view, for if we accept it we must admit that the germ-layers in arthropods and vertebrates are not homologous—that the epiblast of the one becomes the hypoblast of the other, and *vice versa*. Dr. Gaskell does not find this difficulty by any means insuperable, and, as part of his argument, runs a tilt against the germ-layer theory as at present accepted. In this he was largely supported by the subsequent observations of Dr. Gadow and Prof. Stanley Gardiner.

The debate naturally centred around Dr. Gaskell's theory, which was discussed from the standpoints of embryology, comparative anatomy, palæontology, physiology, and even psychology, the subsequent speakers being Prof. MacBride, Prof. Starling, Mr. Goodrich, Dr. Gadow, Dr. Smith Woodward, Prof. Dendy, Sir Ray Lankester, Dr. Chalmers Mitchell, Prof. Stanley Gardiner, the Rev. T. R. R. Stebbing, and the president (Dr. D. H. Scott). Dr. Gaskell replied at length at the end of the second evening.

It is impossible in this article to give more than a very general account of the course of the discussion, and this is the less necessary as the Linnean Society has announced its intention of publishing it in full, while Dr. Gaskell's views have recently been given to the world in book form.

For reasons which have already been indicated, no definite theory was put forward as a rival to that of Dr. Gaskell, though probably no competent zoologist would have much difficulty in formulating such a theory. Amphioxus, however, loomed large, especially in the remarks of Mr. Goodrich. Dr. Gadow, whose remarks, on the whole, tended strongly to support Dr. Gaskell, expressed the opinion that the attempts which have been made to bring Amphioxus into line have not been successful, but it was pointed out that this animal, though in some respects undoubtedly modified—according to Sir Ray Lankester, even degenerate—nevertheless more nearly resembles a primitive vertebrate than any other animal living at the present day. Probably no zoologist now claims it as being in the direct line of descent of the higher vertebrates from their invertebrate ancestors, but it has gone off on its own little side-track for only a short distance from the starting point. In many respects it retains primitive vertebrate characters, such as the notochord, the numerous gill slits, and the comparatively undifferentiated central nervous system (which may, however, be partly explained as due to degeneration). It shows hardly any sign of cephalisation, and no trace of the paired sense organs which form so dominant a feature of the organisation in higher vertebrates. It represents an altogether lower grade of organisation than the lamprey or even the Ammocœtes larva, yet, as Dr. Goodrich clearly showed, there is no difficulty in deriving the lamprey from an Amphioxus-like ancestor by a normal process of evolution in which cephalisation has played the leading part. If, however, we accept an Amphioxus-like ancestor as the starting point of the vertebrate phylum, we must put the arthropod theory out of court at once, for many of the structures upon which Dr. Gaskell lays much stress as evidence in support of his theory, such as the lateral and pineal eyes, have not yet appeared at the commencement of the vertebrate series, and must have been evolved within the limits of the phylum.

As to what preceded the Amphioxus-like ancestor of vertebrates, zoologists, as already observed, refuse to commit themselves to an opinion. They await more evidence. In the meantime, it is pointed out that the possession of nephridia with solenocytes, identical with those of certain chætopod worms, suggests annelidan affinities, and that the worm-like Balanoglossus, with its Amphioxus-like gill slits but very dubious notochord, must also be taken into account, while the evidence of embryology points to some far remote relationship between Amphioxus, Balanoglossus, and the echinoderms.

The chief difficulty in the way of comparing the vertebrate with the annelid lies, of course, in the reversal of the surfaces which such comparison implies. In the annelid the principal part of the central nervous system lies ventrally beneath the gut, in the vertebrate it lies dorsally above the gut. Dr. Gaskell maintains that the old way of getting over this difficulty by turning the animal upside down and making the dorsal surface of the vertebrate represent the ventral surface of the invertebrate ancestor is now universally discredited. Yet we find Prof. Sedgwick saying in his "Text-book of Zoology," so recently as 1905, that it is quite clear that the dorsal surface of the vertebrate corresponds to the ventral surface of other cœlomates, a view which is strongly supported by the history of the ascidian tadpole, in which the mouth is dorsally situated, instead of ventrally, as in higher chordates.

A considerable amount of detailed criticism of Dr. Gaskell's theory was, of course, brought forward during the discussion. Prof. MacBride pointed out that the skin of the primitive vertebrate must have been ciliated, while in the arthropod the entire organisation is dominated by the production of a thick, chitinous cuticle. He also spoke in defence of the germ-layer theory, and criticised Dr. Gaskell's explanation of the hollow gastrula stage of the arthropod Lucifer, the existence of which seems clearly to indicate that the two primary layers of arthropods are identical with those of vertebrates.

An attempt was also made by the present writer to show that Dr. Gaskell's interpretation of the lateral and pineal eyes of vertebrates as the homologues of the lateral and median eyes of arthropods would not bear the test of critical examination. The same speaker endeavoured to explain the hollow tubular character of the vertebrate central nervous system as a comparatively recent adaptation to the requirements of the vertebrate organisation, in which the necessary increase of surface is brought about by the familiar process of folding. Dr. Chalmers Mitchell directed attention to the mode of origin of the nervous system in various invertebrate groups, and scored a point against Dr. Gaskell by his reference to the recent conclusions of Prof. C. Judson Herrick with regard to the arthropodan nervous system.

Prof. Starling maintained that, as regards the principles which must guide any research into the phylogeny of our race, a physiologist has as good a right to be heard as a comparative anatomist, and he thinks that "it is as difficult to conceive that the vertebrate was evolved from a primitive worm-like organism which shot up past the more highly developed Arthropoda as it is to believe that mankind is destined to be replaced by some beast that is now being evolved from lower groups in the depths of the sea." The observations of Dr. Smith Woodward, on the other hand, which dealt with the subject from the palæontological point of view, seemed to indicate that the process of evolution takes place very much in the way which Prof. Starling finds it so difficult to imagine. Moreover, the claims of the ancient ostracoderms to arthropodan affinities, upon which Dr. Gaskell lays so much stress, seem to be extremely dubious; they were probably highly specialised forms, perhaps related in some respects to the lampreys.

Though unable to accept his views on the subject before the meeting, Sir Ray Lankester voiced what must have been a very general feeling amongst those present in expressing his appreciation of Dr. Gaskell's observations.

ARTHUR DENDY.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—The Vice-Chancellor gives notice that the Sadlerian professorship of pure mathematics is vacant. The election to the professorship will take place on Monday, February 28. Candidates are requested to send their names to the Vice-Chancellor on or before Saturday, February 19.

The office of superintendent of the museum of zoology is vacant by the resignation of Prof. Punnett. The stipend at present attached to the office is 200*l*. per annum. Applications should be sent to the chairman of the special board for biology and geology (Prof. Langley, The Museums, Cambridge) on or before March 7.

Mr. J. C. F. Fryer has been elected to the Balfour studentship from March 25.

A grant of 200*l*. has been made from the Balfour fund to Mr. C. F. Cooper, for an investigation into the Tertiary vertebrate fauna of India, and a grant of 40*l*. to Mr. K. R. Lewin, in furtherance of his work in protozoology to be carried on abroad.

The following grants were made in the year 1909 from

the income of the Gordon Wigan fund at the disposal of the special board for biology and geology:—(*a*) 12*l.* 10*s.* to Dr. D. Sharp; (*b*) 50*l.* to Prof. Langley, for the purchase of a Sandstrom kymograph and accessory apparatus; (*c*) 50*l.* to Mr. A. G. Tansley, that the botanic garden syndicate may continue to offer facilities for plant-breeding experiments; (*d*) 50*l.* to Mr. H. Scott, for the care and development of the collection of insects; (*e*) 25*l.* to Mr. H. H. Thomas, for collecting fossil plants in east Yorkshire with the view of a thorough investigation of its Jurassic flora.

OXFORD.—Dr. Henry Wilde, F.R.S., has offered the University the sum of 600*l.* for the foundation of an annual lecture on astronomy and terrestrial magnetism, in honour and memory of Edmund Halley.

A DEPARTMENT of experimental biology has, says *Science*, been organised in the Rockefeller Institute. Prof. Jacques Loeb, of the University of California, has been elected head of the department.

THE total amount received and promised up to the present for the building and endowment fund of Bedford College (University of London) is 47,700*l.*; a further 12,300*l.* is required before the buildings can be begun.

THE twelfth annual dinner of the Central Technical College Old Students' Association will be held at the Trocadero Restaurant, Piccadilly, W., on Saturday, February 12. Among the guests will be Sir Philip Magnus, M.P.

IT is announced in *Science* that the late Mr. D. Ogden Mills, of New York City, bequeathed 20,000*l.* to the American Museum of Natural History, 10,000*l.* to the New York Botanical Garden, and 5000*l.* to the American Geographical Society of New York City. From the same source we learn that Mr. J. S. Huyler, of New York, has given 4000*l.* to Syracuse University.

IN the Journal of the Royal Statistical Society for January Dr. W. Garnett discusses briefly the statistics of certain scholarship examinations of the London County Council. Returns of marks were available for about 10,000 boys and 10,000 girls, in round numbers, in the subjects of arithmetic and English, and Dr. Garnett has drawn up diagrams and formed models illustrating the correlation between the marks in the two subjects for each sex. Some interesting points are brought out very clearly in quite an elementary way, the distributions of frequency in the two cases presenting some conspicuous differences as well as some general similarities. In both sexes, for example, the weaker candidates on the whole did better in English than in arithmetic, and the stronger candidates better in arithmetic than in English; but while boys gaining more than half-marks on the entire examination began to do better as a whole in arithmetic than in English, the same could only be said of the girls attaining 67 per cent. of the total marks or more, *i.e.* it was only the comparatively exceptional girls who did the better in arithmetic.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, February 3.—Sir Archibald Geikie, K.C.B., president, in the chair.—F. D. **Thompson**: The thyroid and parathyroid glands throughout vertebrates.—Prof. E. A. **Minchin** and J. D. **Thomson**: The transmission of *Trypanosoma lewisi* by the rat-flea (*Ceratophyllus fasciatus*). The experiments that form the subject of this communication are concerned essentially with the *method* of transmission and with questions connected therewith. Incidentally, the *fact* of transmission is confirmed. All experiments were arranged so as to eliminate the possibility of infection other than by fleas, and to separate "direct" from "cyclical" infection. When preliminary experiments showed that infection, not "direct," had taken place, further experiments were arranged to determine if fleas once infective retain infection so as to be capable of infecting a series of healthy clean rats without themselves being again exposed to infection, and at the same time to determine by direct observation and within narrow limits (1) the length of the incubation period in the flea, and (2) the length of the multiplication period in the rat. In all the experiments tame rats and fleas bred in captivity were used. The general arrangements and a detailed account of each experiment are given, but cannot be summarised briefly. A few observations on fleas dissected are recorded, and reference is made to Nuttall's experiments and conclusions. The following conclusions are drawn from the results of the experiments:—(1) The rat-flea (*Ceratophyllus fasciatus*) transmits *T. lewisi* from infected to non-infected rats. (2) Transmission takes place by the "cyclical" method. (3) Transmission by the "direct" method did not take place. (4) The incubation period in the flea has a minimum length of about six days, but may be longer. (5) The length of the multiplication period in the rat is about twelve days. (6) In the developmental cycle the establishment of the trypanosome in the flea begins with multiplication of Crithidia-like forms in the rectum. No flagellates have been found by the authors in any fleas which had not fed on infected rats.—Dr. F. **Medigreceanu** (Bucharest): The relative sizes of the organs of rats and mice bearing malignant new growths. The effects have been determined for rats and mice of the growth of transplanted carcinomata and sarcomata upon the weights of the principal organs of the body. The weights of the different organs of normal animals bear a relatively constant ratio to the total weight of the body. Weighing experiments on 200 mice and rats bearing transplanted tumours, and on four mice with spontaneous tumours, have shown (1) no disturbance of the normal ratio for the alimentary canal; (2) hypertrophy of the liver in all cases, and up to a certain point proportional to the weight of tumour; (3) hypertrophy of the heart, also in proportion to size of tumour; (4) no disturbance of normal ratio for the kidneys except in the case of a spindle-celled sarcoma, which induced hypertrophy; (5) varying ratios for the lungs. The most important result has been the discovery of an enlargement of the liver in animals bearing carcinomata and sarcomata, whether transplanted or naturally arising.—Dr. E. F. **Bashford** and Dr. B. R. G. **Russell**: Further evidence on the homogeneity of the resistance to the implantation of malignant new growths. The principal object of the paper is to adduce further evidence that the resistance which animals already bearing transplanted tumours may offer to a second transplantation is identical in nature with the resistance offered by animals without tumours, after immunisation with normal or tumour tissue of the same species. A study of the processes at the site of the second implantation shows that, concomitantly with the establishment of the tumour developing from the first inoculation, an active resistance may be induced by the absorption of tumour tissue. Then the cancer cells implanted at the second inoculation fail to elicit the supporting connective tissue and vascular scaffolding necessary to their development into a tumour, and the process of resistance is exactly analogous to that previously described, when tumour tissue is implanted into mice after a preliminary immunisation with tumour or normal tissue of the same species. The assumption of a distinct form of resistance, "atreptic immunity," is thereby rendered superfluous when tumour-bearing animals are resistant to a second inoculation. Prevailing conceptions of what constitutes immunity to cancer *sensu strictiori* are simplified further by experiments demonstrating that the active immunity to cancer which follows in rats after a preliminary inoculation of mouse cancer is not an immunity against cancer, but against the protein of a foreign species. Therefore hypotheses of cancer immunity, based upon a study of the behaviour of tumours in strange species, have at most only an indirect bearing upon the immunity to cancer of the same species. By actual observation of the processes occurring in animals immunised against the inoculation of cancer of their own species, only one form of induced resistance has been demonstrated to exist, consisting, so far as elucidated, in an inhibition of the chemiotactic powers the cancer cells normally exercise upon the connective tissue and vascular scaffolding of the host. This single explanation harmonises all the observed facts and rids the experimental study of cancer both of confusing hypotheses and of errors.—Dr. M. **Haaland**: The contrast in the reactions to the implantation of cancer after the inoculation of living and mechanically disintegrated cells. Inoculation of living tumour of normal tissue of the same species has been shown to induce resistance to subsequent