THE NATIONAL ACADEMY OF SCIENCES.

The National Academy of Sciences began its main annual session, Oct. 28, at Columbia College in this city. Professor Wm. B. Rogers presided, Vice-President O. C. Marsh occupying the chair during part of the time.

In his opening address the venerable president spoke of some of the aspects of scientific research which had specially excited his interest of late.

'It seems," he said, "as if, in the progress of research, the physical sciences, including the biological department, had reached fields of inquiry which promise the widest results for future investigation. In all branches of discovery we seem to be catching the clews of far-reaching thought, that stretch out where as yet no man's foot has trodden. As among some of the most recent of these may be instanced the evidence, amounting almost to proved assurance, by which Prof. Whitney places the existence of man at least as far back as the Pliocene era. The recent developments in chemistry, through the agency of the spectroscope and the effects of heat in dissociation, have suggested, if they have not proved, that a number of the substances hitherto regarded as elements are hereafter to be regarded as compound. The investigation of the laws of chemical action, following out the suggestions made at the beginning of the century by the great chemist, Berthollet, in regard to the influence of mass on chemical reaction, seems to promise most important discoveries in chemical statics and the possibility of applying mathematical reasoning and formulæ to chemical activities. The marvelous series of experiments presented recently by Crookes, in which have been exhibited the wholly unexpected phenomena which he has described under the designation of what was first referred to by Faraday as a fourth form of matter, which this illustrious experimentalist called radiant matter, seemed to open up a field of research and speculation until now wholly undreamed of. In truth, the active scientific workers have now been brought by their refined and novel researches to touch the near extremities of innumerable lines of thought and investigation, stretching out into unknown regions, whose exploration is to occupy the activity and reward the labors of a coming generation."

The first paper was that of Prof Henry Draper, on photographing the spectra of the stars, in the course of which he described the work which he began in 1872. In these researches he has obtained photographs of the spectra of Vega, Arcturus, Capella, Alpha Aquilæ, Jupiter, Mars, Venus, and other bodies. Particulars were given of the methods by which these results were attained. The subject of planetary spectra is for the present reserved, and will be the subject of a future communication. The spectral photographs of Arcturus and Capella seem to be precisely like those of the sun. Those of Vega and Alpha Aquilæ are totally different. They are banded, not lined. It is clear that hydrogen is present to a large extent in the atmosphere of Vega; but it is equally certain that other substances are quite as prominent. Exactly what these bands mean can only be ascertained by a course of experiments on terrestrial materials, On this study Dr. Draper has fully entered. He is not fully of the belief that the lines of calcium are present. He exhibited portions of his apparatus, and illustrated the subject by diagrams of the spectra and by photographs.

The next paper, by Prof. C. A. Young, embodied a number of spectroscopic notes, principally of a technical character. Surgeon General J. J. Woodward also read a paper giving an account of original researches, reported in the second volume of the "Medical and Surgical History of the War of the Rebellion."

In the afternoon, Dr. J. C. Dalton described the results of observations on the structure of the human brain, which were illustrated by numerous drawings and photographs. He held that the white matter of the cerebrum, composed of fibers, is employed for transmission only, the essential operations of the mind occurring wholly in the gray matter. Of this gray matter there are three distinct deposits. Conditions affecting the first, counting from within outward, produce involuntary action; reaching the second, they produce sensation; reaching the third, conscious cerebration. In the discussion which followed Dr. Woodward said that a brain, specially prepared, had been sawed into a thousand slices for microscopical examination.

Prof. Arnold Guyot next exhibited his new map of the Catskill Mountains, and discussed the geological problems of that region. It was originally a table land, and had been carved into mountains by erosion. He did not regard the carving of the mountains as glacial work, though the evidence of glacier scratches was not wanting. The process which had taken place, he thought, was an elevation of the whole district. But at the time of that rise the Adirondack formation was already in position, and by it the Catskill plateau was squeezed as it rose. The mountains which now occupy the place of that plateau were left by erosion, their valleys being carved out by rivers. Prof. James Hall, in the discussion which followed, expressed himself as delighted with the adhesion of so good an observer as Prof. Guyot to the theory of the formation of mountains by erosion, and not by their separate upheaval. Prof. Rogers described an instance where one of the Shenandoah mountains could scarcely have been formed by a separate upheaval, for all its strata were horizontal from bottom to top; but the surrounding region was full of the evidences of disturbance.

The first paper of the second day was by Prof. James Hall, State Geologist of New York, on certain new and remarkable crinoids from the Lower Helderberg formation. Later a second paper was read by the same gentleman on a more ancient fossil of the same order, which had been mistaken for a plant. Prof. Newberry expressed the hope that the new crinoids might help to furnish the missing link between crinoids and sponges. In the absence of the authors the Secretary read a paper by Prof. Elias Loomis, continuing his studies of the meteorology of the United States as exhibited by the Signal Service weather maps; also one by Prof. Asaph Hall, of the Naval Observatory, giving the latest results of his observations on the moons of Mars. A paper by Prof. Stephen Alexander, describing a method of ascertaining the dimensions and ellipticity of the earth, led to much discussion, Prof. S. P. Langley, of Allegheny, specially challenging it as liable to large mistakes, owing to the irregular variations in the lower strata of the atmosphere.

The main paper of the afternoon session, on the old river beds of California, by Prof. Joseph Le Conte, of Oakland, was read by Prof. Scudder, of Harvard. It described at great length the present and recent conditions of the river valleys of California, and the theories which have been offered to account for the filling up of the old river beds. All were declared untenable except the one which explained the matter by true river action. The old rivers, though rapid, filled up their beds because of the vast amount of material they carried. The deposits in the old beds are very coarse, and must have cut fast, in a geological sense. When the deposits were completed, the streams were displaced by the lava floods. Mere deposits would never displace the streams. The deposited materials were held in the snow and ice originally, but were released by the melting of these by the approach of the subterranean heat of the impending lava flow. This may be objected to as savoring of catastrophism; but the obliteration of an entire system could be effected by nothing short of catastrophe. After the lava came the flow of ash, and the new beds were cut in the ash deposits between the lava deposits. This lava flow did not come from craters, but from fissures, and the side squeezing elevated the mountain ranges, so that the new channels appear in the singular relation of being below instead of above the old. We have then the formation of the Sierra Nevada drainage system, lasting through the Cretacian and Quaternian periods, with neither much erosion nor much detritus. The Glacial period was characterized by snow and ice, with loose *debris* prepared for transporting. The melting snow ran down in overloaded streams, alternately scouring and refilling. Then the fissuring of the high Sierras, lava streams obliterating the river system, and ash irruptions followed. New glaciers and rivers then cut new rivers, showing a preference for the old divides. The high Sierras were ice-mantled, and the lower coast range was covered with snow down to the Bay of San Francisco. New channels were cut below the old lava-filled channels, and meteoric waters charged with lime and silica changed the slate and bed-rock into clay.

Prof. Guyot remarked that this paper modified our ideas of the antiquity of man, which might not be, geologically, very great. It showed how insufficient were our data for estimating chronology, and emphasized the necessity for caution.

Professor Marsh said that the labors in this same field of Professors Whitney and King, leading to different conclusions, should be kept in mind. They both agree that there is no doubt of the Pliocene age of deposits, in which occur human remains. The age of the animals discovered by Marsh was clearly Pliocene. If man is found in the same place with these animals he should be considered as Pliocene also. It is important to say that glacial action began in the Pliocene age. He had seen basalt deposits in Pliocene formations, showing volcanic action previous to the glaciers. The animals found were tropical, as the rhinoceros and great sloth, and in this time early man existed.

Prof. Langley read a paper on the absorptive powers of the solar atmosphere, and Prof. O. N. Rood one on our memory for color and luminosity, intended to prove that human capacity in this respect is greater than has been hitherto believed.

Work and Wages in Lowell Cotton Mills.

In a long account of Lowell and its cotton mills, in the Boston *Journal of Commerce*, we find the following interesting facts and figures:

The first of the great cotton mills of Lowell commenced operations in 1823. Now the entire capital stock in the several corporations is nearly $17,000,000.

Whole number of spindles	800,000
" " " looms	19,000
Females employed	12,000
Males "	8,000
Yards made per week—cotton	3,500,000
" " " " —woolen	115,000
" " " " —carpeting	40,000
Pounds cotton consumed per week	1,000,000
Pounds clear wool consumed per week	175,000
Yards of cotton cloth dyed and printed per annum	93,000,000

As a result of the very great changes in machinery since 1860, the work in the factory is not only done better, but at a less waste of material, and the cost of production in labor reduced 25 per cent. Labor is also less arduous. To such perfection has machinery been brought that from 60 to 64 per cent less labor is now required, for a given amount of product, than in 1860. The machinery is also run at nearly double the speed, a single operative now turning out in a given time about one-third more work than it was possible to do in 1860. Three-fourths of all the labor the mills to-day is done by women, and every year the work is more and more coming into their hands.

Until recently the greater part of the machinery used was imported, as it was believed that it could not be made so well at home as in England, but home built machinery, for all purposes, is now preferred. It not only does its work better, but is better adapted to our operatives, and to the American system of management.

Touching the condition of the factory operatives, the *Journal* says that, judging from reports sometimes made, one might expect to find in our New England cities a class of wretched, half starved beings, prematurely old by overwork, discouraged and heartbroken over present hardships and a still darker future. No such class of operatives is found in Lowell, else all outward signs are deceptive. Their homes are found neat and attractive, and somehow old and young manage to dress well. Their tables are supplied with good food, they have spare money for occasional excursions or to attend places of amusement, while many of the more industrious and frugal have respectable accounts in the savings banks; but after all the most telling fact is the large attendance and creditable standing of their children in the public schools.

The following figures were taken from the books of one of the leading corporations of Lowell:

Average earnings of girls per week in 1860	$3.26
Board per week in 1860	1.25
Leaving net earnings per week, 1860	$2.01
Average earnings of girls per week in 1878	$4.34
Board per week in 1878	1.75
Leaving net earnings per week, 1878	$2.59

The facts, therefore, show that in 1860 female operatives, working 11 hours a day (66 hours a week), received $3.26, while in 1878 the female operatives, when working 10 hours a day (60 hours a week), received $4.34. This applies only to one class of operatives, but the average given is found the same with all the other classes.

The changes in the character of the operatives have been no less marked than in the improved machinery brought into use. In the first twenty years the operatives in the mills of Lowell were nearly all Americans, mostly sons and daughters of New England farmers—many coming from New York State—and all attracted by the better wages offered than could be had at home. To-day the operatives are mostly all foreigners, some English and French, but mainly Irish, while the strictly American element is very small. The figures below will show the rapid increase in the foreign population of the city, which is attributable to this remarkable change in the factory operatives.

Year.	Population.	Foreign.
1836	17,633	2,661
1841	25,163	2,864
1855	37,553	8,500
1865	30,990	9,422
1875	49,688	17,788
1879	53,000	19,000

The same fact is noticeable in all the leading manufacturing cities of the State. In Lawrence 45 per cent of the population are foreign born; in Holyoke 52, and in Fall River 53 per cent.

Manchester and Leeds (England) have their resident operatives, a dependent factory caste—once in the factory, seldom or never a door is found open for escape. In the mills of Lowell the operatives are constantly changing. This has been so from the start, and from the nature of things must always continue. Manufacturing began here by drawing from the very best class of New England young men and girls, who remained until better chances offered elsewhere, others taking their places, and like them used the mills only as stepping stones to something better.

Surely there is nothing in the employment itself that debases, as the fifty years' history of the best mills of New England proves. It is a fact, that however low and sluggish new comers may be, close contact with active, hopeful life inspires in them new hope and new life. Those who are in the mills to-day are not expected to remain a single day after they have found a pursuit more profitable or better suited to their tastes. Our country is a wide one; all nationalities are welcomed, with choice of pursuit open alike to every individual, each taking the place he is best fitted to fill.

The Window Glass Trade.

Replies to a circular of inquiry, sent out by the President of the Window Glass Manufacturers' Association, show that with 68 furnaces and 569 pots devoted to window glass, there are, or soon will be, in operation 546 pots, distributed as follows: New York and Massachusetts, 11 furnaces, 70 pots; New Jersey and Eastern Pennsylvania, 13 furnaces, 104 pots; Baltimore, 5 furnaces, 34 pots; Pittsburg, 21 furnaces, 192 pots; the Western States, 18 furnaces, with 146 pots. Last year there were made 1,463,807 boxes of window glass, a falling off from the output of the preceding year of nearly a hundred thousand boxes. There are 62 more pots running this year than last year.

The Elevated Railway Nuisance.

In New York city, a few days ago, while a truck loaded with cotton was passing through one of the main streets, now occupied by the elevated railway, a spark from a passing locomotive set fire to the cotton. An alarm was given, the fire engines came and extinguished the flames. Many cases of fires, caused by the elevated railway locomotives, have occurred.

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