diseases affecting tropical or subtropical plants, such as the sugar-cane, banana, sweet-corn, etc., which are of no economic importance in this country. If, however, the cultivation of tobacco is to have any great development in Great Britain, a reference to these pages is indispensable as a guide to the destructive

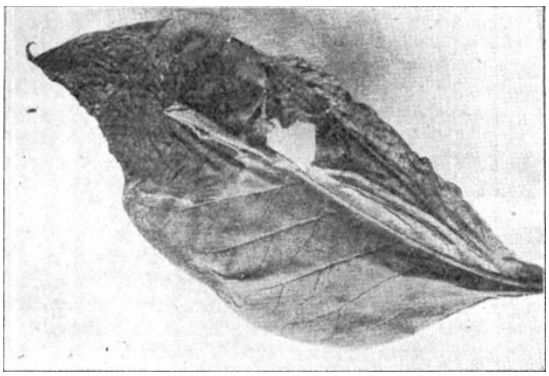

FIG. 1.—Tobacco-leaf from the hothouse, showing the typical red-brown shrivelled spots of the Granville tobacco wilt. The remainder of the leaf was green. *Bacterium solanacearum* abundant in vascular system of the midrib and in many side veins. Plant inoculated in stem, by needle-pricks, on September 23, 1905, using a pure culture of the North Carolina tobacco organism. Photographed February 20, 1906.

attacks to which this crop is subject, and the conditions which influence its successful growth. It seems also to be substantially proved by the author's own examinations and the weight of evidence which he has been able to accumulate, that the various forms of tobacco wilt, including those described by the Dutch

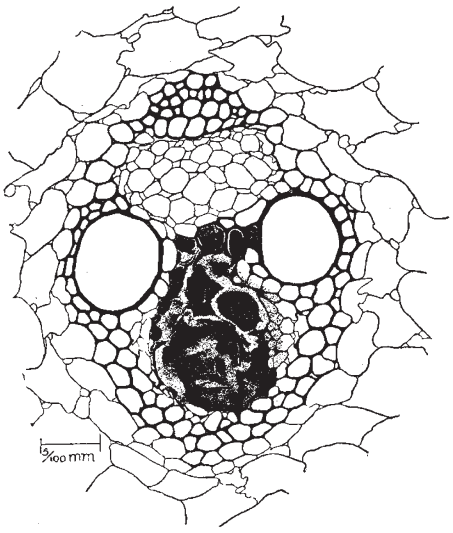

FIG. 2.—*Bacterium vascularum* in stem of sugar-cane received in 1902 from New South Wales. The figure represents a bundle in cross-section. The ground tissue, endodermal sheath, and phloem are still free, also a part of the xylem, including the two big pitted vessels. Sectioned from paraffin and stained with Flemming's triple stain, the contrast being not exaggerated.

and Japanese writers, are due to the same organism, *Bacterium solanacearum*, Smith, which causes the well-known rot of potatoes, tomatoes, and other solanaceous plants. This parasitic disease of tobacco has been known for the last twenty-five years in Japan, and the damage caused is widespread in all countries where tobacco is cultivated; the loss has often been enormous, and many planters have been driven to harvest their crop while unripe and half-grown, in order to save some portion of it.

The specific communicable disease of the sugar-cane, caused by a one-flagellate schizomycete, *B. vascularum*, Cobb, is, so far as is known, confined to this one host plant. It is responsible for a considerable reduction of sugar-content, and is apt to give trouble in the sugar factory, gumming the machinery, and interfering with proper clarification and crystallisation. The disease is most prevalent in the southern hemisphere, and it is satisfactory to learn that it has not been reported from the British West Indies or Porto Rico. It is, however, specially liable to be transmitted in cane cuttings, and planters in these islands are warned to be careful to guard against its introduction. The question of the origin and nature of the "gum," which is such a typical feature accompanying vascular bacterial diseases, is extremely interesting, and it is disappointing to find that nothing has been done on this point since Greig-Smith's work in 1904. His researches, undertaken upon the lines of qualitative chemistry, are entirely confirmatory of the bacterial origin of the "gummosis," as he concludes from tests of the chemical reactions that the "gum" and the bacterial slime from pure cultures on agar are identical. Apparently the mucilaginous substance blocking up the vessels is a bacterial zooglea, but its exact composition has not yet been determined, and remains one of the many unsolved problems of biochemistry. It would seem that these plant-gums are derived by the bacteria from the saccharine contents of the cell-sap, and are clearly not a degeneration product of the cell-wall, as was formerly supposed.

The book is profusely illustrated with excellent photographs and drawings showing all stages of the diseases cited and innumerable inoculation experiments. M. C. P.

ZOOLOGY AT THE BRITISH ASSOCIATION.

SECTION D held its meetings in the lecture theatres of the Universities of Melbourne and Sydney, and presented a full and varied series of papers. It will be noticed from the subjoined summary that about one-half the time of the section was devoted to the consideration of researches on Australian material.

Recent Work in Antarctica.

A discussion on the past and present relations of Antarctica was arranged by Section D, in conjunction with the Sections of Geology, Botany, and Geography. An account of the contributions of the geologists and geographers to this discussion appeared in NATURE of October 19 (p. 241), so that it is only necessary to refer here to the observations made by Mr. Hedley and Prof. Seward on the biological relations of Antarctica.

Mr. C. Hedley stated that naturalists have deduced the age, climate, contour, fauna, and flora of Tertiary Antarctica from the nature of Antarctic refugees now living in southern lands. For instance—(1) the monotremes, once perhaps numerous, are represented by two widely different types which survive in Australia, Tasmania, and Papua; the bones of other monotremes occur in South American deposits; (2) the Thylacines are recent in Tasmania, and fossil in South America and Australia. Either we must consider that these groups arose independently in each hemisphere, or that they spread from the one to the other. In the latter case a south polar land offered the most direct

path. The simplest explanation of the distribution of marsupials, past and present, is that they originated in South America, spread by way of Archihelenis to western Europe, by way of the West Indies to North America, and by way of Antarctica to Australasia. Turning to the Amphibia, Mr. Hedley pointed out that the families Hylidæ and Cystignathidæ have their chief seat in South America, and both families extend to Australasia, where they are best developed in the south-east and gradually vanish before reaching the Moluccas. In these cases also the most direct route between the two centres lies across Antarctica, and by cumulative evidence from plants and animals of many and varied kinds the conclusion is reached that this was the way they went.

Prof. Seward gave a brief account of some of the fossil plants collected by members of Captain Scott's second expedition, with special reference to Dr. Wilson's discovery of Glossopteris in 85° S. Fragments of well-preserved leaves of *Glossopteris indica* found in the rocks of Buckley Island, a nunatak on the Beardmore Glacier, afford important evidence, both as to the age of the Beacon Sandstone formation and as to a former connection between Antarctica and Gondwana Land. The geological distribution of Glossopteris in other parts of the world suggests that the strata of the Buckley nunatak must be assigned to the Permo-Carboniferous period. A large piece of wood obtained by Mr. Priestley from a sandstone boulder on the Priestley Glacier in 74° S. proved to be a gymnospermous stem of considerable botanical interest; the wood shows well-marked rings of growth and exhibits Araucarian characteristics, but in view of certain peculiar features has been referred to a new genus—Antarcticoxylon. Associated with this was found a winged pollen-grain, described as Pityosporites, which bears a striking resemblance to the pollen of recent Abietineæ. In conclusion, Prof. Seward referred to the bearing of these important discoveries on climatic considerations, and pointed out that while there is clear evidence of a considerable change in climatic conditions since the period when Glossopteris flourished on the Antarctic continent, there is no adequate reason to assume any change in the position of the earth's axis. Meagre as it is, the material collected by the polar party calls up a picture of an Antarctic land on which it is reasonable to believe were evolved the elements of a new flora that spread in diverging lines over a Palæozoic continent, the *disjuncta membra* of which have long been added to other land-masses where are preserved both the relics of the southern flora and of that which had its birth in the north.

Plankton.

Prof. Herdman gave an account of some recent plankton investigations in European seas (especially in the Irish Sea and off the west coast of Scotland), and of the apparatus used and the difficulties met with. He exhibited photographs of different samples of hauls showing that the diatoms attain their maximum in spring and are at a minimum in summer, while the copepods are few in spring but numerous in summer. He pointed out the necessity for taking samples simultaneously with vertical and horizontal nets, and for using coarse and fine nets in order to gain a true picture of the total plankton, and referred to the irregularity in distribution of plankton organisms, swarms of organisms being sometimes present in restricted areas, hence it was necessary to be careful in drawing conclusions from the samples taken in a single haul. He briefly discussed the application of plankton investigations to fishery problems, pointing out that diatoms are the ultimate food of marine animals, and therefore the starting-point of the problems.

The Abrolhos Islands.

Prof. W. J. Dakin gave a summary of some of the results of recent work by himself and Mr. W. B. Alexander on the Abrolhos Islands. These are situated in lat. 28° 40′ S., about fifty miles off the west coast of Australia, and near the edge of the continental shelf. The depth of water between the islands and the mainland averages about 25 fathoms, while a few miles west the depth is some hundreds of fathoms. The islands are composed entirely of coral, all the rock above sea-level (the highest point in any of the islands is 50 ft.) being uplifted coral rock or sand. There are distinct traces of a very recent uplift of about 8 ft., but at an earlier date—quite recent geologically—a much greater uplift put the islands in connection with the mainland. As a consequence of this former land connection certain of the islands are now inhabited by large numbers of wallabies, several species of amphibia, and many species of reptiles. There is thus a combination of the features of coral islands and the continental terrestrial fauna. There is evidence that a warm tropical current flows southwards and reaches the Abrolhos, and possibly accounts for certain tropical characters of the fauna of the islands. The neighbouring mainland is bathed by cooler waters, probably of southern origin. Prof. Dakin recorded from the islands a considerable number of interesting animals, including a new species of Ptychodera allied to *P. flava.*

The Development of Trypanosomes in the Invertebrate Host.

Prof. E. A. Minchin showed that if an analysis and comparison be made of those instances in which it can be claimed that the development of a given species of trypanosome in its invertebrate host is known, it is seen that in every such instance there is a part of the developmental cycle which is constant in occurrence and uniform in character, and another part which is of inconstant occurrence and variable in character.

In the constant part of the cycle the parasite always assumes the crithidial type of structure and multiplies incessantly in this form to produce a lasting stock of the parasite, certain individuals of which change sporadically from the crithidial into the trypaniform type and so become the final, propagative form of the development, destined to pass back into the vertebrate host and establish the infection in it. During hunger-periods the crithidial forms may pass temporarily, in some cases (*e.g.* the trypanosome of the skate in the leech Pontobdella), into the resting, non-flagellated leishmanial form, until food is again abundant, when they form a new flagellum and revert to the crithidial type of structure.

The inconstant part of the cycle, when it occurs, is intercalated at the very beginning of the development in the invertebrate, and lasts but a relatively short time; it is derived directly from the trypanosomes taken up by the invertebrate from the vertebrate host, and takes the form of an active multiplication of the parasites in either the trypaniform (*e.g.* *Trypanosoma gambiense* in the tsetse-fly) or leishmanial (*e.g.* *T. cruzi* in the bug Conorhinus) condition. In the cases where this early multiplicative phase is wanting altogether, the trypanosomes taken up by the invertebrate host pass at once into the crithidial phase (*e.g.* *T. vivax* in tsetse-fly).

When a further comparison is made between the development of trypanosomes in the invertebrate host and the development of the closely allied species of

Crithidia (*e.g. C. melophagia* in the sheep-ked) and Leptomonas, which have no alternation of hosts or generations, but are confined during their entire life-history to particular species of invertebrate hosts, it is seen at once that the life-cycles of these parasites of invertebrates are similar in all essential points to the crithidial phases of trypanosomes in their invertebrate hosts. It is evident, therefore, that the crithidial phase in the development of a trypanosome is to be interpreted as a reversion to, or recapitulation of, the type of development that occurred in the ancestral form which was originally a parasite of the invertebrate alone, before it had obtained a footing in the vertebrate host or had acquired the trypanosome-like type of structure; while the multiplicative phases of variable character preceding the crithidial phase in trypanosome-development are to be regarded as having been intercalated secondarily into the life-cycle and of no phylogenetic significance.

Australian Haematozoa.

Dr. J. Burton Cleland remarked that, owing to the geographical isolation of Australia, the study of the blood-parasites of the vertebrates, especially of such as have no easy means of passing over stretches of ocean, is of considerable interest. In some cases, *e.g.* the marsupials, speculation arises as to whether the hæmogregarines found in them reached Australia (1) with the marsupials when these originally came; (2) as parasites of the invertebrate host by a separate arrival; or (3) whether their appearance represented the adaptation in Australia of a parasite, at one time confined to an invertebrate host, to a habitat partly in a vertebrate and partly in an invertebrate host. Dr. Cleland considered the first of these suggestions to be the most reasonable. He directed attention to the records of the principal protozoon parasites of the blood of Australian vertebrates. Plasmodium seems to be rare in birds, while Halteridium is common. Trypanosomes have been found in several species of birds, and often in the same infected birds are large parasites, apparently the intracorpuscular form of the trypanosome.

Australian Trematodes and Cestodes.

Dr. S. J. Johnston passed in review the principal Australian Trematodes and Cestodes, and stated that the entozoan fauna of the host-animals belonging to any particular class of vertebrate might be separated into two divisions: (1) those which have been parasitic in these hosts for a very long time, practically from the first appearance of the host-animals; and (2) those which represent more recent acquirements. The members of the former division may be readily recognised by the fact that they have near relatives parasitic in other branches of the same stock, while members of the latter division generally have not. The members of each genus (or sometimes of several closely related genera) in the former division, in many cases scattered all over the world, constitute a natural group, and must be regarded as derived from common ancestors. These ancestors were parasites of the progenitors of the host-animals in the very early days when the group was much more restricted in its distribution than it is at the present time. A study of the relationships and distribution of the parasites affords some circumstantial evidence of the past movements and paths of dispersal of the host-animals. Dr. Johnston instanced the entozoan fauna of marsupials in Australia, which comprises a number of Cestodes (*e.g.* Linstowia) and Trematodes (*e.g.* Harmostomum), the nearest relatives of which are found in species of the same genera which live parasitic in South American marsupials.

Parasitic Worms of Queensland.

Dr. Wm. Nicoll stated that the hook-worms, Ankylostoma and Necator, are the most common human parasites in Queensland, but these worms are not more common there than in temperate regions. Hydatids are much rarer in Queensland than in other parts of Australia. Dr. Nicoll gave a brief general account of the more important parasites observed in animals in Queensland, and referred in particular to *Onchocerca gibsoni,* the round-worm which causes nodular disease in cattle. The life-history of this worm still remains unknown, but a considerable amount of experimental work has been carried out thereon. It has been suggested that infection is either direct (taking place in young animals) or by the agency of some biting insect. Dr. Breinl's experiments indicate the possibility of infection by means of water, for he was able to induce larvæ of Onchocerca to pass out through the unbroken skin, and to emerge into water where, however, they lived only a short time. Attempts to infect various aquatic animals with the larvæ were unsuccessful. Larvæ ingested by the stable-fly (Stomoxys) were able to live therein for several days, but Dr. Cleland could not detect any development in these larvæ. Dr. Nicoll applied sterile water on a calico pad, or in a glass vessel, to the skin of a cow over an Onchocerca nodule, but did not obtain larvæ. Experiments on excised nodules placed in water showed that the larvæ can, and do, make their escape through the capsule enveloping the worm-nodule, and therefore may be found close to the surface of the body in such positions that they can be readily ingested by a biting insect.

Studies on Echinoderm Larvae.

Dr. T. Mortensen gave an account of his recent work at Misaki (Japan), undertaken with the object of studying the inter-relationships between larval and adult forms of Echinoderms, and of testing the view that within the different families the larvæ have certain structural features in common, for if this prove to be a general rule larval characters may be of considerable importance in helping to settle doubtful cases in Echinoderm classification. Dr. Mortensen reared more or less completely sixteen species. Among these were three Temnopleurids, the larvæ of which have been hitherto unknown. This family has a special form of larva characterised by peculiarities of its skeleton. Four species of Clypeastroids—*Clypeaster japonicus,* Mellita sp., *Laganum fudsiyama,* and *L. decagonale*—were reared; their larvæ all proved to be of the type characteristic of other Clypeastroids. *L. fudsiyama* is a deep-water species (200–1000 mètres), and this is the first time that the larva of a deep-water Echinoderm has been reared. The larva is pelagic and of typical Clypeastroid structure. *L. decagonale* has large eggs, rich in yolk, and in correlation with this the development is shortened, the whole metamorphosis being completed in three to four days. The larva takes no food, the mouth being rudimentary; there is no ciliated band, but a strong general ciliation. The larval skeleton is rudimentary, but of the usual Clypeastroid form; only four larval processes at most are developed, but generally only two, sometimes one, three, or none. *Asterina pectinifera* was found to have a pelagic larva, while the two other species, the development of which is known, take care of the brood and have non-pelagic larvæ. The larva of this species has a Brachiolaria stage, thus proving the correctness of the view that the larval appendages in the young *A. gibbosa* are homologous with the brachiolarian processes of free-swimming larvæ.

Sheep-maggot Flies.

Mr. W. W. Froggatt exhibited specimens of four species of Diptera, the larvæ of which have been found on sheep in New South Wales. The common blow-fly (*Calliphora villosa*) is a serious pest to wool-growers, as it "blows" the soiled wool on the backs of living sheep, and the resulting maggots feed upon the wool-substances, and when full grown fall out and pupate on the ground. This fly will also "blow" meat or any kind of animal matter. Two other species of Calliphora (*oceaniae* and *rufifacies*) also attack sheep and all kinds of animal matter. The fourth fly—*Lucilia sericata*, the green-bottle fly—is the common sheep-maggot fly in Britain, but although found at times breeding in living wool in Australia, is not common in living wool, but is found about Sydney commonly living on all kinds of animal and vegetable matter, and congregating on plants and shrubs. Although it will "blow" meat placed outside, it seldom enters houses as do the common blow-flies. *C. rufifacies* had not been recognised as a sheep-fly as late as 1910, and had not up to that date been bred from the maggots found in soiled wool, though in the west of New South Wales the fly was plentiful about killing yards, freshly skinned sheep, and dead animals. This fly seems to have recently adopted the habit of "blowing" the wool owing to the presence of soiled and "smelly" wool, and in the north and west of the state this is now the common sheep-maggot fly, while the two other species do comparatively little damage in those areas. Mr. Froggatt also exhibited a Chalcid (*Nasonia brevicornis*) which was found to infest the larvæ and pupæ of *C. rufifacies*, and remarked that the discovery of this parasite was important and might possibly lead to new methods of control of the sheep-maggot flies.

The Emergence of the Nymph of ANAX PAPUENSIS.

Mr. R. J. Tillyard described the emergence of the nymph of this insect (order Odonata). During the three days previous to hatching, the beats of the dorsal vessel increase in number from about 30 to nearly 100 per minute, and just before hatching a cephalic heart appears in the posterior head region which drives blood forward into the head. The pressure thus caused forces off the cap of the egg and the nymph emerges quickly, swathed in an outer sheath (the "amniotic covering," Balfour Browne), which is found to be a non-cellular chitinous cuticle, not related in any way to the amnion, but representing the first moult of the larva. The swathed stage, which may be termed the pro-nymph, lasts only a few seconds. The cephalic heart increases enormously and consists of two large chambers which pulsate regularly and drive blood into the head. The latter quickly swells to twice its original size, and thus the pro-nymphal sheath is split dorsally and the young nymph emerges, freeing itself from the sheath by a few convulsive struggles. The cephalic heart quickly subsides in the free nymph. Meanwhile a rectal pulsating organ pumps water into the rectum, the branchial basket there being thus distended, and the whole tracheal system of the nymph becomes gradually filled with air. It is suggested that the rupture and atrophy of the amnion, described by Brandt in the embryology of Odonata, is due to the formation of the pro-nymphal sheath, which forms a close-fitting and far more efficient protection to the embryo.

Scent-distributing Apparatus in Lepidoptera.

Dr. F. A. Dixey pointed out that certain specialised scales found in various situations on the wings, bodies, and limbs of Lepidoptera are well known to be concerned in the distribution of a scent, which is in many cases characteristic of the species. These scales may occur in both sexes, but certain forms of them, *e.g.* the plume-scales of Pierines and Nymphalines, have been found only in males. The Pierine plume-scale often affords a ready means of identifying the species, and is frequently of service in throwing light on questions of affinity.

In some cases a special adaptation exists with the object of economising the scent until it is required for purposes of sexual recognition or attraction; for instance, the costal folds of the fore wing in many Hesperids, and the collection (seen in many Pierines and in some Satyrines and Nymphalines) of the scent-distributing scales into a patch, situated on that portion of the fore or hind wing which is covered in the position of rest.

Mimicry.

Prof. Poulton, after remarking that Australia is the most isolated of all the inhabited continental tracts, considered how far this is reflected in the insect-models and their mimics, and stated that although the subject had hitherto been little studied in Australian material, there were already conclusions of much interest.

Perhaps the most widely spread models in the world are the black, yellow-banded, stinging Hymenoptera. The central members of these powerful combinations are wasps (Diploptera), around which are ranged sand-wasps (Fossores), and, in far smaller numbers, bees (Anthophila), followed by mimetic species of the phytophagous Hymenoptera, and of other orders—Diptera, Coleoptera, Lepidoptera, etc. Throughout this dominant combination of models and mimics the sub-cylindrical body is black, encircled by many bright yellow bands; although widespread over the world, it is especially powerful in the north temperate zone. In Australia, however, its place is taken by a combination with a distinct pattern; the bands are deep-brownish orange (instead of yellow), and are few and broad (instead of many and narrow). This pattern runs through a large and complex set of models and mimics. Prof. Poulton remarked that it was very convincing to compare such a mimetic Asilid fly as the European *Asilus crabroniformis* with the Australian species, and to observe how their very different patterns resemble those of the respective Aculeate models, and that an equally significant comparison may be drawn between the mimetic Longicorn beetles of these two parts of the world.

A question as to whether insects in different geographical areas resembled each other in colour and pattern was answered by Dr. Dixey, who stated that such cases did occur, but were very exceptional, and should, in his opinion, be regarded as mere coincidences. There were no such coincidences known where complex patterns were involved, but when a simple pattern is concerned it may occur more commonly in widely different parts of the world.

Experiments on Silkworms.

Prof. Otto Maas gave an account of his experiments on the feeding of silkworms on different foods, *e.g.* mulberry and Scorzonera. When both parents were fed on Scorzonera the capacity of fertilisation is much inferior to normal, the number of eggs deposited is much fewer, and of the eggs fertilised fewer hatch. In the case where only one parent is fed on Scorzonera the mating may be as fertile as a normal one. A cross between a Scorzonera-fed and a mulberry-fed strain seemed to be superior in strength to one fed only on mulberry.

Species of Victorian Lampreys.

Dr. J. A. Leach stated that examination of 46 lampreys in the National Museum and the University Museum, Melbourne, showed a remarkable amount of

variation in almost every character used by systematists to distinguish different species. In six specimens of *Geotria chilensis* taken alive at the same time, the length of the interspace between the two dorsal fins varied from 0·6 of the length of the dorsal fin to 1·3 times that length. Dr. Leach divides the 24 specimens of Geotria examined into three species, and the 22 specimens of Mordacia into two species. The remarkable, large pouch of *Geotria australis* is not a secondary sexual character, for it is present in females as well as in males; its use is not known.

Notes on Australian Frogs.

Mr. J. Booth commenced work on the Australian frogs in the hope of finding some method of identification without resort to the dissection necessary to examine the sternal apparatus and the sacral vertebræ, but found that description and measurement of the external features could not replace observations on the skeletal girdles, the characters of which are of paramount significance, while the external configuration is more related to the mode of life of the animals and largely corresponds with the classification into swimming, climbing, burrowing frogs. The frogs found in Australia belong almost entirely to the three families of the Arcifera—Cystignathidæ, Hylidæ, and Bufonidæ. To these must be added the family Ranidæ (of the Firmisternia) on account of the occurrence of *Rana papua* in New Guinea, and on account of the recent record of three species of the genus Austrochaperina. Mr. Booth remarked on certain varieties of interest and on the occurrence of abnormal examples, the significance of which was suggested.

Migration of Birds.

Prof. C. J. Patten referred to some features in the diurnal migration of pipits, wagtails, and swallows as observed at Tuskar Rock Light-station (Co. Wexford). In certain periods of spring and autumn a procession of migrants passes this station daily, but owing to the barren nature of the rock comparatively few birds alight. Most birds fly towards the land, even those presumably on emigration. Pipits and wagtails were estimated to travel at about 20 miles per hour, swallows and martins at about 90 miles per hour. On account of the very limited area of the rock, and the considerable altitude at which many of the birds fly, the descending flight for the purpose of alighting, when attempted, is almost perpendicular.

Photographs of Narwhal and Beluga.

Prof. H. F. E. Jungersen exhibited photographs taken at Umanak in Western Greenland by a Danish physician. The first series was of full-grown male narwhals, and showed clearly that the tusk pierces the skin of the left side of the snout above and outside the mouth-opening. Prof. Jungersen remarked that neither text-books nor original descriptions by authors who have examined the narwhal in the flesh give clear statements of the exact relation of the tusk. There is, however, one exception: J. Anderson (1746) states definitely that in a narwhal captured in the Elbe the tusk pierces the left upper lip. The photographs of the Beluga prove that the front end of the snout, under the rounded forehead, forms a short but distinct beak. Most descriptions deny the existence of a "beak," or do not mention it, but in some of the better figures (*e.g.* by Scoresby and Flower) a "beak" is clearly shown.

The Sizes of the Red Blood Cells of Some Vertebrates.

Dr. J. Burton Cleland summarised a series of systematic measurements of the red blood corpuscles of various Australian vertebrates, and stated that the figures seem to indicate that with specialisation has come eventually, both in fishes and birds, a diminution in size of the red cells. The relationships of the various classes of animals to each other is clearly shown in the size of the red cells; those of Elasmobranchs approximate more nearly in size to those of Batrachians and Reptiles than do the red cells of Teleostean fishes. The enormous red cells of the Dipnoi, those of Ceratodus being $39 \times 25\,\mu$, approach those of the Urodela (the red cells of Proteus are said to be $58 \times 35\,\mu$, and those of Amphiuma $77 \times 46\,\mu$). In the frogs and reptiles the size of the red cells has decreased, and in birds the "oldest" forms show distinctly a tendency to larger cells than the more specialised ones, the smallest red cells (10 to 12×5 to $7\,\mu$) being met with in some families of Passerine birds, while the largest ($16 \times 9\,\mu$) are found in the emu.

The Heredity of Some Emotional Traits.

Prof. C. B. Davenport observed that while sociologists, who place great stress on the importance of conditions in determining human traits, have been forced to admit the hereditary basis of feebleMindedness, they still hold, for the most part, to the view that in the moral field heredity plays little part. To test this view, inquiry was undertaken into the inheritance of traits of persons of the criminalistic type, the base of the study being the family history of 165 wayward girls in State institutions of the United States. About 20 traits were considered in some detail; many did not yield any clear-cut results, but in a least five the hereditary factor was clear, and evidently determined the behaviour. (1) The tendency to tantrums or violent outbursts of temper is inherited in adults as a dominent trait, *i.e.*, does not skip generations. In several instances it was possible to trace back the tendency three, four, and even five generations. (2) Violent eroticism was similarly traced back; half of the offspring of a highly erotic parent show similar impulses. (3) Impulsions to suicide are accompanied by depressions, and it appears that this depression is inherited as a recessive or negative character. It ordinarily skips generations, but the tendency is generally found on both sides of the parentage of the affected individual. (4, 5) Two other traits—dipsomania and nomadism—appear to be sex-linked characters transmitted through mothers to some or all of their sons. They appear in daughters typically only when shown by the father and when the tendency is also carried by the mother. If both parents show the trait, all the children have the tendency to develop the trait in due time.

The Hormone Theory of Heredity.

Dr. J. T. Cunningham held that Mendelism throws no direct light on the origin of characters; it deals merely with their transmission. It is inferred, however, by Mendelians that characters transmitted as units arose as units. From the evidence of Mendelian researches it is reasonable to conclude that non-adaptive specific and other diagnostic characters arose in the course of gametogenesis and conjugation, but the doctrine of Mendelism or mutation was, in Dr. Cunningham's opinion, not applicable to the phenomena of adaptation. He cited in support (1) Animals such as the frog, flat-fish, and caterpillar, which exhibit adaptation to two quite different sets of conditions in the individual life, and he held that it was impossible to believe that such transformation was due to mutations not caused by the external conditions, for there is no evidence that the necessary gradual changes could occur unless the conditions produced them. (2) The phenomena of secondary sexual characters, of which one of the most impressive and fully

investigated is that of the antlers of the stag. The Mendelians regard such characters merely as mutations which are coupled with primary sex; but primary sex is determined at fertilisation, and such secondary characters have been shown to be dependent on the presence and function of the gonads. Characters which are determined in the gametes are not generally affected by amputations of the gonads or any part of the body in after life. It has been shown that the effects of castration on the development of secondary sexual characters are due to the stimulus of chemical substances produced by the gonads, especially in their functional activity.

The hormone theory explains how somatic modifications may be transmitted to the gametes, the hypertrophied tissue giving off chemical substances or hormones which stimulate the determinants in the gametes. A special application of this principle is necessary in the case of the functional secondary sexual characters to explain how it is that their development is so closely dependent on the functional activity of the gonads. This special part of the theory assumes that the original modification was produced in the presence of the hormone from the sexual organs, and consequently the inherited modification cannot develop in the soma except in the presence of this hormone.

The following communications were also made to the section, but in the absence of the specimens and diagrams used in illustration they do not lend themselves to the purposes of a summary.—Prof. Poulton gave an account of Dr. Perkins's researches on the colour-groups of Hawaiian wasps, Prof. Jungersen described the anatomy of Pegasus, which he showed to be an Acanthopterygian, and to require at least a suborder of its own, for it is distinguished by several structural peculiarities from all known fishes; Mr. T. Steel exhibited beautifully preserved examples of several species of Peripatus and of Australian land planarians, and added observations on their special features and habits; and Mr. E. de Hamel gave a general account of the ringing of birds and some of the observed results. J. H. ASHWORTH.

THE SUPPLY OF CHEMICALS TO BRITAIN AND HER DEPENDENCIES.[1]

AFTER showing that the foundations of theoretical chemistry were laid almost exclusively by the chemists of England, France, and Sweden, the speaker proceeded to discuss the position of industrial chemistry. The "Report on Chemical and Pharmaceutical Products and Processes" in the International Exhibition of 1862, from the pen of A. W. Hofmann, then professor of chemistry in the Royal College of Chemistry and Royal School of Mines, London, contains the following passage (p. 3):—"The contributions of the United Kingdom, and in particular the splendid chemical display in the Eastern Annexe, prove the British not only to have maintained their pre-eminence among the chemical manufacturers of the world, but to have outdone their own admitted superiority on the corresponding occasion of 1851."

Statistics in relation to the development of the alkali trade show how rapidly the production of what are called "heavy chemicals" was proceeding at this period. Figures derived from returns collected by Mr. Christian Allhusen from 81 per cent. of the manufacturers in the United Kingdom, immediately after the first Great Exhibition, are shown below. These may be compared with statistics prepared by Mr. W. Gossage for the year 1861 immediately before the exhibition of 1862[2]:—

	1852 Tons	1851 Tons
Soda ash	71,193	156,000
Soda crystals	61,044	104,000
Bicarbonate	5,762	13,000
Bleaching powder	13,100	20,000

The value of these products for 1852 was estimated at about $1\frac{1}{4}$ million pounds, while the value of the products of 1861 was calculated by Mr. Gossage at upwards of two millions sterling.

The Board of Trade has recently issued a bulletin concerning German competition in the United Kingdom market, and on p. 2 we find the statement that the soda compounds, excluding chromates and bleaching powder, produced in the United Kingdom in the year 1907, are valued at 3,390,000*l.* The imports from Germany in 1912 are valued at only 8700*l.* As to bleaching materials, the product of the United Kingdom for 1907 is estimated at 527,000*l.*, while the import from Germany for 1912 was 44,600*l.*

From these figures the easy deduction is made that "the imports of these chemicals into the United Kingdom from Germany are relatively insignificant when compared with the output of the same articles in this country. It is clear that in these particular lines British manufacturers have no need to fear German competition in the home market."

Similar remarks apply to aluminous compounds, coal-tar products not dyes, the cyanides, sulphuric acid, and other acids for which the bulletin may be consulted. It thus appears that the British manufacturers of sulphuric acid and soda, from the early times of a century ago, have been able, up to the present, to hold their own against foreign competition, and have thus added substantially to the revenues and well-being of their country.

Now leaving to the department of "heavy chemicals" all such things as agricultural and horticultural washes, coarse disinfectants, and artificial manures, the question arises, How do we in England stand in regard to the supply of drugs, dyes, photographic chemicals, agents for research, and perfumes at a time when many of these things are very urgently needed?

It may be safely asserted that the sources of supply of all these materials in the United Kingdom are seriously inadequate. And, further, we may point to the acknowledged fact that many of the dyes, nearly all the synthetic drugs, and photographic materials have been systematically imported from Germany.

The annual statement of the Board of Trade (p. 108) shows that in 1913 we imported from Germany:—

	£
Alizarin and anthracene dyes	271,119
Aniline and naphthalene dyes	1,382,478
Synthetic indigo	76,681
	£1,730,278

Under the head of "Drugs, unenumerated, including Medicinal Preparations" (p. 107), out of a total of imports from foreign countries and from British possessions amounting to 1,302,860*l.*, more than one-fourth, or to the value of 332,464*l.*, was in 1913 received from Germany. From this is to be deducted the inconsiderable amount of dyes and other chemicals from coal-tar, valued at 24,691*l.*, exported in 1913 to Germany (p. 300). According to the Final Report on the First Census of Production of the United Kingdom for 1907 (p. 547), this country made 139,000 cwt. of coal-tar dyes, valued at 373,000*l.*, of which practically the whole was consumed at home.

[1] Abstract of a paper read before the Royal Society of Arts on November 25 by Sir William A. Tilden, F.R.S.

[2] Gossage's "History of the Soda Manufacture."