tures, infiltrations, and apparent faultings seen in microscopic sections and by the naked eye—these all imply the action of force. M. Daubrée supposes that the union of oxygen and silicon furnishes sufficient heat for making these minerals. If this is possible, those transformations may have taken place in their first home. Dr. Reusch argues that the repeated heating and cooling of the comet, as it comes down to the sun and goes back again into the cold, is enough to account for all the peculiarities of structure of the meteorites. These two modes of action do not, however, exclude each other. Suppose, then, a mass containing silicon, magnesium, iron, nickel, a limited supply of oxygen, and small quantities of other elements, all in their primordial or nebulous state (whatever that may be), segregated somewhere in the cold of space. As the materials consolidate or crystallise, the oxygen is appropriated by the silicon and magnesium, and the iron and nickel are deposited in metallic form. Possibly the heat developed may, before it is radiated into space, modify and transform the substance. The final result is a rocky mass (or possibly several adjacent masses), which sooner or later is no doubt cooled down throughout to the temperature of space. This mass, in its travels, comes near to the sun. Powerful action is there exerted upon it. It is heated. How intense is that heat upon a cold rock, unprotected apparently by its thin atmosphere, it is not possible to say. We know that the sun's action is strong enough to develop that immense train, the comet's tail, that sometimes spans our heavens. It is broken in pieces. We have seen the portions go off from the sun, to come back, probably, as separate comets. Solid fragments are scattered from it to travel in their own independent orbits. What is the condition of the burnt and crackled surface of a cometic mass or fragment as it goes out from the sun again into the cold? What changes may not that surface undergo before it comes back again, to pass anew through the fiery ordeal? We have here forces that we know are acting. They are intense, and act under varied conditions. The stones subject to those forces can have a history full of all the scenes and actions required for the growth of such strange bodies as have come down to us. Some of our meteors, those of the star-showers, have certainly had that history. What good reason is there for saying that all of them may not have had the like birth-place and life?

The pieces which come into our air in any recurring star-shower belong to a group whose shape is only partly known. It is thin, for we traverse it in a short time. It is not a uniform ring, for it is not annual, except possibly the August sprinkle. How the sun's unequal attraction for the parts of a group acts as a dispersive force to draw it out into a stream, those most beautiful and most fruitful discussions of Signor Schiaparelli have shown. The groups that we meet are certainly in the shape of thin streams.

It has been assumed that the cometic fragments go continuously away from the parent mass, so as to form, in due time, a ring-like stream of varying density, but stretched along the entire elliptic orbit of the comet. The epochs of the Leonid star-showers in November, which have been coming at intervals of thirty-three years since the year 902, have led us to believe that this departure of the fragments from Tempel's comet (1866, I.) and the formation of the ring was a very slow process. The meteors which we met near 1866 were therefore thought to have left the comet many thousands of years ago. The extension of the group was presumed to go on in the future until, perhaps tens of thousands of years hence, the earth was to meet the stream every year. Whatever may be the case with Tempel's comet and its meteors, this slow development is not found to be true for the fragments of Biela's comet. It is quite certain that the meteors of the splendid displays of 1872 and 1885 left the immediate vicinity of that comet later than 1840, although at the time of those showers they had become separated two hundred millions of miles from the computed place of the comet. The process, then, has been an exceedingly rapid one, requiring, if continued at the same rate, only a small part of a millennium for the completion of an entire ring, if a ring is to be a future form of the group.

It may be thought reasonable in view of this fact about Biela's comet, established by the star-showers of 1872 and 1885, to revise our conception of the process of di integration of Tempel's comet also. The more brilliant of the star showers from this comet have always occurred very near the end of the thirty-three year period. Instead of there being a slow process which is ultimately to produce a ring along the orbit of the comet, it certainly seems more reasonable to suppose that the compact lines of meteors which we met in 1866, 1867, and 1868 left the comet at a recent date. A thousand years ago this shower occurred in the middle of October. By the precession of the equinoxes and the action of the planets, the shower has moved to the middle of November. One half of this motion is due to the precession, the other half to the perturbing action of the planets. Did the planets act upon the comet before the meteoroids left it, or upon the meteoroid stream? Until one has reduced the forces to numerical values, he may not give to this question a positive answer. But I strongly suspect that computations of the forces will show that the perturbations of Jupiter and Saturn upon that group of meteoroids hundreds of millions of miles in length,—perturbations strong enough to change the node of the orbit 15° along the ecliptic,—would not leave the group such a compact train as we found it in 1866. If this result is at all possible, it is because the total action is scattered over so many centuries. But it seems more probable that the fragments are parting more rapidly from the comet than we have assumed, and that, long before the complete ring is formed, the groups become so scattered that we do not recognise them, or else are turned away so as not to cross the earth's orbit.

Comets, by their strange behaviour and wondrous trains, have given to timid and superstitious men more apprehensions than have any other heavenly bodies. They have been the occasion of an immense amount of vague, and wild, and valueless speculation by men who knew a very little science. They have furnished a hundred as yet unanswered problems which have puzzled the wisest. A world without water, with a strange and variable envelope which takes the place of an atmosphere, a world that travels repeatedly out into the cold and back to the sun, and slowly goes to pieces in the repeated process, has conditions so strange to our experience, and so impossible to reproduce by experiment, that our physics cannot as yet explain it. But we may confidently look forward to the answer of many of these problems in the future. Of those strange bodies, the comets, we shall have far greater means of study than of any other bodies in the heavens. The comets alone give us specimens to handle and analyse. Comets may be studied, like the planets, by the use of the telescope, the polariscope, and the spectroscope. The utmost refinements of physical astronomy may be applied to both. But the cometary worlds will be also compelled, through these meteorite fragments,—with their included gases and peculiar minerals,—to give up some additional secrets of their own life, and of the physics of space, to the blowpipe, the microscope, the test-tube, and the crucible.

THE BRITISH ASSOCIATION

SECTION D—BIOLOGY

Initiation of a Discussion upon the Value of the "Type-system" in the Teaching of Botany, by Prof. Bayley Balfour.—The speaker remarked that within the last fifteen years there had been a complete revolution in the method of teaching botany and zoology. The old method was practical teaching based on classification. In fact, in the olden times it was taught by means of object-lessons, which were sporadically chosen. In that method the real significance of plant life was completely overlooked, and also the position of the plants in Nature and their relationship to the animal kingdom. The result was that they had naturalists bred who had a wide range of knowledge of plant forms, and able to recognise and name a great number of plants, but of the life-history and sequence of events they were in the dark. The knowledge was a wide but superficial one. The new system was the natural outcome of the progress of the science, and as more knowledge of the minuter forms were obtained, it became necessary to select individual forms to be made types for special study. Thus by degrees a system of teaching was introduced which consisted in the selection of a few characteristic forms, and those were thoroughly studied in their structural and physiological relationship. Thus accurate knowledge of a few types was obtained, and the work now, instead of being in the field, was transferred to the laboratory. That new method was greatly used at the present time, and promised to be more widely introduced by the publication of new text-books running along the lines of that teaching. The old system he did not think produced good results, but he thought that teaching from types, combined with a certain amount of old teaching, would be effective.

In the discussion which followed, Prof. Bower said that in the elementary schools it would be well to give first the classification of the higher plants, and then, if the students succeeded in that part, they might pass to the more strict laboratory learning. — Prof. Hartog condemned the use of the type-system with children under sixteen, and, referring to the college instruction, lamented that the study of botany should have to be regulated by the requirements of the medical students.—Dr. Trimen thought the type-system was apt to give the students a false impression of the vegetable kingdom. They were apt to think that those types covered the whole matter to be studied. It would be well if the system could be extended. As to the question of medical students, they certainly did not require a complete course of technical botany. The teaching of botany in some of the London schools was a mere farce.—Prof. Marshall Ward remarked that the type-system has done good service to education, and pointed out how necessary it is to obtain exact knowledge from the study of actual objects, and how valuable is the training due to their careful investigation. The types should be real, and not imaginary or badly-selected ones.—Dr. Shaw observed that it would be a great mistake to drop biology out of the curriculum of the medical student.—Prof. Hillhouse pointed out that the type-system gave the student the advantage of commencing with simplicity and working up to complexity. The system, to be successful, must be carefully arranged and the selection of types judicious.

Remarks on "Physiological Selection, an Additional Suggestion on the Origin of Species," by G. J. Romanes, F.R.S., by Henry Seebohm.—This was a criticism of the above paper, and was followed by a short discussion, the general conclusion arrived at being to the effect that the paper referred to does not contribute anything essentially new to the theory of Charles Darwin. In criticising this theory, Mr. Seebohm pointed out that its author not only demanded an impossible number of coincidences, but coincidences of such a character that, once granted, the additional coincidence of fertility *inter se* but sterility outside the family was almost, if not quite, an unnecessary incumbrance to it.

On the Morphology of the Mammalian Coracoid, by Prof. G. B. Howes.—The author seeks to show that the importance of a third centre of ossification of the mammalian coracoid has escaped attention; he claims that it is the representative of the true coracoid bar of the lower vertebrata, the coracoid process being held to answer to the epicoracoid plate of the monotreme. He further upholds the view that the mammalian shoulder-girdle has been derived from a primarily expanded sheet-like form.

Some Experiments upon the Acquisition of an Unpleasant Taste as a Means of Protecting Insects from their Enemies, by E. B. Poulton.—This paper dealt with experiments upon the acquisition of an unpleasant taste as a means of protecting insects from their enemies. The author remarked that Darwin thinking of the use of colour in animals, and deciding that it was of use in courtship, came across the bright colours of caterpillars, which were sexless. He directed Wallace's attention to the subject, and he ventured a prediction that the bright colours would be associated with an unpleasant taste or smell, so that lizards, &c., refused to eat them. Experiments proved that this was correct, but, on thinking the subject over, it seemed to the writer that some limitations were required. If an insect was distasteful to a lizard, the former would either be starved or would have to put up with an unpleasant taste. It might probably acquire a relish for what hitherto was disagreeable, and then the distasteful organisms being brilliant and conspicuous would be easily caught and exterminated. Mr. Poulton therefore determined to experiment upon them, believing that it would be found that protection by a disagreeable taste was not so complete as was supposed. He obtained lizards from Italy, but found that that was the case. They often refused an insect at first, and took it afterwards unless they were fed on other things which they liked better. It was found that the small lizards refused a large moth, such as the privet hawk, although entirely harmless and undoubtedly palatable. The larger lizards disposed of it at once, and the former were evidently afraid of it, from its size bearing some comparison to their own. Further, the brilliant black and red moth, the cinnabar, was eaten by the tree-frog, and a second specimen was eaten directly afterwards. It was quite clear that the frog did not dislike the taste, but the moths disagreed with the frog, and they were afterwards found floating in the aquarium. The moth of the buff tip, which was protected by resembling a piece of broken rotten wood, was evidently disliked by the lizards, although they ate it in the end. In some cases disagreeable insects were eaten with a relish by those particular animals, such as the larvæ of the common Crœsus found on birch. The protection was therefore less perfect than was supposed to be the case.

On the Germination of the Spores of "Phytophthora infestans," by Prof. Marshall Ward.—One of the objects of this communication was to bring before the meeting copies of some careful drawings of all the stages of germination. These were obtained by actually watching the development, escape, and germination of the zoospores from the "conidia," following all the phases in *one* individual. The curious effects of light and of abnormal conditions upon the development of the zoospores were also pointed out, and the author showed diagrams of other forms of germination obtained by interfering with the conditions. In the short discussion which followed Prof. Marshall Ward referred to some points in the development and escape of the zoospores of the Saprolegnia.

On the Flora of Ceylon, especially as affected by Climate, by Henry Trimen, M.B., F.L.S.—Attention was first called to the fact that the Island of Ceylon was practically known to Europeans only by its south-west part, being about one-fifth of the whole area, but including the chief European centres, the planting districts of the hills, and the railway system. The remainder of the country is thickly covered with jungle, thinly inhabited, and rarely visited by Europeans, save Government officials and sportsmen. This difference was shown to be due to climate, especially to rainfall. The distribution of the rain, so far as is shown by annual amount, was exhibited by a map, in which the great advantage to the south-west of the lofty forest-clad escarpment of the central mountain-mass of over 7000 feet was exhibited. The south-west monsoon wind commencing at the end of May deposits an immense quantity of rain here, especially in the neighbourhood of Adam's Peak. In the rest of the island this wind becomes dry, and the country is parched and arid until the arrival of the north-east monsoon, which commences in October. This wind brings rain to the whole island, and is the only rain which the dry districts get; in many places it all falls in a few weeks, when the country is completely under water, though parched with drought for the rest of the year. This is very different to the well-known south-west of Ceylon, where, save in February or March, a fortnight's drought is a very rare event. In some parts over 200 inches falls in the year. In these respects Ceylon is an epitome or continuation of the Southern Indian peninsula. The peculiarities of the flora were then gone through in some detail, taking first the low country of the wet districts up to 3000 feet—in which the number of introduced tropical plants was commented upon; then of the lower hills, the principal home of the planting enterprise and tea and coffee estates; and next of the higher or true mountain districts above 5000 feet. In the low country the forest has been much destroyed by the indolent and improvident native mode of cultivation called "chena," and but little virgin forest remains in this portion of Ceylon. From 3000 to 5000 feet the agent of destruction has been European planting, and the forest has almost wholly disappeared. Above 5000 feet, land is no longer sold by Government. Attention was specially called to the concentration of endemic species in this wet district—over 800, or nearly 30 per cent. of the whole flora—and to the strongly Malayan, as distinguished from Peninsular Indian, type of these and of the whole flora. There are no Alpine plants in the Ceylon hills; dense forest covers their summits, but a number of temperate genera are represented. This flora is entirely Indian in type, with no *genus* represented which is not also found in the Nilghiris, but the number of endemic *species* is very remarkable, only about 200 being common to both mountain-ranges. A few remarks were then made upon the naturally open grass lands, called "patanas," in the hills, and their peculiar vegetation. The flora of the great dry tracts of Ceylon was then considered. It is completely distinct from that already considered, being mainly the same as that of the Carnatic or Coromandel coast of India, with no Malayan admixture, and very few endemic species. The whole country is covered with forest, apparently primæval; but in reality much of it is secondary, and not more than 800 or 1000 years old, as is reported by native tradition, and evidenced by the vast remains of temples, tanks, and ancient buildings now overgrown with trees. Most of the timbers of importance in trade are obtained in these districts, and, owing to a very faulty forest conservancy, there is now but little first-class timber remaining, save in very remote places. The botanical characters of this forest, which is everywhere evergreen, were given; and the paper concluded with a few remarks on the coast flora, which is very uniform throughout the tropical belt of the world.

On "Humboldtia laurifolia" as a Myrmecophilous Plant, by Prof. Bower.—It had been found that there were considerable numbers of plants in tropical countries which were pre-eminently associated with ants. The Italian botanist Picari propounded a general view with regard to the subject that the association was mutually advantageous to the ants and to the plants. He found that the plants gave shelter to the ants, and in certain cases supplied them with food. No one would deny the statement that the relation was advantageous to the ants themselves, but the converse case was not so clear. In some cases it had been found that the ants served to protect the plants, and drove off other insects. Picari also pointed out that in certain cases the plants derived nutriment from the excreta of the ants, but whether that was the case was a view open to considerable discussion. He (Prof. Bower) had come to the conclusion that the ants derived all the benefit, and that there was no advantage to the plants. Not only were the ants provided with a capital lodging, but it might be fairly assumed that from the glands of the plants the insects derived food as well.

On the Artificial Production of a Gilded Appearance in Chrysalises, by E. B. Poulton.—The author remarked that some years ago Mr. T. W. Wood brought before the notice of the Entomological Society of London some proofs that certain chrysalises imitated the colour of the surfaces upon which they threw off their caterpillar skin. The intimation was received with some amount of credulity by leading entomologists, but evidently without sufficient reason. For some years the writer had been working upon the colour of caterpillars in relation to the colour of their surroundings, and he had shown that the colour could be modified in one generation by the alterations of their surroundings. It seemed certain that through some sensory surface, possibly the eye, caterpillars were affected by their external relations, and a corresponding effect was produced in colour. Mr. Wood's experiment was but a special case of some general method of production. He explained the results by supposing that the moist surface of a fresh chrysalis was photographically sensitive to the colour of surrounding surfaces. That appeared to be merely a metaphor, and was unsupported by proof. It was more probable that the colour was produced by the effect upon the caterpillar before it turned to the chrysalis. Experiments were therefore made by the writer to put the fact itself beyond dispute. That was done first by the use of caterpillars of the peacock butterfly and the common tortoiseshell butterfly. It was found that by allowing them to turn to chrysalises upon a white or a black screen very different results were produced. Those upon white paper were often brilliantly golden, although the chrysalises of the tortoiseshell were not quite so golden. Gilded specimens were sometimes found, but their appearances seemed to be produced as a disease. While that was the case of chrysalises found in the fields, the specimens experimented with by the writer were perfectly healthy, and produced healthy butterflies. He then saw that, although a white paper produced a golden appearance, a gilded surface would produce the same effect to a greater extent. That bore in a most important manner on the use of the metallic tints of many of the exposed chrysalises of butterflies: which were thus seen to have harmonised with some metallic surroundings. The next point was to ascertain the period during which the caterpillar was sensitive to the colour of the surrounding surfaces, and the nature of the surface which was affected. The former end was achieved by carefully watching the caterpillars between the time at which they ceased feeding and that at which they turned to chrysalises. It was found that they were sensitive for many hours, even more than a day, before the change took place. The other object was attained by placing the larvæ suspended downwards for ten or twelve hours before the change took place in a tube, of which the upper part was golden and the lower black, the two being separated by a perforated disk. The caterpillar's head was turned round so that it could not see through the aperture, and the result showed that the chrysalises were the colour of the chamber in which the head was placed. Hence it seemed that the sensory surface must have existed upon that area. The full results, however, had not yet been obtained.

The Nervous System of Sponges, by Dr. R. von Lendenfeld.—The author gives an account of his discoveries on this subject up to date. Sensitive and ganglia cells have been observed by him in a good number of sponges. Their locality varies, their shape is constant. They are mesodermal, and appear to preside over the movements of the membranes and pore-sieves, and so regulate the water current. The great difference between sponges and higher cœlenterates is, that in the former the most important organs are mesodermal, whilst in the latter they are ecto- or ento-dermal. He divides the type Cœlenterata accordingly into *Cœlenterata Mesodermalia*, or sponges, and *Cœlenterata Epithelaria* or Cnidaria, as Lulitypes.

The Function of Nettle-Cells, by Dr. R. von Lendenfeld.—The author gives a detailed account of the structure of the nettle-cells, or cnidoblasts, and discusses some biological facts regarding their function. He comes to the conclusion that the nettle-cells are exploded by direct reflex action when the cnidocil is touched, but that the animal can counteract this reflex action by a centrifugally acting nervous irritation in a similar manner as reflex actions are controlled by higher nervous centres in man.

Note on the Floral Symmetry of the Genus Cypripedium, by Dr. Maxwell T. Masters, F.R.S.—In this note the author adverts to so much of the normal structure of Orchids in general, and of Cypripedium in particular, as is necessary for the elucidation of his subject, and proceeds to describe a case of regular peloria in *Cypripedium caudatum*, which shows a reversion to the typical form of Orchids, and goes to prove that the so-called genus Uropedium is only a pelorian form of Cypripedium. The construction of the andrœcium in these plants is then alluded to, and illustrations given of all intermediate stages from monandry to hexandry. The frequently observed tendencies to a dimerous condition, and to the development of the inner row of stamens, are alluded to, and the significance of these changes pointed out. The morphological changes consequent upon hybridisation, and the inferences to be derived from them, are passed under review. The paper concludes with a general summary of the teratological changes observed in the tribe Cypripedieæ.

Notes on Australian Cœlenterates, by Dr. von Lendenfeld.—The author describes the extraordinary mode of development of *Phyllorhiza punctata*, a rhizostomous Medusa discovered by him in Port Jackson. The Ephyra has eight, the next stage twenty-four, the next sixteen, and the adult again eight marginal bodies. If the umbrella margin is injured and newly formed, marginal bodies appear between *all* the newly-formed flaps. Further, the migrations of *Crambessa masaica* at the breeding time are described. This and other species of that genus of rhizostomous Medusæ migrate far up the rivers, like the salmon, to deposit their young. A remarkable change in the colour of *C. masaica*, which has taken place in Port Jackson since the observations of Huxley about fifty years ago, is described. A new variety, which is brown, seems to have been produced or to have immigrated and superseded the *blue* form, which was observed by Huxley and others in that locality. In Port Phlilip the blue variety is still found. The author has found in examining the lower freshwater animals that the freshwater Hydroids and Sponges, as also the freshwater Rhizopoda of Australia, are very similar to the European, whilst the *marine* species of these groups differ very much in the two localities. He concludes that these freshwater forms are very old and conservative, and may be supposed to be the unchanged offspring of old ancestral forms, as such possessing particular systematic importance.

Bugio; the Biological Relations of an Atlantic Rock, by Michael C. Grabham, M.D., F.G.S., F.R.C.P.—Region almost unknown, but interesting as being typical of flora distribution, and of variation in isolation. Author proposed to illustrate present knowledge by reference to prominent forms, animal and vegetable, existing at Bugio, the most unknown of the Dezerta islets.

Dezerta.—Physical characters: Foundation on a narrow ledge; dimensions never much greater; no evidence of ancient contact; not survivals of an ancient continent, but islands in a Miocene sea, deriving their first colonists from Miocene Europe.

Description of Bugio.—Difficulty of access; central volcanic dyke; large proportion of tufas; no sections of old river-beds or surface obliterations; summit showed deep clay-beds and surface deposits of calcareous sand and earth.

Flora.—How related to Madeira; arbitrary distribution; absence of easily wafted forms; *Senecio incrassatus*, Madeiran and Canarian varieties; *Echium fastuosum*, maritime form of; hybrid with *E. simplex*, remarkable perpetuation of perennial growth, and other changes; several instances of fitful distribution; *Chrysanthemum dæmatomma*, a distinct and only species; remarks on cognate Madeira forms; *Monizia edulis*, Dezertan, Salvagic, and Madeiran examples; Miocene origin of.

Fauna.—Rabbit, identical with that of Porto Santo, described by Darwin as having acquired specific characters in shortened length, and colour of skin. *Sea-birds* breeding at Bugio: *Sternus hirundo*, *Thallassidroma bulwerii*, and many others. *Procellaria anglorum* dominant to the exclusion of *P. major* and *P. obscura*. Influence of birds in migration of plants and mollusks. *Testacea*: Distribution and affinities—*Helix crystallina*, affinities of; *H. erubescens*, distribution of; *H. punctulata*, modification of; *H. Leonina*, area of, and relations; *H. vulgata*, dwarfed example of; *H. polymorpha*, distinct races of; connections of *H. tiarella*, *H. coronula*, and *H. grabhami*. *Coleopterous Deucalion*, isolated species, now related to a Salvagic form.

Summary.—Showing the difficulties attending the determination of the origin and migration of species to be equally great in the component rocks of a group of islands as in the archipelago itself. Agency of man, chiefly in extinction and destruction, illustrated by introduction of opposing or contaminating forms; ravages of Eupatoria and *Phylloxera vastatrix* in Madeira; surviving vigour of Miocene plants. Author's paper only meant to be indicative of those branches and details which might singly occupy the attention of the Section.

The Multiplication and Vitality of certain Micro-organisms, Pathogenic and otherwise, by Percy F. Frankland, Ph.D., B.Sc., F.C.S., F.T.C., Assoc.Roy.Sch.Mines.—In this paper the author records a number of experiments which he has carried out on the multiplication of the micro-organisms present in natural waters, and also on the vitality of certain pathogenic organisms when purposely introduced into similar media. These phenomena have been studied by aid of the method of gelatine-plate cultivation, originally devised by Koch. The first part of the paper treats of the influence of storage in sterilised vessels, upon the number of micro-organisms present in the unfiltered water of the Rivers Thames and Lea, in the waters of these rivers after sand filtration by the companies supplying the metropolis, and in deep-well water obtained from the chalk. Of these three different kinds of water, at the time of collection the unfiltered river-waters are the richest in micro-organisms, containing, as they do, several thousand microbes, capable of being revealed by plate-cultivation, in 1 cubic centimetre of water, whilst the filtered river-waters have this number generally reduced by about 95 per cent., and the number present in the deep-well water rarely exceeds ten per cubic centimetre. On storage in sterilised vessels at 20° C., however, a great change in the relationship of these numbers soon takes place, for whilst the number of organisms in the crude river-water undergoes but little change, or even suffers diminution, that in the filtered river-water exhibits very rapid multiplication, and this increase is even still more marked in the case of the deep-well water. The author suggests that the differences in the rate of multiplication exhibited by these three kinds of water is dependent upon the number of different varieties of micro-organisms which they contain. Thus in the unfiltered river-waters the organisms belong to a number of different kinds; the filtered river-waters exhibit fewer varieties; whilst in the deep-well water the number of varieties is still more limited, the gelatine-plates having generally the appearance of almost pure cultivations. The microbes in the deep-well water will thus be less hampered in their multiplication by hostile competitors than those in the filtered river-waters, and these again less than those in the crude river-waters, in which an equilibrium must have already been established between the various competitors. When the waters were exposed to a temperature of 35° C., the multiplication was in all cases very much more rapid, but both at 20° C., as well as at 35° C., the multiplication was, on prolonged storage, followed by reduction. The pathogenic forms which have been studied by the author are: (1) Koch's "*Comma*" *spirillum* of Asiatic cholera, (2) Finkler-Prior's "*Comma*" *spirillum* of European cholera, and (3) the *Bacillus pyocyaneus*, which produces the greenish-blue colouring-matter frequently present in abscesses. The vitality of these organisms has been studied by introducing minute quantities of their cultivations into sterilised distilled water, deep-well water, filtered Thames water, and London sewage. In these media they present some very striking differences. Thus the *Bacillus pyocyaneus* was found to flourish in all; even in distilled water it was present in largely multipled numbers after fifty-three days. Koch's "*Comma*" *spirillum*, on the orher hand, when introduced into deep-well water was no longer demonstrable after the ninth day, whilst in sewage it was still found in enormously multiplied numbers after twenty-nine days. Finkler-Prior's "*Comma*" *spirillum*, although showing such far greater vital activity than Koch's in gelatine cultures, possesses far less vitality than the latter when introduced into water. Thus in the above-mentioned media it was in no case demonstrable after the first day.

SCIENTIFIC SERIALS

American Journal of Science, September.—A post-Tertiary elevation of the Sierra Nevada, shown by the river-beds, by Joseph Le Conte. In further elucidation of his already published speculations regarding an upheaval of the Sierra Nevada towards the close of the Tertiary epoch, the author here brings forward much additional evidence, also correlating this movement with a contemporaneous elevation in other parts of the western half of the continent. He endeavours to show that the upward movement, which seems to have affected all high latitude regions at that time, but which was oscillatory and therefore temporary on the eastern side of North America and in Europe, on the Pacific slope was permanent, and has largely determined the orographic structure of that region.—The strain effect of sudden cooling, as exhibited by glass and by steel (second paper), by C. Barus and V. Strouhal. In their first communication the authors compared the strains experienced by glass and steel on sudden cooling, by aid of the density variations observed when the bodies carrying strain were annealed, *as a whole*. Here they seek to confirm their earlier inference relative to the temper-strain of glass. They also investigated the density-relations of consecutive similar shells of the Prince Rupert drop, and the optical character of the successive cores. In general it is shown that the optical effect of the temper-strain in glass may be regarded as the analogue of the electrical effect of the temper-strain in steel. In a further communication a more specific inquiry will be made into the causes of hardness itself, with a view to throwing some light on the mysterious transformations of carbon.—Devonian Lamellibranchiata and species-making, by Henry S. Williams. In connection with the publication of Prof. James Hall's monograph on Devonian Lamellibranchs, completing vol. v. part 1 of the "Palæontology of New York," it is pointed out that fossil species, and even genera, are unduly multiplied on totally inadequate data. Species and genera cannot be regarded as established so long as the author himself is unable to distribute the typical specimens, twice alike, without reference to the original labels.—Note on the composition of certain "Pliocene sandstones" from Montana and Idaho, by George P. Merrill. While lately classifying the rocks collected in Montana and Idaho by Dr. A. C. Peale in 1871, the author's attention was called to some fragments labelled as "Pliocene" sandstones. A glance, however, showed that they strongly resembled compacted volcanic dust and sand, and a microscopic examination made it evident that the stones consisted very largely of minute flakes of pumiceous glass sufficiently compacted to be readily broken out into hard specimens, but extremely friable. The specimens are fully described and some speculations offered as to their probable origin. It is added that in Kansas and Nebraska these dusts are collected and sold as "diamond polishing powder," or used in the preparation of the so-called "geyserite" scouring-soap.—Contributions to mineralogy, by W. Earl Hidden, with crystallographic notes by A. Des Cloizeaux. The paper deals with the ipodumene, black tourmaline, xenotime, and twin crystals of monazite from North Carolina; a remarkable crystal of herderite found in 1884 near Stoneham, Maine; a twin crystal of molybdenite from Renfrew, Canada; and the phenacite from Florissant, El Paso County, Colorado.—Turquois from New Mexico, by F. W. Clarke and J. S. Diller. A full analysis and microscopic study is given of some specimens from the turquois mines of Los Cerillos, New Mexico, about 22 miles south-west of Santa Fé. The turquois-bearing rock appears to be eruptive, and probably of Tertiary age, while the small size of the veins and their limited distribution show that the turquois is of local origin, possibly the result of alteration of some other mineral.—On the electrical resistance of soft carbon under pressure, by T. C. Mendenhall. In reply to Prof. Sylvanus P. Thompson's objections, the author describes some fresh experiments fully confirming his views regarding the change in the resistance of carbon due to change of pressure. In the form of compressed lampblack the electrical resistance of carbon varies greatly with the pressure to which it is subjected, and the variation is mainly due to a real change in the resistance of the carbon itself.—Com-