Ehrenberg's older nomenclature. Like Hertwig, I regard the skeletonless *Cystidium inerme*, discovered by him (*l.c.* pp. 87, 136, taf. vii. fig. 1) as the ancestral form of the order. *Cystidium inerme* is distinguished essentially from *Actissa* by the restriction of the capsule pores to a single area, and the consequent monaxonous fundamental form of the central capsule. All other Nassellaria are derived from *Cystidium* by the development of a characteristic siliceous skeleton. Hertwig assumes that there are at least two or three entirely different original forms for the Nassellaria skeleton, viz. a simple siliceous ring (*Lithocircus*) for the Cricoid skeleton of the Acanthodesmida and Zygocystida, and a triradial siliceous framework consisting of three spicules united at one point (*Plagiacantha*) for the Plagiacanthida and Cystida (*l.c.* p. 126, &c.). I then endeavoured to refer these two fundamental forms to a single form, as I made out the combination of the simple siliceous ring and the triradial framework in many Cystida and Spyroida (or Zygocystida). In my "Prodromus" (October, 1881, *l.c.* pp. 423-444) I divided the Nassellaria order into five families, and placed the *Plectida* (with triradial siliceous framework) as the common ancestral group. From it I derived first all the *Cystida*, from these again the *Botryoida* and *Spyrida* (=Zygocystida), and from the latter the *Stephida* (= Cricoidea). At the same time, and quite independently of my researches, Bütschli was busy with the same morphological problem, and arrived at essentially the same conclusion, except that he reversed the phylogenetic series of the forms. In his admirable treatise on the skeletons of the Cystida (also dated October, 1881, published in the *Zeit. f. wissen. Zoologie*, 1882, bd. 36, p. 485) he tries to prove the morphological connection of all Nassellaria (his *Cricoidea*), but regards the *Stephida* (= *Acanthodesmida*) as the primitive ancestral form, not as the last degenerated scion, an opinion which I myself formerly shared (compare Hertwig, 1879, p. 126). Which of these two opinions is correct cannot be determined at present. Important facts favour my present view, that the triradial siliceous framework may be the common ancestral form of all Nassellaria (*Triplagia*, *Plagiacantha*). Again, other important facts favour Bütschli's view that this ancestral form may be the simple siliceous ring (*Lithocircus*, *Monostephus*). Finally, there are good grounds for supporting Hertwig's opinion, that both these ancestral forms (the triradial and the annular) may have arisen independently from the skeletonless Cystidium. I shall discuss this difficult and interesting question at length in my work on the *Challenger* Radiolaria.

IV. The Phæodaria were only known up to 1876 by three types described by me in 1862 (*Aulocantha*, *Aulosphæra*, *Cœlodendrum*). By the discovery of numerous forms in the *Challenger* collection this has since acquired an importance of which we had no previous idea, as those Radiolarians far surpass all others both in size and singularity of form, as well as in peculiar combinations of structure. In my preliminary paper on the Phæodaria, 1879 (*Jena. Naturwissen. Sitzungsb.*, December 12) I distinguished 10 families with 38 genera, a number which has since been increased considerably by the continuous and astonishing discovery of new forms. As in the majority of these the skeleton is composed of hollow, siliceous tubes (differing therefore from that of all other Radiolarians), I termed the whole order *Pansolenia*, 1878 ("Protistenreich," p. 102). This name, however, suits all members of the family as little as the name *Tripylea*, proposed by Hertwig, 1879. On the other hand, the present name *Phæodaria* indicates the common characteristic of the whole order, the peculiar *phæodium*, a voluminous, dark body of pigment, lying excentrically outside the central capsule. The latter is, moreover, universally distinguished by its double membrane and by the peculiar opening furnished with a radiated operculum, which lies at the pole of the axis, and may therefore be termed the principal opening. In addition to it there are usually (though by no means invariably) two small accessory openings, lying one beside the other at the opposite (aboral) pole. Sometimes there are more than two, whilst at other times they are entirely wanting. Despite the extraordinary diversity of the peculiar, and often very complicated siliceous skeleton, all Phæodaria may likewise be derived from a common ancestral form—the skeletonless *Phæodina*.

The further phylogenetic question, whether all the hypothetic primitive forms already mentioned of the four Radiolarian orders can be referred to a single common primitive form, may now in all probability be decided in the affirmative. From *Actissa* the parent form of the Spumellaria, the ancestral form of the three other orders may be derived without difficulty. *Actinilius*, the ancestral form of the Acantharia, may have arisen from *Actissa* by the thickening of part of the radial pseudopodia into acanthine spicules. *Cystidium*, the probable ancestral form of the Nassellaria, may be derived from *Actissa* by the pores of the capsule membrane, originally developed equally and on all sides, becoming restricted to a single distinct porous area. *Phæodina*, the ancestral form of the Phæodaria may have arisen in a similar way from *Actissa* by the porous area becoming replaced by a single, simple opening, or small, additional, accessory openings, still being left, whilst at the same time the capsule membrane became double, and the pigment mass of the phæodium deposited excentrically round it. Whilst, on the one hand, the simplest Spumellaria form, *Actissa*, may be easily accepted as the ancestral form of all Radiolaria, *Actinosphærium* and *Actinophrys* show, on the other hand, how it may be derived from the simplest Rhizopoda.

(*To be continued.*)

UNIVERSITY AND EDUCATIONAL INTELLIGENCE

THE Technical Schools in connection with the University College, Nottingham, will be formally opened by Sir Frederick Bramwell on the 24th inst.

MR. J. T. DUNN, M.Sc., Demonstrator in Chemistry at the College of Science, Newcastle, and formerly Demonstrator in Physics, has been appointed Science Master and Director of the Chemical Laboratory in the High School for Boys, Gateshead. In the Gateshead High School, which opened in May 1883, there are already about 175 boys, and it is intended that all the boys shall learn Physics and Chemistry at some period of their school course.

SCIENTIFIC SERIALS

Journal of Franklin Institute, vol. cxvi. No. 696, December, 1883.—The cheapest point of cut off, by W. D. Marks. Partially based on, and in criticism of, a previous paper by Mr. Hill.—Experiments upon non-conducting coverings for steam pipes, by Prof. J. M. Ordway. In this research calorimeters are used, consisting of sheet-brass vessels so shaped that they can be clamped together outside the steam pipe, inclosing a known length of it and of its covering. Of more than fifty substances tried, simple hair-felt with a cheap cover of burlap proved best; seventeen other compositions owed their efficiency to hair. Asbestos hard pressed was a very bad material; it was non-conductive only in the downy state when full of air.—Pressure attainable by the use of the "Drop Press," by Prof. R. H. Thurston. These presses appear to be very efficient for forging hot iron.—The theory of turbines, by Prof. R. H. Thurston. This is the first part of an abstract of a most valuable mathematical discussion of the subject.—A new valve-motion, by Carl Angstrom. This is a so-called "radial" valve-motion, resembling those of Brown, Marshall, and Joy.—A simple and sensitive thermostat, by Dr. N. A. Randolph, designed for incubation and other experiments in the physiological laboratory. The adjustment is obtained by the more or less closing of the orifice for the gas by the expansion of alcohol causing mercury to rise toward the orifice.

Annalen der Physik und Chemie, xx. No. 12 (*a*), December, 1883.—On the condensation of carbonic acid on smooth surfaces of glass, by Prof. R. Bunsen. The condensation of the gas goes on for years, in spite of continual changes of density and pressure. In three years each square centimetre absorbs, at standard pressure and temperature, 5·135 cubic centimetres of the gas, about two-thirds of this amount being absorbed during the first year.—Density proportions of normal salt solutions, by C. Bender.—The law of rotational dispersion, by E. Lommel.—A simple method of investigating the thermo-, actino-, and piezo-electricity of crystals, by Prof. A. Kundt: consists in applying Lichtenberg's powder.—On the measurement of electric forces by means of the electric mill, by D. Kaempfer.—On the question whether the condensation of steam produces electrification, by S. Kalischer.—On the influence of the hardness of steel on its magnetisability, by V. Strouhal and C. Barus; also, on the influence of annealing on the retentivity of the magnet, by the same authors. These are two very elaborate and important

papers, covering the ground of many previous scattered researches. The first gives the curious result that, to obtain the highest possible degree of magnetisation, short magnets should be tempered glass hard, but long magnets should be at the other extreme of softness. The second research gives the result that the most constant magnets are those which, after fairly hard tempering, are annealed for twenty to thirty hours by heating in a steam bath, then magnetised, finally heated in steam for five hours more.—Correction, by A. Guébhard, relative to his electrochemical figures.—Use of the method of "Schlieren" for investigating intrusions in quartz, by A. Kundt.—On absolute measure, by Prof. C. Bohn.

Journal de Physique, t. ii. No. 23, November, 1883.—A. Potier, on the experiments of Wroblewski and Oltzewski on the liquefaction of oxygen, nitrogen, and carbonic oxide.—B. Elie, electrodynamic and magnetic potentials in elasticity.—A. Terquem, description of a new cathetometer of M. Dumoulin Froment. This cathetometer is divided into two parts—a vertical standard scale mounted on three levelling feet, to be set up near the apparatus, and a levelled observing telescope sliding upon another vertical stem to be set up at a distance, this second part of the apparatus being just an ordinary cathetometer without a scale.—Bichat and Blondlot, influence of pressure on the electric difference between a liquid and a metal in contact.—Krouchkoll, on immersion currents and on those due to the movement of a metal in a liquid, and on currents of emersion.—E. H. Hall, abstracts (by M. Leduc) of papers on so-called rotational coefficient.—Aug. Righi, on Hall's phenomenon. Righi finds this phenomenon to be 5000 times as strong in bismuth as in gold. The process by which his film of bismuth, only 0·079 mm. in thickness, was procured is not stated.—H. Roiti, on Hall's phenomenon in liquids.—H. Koch, on magneto-electric rotations.

Bulletins de la Société d'Anthropologie de Paris, tome vi. fasc. 3, Paris, 1883, contain :—A paper by M. Hamy, on the interpretation of an inscription on the Mexican stone tablet in the Museum of the Trocadéro, supposed by him to refer to the foundation, in 1483, of the temple of the great Aztec divinity, Hiutzilopochtli.—On the special frequency in criminals and in the insane of an anomalous medial occipital fossa, by Prof. Lombroso.—On the significance of the interlaced hearts common in the ornamentation of rings, crosses, &c., in use in La Bretagne and La Vendée, by M. Bonnemère, who regards them as of mediæval origin, and connected with marriage, while Madame Clémence Royer showed that they were of modern design, and religious in character, representing the hearts of Jesus and the Virgin, as symbolised in the convents of the Sacré Cœur.—A communication from Madame Clémence Royer, setting forth her claim to be regarded as the first person who pointed out that Lamarck was the true father of the theory of evolution, she having expounded his doctrines in a course of lectures on philosophy given by her in 1859-60.—On the explorations of the Grotto des Cottés in Poitou, by M. de Rochebrune. The finds exhibit fossil bones in great abundance, well-cut flints, and a human skeleton, which has been submitted to M. de Mortillet.—On the Chelléan deposits of Ternifine, in Algiers, by M. le Dr. Tommasini. These contain remains of so-called *Elephas atlanticus*.—On Prof. Putnam's recent explorations of Kjökkenmöddings, mounds, ash-pits, and stone-graves in Maine, Ohio, and Tennessee, by M. de Nadaillac.—On a more correct mode of classifying the colour of the eyes and hair in reference to the determination of ethnic characteristics, by M. Ikow.—On the "Er Fousen," or pit-graves in St. Pierre-Quiberon, in La Bretagne, by M. Gaillard.—On the anthropomrtric determination of the principal races of France, by M. le Dr. Collignon. A detailed and exhaustive treatise, in which the author, after setting apart a distinct group of Frenchmen, considers the rest of the French nation, somewhat arbitrarily, under four heads—Celts, Cimri, "Lorrainians," and so-called "Mediterranéens." Under the latter term he treats of those south-western races of France, whose chief source of origin is the Eastern Pyrenees, and who designate themselves as Catalans.—On the craniometric study of plagiocephalics, by M. le Dr. Manouvrier, bearing on the question af cerebral asymetry as a characteristic of superior brain-capacity.—On anomalous muscles in man, by M. le Dr. Testut.—Note on the various objects of fetish from Upper Ogooe, by M. Delisle. In the discussion to which the communication gave rise, M. de Mortillet maintained the view, to which he has frequently given expression, that in Africa originated the use of iron for industrial purposes, while the African was the only savage who knew how to extract and work the metal. In the iron projectile arms from the Congo M. de Mortillet believes we have analogous weapons to those seen in the hands of the Assyrian kings when represented as engaged in lion-hunting.—On the decrease of the population in France, by M. Lagneau. This decrease was known to amount to seven for every hundred inhabitants in twenty-six Departments, although there were only eight of these in which the deaths exceeded the births.—On the "Questionnaire de Sociologie et d'Ethnographie" of the Society, drawn up by MM. Hay, Hovelacque, and Vinson, and submitted by them to their *confrères*.—On two crania found in the Department de la Drôme, by M. le Dr. Delisle. One of these is dolichocephalic, and similar to the Cro-Magnon type; the other is brachiocephalic.—On the dangers of premature exercise of the higher intellectual faculties and of the physical powers in relation to the present excessive academic requirements and early term of military service in France, by M. Dally.—On M. Testut's elaborate prehistoric chart of La Dordogne, by M. Hamy.—On the practices and superstitions which prevail in Artois and Picardy in connection with bees, by M. E. T. Hamy. Such practices in no way differ from those described in the "Georgics," excepting in as far as concerns the aspersion of the hive with holy water by the modern peasant bee-cultivator. In Artois, as in Berry, when the master of the house dies his hives must be covered with black, and the fact of his decease whispered to the bees to avert their otherwise inevitable death.—On some cephalometric determinations on the living subject in Greece, by M. Apostolides. He consiners that the people of the Peloponnesus have best preserved the dolichocephalic type of the ancient Greeks, as shown in the crania of tombs belonging to the fourth century B.C.—The first part of a paper by M. de Ujfalvy on the "Kafirs-Siapochs," or "Black-robed" tribe of the Hindoo-Koosh.

Archives of the Physical and Natural Sciences, Geneva, Nov. 15, 1883.—Researches on the absorption of the ultra-violet rays by aqueous and vitreous humours, albuminoids, and other substances, by M. J. L. Soret.—On electrolytic condensers, by Dr. C. E. Guillaume.—Sixty-sixth session of the Helvetic Society of Natural Sciences held at Zurich in August, 1883: Report on the Geological Session, president, Prof. Suess of Vienna. Papers were read on the structure of the Alps, by the President, who rejected the theory of upheaval, denying the existence of any natural motive power capable of raising lofty mountain ranges; on the old glaciers of the northern slopes of the Alps, by M. Alph. Favre; on the climateric zones during the Jurassic and Chalk epochs, by Prof. Neumayr of Vienna; on the Kimmeridge formations of the Vaude Alps, by M. Schardt of Montreux; on the fossils of the same geological area, by M. de Loriol; on the physical and chemical changes undergone by rocks subject to glacial pressure, by Prof. Mühlberg of Aarau; on some specimens of spath fluor recently found in the dolomitic limestones of Trolerengraben, Valais, by M. Ed. de Fellenberg; on the hydrographic system of the Jura range in the canton of Neuchâtel, by M. Jaccard; on the mollasse and glacial formations of Upper Suabia, by M. Probst of Essendorff; on the gypsum formations of Vorarlberg, by M. Chavannes; on a sectional profile of the Schlossberg in the Titlis range, showing the geological dispositions of the limestone rocks of the twelfth sheet in Dufour's map, by Dr. C. Moesch of Zurich; on the fauna of the coal and limestone formations in the Permian system of Bohemia, by Dr. A. Fritsch; on an ancient post-Glacial lacustrine basin in the Soleure district, formed by three concentric frontal moraines, slight traces of which still survive in the Aar valley, by M. Alph. Favre; on the earthquake at Ischia, by Prof. Suess.

Nachrichten of the Royal Society of Sciences and of the University of Göttingen, July 30, 1883.—On some historical documents connected with the history of Bavaria during the fourteenth century, by Ludwig Weiland.—Remarks on Jacobi's theory of elliptical functions, with special reference to his logarithm of theta functions (continued), by A. Enneper.

SOCIETIES AND ACADEMIES

LONDON

Royal Society, December 20, 1883.—"Note on the Constitution of Chlorophyll." By Edward Schunck, F.R.S.

The author having for some time been engaged in examining the derivatives of chlorophyll, the question of the constitution of