so small, momentary ebullition could generally be renewed again and again for the space of five minutes after they had been hermetically sealed, by the mere application of one of my fingers, which had been dipped into cold water, to a portion of the glass above the level of the fluid. The water-hammer effect was also very obvious in several which were tested in this fashion.

I believe that an almost perfect vacuum can be produced in this way; in the first violent ebullition the air is driven out of the flask by the fluid, and as ebullition is continuously kept up after this till the flask is hermetically sealed, there is always an outpouring of heated vapour, and no opportunity for a re-ingress of air. But, even if in any given case the vacuum should not prove to be absolute, it does not seem to me that there would be any material abatement from the severity of the conditions which the panspermatists have a right to demand. If, on the one hand, absolutely the whole of the air had not been expelled from the flasks during the process of ebullition, what remained would necessarily be mixed up with a very much larger quantity of continually renewed aqueous vapour, and the effect would probably be that any living things would be just as effectually and destructively heated as if they were lodged in the boiling solution itself; whilst if, on the other hand, the boiling had been arrested for one or two seconds before the complete closure of the almost capillary orifice at the mouth of the flask, even if any air entered, it would have had first to pass through the blow-pipe flame, and then through the white-hot capillary orifice—it would in fact have been calcined as in Schwann's experiment. The conditions of the experiment would then have been no less severe, and the only effect would be that the vacuum with which I prefer to work would have been rendered by so much the less complete. Although I make these remarks with the view of meeting criticisms, I am inclined to think that the vacuum in my experiments has been complete'; and it should be remembered that M. Pasteur always adopted this method when he wished to preserve solutions for a time *in vacuo*. Whenever he desired to make comparative trials with the air of different localities, the solutions which had been prepared in this way were assumed by him to be contained *in vacuo*, so that the flasks could then be taken to the localities, with the air of which he wished to experiment. There the necks of the flasks were broken, in order that they might become filled with the air of the respective localities. After this had been done the flasks were resealed, and kept for future observation of their contained fluids. M. Pasteur, M. Pouchet, and others who adopted this method, carried away their experimental fluids *in vacuo*, during a two or three days' journey to the Alps or to the Pyrenees, and it never seemed to have occurred to either of them that evolutional changes might be taking place during their journey. M. Pasteur, in fact, habitually shut his eyes to all such possibilities, they did not come within the range of what he considered possible; such thoughts might, however, have suggested themselves to M. Pouchet and others, although this does not seem to have been the case.

After the flasks had been prepared in the way above mentioned, they were suspended beneath the mantelpiece in my study. During the day there was always a fire in the room, and at night I put my reading lamp underneath them with the flame properly turned down. So far as I have been able to ascertain, the temperature to which they have been subjected has mostly ranged between 23°—29° C. (75°—86° F.) Sometimes they have been exposed to the lower temperature and sometimes to the higher, and I suspect that a variation of this kind may perhaps be more favourable for the production of evolutional changes than maintenance at a constant temperature.

In detailing the results of the following experiments, I shall not enter into any minute description of the organisms found. My main object throughout has been to obtain evidence on the subject as to whether a *de novo* evolution of Living things could or could not take place. The demands upon my time have been so serious in the carrying on of these investigations, that occasionally it has only been small portions of the experimental fluids which have been examined. If, for instance, what I found in the first few drops of the fluid left no doubt in my mind as to the nature and abundance of some Living things contained therein, the remaining portions of the fluid were frequently not examined. Other bodies, therefore, may have been contained in the solutions, which were never seen at all.

H. CHARLTON BASTIAN

(To be continued.)

SCIENTIFIC SERIALS

THE *American Naturalist* for June contains several excellent articles. The first is by Prof. J. S. Newberry, "On the Surface Geology of the Basin of the great Lakes and the Valley of the Mississippi." In the northern half of this area down to the parallel of 38° to 40° N. lat., are found, not everywhere, but in most localities where the nature of the underlying rocks is such as to retain inscriptions made upon them, the unmistakeable indications of glacial action. Some of the valleys and channels which bear the marks of glacial action, evidently formed or modified by ice, and dating from the ice period of an earlier epoch, are excavated far below the present lakes and water-courses which occupy them. These valleys form a connected system of drainage at a lower level than the present river system, and lower than could be produced without a continental elevation of several hundred feet. Upon the glacial surface are found a series of unconsolidated materials, generally stratified, called the drift deposits. These consist in the lowest stratum of the Erie clays of Sir William Logan, above which are sands containing beds of gravel; and near the surface elephants' teeth have been found, water-worn and rounded. Upon these stratified clays, sands, and gravel of the drift, are scattered boulders and blocks of all sizes, of granite, greenstone, siliceous and mica slates, and various other metamorphic and eruptive rocks, generally traceable to some locality in the Eozoic area of the lakes. Among these boulders many balls of native copper have been found, which could have come from nowhere else than the copper district of Lake Superior. Above all these drift deposits, and more recent than any of them, are the "lake ridges," corresponding to our raised sea-beaches, embankments of sand, gravel, sticks, leaves, &c., which run imperfectly parallel with the present outlines of the lake margins, where highlands lie in the rear of such margins. The general conclusions drawn are the existence of a glacial epoch over the northern half of the continent of North America, probably contemporaneous with that of Europe, and with a climate comparable to that of Greenland; that the courses of these ancient glaciers correspond in a general way with the present channels of drainage; and that at this period the continent must have been several hundred feet higher than now.—"A Winter's Day in the Yukon Territory," by W. H. Dall, refutes the prevalent idea, perpetuated even by "official" reports, that the island of St. Paul is surrounded in winter by immense masses of ice, on which the polar bears and arctic foxes sail down from the north and engage in pitched battles with the wretched inhabitants. The fact is that there is no solid and very little floating ice near St. Paul in winter; the arctic foxes found there as well as on most of the islands were purposely introduced by the Russians for propagation, a certain number of skins being taken annually; and there is no authentic evidence that the polar bear has ever been found south of Behring's Straits. The country of Alaska comprises two climatic regions, which differ as widely as Labrador and South Carolina in their winter temperature. One contains the mainland north of the peninsula of Alaska and the islands north of the St. Matthew group; the other includes the coast and islands south and east of Kadiak, while the Aleutian Islands, with the group of St. Paul and St. George, are somewhat intermediate. A day's excursion during the winter season in the northern and more inhospitable of these two regions yielded a considerable number of interesting animals.—Articles of a popular character are "Our native Trees and Shrubs," by Rev. J. W. Chickering, Jun.; and "A Few Words about Moths," by A. S. Packard, Jun. A review of Principal Dawson's article in the *Canadian Naturalist* on "Modern Ideas of Derivation," criticises, favourably on the whole, that writer's strictures on the Darwinian theory of Natural Selection.—The Natural History Miscellany contains many interesting notes, either original or culled from English scientific journals.

The fourth part of the *Jenaische Zeitschrift für Medicin und Naturwissenschaft*, June 1870, contains the following important articles. 1. Gegenbauer on the skeleton of the limbs of Vertebrata, and of the Selachia and Chimæra in particular. 2. Abbe on a spectrum apparatus for the microscope. 3. Dr. Dohrn: Further researches on the structure and development of the Arthropoda, especially bearing on the Zoea stage of Crustacea; and lastly, a long and interesting paper by Ernst Haeckel on the "Plastiden-theorie," in which he treats fully of the deep-sea life brought to light by the dredgings of Drs. Wallich, Carpenter, Wyville Thomson, Huxley, and others, describing the Bathybius, Coccoliths, Globigerina, &c. He confesses himself unable to

solve the problem of the origin of the immense quantities of protoplasm that form a bottom to the sea, but is disinclined to regard it as consisting of the mycelium of sponges, an opinion advanced by Wyville Thomson. He finds the well-known yellow cells of Radiolaria to contain starch, the reactions of which are not distinguishable from those characteristic of starch derived from vegetables. These starch granules make up more than half of the entire mass of the Radiolaria.

The *Bulletin de la Société Imperiale des Naturalistes de Moscow*, 1869, No. 2 (received June 15, 1870), contains, amongst other valuable papers, a carefully-worked-up description of the anatomy and development of the *Pedicellina*, by B. Uljanin, which is accompanied by two plates illustrating the changes undergone as far as he had an opportunity of observing them.

In the last number (Heft iv. Band lx.) of the *Sitzungsberichte der K. Akad. der Wissenchaften zu Wien* is a long paper by Dr. A. Polotebnow on the origin and mode of increase of Bacteria. These, as most of our readers are aware, consist of very small rods, which present a kind of tranverse striation at tolerably regular intervals, like an extremely diminutive sugar-cane of from two to six or seven joints, and which exhibit irregular vibratory movements. They have been, like other lowly organised forms, sometimes considered, as by Dujardin, to belong to the animal kingdom; sometimes, as by Cohn, to represent a form of vegetable life; and sometimes, as by Pertz, to occupy an intermediate position on the confines of the two kingdoms. Dr. Polotebnow finds that an unbroken series of forms can be observed between the minute round cells which form the mycelium of *Penicillium*, and probably other fungi, and fully-developed Bacteria. In regard to their multiplication, he thinks this can only occur from the cells above mentioned, and that when they have once become fully formed Bacteria they are no longer capable of further multiplication.

SOCIETIES AND ACADEMIES

LONDON

Geological Society, June 8.—Mr. Joseph Prestwich, F.R.S. president, in the chair.

Mr. Henry G. Vennor, of the Geological Survey of Canada, Montreal; Alexander Kendall Mackinnon, Memb. Inst. C. E., Director-General of Public Works, Montevideo, South America; and Mr. Arthur Roope Hunt, Quintella, Torquay, were elected Fellows of the Society.

1. "On the Superficial Deposits of the South of Hampshire, and the Isle of Wight." By Thomas Codrington, F.G.S. This paper treated of the gravel deposits covering the tertiary strata of the country between Portsmouth and Poole, and of the Isle of Wight. The strikingly tabular character of the surface is best seen on the east of the Avon, where from the coast for more than twenty miles inland a gravel-covered plain can be followed, rising gradually from 80 feet to 420 feet above the sea, at the rate of about 20 feet per mile. The high plains of the New Forest, to the eye perfectly level, and indented by deep valleys, are portions of this table-land. The plateau between the Bournemouth Cliffs and the Valley of the Stour, and detached gravel-capped hills further inland, are the remnants of a similar table-land on the west of the Avon, while eastwards the same character prevails up to Southampton Water. Sections parallel with the coast show the level nature of the country, broken only by well-defined river-valleys. On the east of Southampton water a similar tabular surface, sloping at a steeper angle towards the shore-line, and cut through by the valleys of the Itchen, Hamble, and Titchfield rivers, remains; and in the Isle of Wight the gravels capping the flat-topped tertiary hills coincide with a corresponding plain sloping northwards. The gravel covering these table-lands is composed chiefly of subangular chalk-flints, with a varying proportion of tertiary pebbles. Sarsen stone blocks are found everywhere, and on Poole Heath granitic pebbles; and in the gravel of Portsea large boulders of granitic and palæozoic rocks are met with. In the Isle of Wight, chert from the Upper Greensand, and materials from the Lower Cretaceous beds also occur. The colour of the gravel is generally red; and the origin of the white gravel, which often overlies the red, is to be ascribed to the bleaching action of vegetable matter. Brick-earth is generally associated with the gravel at all levels but the highest; but the contorted appearances attributed to glacial action only occur at low levels. No organic remains have been found in the gravel covering the plains, while the valley-gravels of the district have afforded mammalian bones and teeth of the usual species. Flint implements have been found at Bournemouth at 120 feet above the sea; at Lymington, near Southampton, at 80 and 150 feet; and also along the shore between Southampton Water and Gosport, at 35 feet above the sea, from gravel forming part of the covering of the tabular surface, and unconnected with the river valleys. The gravel capping the cliffs of the south coast of the Isle of Wight, in which the remains of *Elephas primigenius* have been found near Brook and Grange, was probably deposited in the same river-basin as the mammaliferous gravel of Freshwater; and the cutting back of the coast-line by the sea has given the tributaries of a river which flowed by Freshwater northwards to the Solent, a direct outfall to the sea; and the streams thus intercepted at a high level, under the changed condition of flow, have originated the *Chines*. The gravel cliff of the Foreland, at the eastern end of the Isle of Wight, consists principally of raised shingle, which towards the south thins out, and is overlain by a thick deposit of brick-earth, a continuation of which caps the cliffs up to the chalk, and in which a flint implement was found by the author at 85 feet above the sea.

General Considerations.—The marine gravel, with granite boulders covering the south of Sussex, is continued westward by the gravel with similar boulders covering Portsea Island; and this again by the Hill-head gravels, with large blocks of Sarsen stone, these lower gravels being bordered on the south by the raised shingle deposits of the Isle of Wight, and on the north by the higher marine gravels of Avisford, Waterbeach, and Bourne, from which the lower gravel is divided by a well-marked step, extending beyond Portsdown Hill to Titchfield, and traceable on the west of Southampton Water. The Hill-head gravels are considered to be an estuarine deposit, of the same age as the marine gravels of Sussex, and the low-level gravels of the river-valleys; they are supposed to have been formed when the Isle of Wight was still joined to the main land, and all the rivers now reaching the sea by Poole Harbour, Christchurch Harbour, Southampton Water, &c., were affluents of a river communicating with an estuary opening to the sea in the direction of Spithead. The gravels lying above the step, such as those of Avisford and Waterbeach, Titchfield Common, Beaulieu Heath, and Bournemouth, are looked upon as equivalent in position and age to the high-level valley gravels. The level of the gravels on the highest parts of the table-lands is such as to indicate an age far greater than that of the highest gravels of the river-valleys; but the uniform surface from the 400-feet level downwards points to a long continuance of similar conditions, during which the gravel from the highest levels to that of the Bournemouth Cliffs was deposited. The area that can with any probability be assigned to the catchment basin of a river such as that which has been before alluded to, is only three-quarters of the basin of the Thames above Hampton, within which it is difficult to imagine that such an extent of gravel could have been spread out; and the inclination of the flattest of the table-lands is for a river such as only mountain-streams have, and quite incompatible with the spreading out of large even surfaces more than twenty miles across. It is considered more probable that the materials of the gravel were brought down from the chalk country on all sides by rivers, and spread out in an inlet of the sea shut in on the south, and opening out eastwards. This view is not without difficulties; it involves a gradual upheaval of the land, which, when the highest gravels now remaining were being spread out at or near the sea-level, must have stood more than 400 feet lower; and a considerable part of this upheaval must have taken place since the formation of the gravel in which implements fashioned by man are imbedded.

2. "On the relative position of the Forest-bed and the Chillesford Clay in Norfolk and Suffolk, and on the real position of the Forest-bed." By the Rev. John Gunn, M.A., F.G.S.

The author commenced by stating that both at Easton Bavent and at Kessingland the Forest-bed is to be seen forming part of the beach, or of the foot of the cliff, and underlying the Chillesford Clay. He considered that the soil of the Forest-bed had been deposited in an estuary, and that after its elevation the trees, of which the stools are now visible along the coast, grew upon it, and the true Forest-bed was formed. After the submergence of this first freshwater, then fluvio-marine, and finally marine deposits were formed upon it; and the author proposed to give the whole of these deposits the name of the "Forest-bed