

looked upon as the means of occasionally obtaining isolated items of information from the upper regions; the world had not then awakened to the possibility of the work inaugurated by Prof. Moore in July 1895, which looks to the compilation of a daily map of simultaneous observations high above the earth's surface and over a large portion of the United States, for study in connection with the map of surface conditions. Observations of the air at a single station can have but little value compared with the international balloon work of Europe, or the extended national kite work of the U.S. Weather Bureau.

In an address at Toronto, before the British Association, Prof. Moore is reported by the *Review* to have said:

"For twenty-seven years the forecasters of the Weather Bureau have studied the inception, development, and progression of these different classes of atmospheric disturbances. From a knowledge personally gained by many years' service as an official forecaster, I do not hesitate to express the opinion that we have long since reached the highest degree of accuracy in the making of forecasts possible to be attained with surface readings. It is patent that we are extremely ignorant of the mechanics of the storm; of the operations of those vast yet subtle forces in free air which give inception to the disturbance, and which supply the energy necessary to continue the same. Long having realised this, I determined at once, on coming to the control of the United States Weather Bureau, to systematically attack the problem of upper-air exploration, with the hope ultimately of being able to construct a daily synoptic weather chart from simultaneous readings taken in free air at an altitude of not less than one mile above the earth. It appeared to me that all previous plans for investigating the upper air, by means of free and uncontrollable balloons, by observers in balloons, or by isolated kite stations or mountain observatories, were of little value in getting the information absolutely necessary to the improvement of our methods of forecasting. Simultaneous observations, at a uniform high level, from many co-operating kite stations, was the fundamental feature of the plan that I inaugurated for the prosecution of this important investigation.

"Prof. Marvin was assigned to the difficult task of devising appliances and making instruments, and I am pleased to say that we have improved on kite flying to such an extent that apparatus is now easily sent up to a height of one mile in only a moderate wind. We have made an automatic instrument that, while weighing less than two pounds, will record temperature, pressure, humidity, and wind velocity. By January next we expect to have not less than twenty stations placed between the Rocky Mountains and the Atlantic Ocean taking daily readings at an elevation of one mile or more.

"We shall then construct a chart from the high-level readings obtained at these twenty stations, and study the same in connection with the surface chart made at the same moment. As we shall thus be able to map out not only, as now, the horizontal gradients for the lower surface conditions, but in addition the simultaneous gradients for the upper level, and, what is of still more importance, shall be able to deduce from these, for any section of the atmosphere, the simultaneous vertical gradients of temperature, humidity, pressure, and wind velocity, we may confidently hope to better understand the development of storms and cold waves, and eventually improve the forecasts of their future course, extent, and rate of movement. It will be a fascinating study to note the progress of cold waves at the upper and lower levels, and to determine whether the changes in temperature do not first begin above. I am anxious to know the difference in temperature between the surface and the upper stratum in the four quadrants of the cyclone, and also of the anti-cyclone, especially when the storm or cold-wave conditions are intense. The vertical distribution of temperature in the several quadrants may give a clue to the future direction of movement of the disturbance."

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

MISS EMILY PENROSE, principal of Bedford College, London, has been appointed principal of the Royal Holloway College, Egham.

MR. WM. H. SAGE and Dean Sage have presented to Cornell University the large residence of the late Mr. Henry W. Sage, at Ithaca, for a students' hospital, and will equip it and endow it with 100,000 dols. The residence is valued at 80,000 dols.

NO. 1468, VOL. 57]

THE following resolution has been unanimously passed by the lecturers and teachers in the medical school of Guy's Hospital: "That the medical school of Guy's Hospital earnestly request Her Majesty's Government to reintroduce into Parliament the London University Commission Bill of 1897, and to pass it into law during the ensuing Session."

AMONG the institutions created during the last half-century for the promotion of scientific research and education, the Sheffield Scientific School of Yale College, New Haven, holds an honourable place. A review of the foundation of the School, and of the work of the distinguished investigators who have been connected with it, was given in a discourse delivered by President Gilman at the semi-centennial anniversary recently held. It was in 1847 that Profs. Silliman and Norton opened a laboratory on the College grounds for the purpose of practical instruction in the applications of science to the arts and agriculture. Thus was born the Sheffield Scientific School of Yale University. At first chemistry was alone; engineering soon found a place; mathematics, physics and astronomy joined the oligarchy; in due time, mineralogy, geology, physical geography, zoology, botany and physiology found a welcome; modern languages and literature, history and economics, became strong allies. While this evolution was going on, not a word was spoken in disparagement of classical culture, nor a word of religious controversy. From the beginning onwards the institution has been the department of a University which never suffered its love of letters to blind its eyes to the value of science. The School largely owes its success to its association with the fame, the fortune, and the followers of a great *alma mater*. Substantial advantages were bestowed by the mother upon her offspring; and the present high position which the School occupies shows that the child has deserved the encouragement it has received.

A MEETING was held at the University of London on Tuesday afternoon, the Chancellor (Lord Herschell) presiding, to discuss the proposed legislation on the University of London question. The *Times* reports that there were present, besides the Vice-Chancellor (Sir Henry Roscoe), representatives of the Corporation of the City, the Technical Education Board of the London County Council, the Royal Colleges of Physicians and Surgeons, the various medical schools, University College, King's College, Bedford College, the Royal College of Science, and the City and Guilds of London Institute. The Chancellor invited expression of opinion on the London University Commission Bill which the Government propose to reintroduce early in the Session. He said that the Bill embodied the compromise between the various parties hitherto in conflict, and that it was to receive the support of the Senate, as also of both parties in Convocation. The Chancellor further explained why no proposal for any new charter was within the range of practical politics, reconstitution at the hands of a statutory commission being the only remaining course. He therefore urged the acceptance of the compromise. Many of those present spoke in favour of the scheme, and urged that a deputation should wait upon the Vice-President of Council at an early date. The only objection came from one of the smaller medical schools, which declared its preference for the creation of a second University in London. The feeling of the conference was, however, entirely in favour of the reconstruction of the existing University. A deputation to the Government will be appointed as suggested to urge the passing of the Bill.

SCIENTIFIC SERIALS.

Bulletin of the American Mathematical Society, November 1897.—The number opens with an account, by Prof. Osgood, of the proceedings at the International Congress of Mathematicians held at Zürich in August last. The transactions of the Congress, which was attended by about two hundred mathematicians, together with the papers read, or presented, are to be published in full.—Prof. J. McMahon performs a like work for the Detroit meeting of the American Association for the Advancement of Science. An analysis of the twenty-one papers presented to the Section is given. One of these communications was an account of stereoscopic views of spherical catenaries and gyroscopic curves by Prof. Greenhill, who was present at the meeting, and to whom the Section "is also indebted for instructive remarks made in connection with many of the other papers." Then follow five papers read before the American Mathematical

Society, viz. before the Chicago Section (April 24, 1897): Quaternion as members of four-dimensional space, by Prof. A. S. Hathaway. Note on the invariants of n points, by Dr. E. O. Lovett, is another communication which was made at the same meeting.—Dr. Lovett contributes also a note on the fundamental theorems of Lie's theory of Continuous Groups (October 30). The object of the note is to call attention to a misapprehension, if not an error, in a paper, by J. E. Campbell, on a law of combination of operators bearing on the theory of continuous transformation groups, read at the March 11 meeting of the London Mathematical Society (*Proc.*, vol. xxviii. pp. 381-390). The fourth paper is one read at the Toronto meeting, August 16. It is an interesting short note by Prof. T. F. Holgate, and is entitled, "A geometrical locus connected with a system of coaxial circles." The writer's object is to find the locus of points through which three lines can be drawn tangential to three circles of a coaxial system in pairs.—Condition that the line common to $n-1$ planes in an n space may pierce a given quadric surface in the same space, by Dr. V. Snyder, was read at the Detroit meeting mentioned above. The note is a generalisation of a proof recently given by the author (criteria for nodes in Dupin's cyclides) of the geometric significance of a certain determinant.—Dr. E. W. Brown gives a valuable analysis of Prof. H. Lamb's *Hydrodynamics*. Of this the reviewer writes: "The author is to be congratulated on the completion of a task which will earn him the gratitude of all those who are now, or may in the future be, interested in *Hydrodynamics*.—In the Notes are particulars of the British Association meeting at Toronto, in so far as it concerned mathematicians.—Other matters are a list of the mathematical courses for the winter semester (1897-98) in the Universities of Göttingen, Leipzig, Munich, Vienna and Strassburg.

In the *Meteorologische Zeitschrift* for November, Dr. J. Hann gives the daily range of the meteorological elements at Cairo, deduced from the observations of the five years 1891-5, as published in the *Résumé Mensuel* of the observatory at Abbassieh. These values are of some interest, as Dr. Hann states that the monthly means contained in the tables give for the first time the true daily means for Cairo. The barometric range exhibits the small amplitudes for the latitude that have been noticed in other parts of the Mediterranean. The night minimum does not appear to fall below the daily mean throughout the year. The range of temperature shows no special peculiarities; it is greatest in June, and is greater in the dry spring than in the damp autumn. The daily range of wind force is noteworthy, especially during spring and autumn; during the year there is only a very slight variation at night-time, but in the afternoon there is a great increase in the force from winter to spring, and from summer to autumn. During the winter half-year the nights are clear, while cloud prevails at the middle part of the day; in the summer the morning hours are cloudiest, but from about noon the sky is almost cloudless. The influence of the overflow of the Nile in the autumn naturally affects the range of humidity.

In the *Journal of Botany* for November and December, Mr. F. Townsend completes his monograph of the British forms of *Euphrasia*, of which he makes fourteen "species" founded on von Wettstein's monograph of the genus. It is accompanied by seven plates illustrating the habit of each "species," and details of the form of the flowers and leaves.—In a paper on "New and Critical Marine Algæ," Mr. E. A. L. Batters describes a number of species new to science, together with a new genus, of Floridææ, *Porphyrodiscus*, from Berwick, with the crustaceous habit of *Hildenbrandtia*.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, November 25.—"On certain Media for the Cultivation of the Bacillus of Tubercle."¹ By Dr. Arthur Ransome, F.R.S.

The following conclusions had been drawn from previous experiments:—

(1) That finely divided tuberculous matter, such as pure cultures of the bacillus, or tuberculous matter derived from

¹ By permission of the Royal College of Physicians, this research, which forms a portion of the Weber-Parkes prize essay, is communicated to the Royal Society before publication. The cost of the inquiry is defrayed by the Thrustan prize, presented to the author this year by Gonville and Caius College, Cambridge.

sputum, in daylight and in free currents of air is rapidly deprived of virulence;

(2) That even in the dark, although the action is retarded, fresh air has still some disinfecting influence; and

(3) That in the absence of air, or in confined air, the bacillus retains its power for long periods of time.

These observations afforded an explanation of the immunity of certain places, and the danger of infection in others. They show that where tuberculous sputum is exposed to sufficient light and air, to deprive it of virulence before it can be dried up and powdered into dust, no danger of infection need be dreaded. It would appear further, from this research and others, that it is only when there is sufficient organic material in the air, derived from impure ground air, or from the reek of human bodies, that the tubercle bacillus can retain its existence and its virulent power.

But, in addition to the above-mentioned researches, it seemed desirable that an attempt should be made to ascertain what part was played respectively by the several forms of organic impurity that are present in insanitary dwellings. It was determined, therefore, to collect the aqueous vapours arising from the ground, or from human bodies, and to submit these products to the test of trying whether they would serve as cultivating media for the bacillus of tubercle.

By means of a simple freezing mixture of ice and salt it was easy to condense the aqueous vapour, both of the breath and that coming from ground air.

Some evidence was obtained with simple glycerine agar that the organic fluids facilitated cultivation to some extent. With the organic fluids there were only two failures, and growth was fairly rapid.

In the next series of trials, it was decided to use as the material bases some non-nitrogenous substance, and at length it was determined to use a particularly pure "filter-paper."

Some degree of success was attained in twelve out of fifteen specimens of the organic fluids.

The degree of growth was also much the same as in the previous series, though perhaps slightly less vigorous.

It was now determined to try to do without the help of the glycerine, which, as is well known, so greatly assists the ordinary cultivations of the bacillus. Accordingly, four tubes with simple filter-paper as the supporting medium, and condensed fluids, from the breath of a healthy person, and from that of a phthisical patient, as nutrient fluids, were inoculated, and no glycerine was added. In these tubes the same cultivation was used as in the previous experiments.

Shortly afterwards, two similar tubes with fluid from healthy breath alone, but with 5 per cent. of glycerine, were sown with the same cultivation, and were left at the ordinary temperature of the laboratory, about 21° C.

All of the former group took on active growth within four weeks, and one of the latter. In other words, it was proved that pure filter-paper, moistened with these condensed fluids, alone would suffice to nourish and promote the growth of the bacillus, and, further, that this growth would take place at ordinary temperatures. It may hence be concluded that when this organic fluid is present in ordinary dwellings, the bacillus may grow at the temperature of living rooms as well as at the temperature of 35° C.

Two sets of tubes were then prepared of condensed vapour from breath, and from ground air from a pure sandy soil. No glycerine was added; but for the solid medium, in some instances, the pure filter-paper was employed; in others, an ordinary lining paper, containing a little size, but carefully sterilised, was used.

Some of these were placed in the incubator at a temperature of 37° C., others were left in the dark at the ordinary temperature of the laboratory.

In many of the tubes a free growth was observed as early as the end of the first fortnight.

Out of the total number in this series of 37, in thirty six instances there was free growth on the medium employed, on both kinds of paper, and all kinds of condensed fluid. Eleven of them were grown at a temperature of about 20° C. In only one instance was there complete failure (vapour from healthy breath).

The bearing of these researches upon the subject of the prophylaxis against tuberculosis seems to be of some importance.

They prove that any one of the various organically charged vapours, whether coming from healthy or from diseased lungs,