

open question in the present condition of the inquiry. The close connection with Hallstadt renders the latter view the more probable, although there is clear proof of the Greek influence from the south. This, however, it must be admitted, may belong to a later period.

In closing this review, we may congratulate Dr. Munro on his success in writing a book which is short, picturesque, and scientific; and we feel sure that he will gain his end, of attracting attention to the archæological treasures awaiting the explorer in this hitherto little-explored corner of Europe.

W. BOYD DAWKINS.

#### EXPERIMENTS IN MECHANICAL FLIGHT.

I HAVE been for some years engaged in investigations connected with aerodynamic problems, and particularly with the theoretical conditions of mechanical flight. A portion of these have been published by me under the titles "Experiments in Aerodynamics" and "The Internal Work of the Wind," but I have not hitherto at any time described any actual trials in artificial flight.

With regard to the latter, I have desired to experiment until I reached a solution of the mechanical difficulties of the problem, which consist, it must be understood, not only in sustaining a heavy body in the air by mechanical means (although this difficulty is alone great), but also in the automatic direction of it in a horizontal and rectilinear course. These difficulties have so delayed the work, that in view of the demands upon my time, which render it uncertain how far I can personally conduct these experiments to the complete conclusion I seek, I have been led to authorise some account of the degree of success which has actually been attained, more particularly at the kind request of my friend Mr. Alexander Graham Bell, who has shown me a letter which he will communicate to you. In acceding to his wish, and while I do not at present desire to enter into details, let me add that the aerodrome, or "flying-machine" in question, is built chiefly of steel, and that it is not supported by any gas, or by any means but by its steam-engine. This is of between one and two horse-power, and it weighs, including fire-grate, boilers, and every moving part, less than seven pounds. This engine is employed in turning aerial propellers which move the aerodrome forward, so that it is sustained by the reaction of the air under its supporting surfaces.

I should, in further explanation of what Mr. Bell has said, add that owing to the small scale of construction, no means have been provided for condensing the steam after it has passed through the engine, and that owing to the consequent waste of water, the aerodrome has no means of sustaining itself in the air for more than a very short time—a difficulty which does not present itself in a larger construction where the water can be condensed and used over again. The flights described, therefore, were necessarily brief.

S. P. LANGLEY.

Through the courtesy of Mr. S. P. Langley, Secretary of the Smithsonian Institution, I have had on various occasions the privilege of witnessing his experiments with aerodromes, and especially the remarkable success attained by him in experiments made on the Potomac River on Wednesday, May 6, which led me to urge him to make public some of these results.

I had the pleasure of witnessing the successful flight of some of these aerodromes more than a year ago, but Prof. Langley's reluctance to make the results public at that time prevented me from asking him, as I have done since, to let me give an account of what I saw.

On the date named, two ascensions were made by the aerodrome, or so-called "flying machine," which I will not describe here further than to say that it appeared to me to be built almost entirely of metal, and driven by a

steam-engine which I have understood was carrying fuel and a water supply for a very brief period, and which was of extraordinary lightness.

The absolute weight of the aerodrome, including that of the engine and all appurtenances, was, as I was told, about 25 pounds, and the distance, from tip to tip, of the supporting surfaces was, as I observed, about 12 or 14 feet.

The method of propulsion was by aerial screw propellers, and there was no gas or other aid for lifting it in the air except its own internal energy.

On the occasion referred to, the aerodrome, at a given signal, started from a platform about 20 feet above the water, and rose at first directly in the face of the wind, moving at all times with remarkable steadiness, and subsequently swinging around in large curves of, perhaps, a hundred yards in diameter, and continually ascending until its steam was exhausted, when, at a lapse of about a minute and a half, and at a height which I judged to be between 80 and 100 feet in the air, the wheels ceased turning, and the machine, deprived of the aid of its propellers, to my surprise did not fall, but settled down so softly and gently that it touched the water without the least shock, and was in fact immediately ready for another trial.

In the second trial, which followed directly, it repeated in nearly every respect the actions of the first, except that the direction of its course was different. It ascended again in the face of the wind, afterwards moving steadily and continually in large curves accompanied with a rising motion and a lateral advance. Its motion was, in fact, so steady that I think a glass of water on its surface would have remained unspilled. When the steam gave out again, it repeated for a second time the experience of the first trial when the steam had ceased, and settled gently and easily down. What height it reached at this trial I cannot say, as I was not so favourably placed as in the first; but I had occasion to notice that this time its course took it over a wooded promontory, and I was relieved of some apprehension in seeing that it was already so high as to pass the tree-tops by twenty or thirty feet. It reached the water one minute and thirty-seconds from the time it started, at a measured distance of over 900 feet from the point at which it rose.

This, however, was by no means the length of its flight. I estimated from the diameter of the curve described, from the number of turns of the propellers as given by the automatic counter, after due allowance for slip, and from other measures, that the actual length of flight on each occasion was slightly over 3000 feet. It is at least safe to say that each exceeded half an English mile.

From the time and distance it will be noticed that the velocity was between twenty and twenty-five miles an hour, in a course which was constantly taking it "up hill." I may add that on a previous occasion I have seen a far higher velocity attained by the same aerodrome when its course was horizontal.

I have no desire to enter into detail further than I have done, but I cannot but add that it seems to me that no one who was present on this interesting occasion could have failed to recognise that the practicability of mechanical flight had been demonstrated.

ALEXANDER GRAHAM BELL.

#### THE APPROACHING CELEBRATION OF THE KELVIN JUBILEE IN GLASGOW.

IT may interest our readers to state the programme of the approaching celebration of the jubilee of Lord Kelvin as Professor of Natural Philosophy in the University of Glasgow.

On the evening of Monday, June 15, at 8.30 p.m., the University will give a conversazione, when there will be an

exhibit of Lord Kelvin's inventions. On Tuesday, June 16, addresses will be presented to Lord Kelvin by delegates from home and foreign University bodies, from several of the learned Societies of which he is a member, from student delegates from other Universities, and from the students and graduates of the University of Glasgow. It is expected that the honorary degree of LL.D. will be conferred on the same day on several of the distinguished foreign visitors. On Tuesday evening, June 16, the City will give a banquet to Lord Kelvin, to which the visitors who have come to do him honour have been invited.

On Wednesday, June 17, the Senate of the University will invite the visitors of the University staff to sail down the Clyde. The students of the University also invite the students' delegates from other Universities to a similar trip.

Representative scientific men—about fifty in number—from America and the British colonies, and from all the European countries, and about 150 from the United Kingdom, have signified their intention to be present.

The exceptional nature of the occasion, and the feeling which Lord Kelvin's name awakens everywhere, will give these proceedings a peculiar interest.

#### NOTES.

THE University of Wales is to be represented at the forthcoming celebration of the Kelvin jubilee by Principal J. Viriamu Jones, F.R.S., of Cardiff (the Vice-Chancellor for the year), and Prof. A. Gray, of Bangor.

THE Mayor of Bristol, at the suggestion of a deputation representing the chief local scientific societies and educational institutions, has decided to invite the British Association to visit Bristol in 1898. A visit to Bristol after the Toronto meeting would be made in a singularly opportune year, for it was in 1497 that Cabot discovered the American mainland, where the Association will be in 1897, whence he started on his second voyage in 1498. The meeting would thus serve to commemorate the tercentenary of a memorable voyage of one of Bristol's greatest citizens. That the Association should take Bristol after Canada would, therefore, be very appropriate.

THE Epidemiological Society of London has resolved, having regard to the historical connection of the Society with vaccination and other preventive measures, to found a medal in memory of Jenner. It is proposed that the medal shall be founded with a view to the promotion of epidemiological research, and that it shall be bestowed from time to time by this Society on persons who shall have contributed to the knowledge of preventive medicine. Donations (not exceeding one guinea) may be sent to the Honorary Treasurer, 6 Hereford Mansions, Bayswater, W.

THE death is announced of Dr. August Hosijs, Professor of Mineralogy and Palæontology in Münster University.

THE King of Belgium has honoured Prof. Leo Errera, Professor of Botany in the Université Libre de Bruxelles, and Director of the Institut botanique, by creating him a Chevalier of the Order of Léopold.

REUTER'S correspondent at Adelaide states that a well-equipped expedition started on May 22 to explore the interior of the Australian continent. It will be absent eighteen months. Mr. Calvert is defraying the cost of the expedition.

AN extra Friday evening meeting of the members of the Royal Institution will be held on June 19, when Mr. Thomas C. Martin, of New York, American Delegate to the Kelvin jubilee, will deliver a lecture on "The Utilisation of Niagara."

WE learn from the *American Naturalist* that a biological station will be opened on June 22 at Biscayne Bay, Florida, and will remain open for six weeks. The place is well situated for

the study of the tropical and subtropical flora and fauna, while its situation upon the continent makes it more readily accessible than the West India Islands. The station will be under the direction of Prof. Charles L. Edwards, of the University of Cincinnati.

MR. T. D. A. COCKERELL proposes to establish a biological station at Las Cruces, New Mexico, U.S.A. The climate of the country is exceptionally favourable for persons in the earlier stages of phthisis, while the abundance of new and interesting forms of life, especially among the insects, is remarkable. Many interesting general problems, such as those of the life-zones, can also be studied in New Mexico to great advantage. A beginning will be made this summer if students can be found. Mr. Cockerell will be glad to hear from any who are interested in the matter, and especially from those who might be inclined to work with him for longer or shorter periods during the present summer.

A GENERAL meeting of the members of the Federated Institution of Mining Engineers will be held in London on Thursday, June 4, and on Friday, June 5. The following papers will be read, or taken as read:—Presidential address, by Mr. Geo. A. Mitchell; "The Causes of Death in Colliery Explosions," by Dr. J. S. Haldane; "Road Engines," by Mr. John McLaren; "The Gobert Freezing Process of Shaft-sinking," by Mr. A. Gobert; "Precautions necessary in the Use of Electricity in Coal-mines," by Mr. H. W. Ravenshaw. The papers down for discussion are: "Photography in the Technology of Explosives," by Mr. Alfred Stiersch; "Coal-washing Plant at the Wirral Colliery, Neston, Cheshire," by Mr. J. Platt; "Lead and Lap of Winding and other Engines," by Mr. Hargrave Walters.

THE gold medal of the Linnean Society of London, which is annually presented alternately to a zoologist and to a botanist, has this year been awarded to Prof. George James Allman, F.R.S., for distinguished researches in zoology. A graduate in medicine in the University of Dublin in 1844, and subsequently Regius Professor of Botany there, he was elected a Fellow of the Royal Society in 1854, and from 1855 to 1870 held the chair of Regius Professor of Natural History in the University of Edinburgh, where the honorary degree of LL.D. was conferred upon him. In 1873 he was awarded the "Royal Medal" of the Royal Society. In 1874 he was elected President of the Linnean Society in succession to Mr. Bentham, and in 1879 was President of the British Association on the occasion of its meeting at Sheffield. His chief scientific work has relation to the lower forms of animal life, concerning which his most notable publications are his monographs of the Fresh-water Polyzoa and Hydroids—issued by the Ray Society—and his exhaustive report on the Hydroids collected by the *Challenger* exploring expedition. The medal will be presented at the anniversary meeting of the Linnean Society, to be held on Thursday, June 4, at 8 p.m.

MESSRS. C. GRIFFIN AND CO. have just published the thirteenth annual issue of their "Year-Book of Scientific and Learned Societies of Great Britain and Ireland." The work comprises lists of papers read during 1895 before these societies, which are arranged into fourteen classes according to the branches of science fostered by them. As a handy and accurate index to our scientific societies, and a record of progress, the work is most useful.

WE learn from *La Nature* of May 23 that a meeting was held on April 24, at the Geological and Geographical Society of Stockholm, in favour of the Polar expedition of M. Andrée. That gentleman opened the meeting by an explanation of the preparations already made, and of the prospects of the expedition. The generator of the hydrogen gas is nearly