Relation of Instinct to Reason, with some Special Study of the Nature of Religion. By Henry Rutgers Marshall. New York: The Macmillan Company. Pp. 574. Price, $3.50.

[M] A Short History of Astronomy. By Arthur Berry. New York: Charles Scribner's Sons. (The University Series.) Pp. 440. Price, $1.50.

Transcriber's Notes.

Obvious printer's errors have been repaired, other inconsistent spellings have been kept.

Some illustrations were relocated to correspond to their references in the text.

Midi files have been created for the five music pieces on pages 663 to 671. Click the link "Listen" underneath each piece to listen to the midi files. In regards to the transcribing of the music, there are two notes:

For the music piece on page 665 (starting with "Mary and Marthy..."): In measure 8, the sixteenth note, dotted thirty-second note passage was notated as a dotted sixteenth note, thirty-second note instead. This matches the rhythm as previously notated in the song, and corrected the incorrect number of beats in the bar.

For the music piece on page 671 (starting "Gawd bless dem..."): In the fifth complete measure, the half note was changed to a dotted half note to ensure that there were a sufficient number of beats in the measure.

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