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