

sylvania, — a position he held until 1872, when the increased executive duties in connection with the Geological Survey of the Territories induced him to resign.

In the summer of 1866 he undertook another expedition to the Bad Lands of Dakota, under the auspices of the Academy of Natural Sciences of Philadelphia, for the purpose of clearing up some doubtful points in the geology of that region, and returned with large and valuable collections of vertebrate fossils, which were described in a memoir published by the Academy of Natural Sciences of Philadelphia in 1869. From 1867 to 1879 the history of Dr. Hayden is the history of the United States Geological Survey of the Territories, of which he was geologist-in-charge, and to the success of which he devoted all his energies during the twelve years of its existence. In this time more than fifty volumes, together with numerous maps, were issued under his supervision. One of the results of his surveys, and the one in which he probably took the greatest interest, was the setting-aside by Congress of the Yellowstone National Park. The idea of reserving this region as a park or pleasure-ground for the people originated with Dr. Hayden, and the law setting it apart was prepared under his direction. The work of the Geological Survey of the Territories had its consummation in the Atlas of Colorado, which increased greatly our knowledge of one of the most interesting portions of the Great West. In 1879, after the disbanding of the Survey of the Territories, Dr. Hayden received an appointment as geologist on the newly organized United States Geological Survey. For about three years he was occupied in the completing of the business of the Geological and Geographical Survey of the Territories, and the preparation of the final results of that survey. His health had already begun to fail, but early in 1883 he asked to be relieved from the supervision of the printing of the reports, and during the three following seasons he undertook field-work in Montana. By the latter part of the year 1886 his health had become so poor that he was confined most of the time to his bed. He then resigned his position as geologist, closing an honorable connection with the government that included twenty-eight years of actual service as naturalist, surgeon, and geologist. To the general interest in science excited by the enthusiastic labors of Dr. Hayden, in his geologic explorations, is due in a great degree the existence and continuance of the present United States Geological Survey.

In 1876 the degree of LL.D. was conferred upon him by the University of Rochester, and in June, 1886, the same degree was conferred upon him by the University of Pennsylvania. Dr. Hayden was a member of the National Academy of Sciences and of many other societies scattered throughout the country. He was also honorary and corresponding member of a large number of foreign societies.

As to Dr. Hayden's personal character, those who were personally associated with him know best how genial he was, and how sincere and enthusiastic his desire to forward the cause of science. Although impulsive at times, he was generous to a fault. His subordinates all knew that each one stood upon his own merits, and that due credit would be awarded his successful efforts. The same spirit actuated him in respect to those not immediately connected with him. His views are expressed as follows in one of his earliest reports, when speaking of those who had preceded him: "Any man who regards the permanency or endurance of his own reputation will not ignore any of these frontier men who made their early explorations under circumstances of great danger and hardship."

His ideas were broad and liberal. He aimed to make a thorough astronomical, topographical, geological, and botanical survey of the Great West, with a view to the development of its mining and agricultural resources. The greater part of his work for the government and for science was a labor of love.

SCARLET-FEVER REPORT.¹—II.

DR. R. G. ECCLES of Brooklyn, N.Y., does not believe that scarlet-fever ever arises except from a pre-existent case, and says, "The following from Dr. H. B. Baker of Lansing, Mich., will help to explain some possible cases of so-called *de novo* origin:

'The Michigan State Board of Health has received information from Dr. Sifton, health-officer of Sutton's Bay Township, which illustrates in a striking way how this country gets contagious diseases from the old countries. Oct. 2, 1887, a family arrived in Sutton's Bay, Leelanaw County, direct from Norway. The family came over in the steamship "Ohio," of the Inman line, reaching New York, Sept. 30. Scarlet-fever was on board the steamer during the passage, one child dying before the landing, and "several more were sick in the same way." One child of this family was taken sick with scarlet-fever the day after reaching New York. The family, however, proceeded over the New York Central and the Lake Shore and Michigan Southern, to Michigan; then over the Detroit, Grand Haven, and Milwaukee, and the Grand Rapids and Indiana, to Traverse City; then to Sutton's Bay. Another child of the family has since come down with the disease. The family had a certificate, signed by the surgeon of the steamer, that they had been protected by vaccination against small-pox: so they passed without detention the quarantine authorities at the port of New York, after they had been exposed to a contagious disease which causes more deaths by far in this country than small-pox causes.'" He gives the following as an instance of the communicability of scarlet-fever which came under his own observation: "Arthur G., aged eight, came from the country to his Brooklyn home in sound health. A case of scarlet-fever (convalescent) being in the house upon his arrival, he was within twenty-four hours removed to other quarters, where there were no children and no disease. In a few days he had a severe attack. By perfect isolation no new cases occurred. Many such instances of short contact giving the disease have come under my observation. The best illustration my experience affords occurred during a visit I made to Wyandotte, Kan., in the winter of 1883. Mrs. S. had been visiting relatives in a distant State. In one family she called upon, they had scarlet-fever. The children were not with her. On her return home in a few days, a daughter, aged seven, was taken sick with what proved to be scarlet-fever. At this time there was not a case but itself in the town, nor had there been for many months. In their trouble, neighbors called, and within two weeks there were ten or more cases. A relative who helped them in the care of the child had three cases in his own family, he proving to be one of the victims. Two customers of his who were waited upon by him while indisposed, but not confined to bed, had each cases among their children after the exposure. No other source of contagion was possible. It must here have been carried in the clothing. Mrs. H. (my wife's mother), living in the country, visited a neighbor some miles distant, where a child was sick with scarlet-fever. A few days after the visit, her own son, aged four, who had not been exposed, was taken sick of this disease and died. There was no possible way of carrying the contagion other than upon the mother's clothes. Boards of health should require all cases to be reported to them by district sanitary inspectors, aided by physicians, the police, and the public. Their duties should be the ferreting-out of every case of contagious disease. To-day the position of inspector is a sinecure. Those holding such positions are well paid for doing almost nothing. Nearly half the cases of contagious diseases that occur, physicians do not see, nor even hear of, until some dangerous complication arises to give alarm. If they pursue a mild course, they are not heard of by the board of health, and the public schools and public conveyances scatter their virus broadcast. Conscientious physicians, too, are put at a disadvantage by their unscrupulous competitors for public favor. The doctor who is known to faithfully report every case loses his practice. People are afraid to call him, because he interferes with the progress of the children at school, and often cuts off their source of livelihood, where they carry on some industry at home. Very many physicians have boasted to me that they never report such cases unless they become so serious that they are likely to lose them. Nor can any law compel them to do so, as it is easy to introduce the claim that they had not made out a positive diagnosis. Let the inspectors, who are independent of the patients' friends, discover and report them, using all possible means as assistance."

In reference to a plan for preventing the spread of the fever, Dr. Eccles says, "The evidence we have, indicates that the germs or spores float as impalpable dust in the air. It is found by experiment that wet gauze, by evaporation, is colder than surrounding

¹ Continued from *Science* of Dec. 16, 1887.

air. Dust is attracted from warm air to a cold body. If that body is wet, it adheres. By canopies of mosquito-netting over the sick-bed, kept wet with bichloride-of-mercury solution containing glycerine, no dust can pass through the meshes in either direction. The cooled threads attract across the narrow space of the mesh all dust that reaches there. The glycerine and water fix it, and the corrosive sublimate sterilizes it. To keep up the application, two layers of netting are required, — one fixed, the other removable. The outer removable one can at stated times be wrung out of a fresh solution, and put back again. Overlapping folds can allow the passage of food, medicine, etc., to the patient. This provides perfect isolation even in a room occupied by others."

R. Harvey Reed, M.D., Mansfield, O., secretary State Sanitary Association, has known cases where old rags taken and sold from scarlet-fever cases have been used by wipers, and they in turn have communicated the disease to their families. He could give many others if it were necessary, but this fact has long since been established.

D. S. Kellogg, M.D., Plattsburgh, N.Y., believes that the disease may arise *de novo*, and bases his belief on the ground that he has had cases which he cannot *reasonably* determine, after careful investigation, originated from any previously existing case. He says, "I believe scarlet-fever to be communicable, yet last spring my belief received a severe blow. My little boy, aged six, was severely sick with this disease. My baby, aged three, slept across the hall; and my son, aged eight, slept down stairs. The sick boy was kept in a room by himself. Yet his mother and I were constantly going from the sick one to the well ones, and *not either* one of them took the disease. The sick boy 'peeled' so thoroughly that the sheets had to be shaken in order to get rid of the fine flakes of skin. He had many toys that he played with after convalescence set in. I disinfected the room in about six weeks from the beginning of his sickness, and the toys. He and the two other children have played with these toys ever since, have slept in the room for a number of months, and have not had any further scarlet-fever." He does not believe that anything can be done by the use of remedies to prevent well persons from contracting the fever. He believes that if a person has been exposed to scarlet-fever, the better his physical condition, the better is he able to endure the disease. There are many instances that would make this not seem true.

T. D. Crothers, M.D., Hartford, Conn., says, "In 1868 I traced in an epidemic twenty-one cases to contagion clearly. The communicability was by contact in most cases; in others it was through the near association. In two instances a linen picture-book was the medium of communication of the poison. In several cases it was taken by the clothing of persons who had been nursing such cases. Clothing has retained this infection several weeks when confined in a trunk. Many cases have occurred in a community, and been confined to a single case by means of isolation, quarantine, disinfection, and extreme cleanliness."

William H. Brewer, professor in Sheffield Scientific School of Yale University, New Haven, Conn., in reply to the question whether scarlet-fever ever arises *de novo*, says, "There are insufficient data for a *positive belief*. From the evidence, however, that we have, I say *no*, until better evidence is brought forward that it does arise *de novo*. Quarantine the cases if public opinion will justify: if not, then the first duty of the board is to educate the public as to the facts and the dangers. So soon as the public is ready for it, scarlet-fever will be more rare than the small-pox. But before this can be brought about, there must be a strong public feeling that it is a controllable disease."

W. C. Van Bibber, M.D., Baltimore, Md., thinks that boards of health should endeavor to change the non-sanitary condition of neighborhoods and places; for, although scarlet-fever may not now be fairly numbered among the filth-diseases, yet cleaning and sanitary laws may do good on general principles. Cleaning, segregation, and belladonna internally, ventilation, and increased vigor by increasing the vigor of individuals, should be employed. He says, "I attended Christ Church Charity School, Baltimore, for thirty-six years. The means above mentioned were used where a case of scarlet-fever occurred. The school consisted of thirty-two children. In thirty-six years there was but one death. The disease appeared in the school more than twenty times, and was al-

ways kept confined to but few children by means of these precautions. By personal hygiene, continued life in open air, the use of belladonna internally to those exposed, and rubbing the diseased body with disinfectants, much may be done to prevent the spread of the disease. I combine in an oil embrocation (thymol, anise-oil) carbolic and salicylic acids, and camphor.

DO FORESTS INFLUENCE RAINFALL?

It is very generally believed that the culture of forests induces an increase in rainfall, and that their destruction diminishes it. A satisfactory explanation of this supposed phenomenon has never, as far as I am aware, been offered; and the only tangible support for the theory appears to consist in a few observations of rainfall in limited areas in central Europe, made before and after reforestation. It seems desirable that the question should be tested by all the evidence at hand, and the theory established or disproved by the facts. We have in this country the material for testing both phases of the theory upon a large scale and in an exhaustive manner.

The prairie region, including Iowa, northern Missouri, southern Minnesota, most of Illinois, and a small part of Indiana, has, during the past thirty years, undergone a great change with respect to its vegetation. This great area of over 100,000 square miles, was, when settlement commenced, mainly grass-covered. It contained no forests. Belts of trees were found along the water-courses, upon the slopes of river-bluffs, and here and there upon the slight elevations. But man has encouraged the growth of trees, and the area of arborescent vegetation has been greatly increased. It is an example of reforestation upon an immense scale, unequalled elsewhere upon the globe. Has the rainfall correspondingly increased?

* The early settlers in Ohio found it mainly a forest-covered region. It has been remorselessly cleared. This area of 40,000 square miles does not contain to-day a tithe of the timber-land that it contained fifty years ago. Has the rainfall diminished?

The States of Massachusetts, Rhode Island, and Connecticut, with adjacent parts of New York, New Hampshire, and Maine, — an area of perhaps 25,000 square miles, — were, when Europeans entered them, densely covered with forests. In time these were almost entirely cleared away. In recent years, however, a change in the occupations of the people of this densely settled region, in virtue of which the farms are being abandoned, while the inhabitants are becoming massed in the cities, has allowed an enormous increase in the wooded area of these States. To-day at least half this area is again covered with woods.

If this theory be correct, the rainfall in this region should have diminished from the colonial times down to, say, 1860, while since that date it should have been on the increase. Are these the facts?

We have here three areas of considerable magnitude, in which radical changes in the forest-covering have been made during the present century. Fortunately, also, we have ample records of the rainfall during these periods.

First, however, a word as to the character of the rainfall. Of all current meteorological phenomena, rainfall is the most irregular, both as to time and place. The rainfall of one year may be double or treble that of the year before or the year following. At any one station these fluctuations are ordinarily so great as to thoroughly mask any secular change. It may vary greatly from place to place, even though the distance be small, while the change of the location of a gauge from the ground to the top of a house may make it give very different indications. For these reasons it is apparent that reliable results, in regard to a general increase or decrease of rainfall, are to be obtained only by combining a large number of observations scattered over many years and over the greatest possible variety of conditions. It is a very easy matter to so select stations, and years of observation, as to obtain any pre-arranged result.

If there has taken place a change in the amount of rainfall in any or all of these regions, it must, in the nature of things, have been a progressive one, however disguised by sporadic fluctuations. Moreover, if this increase or decrease in rainfall produces the results claimed for it, making a desert fruitful, or the reverse, it must