$$\mathfrak{B} = \mathfrak{H} + 4\pi\mathfrak{I},\ \mathfrak{H} = \mathfrak{F} - \tfrac{4}{3}\pi\mathfrak{I},\ \text{and}\ \mathfrak{I} = \frac{\mathfrak{F}}{4.19};$$

whence

$$\mathfrak{H} = 4.19\,\mathfrak{I} - \tfrac{4}{3}\pi\,\mathfrak{I} = 0,$$

and

$$\mathfrak{B} = 4\pi\mathfrak{I} = 4\pi \times \frac{\mathfrak{F}}{4.19} = 3\,\mathfrak{F},$$

which is the result reached by Stefan and Thomson.

A precisely similar line of reasoning applies in case of the disk; the fact that $\mathfrak{H}$ in both the sphere and the disk becomes 0 explaining how it happens that $\mathfrak{I}\,[= \kappa\,\mathfrak{H}]$ remains finite, though κ is supposed infinite.

The fact seems to be, that Mr. Bosanquet does not understand the full meaning of Maxwell's $\mathfrak{H}$. He apparently supposes that it is the magnetizing force arising from external sources,[1] just what has been denoted above by $\mathfrak{F}$. Having, therefore, found that his own formula, $\mathfrak{B} = 4\pi\mathfrak{I}$, gives, in the case of the sphere of infinite conductivity, $\mathfrak{B} = 3\,\mathfrak{F}$, he naturally concludes that Maxwell would obtain $\mathfrak{B} = \mathfrak{F} + 3\,\mathfrak{F} = 4\,\mathfrak{F}$.

The two above-mentioned cases, then, are of interest, not as showing the inaccuracy of the ordinary formulas, but as instances in which Mr. Bosanquet's formulas hold good. In any medium possessing finite magnetic conductivity only, i.e., in any known medium, Mr. Bosanquet's formulas will evidently lead to results different from those given by Maxwell's; and it remains to be shown, I think, that Maxwell is in error.

Indeed, it is by no means evident that Maxwell's formulas need be essentially changed in order to be in accordance with the requirements of the theory Mr. Bosanquet is advocating; for, though Maxwell preferred to speak of magnetization as an induction phenomenon, he was, of course, perfectly well aware of its analogy to conduction, as might be shown by numerous quotations from his treatise, of which only one need be given.

"In many parts of physical science, equations of the same form are found applicable to phenomena which are certainly of quite different natures, as, for instance, electric induction through dielectrics, conduction through conductors, and magnetic induction. In all these cases the relation between the force and the effect produced is expressed by a set of equations of the same kind, so that when a problem in one of these subjects is solved, the problem and its solution may be translated into the language of the other subjects and the results in their new form will still be true."[2] E. H. HALL.

Cambridge, Mass., April 19, 1883.

THE SMALL PLANETS.

THE following statement of the condition of the prize question of the Royal Danish society of sciences appears in *Copernicus* for March, 1883: —

The number of small planets between the orbits of Mars and Jupiter has by degrees become so large, that it is not to be expected that it will in future be possible to compute, in advance, the motion of every single one. And it will even be less possible to compute their influence singly on the motions of the large planets or of comets. Fortunately, however, the masses of the small planets are so trifling that the perturbation caused by any one separately may be left out of consideration; but it is very doubtful whether their collective influence might not be traced in the motion of the nearer planets or comets. In order that researches on this point should give a reliable result, it is necessary first to know the form and position of the ring formed by all the small planets, and the distribution of the masses in this ring.

No degree of accuracy can be attempted in the statistical description of the ring; and, with very few exceptions, the systems of elements already deduced for each planet may be adopted; the more so, as it will be of no importance whereabouts in its orbit a planet is at any time. As to the single masses, it is, of course, necessary to draw conclusions from the apparent brightness; but the number is so considerable that a fairly reliable result may be hoped for. In the statistical researches hitherto made, the separate elements only have been discussed, apart from their connection with the other elements; but this cannot be considered satisfactory. Thus the fact that the planets, arranged according to their mean distances, are divided into a number of distinct groups, does not, by any means, prove that the ring formed by them around the sun is dissolved into a number of fairly concentric rings.

The Royal Danish society of sciences, therefore, offers its gold medal (value 320 crowns, equal to nearly ninety dollars) for a statistical investigation of the orbits of the small planets considered as parts of a ring around the sun. The form, position, and relative distribution of mass, should, if possible, be stated with at least so much accuracy as is judged necessary for computing its perturbing influence on planets and comets.

The memoirs should be written either in Latin, French, English, German, Swedish, or Danish, and must be sent before the end of October, 1884, to the secretary of the society, Dr. H. G. Zeuthen, Copenhagen. They should not bear the author's name, but only a motto, while the name should be enclosed in a sealed envelope.

RESEARCHES ON THE DICYEMIDAE.

DR. C. O. WHITMAN has published an article[1] on these puzzling and imperfectly known parasites of the cephalopods. The number of genera is reduced to two, — Dicyema, with eight cells around the anterior end of the body; and Dicyemennea, with nine. The number of species is increased to ten, all of which are carefully described. Three are new.

As these animals have been taken by Ed. van Beneden as the type of a new division of the animal kingdom, and as they have been the subject of much discussion, we reproduce Whitman's summary. The dicyemids may be divided, according to the share they take in the work of reproduction, into monogenic and diphygenic individuals. The first produce only vermiform, the latter, first infusoriform, and then vermiform embryos. It is doubtful whether the two kinds of individuals are heterogeneous forms; for they are alike in origin, development, and adult form and structure; but their germ-cells, for unknown reasons, pursue different courses of development. There is a relation, the meaning of which is unknown, between the age of the host and the condition of the parasites; the nematogens predominating in the young, the rhombogens in the adult cephalopods. The rhombogens alone have a plurinucleate axial cell, which then contains, first, its own large nucleus; second, bodies, probably correspond-

[1] Maxwell does, in art. 437, use $\mathfrak{H}$ in this sense; but he does not use it thus in his formulas.

[2] Art. 62, new edition.

[1] Mittheil. zool. stat. Neapel, iv. 1.

ing to polar globules, thrown off from the germ-cells before they develop into embryos; third, the 'residual nuclei' of the germogens set free, as the final event in the history of infusorigens. The infusorigen is a group of cells, consisting, at one period, of a peripheral layer of cells partially enveloping a large central cell. Its development from a single cell by a process of cleavage, and the epibolic growth of its peripheral layer, give ground for believing that it passes through a gastrula stage. In diphygenic individuals the germ-cells are different for the two kinds of embryos. The first to appear, one or two at a time, are the large germ-cells of the infusoriform embryos. After these embryos escape, there remain in the parent-body small cells, which multiply until they fill the greater portion of the axial cell, and eventually give rise to vermiform embryos. The difference between developmental division (cleavage) and multiplicative division of cells is here brought in striking contrast. No definite evidence of fecundation has been obtained, but it perhaps occurs with one form of embryo. In the development of the vermiform embryo, karyokinesis splits the germ-cell into two unequal parts. Then follows a three, and next a four celled stage, in which three cells form a cap over the fourth. This leads to a gastrula, in which a single entoderm-cell is enveloped by a small number of ectoderm-cells. The blastopore closes, and the multiplication of cells at this pole soon leads to the pyriform embryo, of which the pointed end is the blastoporal region; while the rounded end corresponds to the future cephalic pole. In this stage the first germ-cell appears at the hind end of the entoderm; the second germ-cell, at the anterior end; and from these two arise the other germ-cells. There is, therefore, a triploblastic stage, if we regard the two germ-cells as representing the mesoderm.

It may be added, that important errors of van Beneden have been corrected by Whitman, whose article is one of unusual interest and merit. As to the relationship of the dicyemids, Whitman says, "I see no good reason for doubting the general opinion that they are plathelminths, degraded by parasitism. Whether they, and their allies the Orthonectidae, have descended from ancestors represented now by such forms as Dinophilus, or from the Trematoda, is a question which further investigations must decide."

C. S. MINOT.

TEMPERATURE AND ICE OF THE BAVARIAN LAKES.

AFTER an account of temperature observations on Swiss lakes by earlier observers, as Brunner and Fischer, Simony and Forel, A. Geistbeck (*Ausland*, 1882, 961, 1006) gives a detailed tabulated statement of his observations during 1881 on sixteen Bavarian lakes, showing the following results. As to variation with depth, the first six metres are almost constant; between six and eighteen metres there is a rapid cooling; then, to fifty metres, a slow decrease; and, below this, an almost constant temperature of a little less than 5° C. Daily variation is distinct to six metres, but ends at eighteen. Annual variation is reduced to from 0.2° to 0.9° at the bottom of the deeper lakes. Two groups are noted. The warm lakes, with an average temperature of 7.3° to 17°, are less than one hundred metres deep, their bottom temperature is below 5°, and they have a decided annual variation through their entire depth. The cold lakes, Königs, Starnberger, Walchen, and Achen, are from 115 to 196 met. deep, and, below fifty metres, are always cooler than 5°, with an average temperature of 5.2° to 5.6°: these have, therefore, a great volume of cold water even in midsummer, and a slow and small annual temperature range. The cause of this difference is seen partly in the depth of the lakes, and further in the relation of lake-surface to drainage-area, which, in the cold lakes, averages 1 to 10, and, in the warm, 1 to 30. Exceptions, here and elsewhere, to the rule of depth, are Barm (31.5 met. deep), Gosau (63), and Toplitz (105), which belong under the cold group; for, in spite of their moderate depth, they are well protected by steep shores from warming by sun and wind. On the other hand, Geneva (334) and Gmundener (190) approach the warm group, presumably on account of their large drainage-area. Certain small mountain-lakes, fed mostly by springs, show a relatively low summer and high winter temperature. Form of the bottom, and nearness to entering-streams, have strong control over the water's warmth. The lacustrine flora and fauna are determined chiefly by temperature and light. Reeds and algae are common along shallow shores, but all rooted plants end at a depth of twelve metres. The littoral molluscan and crustacean fauna disappears at twenty metres. In deeper water there is a special 'pelagic' fauna. (In this connection, see Forel, La faune pélagique des lacs d'eau douce, — *Arch. sc. phys. nat.*, viii. 1882, 230.)

The lake temperatures fall quickly in the autumn by circulation, but rise slowly in the spring by conduction and wave action. In winter a temperature lower than that of maximum density penetrates to a considerable depth: less than 3° has been found at forty metres. Ice forms first on the shallows along the shore, and spreads outward. The high lakes freeze every year, sometimes as early as October or September; the larger lower lakes, at later dates and more seldom. Walchen has frozen over only three times in this century; Constance, seven times since 1277; Gmundener, five times in the last four hundred years. In the severe winter of 1879–80 Tegern closed on Dec. 21; Zurich, in the middle of January; Walchen, on Feb. 3; and Constance and Gmundener, on the 6th. Changes of temperature produce long cracks in the ice, so characteristic as to have local names — *lehnen*, *schübe*, *wunen*, *frageln* — on the different lakes. Further description is given of the thickness and color of the ice, and certain peculiarities in the freezing of some of the lakes.

W. M. DAVIS.

LETTERS TO THE EDITOR.

Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.

Zoölogical 'regions.'

MY attention has been drawn, by a notice in one of the last numbers of SCIENCE, to what seems to me to be sources of error. I refer to the determination of zoölogical regions by percentage calculations, and the idea that regions should have a certain amount of numerical equivalence. This seems to be an artificial and hence fallacious method of dealing with the subject, engendered by the lack of a proper conception of the matter under consideration. No definition or description of a 'region,' or synonymous word, can be found in any of the leading works on zoogeography; but, if we put two and two together, an idea can be formed which will, I hope, help solve some mooted questions.

Regions are known to differ in the kinds of animals occupying them, as well as in location. All, or all but one, are geographically very distinct; and all are well