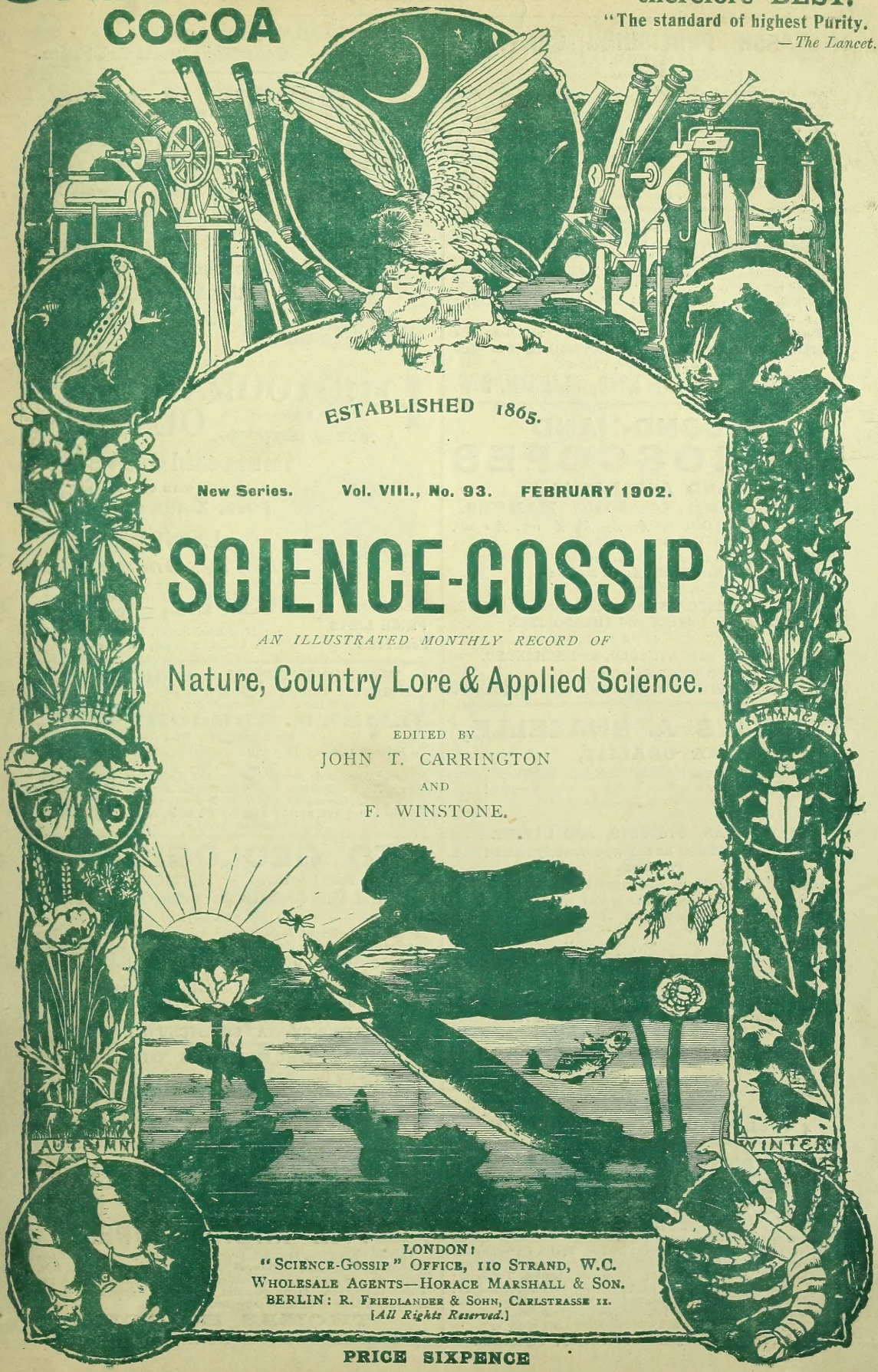


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# SCIENCE-GOSSIP

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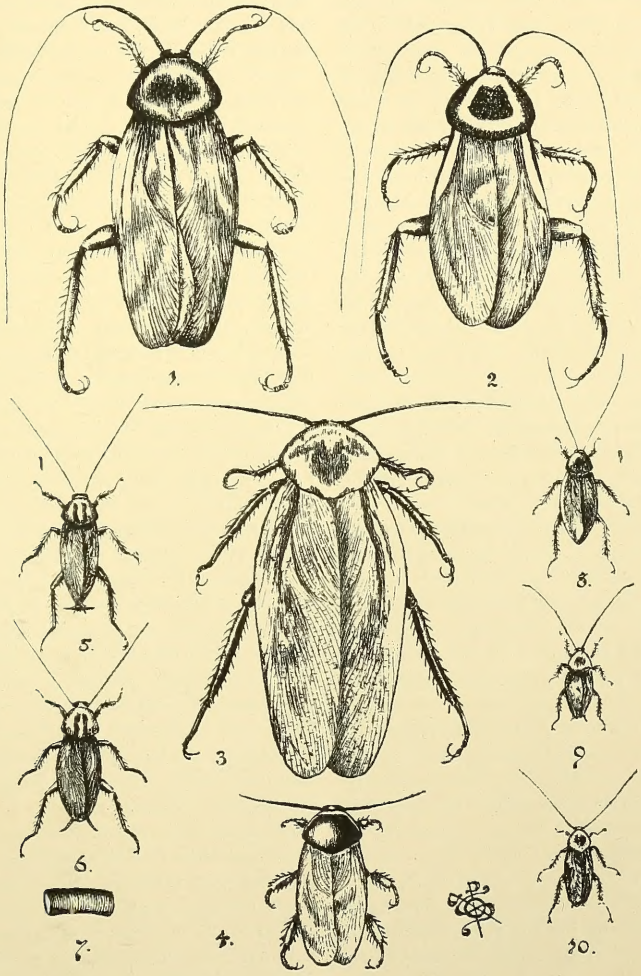
# OUR COCKROACHES.

By E. J. Burgess Sopp, F.R.Met.Soc., F.E.S.

## BLATTIDAE.

At a coroner's inquest held some months ago in the South of England it transpired that the death of the unfortunate victim had been caused through a chance encounter with a "blackbeetle" on the stairs, so terrifying her that she slipped and sustained injuries which proved fatal. Although happily rarely resulting in so tragic an end, there is little doubt that our common cockroach is the unwitting cause of frequent shocks to the fairer sex. Well known although he now is, and faithful to a degree, this familiar household scavenger has never become a favourite. He never figures as an example like others of his class in the story-books of our youth, nor has he evoked the rapture of the poets like his more fortunate allies, the grasshoppers and crickets. Even naturalists have little




1. *Periplaneta americana* Linn. 2. *P. australasiae* Fabr. 3. *Rhyparobia maderae* Fabr. 4. *Leucophaea surinamensis* Linn. 5. *Phyllodromia germanica* Linn., male. 6. *P. germanica* Linn., female. 7. *Oötheca of P. germanica* Linn. 8. *Ectobia lapponica* Linn., male. 9. *E. panzeri* Steph., male. 10. *E. livida* Fabr. (Drawn by E. J. B. Sopp.)

to say in his favour, and one may search entomological literature in vain, from Moufet's "Insectorum Theatrum" (1634) to Dr. Sharp's monograph in the "Cambridge Natural History" (1895), for any substantial testimony to the credit of the cockroach. One author, for instance, assures us that this "pestiferous race of beings," *i.e.* cockroaches, "are particularly noisome to collectors," though we are not told in what way; whilst again we learn that "these nasty and voracious insects fly out in the evenings and commit monstrous depredations . . . they are very fond of ink and of oil into which they are apt to fall and perish. In this case they soon turn most offensively putrid, so that a man might as well sit over the cadaverous body of a large animal as write with the ink in which they have died" (1). In common too with its near ally, the earwig, the cockroach has often been misunderstood, and occasionally maligned. It has been seriously suggested that certain of his ancestors constituted themselves one of the plagues of Egypt (2), the Hebrew word "Oreb," usually translated "fly," being rendered "beetle" by Geddes and others, and the species designated by Dr. Harris, "Nat. Hist. of Bible," *Blatta aegyptiaca* Linn., in which he has the support of Rosenmuller and Michaelis, "Oriental Bible," nov. pp. 5, 28. It must, however, be borne in mind, as pointed out by Hope (3), that the word *Blatta* had not amongst the ancients the restricted meaning which it now enjoys, and there is no evidence to show that "Oreb" would be more correctly rendered a swarm of cockroaches than a plague of flies.

The ancestry of our cockroaches extends so far back in time, that they can well afford to waive all claim to having played a questionable part in Egyptian history, a paltry three or four thousand years ago; a period which, although to us dim with antiquity, is but yesterday in the lineage of the Blattidae. It is often asserted that the oldest remains of a cockroach are those which were found in the Caradoc Beds of Calvados in France during 1884 by M. Douville, and named after him *Palaeoblattina douvillei*. This is scarcely confirmed by later authorities, who maintain that the claim of these ancient wing-remains to be considered orthopterous at all, rests on extremely slender grounds, and that our oldest undoubted cockroach remains are ultra-European. The most archaic types at present known have been found in the Lower Carboniferous strata of the United States of America. This question of origin, however, does not concern us here, and we may well leave its discussion to the geologists and palaeontologists, whom it more closely interests. In either case the claim of the cockroach to extreme antiquity is fully established, and in consideration of the fact it may not prove uninteresting to glance back for a moment to the conditions prevailing in those far-off days, when its early ancestors were known to exist.

During Devonian times the amount of dry land appearing above the waters had probably been greater than in preceding ages. The earlier strata of that system were principally laid down beneath the sea, but later formations seem to have been largely precipitated in extensive and probably somewhat shallow inland seas or lakes. Ireland was joined to England, and it is not unlikely that one of the land-locked basins of Scotland extended across to the Irish region. The period was one of considerable volcanic activity. Evidence of both sub-aqueous and sub-aërial eruptions is furnished in Britain, the former by the intervening beds of lava in Devon, Cornwall, etc., the latter by the Cheviots and Sidlaw Hills (4). Shortly after the commencement of the Carboniferous period a general submergence of the land occurred in this part of the globe, until Britain was represented in prehistoric seas by an archipelago, of which perhaps the largest islets consisted of the higher land of Ireland, Scotland, a portion of North Wales, the Midlands, and the Silurian district of Cumberland. That long and continuous submergence occurred, is evinced in many localities by the thickness of the limestone deposits of the earlier period, whilst the numerous bands of coal and the alternation of land and marine fossils point to subsequent frequent and often somewhat rapid secular oscillations of the surface. During these later periods of elevation vast forests flourished on the boggy mud flats along the courses of, and about the mouths of rivers, on the low spongy margins of primeval lagoons or estuarine waters, which were likened by the late Dr. Brown to the mangrove swamps of the West African rivers and Indian coast, or the cypress swamps of the Lower Mississippi at the present day. Amongst the debris of this rank vegetation and in the tangled jungles that clothed the higher slopes, it is probable early ancestors of our cockroaches flourished, in a climate rather more tropical in character than that of the Northern Island of New Zealand now (Hooker), in an atmosphere slightly more charged with carbonic acid than is ours, which would conduce to a uniformity of temperature over wide areas at present differing considerably in climate. I am aware this latter premise has been rupudiated by many authorities; Dubois, for instance, goes so far as to say "the supposition of a formerly greater amount of carbonic acid in the atmosphere can no longer be seriously discussed" (5), but the enormous heat-retaining and protecting power of carbonic acid was not until recently known, all the earlier theories propounded

(1) "Nat. Hist. of Insects," Lond. vol. ii. 92.

(2) "Bridgewater Treatise," ii. 357.

(3) F. W. Hope, "Observations in Support of Opinion that the Blatta or Cockroach cannot be considered the same insect as Oreb," 8vo. Lond. 1839.

(4) Robert Brown, "Our Earth," vol. ii. ch. 5.

(5) "The Climates of the Geological Past," Eug. Dubois.

requiring so great an increase of this irrespirable gas to explain the warm and uniform climate of earlier geological epochs, as to have rendered the atmosphere fatal to all animal life. Basing his calculations on the result of researches by Fourier, Tyndall, Pouillet, Langley, Paschen, Knut Angström, and other workers, the eminent Swedish meteorologist, Svante Arrhenius ([6]), has been able to present the matter to us in quite a different light. The later invaluable contribution to the subject by Dr. Nils Ekholm ([7]), has still further served to acquaint us with the very slight variation necessary in the apparently insignificant amount of carbonic acid now present in the atmosphere, to change our present climate to that of the Great Ice Age, or to give to the arctic regions the genial warmth of the temperate zone.

Although fossils had attracted attention from very early times they were formerly regarded more as "freaks of nature" than as links with the past, and it was left for the celebrated French naturalists, Buffon and Cuvier, to first direct serious attention to them, the study of insect palaeontology being shortly afterwards taken up by Marcel de Serrés. The first publication dealing with purely British fossil insects was Brodie's ([8]) monograph, whilst for our knowledge of the ancestral development and evolution of the cockroach in particular, we are more especially indebted to the indefatigable labours of the eminent American phytogenist, Samuel H. Scudder ([9]). Almost the whole of our knowledge of these earlier types has been derived from the wings, the membranes and veins of which are sometimes preserved with astonishing perfection. From these we learn that although through the long eons of time that have elapsed the general form and appearance of the Blattidae have altered little, existing species differ from their earliest ancestors in detail. For whereas in modern cockroaches the anterior pair of wings has become modified into tough protecting covers or tegmina, in archaic forms all four of these thoracic appendages were alike in structure and equally transparent. The number of main veins, too, in these antique species were the same in all the wings, whereas in existing members of the group, two or more have blended in the anterior pair and thus stiffened them for shielding purposes. Having thus briefly contrasted our earliest and latest insects, it will prove of interest to refer in passing to the intermediate or Mesozoic types, which we may, perhaps, as a whole be allowed to claim as "connecting links," for although some few show little alteration from the archaic form, in a by no means inconsiderable portion, the venation of the tegmina exhibits a distinct advance approximating to that of our modern cockroaches.

Nearly seventy species have been found in England, principally from the Purbecks of Wilts and Dorset, and the Upper and Lower Lias of Gloucestershire, Warwickshire, and Worcestershire ([10]). The Coal-measures of Commentry in France have yielded over six hundred specimens of cockroaches, whilst many more have been recorded from the rich fossiliferous Carboniferous Rocks of Switzerland by Heet, who states that during this geological period they were unquestionably the most widely distributed and abundant of all our insects. This opinion is fully endorsed by Scudder, who says "they [cockroaches] so far outnumber all other types of insects that this period, so far as its hexapodal fauna is concerned, may fairly be called the 'age of cockroaches'" ([11]). It has been noted that the average size of specimens from the British Oölites is less than those from the Lias, which in turn are slightly smaller than those from the underlying Triassic beds. That is to say, so far as our British fossils are concerned, the farther we go back in time the larger do our cockroaches appear to have been. In a paper on fossil insects generally, read before the Warwickshire Naturalists' and Archaeologists' Field Club at Warwick in 1889, the president, the Rev. P. B. Brodie, said: "There is a great difference between the Purbeck insects in the two chief localities in Wilts and Dorset, where they occur most frequently. In the limestone in the former, which contains the Middle Purbecks, they are much better preserved, with the wings and other parts of the body attached, though the wings are rarely expanded. In the latter county they are generally in masses, often covering the slabs of stone, much broken up, wings and elytra of beetles with other parts of insects lying thick together, but entire insects are extremely rare. The mode of deposit in these two cases must have varied considerably" ([12]). In treating of the fossil insects of Bavaria, Dr. Hagan has called attention to the perfect state of preservation of the majority of specimens from that part of Germany, from which he infers both a proximity to land and slow precipitation of sediment at the time they were embedded. Whether any such factor could have contributed to mark the difference between our

(6) "On the Influence of Carbonic Acid in the Air upon the Temperature of the Ground."

(7) On the Variations of Climate of the Geological and Historical Past and their Causes, "Quart. Jour. R. Met. Soc." 1901. (For recent publications bearing on earlier climate generally see also Harmer, On the Influence of Winds upon Climate during the Pleistocene Epoch, "Jour. Geol. Soc.," 1901; Phipson, "Researches on History of Earth's Atmosphere," 1901.)

(8) "History of the Fossil Insects in the Secondary Rocks of England," P. B. Brodie, Lond. 1845.

(9) "Palaeozoic Cockroaches," Boston, 1879; "Review of Mesozoic Cockroaches," Boston, 1886; "The Cockroach of the Past," London, 1886.

(10) P. B. Brodie, "On the Prominence and Importance of the Blattidae in the Old World" (1889); see also H. Woodward, "Some new British Carboniferous Cockroaches" (1887) and "On a Remarkable Fossil Orthopterous Insect from Scotland."

(11) "The Cockroach of the Past."

(12) P. B. Brodie, "On the Character, Variety, and Distribution of Fossil Insects in the Palaeozoic, Mesozoic, and Cainozoic Periods."

Wiltshire and Dorsetshire remains, it is not my intention to discuss in the present article. Although these beds are mainly of fresh water, or at the most of brackish origin, possibly pointing to nearness of land, it must not be overlooked that there is a break pointing to a change of conditions at one period of their formation. Of Cainozoic types there is a paucity; but these, few as they are, are of interest in still further exhibiting a continuity of development on the lines of our existing cockroaches, more especially in the thickening of the forewings or tegmina, which now approach to an almost exact likeness of those borne by present members of the family.

Our British cockroaches lack the beautiful colouring often displayed by others in different quarters of the globe. In *Corydia petitveriana*, for instance, which I lately received from Madras, the under-wings and sides of the abdomen are bright orange, the deep black elytra being boldly decorated with seven large cream-coloured spots. *Panesthia javanica*, from Sumatra, has its upper surface pleasingly relieved by two yellow triangular patches. Neither can we boast of so many species as would probably be the case were our climate less fickle and our winters less severe, for the Blattidae are lovers of warmth and are only numerous in tropical regions. Although a few are indigenous to our islands, it is with an introduced species, *Blatta* (*Stilopyga*) *orientalis* (figs. 11, 12, 15, and 16), we are mostly familiar. This is the ubiquitous "blackbeetle" of our kitchens and cupboards, which insect, although now generally known by the latter name, it is scarcely necessary to remark, is neither black nor a beetle at all. The colour of this household pest is of a warm dark ruddy brown, save where its chitinous covering is thinnest, when it partakes of a brighter amber hue, whilst it belongs to the Orthoptera and not to the Coleoptera, the former family once forming the order Dictyoptera of Leach. Our word "cockroach" is derived from the Spanish *cucarácha*, which signifies both cockroach and wood-louse ([13]), the former portion of the word being in turn traceable to the Latin *coccum*, a berry, the diminutive termination *-ácha* denoting mean or contemptible (Jas. M. Miall), so that the whole term is capable of a somewhat free rendering as a "contemptible little berry." The habit of the wood-lice of rolling themselves into balls is well known, and the term may have been first applied in the case of the cockroaches in connection with the oöthecae or egg-purses (figs. 7 and 14), which in many species, as in our common "blackbeetle" for instance, certainly bear a superficial resemblance to seeds or berries, more especially after exposure to the air has imparted to them their dark brown hue.

(13) "Standard Dict. of English Language," 1900, vol. i. p. 362.

(*To be continued.*)

## STUDY OF A LOWER ORGANISM.

By Harold A. Haig.

It frequently happens that whilst seeking for some object under the microscope the searcher comes across various animalcula whose sizes range from the minute dot that is seen darting about in all directions, apparently without any fixed purpose, to those of more considerable dimensions that move less rapidly and appear, from their constant presence near filaments of algae, to be looking for food.

Now, many of these organisms are to be found in preparations of pond-water where *Spirogyra* or *Vaucheria* abound; one of them, *Paramoecium*, is particularly interesting, both on account of the ease with which observations may be made upon it, and also the fact that it is unicellular, bringing us down to some of the fundamental problems of cell-life. With a microscope giving a magnification of some 600–700 diameters we may make out all that we require. It is best to study the living organism; but we may also "fix" it, if necessary, by slightly warming the slide over a gas-flame. The latter method is often employed where structural details are under observation.

If we focus the body of this animalcule ([1]) into different planes we may determine that it is made up of (i.) a firm outer layer that has been called the "ectosarc"; and from the motions of certain particles inside this outer layer we argue the existence of (ii.) a more fluid inner portion or "endosarc." Both of these are protoplasmic in nature, and the whole organism is thus comparable in gross structure with an amoeba in which we see the same two subdivisions into "ectosarc" and "endosarc."

The greater part of the surface of the body is covered with a number of whip-like processes, or cilia, which are in continual movement. It is by means of these that the organism is propelled along in the medium in which it lives. We shall return later to the peculiar motion that each cilium presents if closely watched. If we view the lateral or broader surface of the body, we shall notice

(1) It may be here mentioned that in form *Paramoecium* is oval and bilaterally compressed, so that if viewed edgewise it is spindle-shaped. (See fig. 1.) The surface of the body presents longitudinal striations.

along one of the borders a curious vesicle, quite clear in appearance. This is probably only a space in the endosarc, but, if watched, it will be seen to vanish suddenly at intervals of about half a minute; then to slowly reappear and grow to its full size. This vesicle is termed the "contractile vacuole." It is important in being functional as an excretory organ; and if we watch carefully we shall see close to the vesicle, near the border of the body, one or more narrow slits through which the fluid contents of the vesicle are suddenly expelled. The waste products that are constantly being formed by the oxidation of the protoplasm are being continually poured into the vesicle, which grows during the process, and when full is forcibly contracted. Moreover, at a certain spot at the side, the ectosarc dips down into a sort of cavity, one side of which is fringed with a number of processes or cilia, comparable to those on the general

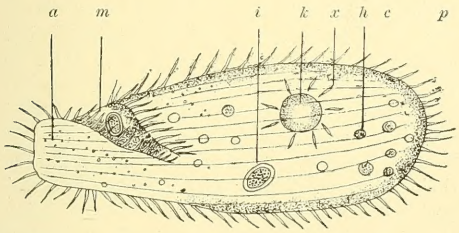



Fig. 1. Paramoecium in Optical Section.

*a*. Anterior end. *p*. Posterior end. *m*. Mouth. *i*. Desmids undergoing digestion, one having just been taken in at mouth. *k*. The contractile vacuole. *x*. Radial slits for passage outwards of excretory products. *h*. Food-particles. *c*. Cilia.

surface of the body. This cavity forms the mouth, or stomodaeum, of the organism. On viewing the lateral surface we can discern that from this mouth there proceeds a funnel-shaped depression that leads into the endosarc. It is this depression that forms the so-called pharynx, through which particles of food or small organisms are introduced into the interior. (See fig. 1.)

The possession of a fringe of cilia along the margins of the pharynx enables *Paramoecium* to feed—*i.e.* capture small objects such as Desmids or Diatoms. The manner in which this is brought about is of especial interest. The cilia of the fringe produce by their rapid to-and-fro movements currents that sweep small particles and large, lying near, right into the pharyngeal tube, thence on into the endosarc. At the same time the power is possessed of being able to reject such matters as are not suitable for food, and these are swept past the mouth with great rapidity. Once in the pharynx the particle is forced down into the internal protoplasm, where a process of digestion goes on, aided, in all probability, by a certain ferment manufactured by the protoplasm. The hard external layers (cellulose) of such objects as Desmids are here partly dissolved, or partly thrown out again, through the stomatal orifice. In the accompanying figure two algal cells (probably

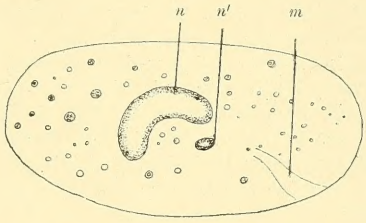



Fig. 2. A Single Paramoecium fixed by Heat and stained with Eosin and Methylene-blue to differentiate the Nuclei from the Cell-body.

*n*. Macronucleus. *n'*. Micronucleus. *m*. Mouth.

Desmideae) have just been taken in, and one is in the act of entering the pharynx.

The contractile vacuole (2) will on closer observation be seen to present certain stages during growth to its full size, the first of these being one in which the vacuole possesses an elongated form, then more spherical, until finally it becomes quite circular in outline and suddenly bursts, the contents being forced out through the slit that we have already noticed. These contents are always quite clear and fluid. From this it may be argued that the nitrogenous, and perhaps some of the carbonaceous waste leaves the organism in solution as ammonia and carbon dioxide, or at least in some highly oxidised form.

*Paramoecium* is one of those protozoans in which occurs the method of reproduction known as "rejuvenescence." Up to this point we have made no mention of the "nuclei" that are

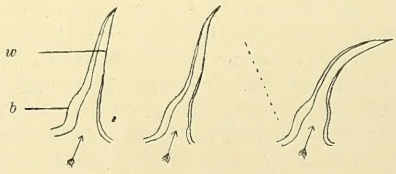



Fig. 3. Diagrams illustrating the Action and Structure of a Cilium.

(1) *b*. Base of cilium; *w*. Thin-walled side. (2) Cilium half-bent by influx of endoplasm, indicated by arrow. (3) Cilium nearly wholly bent. The dotted line indicates the extent to which it will spring back.

present in this organism, of which there are two—a "macronucleus" and a "micronucleus." It is the latter of these that is potential in reproduction; the former during rejuvenescence merely disintegrates and is absorbed, being probably of some nutritive value.

In rejuvenescence two individuals, of identical

(2) There may be more than one vacuole present, but there is usually one large one.

form and dimensions, for there is no absolute sexual difference, join by means of their stomata, and the micronuclei divide several times, the result being the presence of four nuclei at both ends of each organism. An interchange of certain of these then takes place, and fusion of them results in the so-called rejuvenescence. The advantage of this process is, that the species is practically immortal, as is the case in many of these lower organisms. (See fig. 2.) *Paramoecium* may also reproduce by fission, or dividing into two, and so on; but the former method is the more frequent.

We will now study more in detail the "cilia" and their movements. Each cilium is seen by careful focussing to consist of two parts—(1) a basal part, and (2) an apical whip-like prolongation. The greatest range of movement takes place in this latter portion. There occurs a sudden bending in one direction, and then one just as rapid in the opposite direction, so that the cilium is brought back to its initial position. The explanation of this movement is based upon certain assumptions. First of all, that side of the cilium towards which the first movement takes place is held to be thinner than the opposite side, and gets gradually attenuated towards the apex. Let us now suppose that some fluid is forced suddenly into this cilium, which is necessarily hollow. It will bend towards that side where there is least resistance—i.e. towards the thinner side. If we now replace our fluid by the endosarc of *Paramoecium* we have practically the same result. Moreover, if the fluid be suddenly withdrawn we have the cilium rapidly straightened, and perhaps springing back in the opposite direction. (See fig. 3.)

We have seen that *Paramoecium* feeds, but we have also a process of respiration going on, or rather an internal respiration, oxygen entering in solution through the ectosarc or through the mouth, being used up in oxidising the substance of both ectosarc and endosarc. The result of this is the breaking down of the protoplasm into bodies such as ammonia and carbon dioxide, as final products of katabolism, these being got rid of by the agency of the contractile vacuole.

We have, therefore, in this organism a striking exponent, on a small scale, of some of the fundamental life-factors, namely, absorption, respiration, excretion, and, last of all, but not least, reproduction. In other words, it presents us with an illustration of what must, to a certain extent, go on in every living cell, whether solitary or forming a portion of some living tissue. Moreover, this organism possesses a certain power of selection, a fact which is of especial importance to the biologist, as it explains many difficulties that have arisen with respect to nutrition; but this selection is of a more or less instinctive variety, as is evidenced by the fact that unsuitable materials are rejected, suitable ones taken in, and this choice exhibited in a very marked manner. We see in the vegetable kingdom a power of selection possessed by the root-hairs of plants, but this, although perhaps of the same ultimate origin, is only evidenced in a passive manner. In fact we find in such organisms as *Amoeba* and *Paramoecium*, indeed most Protozoa, the first signs of that rather vague term "instinct," which we use so frequently in speaking of animals on a higher scale of evolution.

The differentiation of the body of *Paramoecium* into ectosarc and endosarc opens up another question of great biological interest, for here we get the first indication of that great division into two main layers, "epiblast" and "hypoblast," that we find in higher animals. The former of these layers is that which gives rise to the protective and nervous systems, the latter remaining for the most part absorptive in function. In the earlier stages of development of all animals, and in some Hydrozoa (*Hydra*) for the whole of their existence, these layers are to be distinguished, but in these cases are more differentiated than mere ectosarc and endosarc, for we have the layers comprised of a large number of cells, and there is on this account a greater division of labour. Nevertheless, the two cases are comparable in their gross relations. The ectosarc is certainly protective, and the cilia may act on occasion as tactile organs, the endosarc being chiefly concerned in nutrition.

We thus see that *Paramoecium* repeats on a small scale most of those functions which in more highly organised animals are divided between various aggregates of cells, going to form organs. It is only in this sense that we can speak of these other animals as being on a higher scale of evolution, in that they are enabled by means of these cell-aggregates to effect a division of labour. Further, it is this absence of division of labour which in the case of *Paramoecium* entitles us to speak of it as a lower organism, for in ultimate analysis of function it is as perfect as any other.

*University College, London, W.C.*

ETHNOLOGY OF THE MASAI.—Mr. Sidney Hinde, the well-known Resident of the British East African Protectorate, has just written a fascinating work on "The Last of the Masai." When at the height of their prestige, the Masai neither made slaves nor took prisoners on their raiding expeditions, nor did they marry or allow their women to marry outside the sept. As they were in no sense traders, they remained an isolated race. One result of this was the survival of customs and superstitions which elsewhere were surrendered under the pressure of civilisation. Their rulers are credited with the power of second sight, which the people say they can evoke at will. They are believed to transmit the gift to their heirs through the agency of a cunningly kept secret. Mr. Hinde refutes the prevailing view that the Masai are of the same stock as the Zulus.—(*Rev.*) *J. M. Cobbett. Albany Street, London, N.W.*

# NOTES ON SUSSEX PLANTS.

By Thomas Hilton.

In August 1899 I sent to Science-Gossip (vol. v., N.S., p. 260) some notes on the flowering plants of the county of Sussex. Since then most of the following have come under my notice.

The year 1901 was in some respects unfavourable to collectors of specimens. The warm weather began very late in the season, and the summer was very dry. Many plants, orchids especially, were consequently not plentiful. This condition of things was compensated by a good autumn growth.

*Adonis autumnalis* Linn.—This plant has been known on cultivated land at Telscombe for many years.

*Ranunculus hiltoni* H. and J. Groves.—Occurred with *R. lenormandi* and *R. peltatus* on Copthorne Common, East Sussex.

*Fumaria pallidiflora* Jord., *F. confusa*, and *F. muralis* Sonder.—All these species were found near Uckfield on cultivated land.

*Sisymbrium columnae* Jacq.—Found at Brighton.

*Diplotaxis tenuifolia* DC.—Found near Newhaven, East Sussex.

*Lepidium virginatum.*—At Fishersgate, East Sussex.

*Lepidium perfoliatum.*—At Aldrington Quay, East Sussex.

*Viola hirta* f. *lactiflora* Reich.—At Chanctonbury Ring, West Sussex, at an altitude of 780 feet. I had not found the white form before, and this year it was not produced, probably through the lateness of spring.

*Viola sylvestris* f. *leucantha* G. Beck.—Found at Newtimber.

*Viola lactea* Sm.—Chailey Common, East Sussex.

*Polygala oxyptera* Reichb.—Downs above Bevendean, East Sussex.

*Polygala dunense* Dum.—Found on Downs near Jevington, East Sussex.

*Silene nutans* var. *paradoxa* Sm.—I have found this variety in three places on the open Downs within a few miles of Brighton, where it is certainly native. In Babington's "Manual" a plant that is found at Dover is described under the above name. I can find no difference between them, but Mr. Marshall names this *Silene italica* Pers.

*Silene gallica.*—On cultivated land at Woodendean, East Sussex.

*Stellaria media* var. *boraeana* Jord.—On the foreshore at Aldrington, East Sussex.

*Montia fontana* var. *erecta* Pers.—Chailey Common, East Sussex, in May.

*Elatine hexandra* DC.—I found this on the margin of a pond at Piltdown, East Sussex.

*Trigonella caerulea.*—Occurs at Fishersgate, East Sussex.

*Spiraea denudata* Boenn.—By Horsted Keynes Railway Station, East Sussex.

*Rubus plicatus* var. *bertramii.*—On Wiggenholt Common in West Sussex.

*Rubus anglosaxonicus* Gelert.—Occurred at Wiston, in West Sussex, during 1900.

*Drosera intermedia* Hayne.—Also occurred in Ashdown Forest, East Sussex.

*Myriophyllum verticillatum* Linn.—Occurs in ditches at Old Shoreham, West Sussex.

*Callitriche hamulata* var. *pedunculata* DC., with many of the flowers long peduncled.—Mr. C. E. Salmon appears to agree with this naming; but as in the "Student's Flora" it is described as having all the leaves linear, and in this all the leaves are obovate, I am not quite satisfied with my identification.

*Caucalis latifolia* Linn. and *C. daucoides* Linn.—Both these plants grew by the Custom House, Kingston, West Sussex, in June 1900 and 1901.

*Lonicera caprifolium* Linn.—At Clayton Holt, East Sussex.

*Galium anglicum* Huds.—In two places between Seaford and Berwick in East Sussex. I think this is a new record for Sussex, though it was first found by the Rev. E. Ellman at Plumpton in this county.

*Valeriana mikanii* Syme.—Found in June at Newtimber Holt, East Sussex.

*Xanthium strumarium* Linn.—Grows near the Custom House, Kingston, West Sussex.

*Xanthium spinosum.*—This Australian plant grew freely and ripened its fruit in August 1900 on a sandy patch by the Custom House at Kingston, West Sussex, but has not reappeared in 1901.

*Crepis foetida* Linn.—Field near Seaford in 1900, and in three places near Brighton in 1901.

*Crepis setosa* Hall.—In a field of saintfoin near Brighton.

*Lactuca virosa* Linn.—Found at Amberley Castle in West Sussex.

*Anagallis caerulea* Schret.—Grows by the Custom House, Kingston, West Sussex.

*Solanum rostratum.*—Several plants on Perching Sands Farm, Fulking, West Sussex. It is a Mexican plant.

*Linaria vulgaris* Mill.—The peloria form was found on Warren Farm, at Rottingdean, East Sussex.

*Euphrasia kerneri.*—Found in Stanmer Park, East Sussex.

*Galeopsi tetrahit* var. *nigrescens.*—At Houghton, West Sussex, in August.

*Lamium hybridum* Vill.—Tongdean and Ditchling in East Sussex.

*Amaranthus albus.*—Found on cultivated land at Woodendean, East Sussex.

*Chenopodium vulvaria* Linn.—Near Shoreham in West Sussex.

*Chenopodium opulifolium* Schrad.—By Shoreham Harbour, West Sussex.

*Atriplex rosea.*—Fide Mr. J. Groves.

A group of vigorous plants occurred in 1900 and 1901 at Shoreham.

*Salicornia appressa* Dum.—Found in August near Shoreham, West Sussex, and at Cuckmere Haven in East Sussex.

*Polygonum minus* Huds.—Found in August at Amberley, Wildbrooks, West Sussex.

*Rumex palustris.*—Near Lewes, and at Charleston Pond, near Cuckmere Haven, East Sussex.

*Salix pentandra* Linn.—Found in osier-beds at Edburton, West Sussex.

*Epipactis latifolia* All.—Woolstonbury Hill, Piecombe, East Sussex.

*Potamogeton alpinus* Balb.—In a stream at Barcombe Mills, East Sussex. *P. obtusifolius* Mert. and Kock.—In ditches at Barcombe Mills, East Sussex.

*Potamogeton trichoides* Cham.—Reported before; has now been identified by Mr. A. Bennett as the variety *trimmeri* Casp.

*Ruppia rostellata* Koch.—Occurs in July in a ditch near Lewes, East Sussex.

*Eleocharis acicularis* R. Br.—At a pond on Slaugham Common, and abundant at Slaugham Pond, West Sussex.

*Scirpus setaceus* Linn.—Ashdown Forest, East Sussex.

*Eriophorum vaginatum* Linn.—At Amberley Wildbrooks, West Sussex, in June.

*Rhynchospora alba* Vahl.—Found in Ashdown Forest, East Sussex.

*Carex hirta* Linn.—A form, almost glabrous, is plentiful on the Downs, near Baldsdean, East Sussex, where there is no water except sheep ponds for miles around.

*Alopecurus fulvus* Sm.—In a swamp in Ashdown Forest, East Sussex.

*Poa bulbosa* Linn.—On the race-hill at Brighton. This grass grows chiefly in the sand on the coast. I am not aware that it has been found elsewhere on the Downs.

*Festuca elatior* Linn., × *Lolium perenne* Linn.—Occurs in swamp by the "Pad" at Lancing, West Sussex.

*Equisetum maximum* Lam.—Occurs at Poynings in East Sussex.

*Pilularia globulifera* Linn.—Found at the pond on Slaugham Common, West Sussex.

*Tolypella prolifera* Leonh.—Occurred at Amberley in West Sussex in ditches in 1900–1901. Mr. J. Groves writes of this plant: "It is a very interesting find, not having been collected in Sussex since Borrer originally described it."

*Nitella flexilis* Agardh.—Found in July at a pond on Chailey Common, East Sussex.

The following are alien genera:—

*Erysimum repandum.*—Occurs at Fishersgate, East Sussex.

*Ambrosia artemisaefolia.*—At Fishersgate in East Sussex.

*Eruca sativa.*—At Fishersgate, East Sussex.

I am not able to compare the number of flowering plants found in other counties with those of Sussex, but the Brighton and Hove Natural History Society have in their herbarium over 1,100 species and varieties, all collected in the last ten years.

16 *Kensington Place, Brighton,*
*January* 1*st*, 1902.

## AN INTRODUCTION TO BRITISH SPIDERS.

By Frank Percy Smith.

(*Continued from page* 236.)

### GENUS *ERO* KOCH.

Legs I. and II. are furnished with a row of long strong spines upon the undersides of the tibiae, metatarsi, and tarsi. The abdomen is almost spherical, ornamented with two or more protuberances upon its upper surface.

**Ero furcata** Vill. (*Ero thoracica* in "Spiders of Dorset"; *Theridion variegatum* Bl.)

Length. Male 2.7 mm., female larger.

In this species the abdomen is furnished with two small prominences near the centre of its upper side. It is not uncommon.

**Ero tuberculata** De Geer.

Length. Male 3.2 mm., female larger.

Abdomen furnished with four distinct protuberances. An extremely rare spider.

### FAMILY *ARGIOPIDAE.*

The representatives of this family may as a rule be distinguished from the Theridiidae by the clypeus being narrower than the ocular area. The eyes are usually arranged in three well-separated groups of 2, 4, 2. Most of the included species are of moderate or large size, and the majority fabricate orbicular snares.

### GENUS *PACHYGNATHA* SUND.

Falces greatly developed and divergent. Maxillae very long. Legs without spines. Female without epigynum, the genital aperture being a simple transverse opening some distance behind the spiracular plates. The spiders of this genus are found in low herbage, flood refuse, etc. They spin a snare of a most rudimentary type, consisting simply of a few threads placed apparently at random.

**Pachygnatha degeerii** Sund.

Length. Male 3 mm., female 3 mm.

Cephalo-thorax blackish-brown. A very common species.

**Pachygnatha clerckii** Sund.

Length. Male 6 mm., female 6.5 mm.

Cephalo-thorax warm yellowish-brown, with central and two lateral blackish markings. Not rare.

**Pachygnatha listeri** Sund.

Length. Male 3.5 mm., female 3.7 mm.

Cephalo-thorax bright reddish-brown, with a distinct central black band. Somewhat uncommon.

GENUS *TETRAGNATHA* LATR.

Falces enormously developed. Maxillae extremely long and very wide at their extremities. Legs long, slender, and furnished with numerous spines. Lateral eyes considerably closer than the fore-centrals to the hind-centrals, but not in contact. These spiders spin orbicular snares.

**Tetragnatha solandrii** Scop.

Length. Male 7 mm., female 9 mm.

This common species is figured.

**Tetragnatha extensa** Linn.

Length. Male 7 mm., female 9 mm.

Closely resembles *T. solandrii* in size and markings. The female, however, lacks the toothlike protuberance upon the fang near its base, and the extremity of the palpal organs of the male is not suddenly bent backwards, but is somewhat sinuous and points slightly upwards. A common species.

**Tetragnatha pinicola** L. Koch.

Length. Male 5 mm.

In this species the prominent denticulation upon the external surface of the male falx is not bifid. The denticulations of the fang groove of the female are very regular in size and arrangement, and the fang is of a somewhat swollen form near its centre. A rare species.

**Tetragnatha obtusa** Koch.

Length. Male 6 mm.

Easily distinguished by reason of the short, thick humped abdomen. A very rare spider.

**Tetragnatha nigrita** Lendl.

Length. Male 6.5 mm.

The whole spider is of a rather blackish sombre hue. The male may be at once recognised by the great length of the radial joint, which exceeds that of the digital joint and the palpal organs. A rare spider.

GENUS *EUGNATHA* SAV.

This genus is closely allied to *Tetragnatha*, but the lateral eyes are far more widely separated.

**Eugnatha striata** L. Koch.

This rare spider is our sole member of the genus.

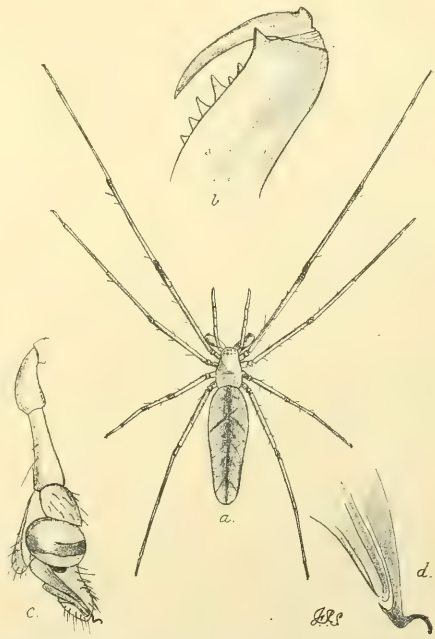
GENUS *META* KOCH.

Eyes in three well-separated groups of 2, 4, 2. Legs long and armed with spines. Female genital aperture with a distinct but not highly developed epigynum. Maxillae considerably longer than broad.

**Meta segmentata** Clk. (*Epeira inclinata* + *E. mengii* Bl.)

Length. Male 6 mm., female 7.5 mm.

The anterior metatarsi of the male are only provided with spines near the base. The digital joint of the palpus is very complex, with three prominent apophyses, of which the superior one is sharply pointed. The posterior central eyes of the female are rather more separated than the anterior centrals.




*Tetragnatha solandrii.* *a.* Female; *b.* Falx of Female; *c.* Palpus of Male; *d.* Extremity of same more highly magnified.

An extremely common spider spinning an obliquely placed web in bushes and hedgerows.

**Meta merianae** Scop. (*Epeira antriada* + *E. celata* Bl.)

Length. Male 8 mm., female 10 mm.

Closely allied to *M. segmentata*. The anterior metatarsi of males, however, are furnished with median spines, posterior central and anterior central eyes of the female are equally separated. Rather common.

**Meta menardii** Latr. (*Epeira fusca* Bl.)

Length. Male 10 mm., female 13 mm.

This spider may be easily distinguished from the preceding by its large size. The superior digital apophysis of the male, also, is thick and blunt, and the sternum of the female is furnished with a prominence near its centre. This spider frequents caves and other dark situations, but is not common.

GENUS *NESTICUS* THOR.

Maxillae straight. Legs very long and slender, without spines, but thickly clothed with hair.

**Nesticus cellulanus** Clk. (*Linyphia crypticolens* Bl.)

Length. Male 3.5 mm., female 4 mm.

This spider, which is our only representative of the genus, is almost invariably found in dark cellars, caves, or sewers. It is said to be rather uncommon, but could probably be found in abundance if systematic search were made.

GENUS *THERIDIOSOMA* CB.

Eyes closely grouped. Posterior row rather strongly curved. Anterior centrals placed upon a distinct prominence. Legs short, somewhat stout, clothed with coarse hairs and a few slender spines. Maxillae broad at their extremities.

**Theridiosoma argenteolum** Cb.

Length. Female 2 mm.

The abdomen of this beautiful spider is of a silvery hue, tinged upon its upper side with gold. It is extremely rare.

GENUS *CYCLOSA* MENGE.

Cephalo-thorax with a transverse impression near its central part. Abdomen produced posteriorly in one or more protuberances.

**Cyclosa conica** Pall. (*Epeira conica* Bl.)

Length. Male 5 mm., female 6 mm.

This spider may be easily distinguished from all other indigenous species by the posterior conical prolongation of the abdomen. It spins an orbicular snare, and is not very common.

GENUS *CERCIDIA* THOR.

Maxillae broad as long. Posterior row of eyes almost straight. Fourth leg longest.

**Cercidia prominens** Westr. (*Epeira bella* Bl.)

Length. Male 4 mm., female 4.5 mm.

This rare spider is the sole British representative of the genus.

GENUS *SINGA* KOCH.

First leg longest. Labium wider than the length Anterior eyes almost equidistant.

**Singa sanguinea** Koch. (*Epeira herii* Bl., description only.)

Length. Male 4 mm., female 4.5 mm.

Cephalo-thorax warm yellowish-brown. Legs yellow, marked with black. Genual joints of the first pair have, in the male, each a strong tapering spine. Rare.

**Singa albovittata** Westr. (*Epeira calva* Bl.)

Length. Male 3 mm., female 3.5 mm.

Cephalo-thorax yellowish-brown, palest in front. A white patch is situated behind the eyes. Rare.

**Singa hamata** Clk. (*Epeira tubulosa* Bl.)

Length. Male 4 mm., female 5 mm.

Cephalo-thorax dark blackish-brown. Legs yellowish-brown, indistinctly annulated. The posterior central eyes of the male are very close together. Rare.

**Singa pygmaea** Sund. (*Epeira anthracina* + *E. herii*, plate only, Bl.)

Length. Male 2.5 mm., female 3 mm.

Cephalo-thorax dark brown. Legs bright reddish yellow. Abdomen brownish black with three distinct longitudinal yellowish stripes.

This species is not uncommon.

**Singa herii** Hahn.

An extremely rare species described in "Proc. Dorset Field Club," vol. xiv.

(*To be continued.*)

## BUTTERFLIES OF THE PALAEARCTIC REGION.

By Henry Charles Lang, M.D., M.R.C.S., L.R.C.P. Lond., F.E.S.

(*Continued from page* 237.)

LYCAENIDAE. (*Continued.*)

PASSING from the British Isles to the Continent of Europe, there will be noticed a great stride as regards the number of species of Lycaenidae, which altogether amount to seventy. The greatest increase will be seen in the genera *Chrysophanus* and *Lycaena*. The species of these genera are chiefly found in the more elevated or in the Alpine regions of Central Europe, in the districts of the Swiss, Austrian, and French mountains, the Balkans, the Greek mountains, etc. Some species, such as *Lycaena melanops* and *L. lysimon*, occur almost exclusively in the Mediterranean districts of Western Europe. Several genera are represented of which there are no British species: these are *Lacosopis*, which contains only *L. roboris*, which has never been taken except in South-western Europe; so that, according to our present knowledge, it may be looked upon as one of the most locally restricted butterflies in the world. Two species of the genus *Thestor* occur in Europe, one, *T. ballus*, commonly in the South of France and Spain in the neighbourhood of the Mediterranean, and the other, *T. callimachus*, only in South-east Russia. The genus *Lampides* is represented in Europe by four species.

The commonest of these is *L. telicanus*, which is rather widely distributed in South-western and some parts of Central Europe. *L. boeticus* is a wandering species, most commonly seen in South Europe, and, as has been mentioned previously, is sometimes seen in England. *L. balcanica* and *L. theophrastus* are very local, belonging rather to the Asiatic and African continents. *Chiliades trochylus*, the sole Palaearctic representative of the genus is as a European species, confined to the Southern Balkan provinces. It is generally accounted the smallest European butterfly.

All the British Lycaenidae, with the exception of the typical *Chrysophanus dispar* and the variety *artaxerxes* of *Lycaena astrarche*, are found on the Continent, and are usually much more widely distributed and more abundant than with us. They are also subject in most cases to greater variation.

The distribution of the Lycaenidae in the Palaearctic Region will be best understood by reference to the accompanying table, in which the number of species of each genus is given first in the whole region, then in each of the four sub-regions proposed in this work. In the last two columns will be seen a numerical comparison between the European and British species.

| Genera. | No. of Species in Palaearctic Region. | In Sub-regions. | | | | In Europe. | In British Isles. |
|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | | |
| Rapala .. .. .. | 2 | — | — | — | 2 | — | — |
| Laeosopis .. .. .. | 1 | — | 1 | — | — | 1 | — |
| Satsuma .. .. .. | 1 | — | — | 1 | 1 | — | — |
| Niphanda .. .. .. | 1 | — | — | — | 1 | — | — |
| Thecla .. .. .. | 16 | — | 8 | 12 | 8 | 6 | 2 |
| Callophrys .. | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Zephyrus .. .. .. | 17 | — | 2 | 1 | 16 | 2 | 2 |
| Thestor .. .. .. | 6 | — | 4 | 5 | — | 2 | — |
| Chrysophanu .. .. | 23 | 5 | 12 | 20 | 6 | 10 | 2 |
| Cigaritis .. .. .. | 4 | — | — | 4 | — | — | — |
| Hypolycaena .. .. | 1 | — | — | 1 | — | — | — |
| Iolaus .. .. .. | 1 | — | — | 1 | — | — | — |
| Lampides .. .. .. | 10 | — | 5 | 7 | — | 4 | — |
| Chiliades .. .. .. | 1 | — | 1 | 1 | — | 1 | — |
| Lycaena .. .. .. | 110 | 7 | 54 | 89 | 24 | 42 | 8 |
| Cyaniris .. .. .. | 1 | — | 1 | 1 | 1 | 1 | 1 |
| Total Number of Lycaenidae .. .. | 196 | 13 | 89 | 144 | 60 | 70 | 16 |

It will be noticed that six genera not occurring in Europe are represented in the region. These are *Rapala*, *Satsuma*, and *Niphanda*, three genera that have separated from the old genus *Thecla*. These, with the exception of *Satsuma*, which occurs in the Altai and Central Siberia, are peculiar to the fourth, or Manchurian Sub-region. *Cigaritis* has four representatives, all of which are confined to the third, or Eremian Sub-region, as are also *Hypolycaena* and *Iolaus*. These six genera may be looked upon as outliers in the general system of the Palaearctic butterflies, and to belong largely to those parts of the region whose fauna has a tendency to blend with those of neighbouring regions.

It will be seen that the greatest number of Lycaenidae is found in the Eremian or Desert districts of Central Asia, etc. The smallest number is represented in the Panarctic, or first Sub-region—that is the most northerly part where a cold temperature prevails, though even there five species of *Chrysophanus* and seven of *Lycaena* are found.

The great increase in the number of species of *Zephyrus* in the fourth sub-region is remarkable. It is owing to the fact that the real headquarters of this genus are in the east of Asia, principally in China and Japan, and that some of the species extend into the Amur and Corea. All the Palaearctic species except *Zephyrus quercus* occur in the Manchurian sub-region. The extension westward even to Western Europe of *Zephyrus*, as seen in the latter species and *Z. betulae*, is a curious fact. Both species are closely allied to their Oriental congeners.

Genus 19. *RAPALA*, Moore 1881, Stgr. Cat. 1901. p. 68. *Thecla* Stgr. Cat. 1871.

Small butterflies greatly resembling those of the genus *Thecla*, with wings of steel-blue colour, bordered with brown or black. Hind wings with a slender short filiform tail. U.s. streaked as in *Zephyrus*. H.w. with a cluster of four spots near an. ang. Subcostal nervure of f.w. four-branched. Eyes smooth. Antennae rather short and with elongate clubs.

1. **R. arata** Brem. Lep. Ost. Sib. p. 25, t. 3, f. 6 Stgr. Cat. 1901, p. 68, R. H. 189.

29—36 mm.

Wings dark brown. Those of ♂ shot with greenish-blue, except along ou. marg. ♀ less

*R. arata.* Male and Female.

bright in colour, but somewhat larger than ♂ H.w. with a short slender tail; at an. ang. is a black spot with a faintly marked orange centre. U.s brownish white, with rather broad brown stripes. H.w. with four black spots at an. ang. placed on a square orange patch.

HAB. Amur, Uss, Corea, Japan.

*a.* var. *thyriantina* Batl. Ann. and Mag. (5). VII. 1881, p. 34, t. 4, f. 5. Larger than type and with a more violet blue coloration. U.s. browner and with broader stripes. HAB. Mandschuria, N. China.

2. **R. micans** Brem. and Grey, p. 9 (1853), R. H. 736, Stg. Cat. 1901, p. 68.

32 mm.

Wings dark brown, shot with metallic blue. H.w. tailed. U.s. ashy grey, with a yellowish tinge, with darker bands as in the last. The dark markings on h.w. form a W-shaped mark, like that in *Thecla W-album*, but more rounded. Two rounded black spots near an. ang. on yellowish crescentic patch.

HAB. Mandschuria, N. China.

Genus 20. *LAEOSOPIS* Rbr. Cat. Lep. Andal. I. p. 33. 1857. *Aurotis* Dalman.

Eyes not hairy. Hind margins not scolloped near an. ang. in h.w. U.s. not streaked beneath, but plain with a sub-marginal row of black spots between white and orange ones. Antennae rather long and with elongated clubs. There is only one species in this genus.

1. **L. roboris** Esp. 103, 5 (1789). Lg. B. E. pl. xviii. fig. 4. Stgr. Cat. 1902, p. 68. Evippus Hb. Vög. & Schmet. t. 56, 57 (1793).

34—37 mm.

F.w. rather pointed, more so in ♂ than in ♀. H.w. with a very slight indication of a tail.

*L. roboris.* Male and Female.

♂ broadly dark brown along ou. marg. of all the wings. F.w. with a triangular patch of shining purple, extending over the greater part of the

*L. roboris.* Under-side.

wing area. H.w. purple in the basal portion, three or four violet-blue spots on the ou. marg. towards an. ang. ♀ rather larger than ♂. Blue patch only on f.w. and solely on basal portion; brighter in colour than in ♂. H.w. with sub-marginal spots larger and more distinct, because lighter. U.s. uniform brownish-grey. F.w. with an indistinct sub-marginal row of black dots edged with white and orange. H.w. with a similar row, but much larger and brighter in colour. Marginal fringes white, antennae black, tipped with yellow.

HAB. South France, Spain and Portugal, also Botzen and Meran.

The distribution of this species is very limited in South-western Europe; it has not been taken in any other parts but those mentioned under the generic notes, and does not occur in any non-European locality. VI.–VII.

LARVA.—Dull brown with a black dorsal streak bordered by obscure yellow markings. Most authors consider that it feeds on oak, but *Fraxinus excelsior* is its real food plant.

*Laeosopis roboris* is very fond of settling on privet blossoms; but in 1901 I found it abundant at St. Martin Vesubie in the Maritime Alps, round low bushes of various kinds, especially on walnut saplings. It flies only in the brightest sunshine, and instantly disappears among herbage, bushes, or the branches of trees directly the slightest cloud overshadows the sun. Its flight is not by any means strong, and it has a habit of returning to a favoured spot if driven away from it. I found the ♂ abundant at the end of June, the ♀ emerging at the beginning of July.

*Laeosopis roboris* is illustrated herein, although a figure of it occurs in "The Butterflies of Europe," as it is the only representative of the genus to which it belongs.

*a.* var. *lusitanica* Stgr. Iris IV. (1891), p. 232. Stgr. Cat. 1901, p. 68. U.s. ochreous-grey. Marginal bands reddish ochre. HAB. Portugal.

(*To be continued.*)

## COLEOPTERA NEAR CARLISLE.

BY JAMES MURRAY.

A FEW notes on my captures in this district during 1901 may be of interest to other coleopterists. In the early part of the year, under the bark of a fallen tree, I got a few specimens of *Cerylon histeroides* and *Bolitochara obliqua*; and from the dry skin of a dead hedgehog a long series of *Silpha thoracica*. Under a stone a single specimen of *Badister bipustulatus* occurred. This beetle is not very common here. As the spring advanced collecting became more remunerative, and an afternoon up the valley of the Petterill on May 11th produced *Bembidium atrocoeruleum* and *B. punctulatum* in numbers and a few *B. femoratum*. These occur among gravel by the river-side. On muddy flats by the same river *Elaphrus riparius*, *Tachyusa flavitarsis*, and *T. constricta* were commonly found, but *T. constricta* was very local. A ramble on the banks of the river Irthing on June 1st gave me several good species, as *Bembidium monticola* and *B. schüppelii*, *Tachypus flavipes*, *Stenus guttula*, etc. While searching for these, a dead but perfect specimen of *Aegialia sabuleti* was found.

The effect of sweeping a marshy place in a meadow was to disclose two *Poophagus sisymbrii*, and any number of *Donacia sericea*, *Chrysomela polita*, etc. In the valley of the Gelt, *Coeliodes*

*geranii* was swept in abundance from wild geranium. The other tenants of the sweep-net included *Limonius cylindricus*, *Corymbites quercus*, *Apion ervi*, *Stenus pallitarsis*, *Luperus flavipes*, and *Lema melanopa*. *Melasoma aeneum* was plentiful on alder. *Elmis aeneus* occured in plenty among moss (*Hypnum palustre*) growing on stones submerged in the river. *Anthobium sorbi* was in thousands on hemlock. An afternoon at Orton in the middle of June produced some good things, including *Asemum striatum* and *Pissodes pini* from fir logs. A small pond contained *Agabus bipustulatus*, *A. chalconotus*, and *Hydroporus memnonius*. Many species of beetles were found by beating. From sallow came *Elleschus bipunctatus*, *Cryptorhynchus lapathi*, *Rhynchites minutus*, etc. From birch, *Rhynchites betulae* and *Luperus rufipes*. *Rhamphus flavicornis* was obtained commonly this year by general beating. In the Orton district later in the year I found a single specimen each of *Trechus secalis* and *Amara spinipes*, both under stones, and by sweeping, *Mantura obtusata*.

In another visit to Geltsdale at the end of July I was fortunate in taking *Pachyta octomaculata* from hemlock, and in the quarry *Clivina collaris*. *Bembidium paludosum* was fairly common on a sandy stretch by the river. In the Newbiggin Woods by the river side I found *Donacia linearis* in abundance on iris, many specimens having a fine purple gloss, which, however, almost disappeared after death. During the late autumn I was unable to do much collecting, but on November 2nd, 1901, at Durdar, with Mr. F. H. Day, we each took a single specimen of *Euryporus picipes* from *Sphagnum*, these being, perhaps, the gems of a fairly successful season's collecting.

11 *Close Street, Carlisle.*

## MANGANESE ORES OF THURINGIA.

By C. Boulenger.

During a stay in Thuringia last autumn I had the opportunity of visiting the manganese mines of Ilmenau and its neighbourhood. Although now practically exhausted these mines were extensively worked some ten years ago, and this district was placed among the most important manganese centres of Europe. The cessation of activity is, however, not entirely due to exhaustion of the yielding powers of the mines, but also to the increased price of labour and the large importation of cheaper though inferior ores from America and elsewhere. From a commercial point of view, the chief ores are pyrolusite and psilomelane, both of which occur at Oehrenstock, near Ilmenau, as well as on the Rumpels and Mittel mountains near Elgersburg. At the former locality two mines only are still worked; yet the numerous waste-heaps, a striking feature of the plateau upon which the village is situated, testify to the extensive mining operations carried on in former years.

Pyrolusite, termed by the German miners "Weichbraunstein," is the more important of the above-mentioned ores on account of its great purity, and of the almost total absence of silica and oxides of iron. That extracted from the Gottesgabe mine at Oehrenstock contains about 97 per cent. of pure manganese dioxide and 2 per cent. of water; the remainder consists of various impurities, such as lime, baryta, and occasionally traces of silica. The ore occurs chiefly with tabular heavy spar, and exceptionally with calcite or fluorite in quartz porphyry. The breadth of the lodes varies from a few inches, in which case the porphyry mass is occasionally covered with a network of fine veins, to ten or eleven feet. This, however, is very exceptional. The strike of the manganese lodes is from N.E. to S.W., the inclination is mostly 10°–25°.

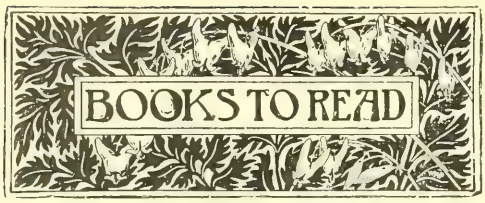
The pure ore is highly valued, the current price during my stay being 35 marks per cwt. Large quantities are used by glass manufacturers for the purpose of discharging the brown and green tints in glass, due to oxides of iron. Hence the name "pyrolusite." For a similar reason the manganese compound is called by the French "le savon des verriers." Extensive use of this mineral is also made for electric batteries and for evolving chlorine in the preparation of bleaching powder. For the above purposes the pyrolusite is used without any preparation. An alloy of iron and manganese called "Spiegeleisen" is employed in the Bessemer process for the manufacture of steel.

Psilomelane occurs, likewise in quartz porphyry, on the Lindenberg at Ilmenau and at Elgersburg; at the former locality together with violet fluorspar, at the latter mostly without gang. This ore, called by the miners "Hartbraunstein," is very impure; hence the composition is doubtful. Dana calls it hydrous manganese manganate, and gives the formula $H_4MnO_5$. That from Ilmenau does not contain much more than 70 per cent. of oxides of manganese, the impurities consisting chiefly of oxides of barium, calcium, magnesium, and a considerable amount of silica. This greatly diminishes the value of the ore, one hundredweight being worth but a few marks.

Of the other ores found in Thuringia hausmannite and braunite formerly occurred together, though in small quantities, in the mines of Oehrenstock. Specimens may still be obtained, by patient search, on the waste-heaps of the exhausted mines

Dana, in his "System of Mineralogy," mentions manganite as occurring with the other ores in the porphyry of Ilmenau and Oehrenstock. I was, however, unable to come across any specimens during my stay, nor did I see any in the large collections of manganese ores at Ilmenau.

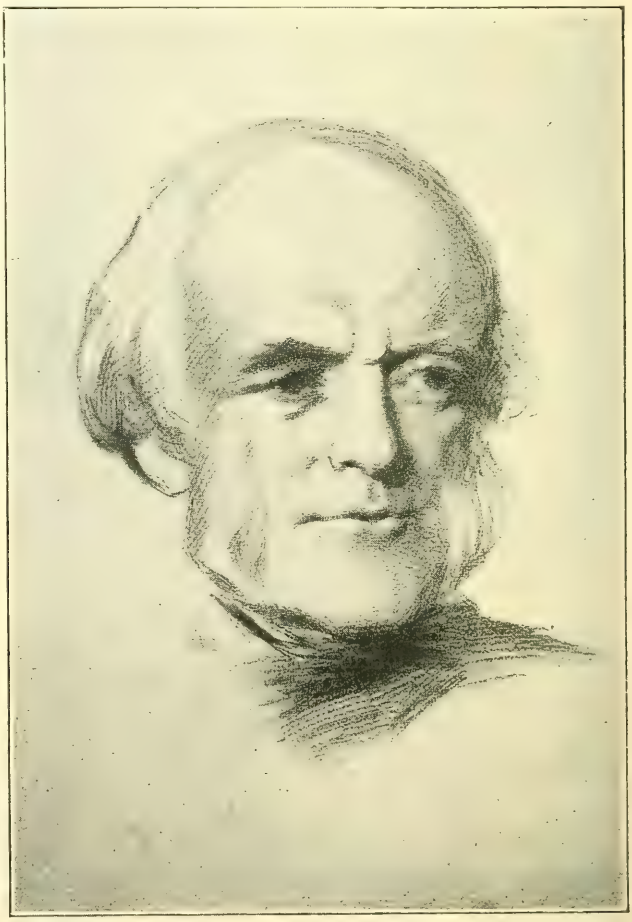
8 *Courtfield Road,*
*South Kensington, S.W.*




NOTICES BY JOHN T. CARRINGTON.

*History of Geology and Palaeontology.* By KARL ALFRED VON ZITTEL. Translated by MARIA M. OGILVIE-GORDON, D.Sc., Ph.D. xv + 562 pp., 7½ in. × 5 in., with 13 portraits. (London: Walter Scott. 1901.) 6*s*.

We have to congratulate Mrs. Ogilvie-Gordon upon the admirable way in which she has translated Karl von Zittel's well-known "History of Geology." The translation is indeed an improvement upon the original work, as it gives all the information one needs without being encumbered with much detail, which is liable to obscure the "pith" of the book. The volume before us, therefore, becomes of interest to general readers as well as to students of Geology. To the latter, however, it is indispensable, for every good geologist should have a full grasp of what has preceded in the science. There are few sections of Nature's study that have had a harder fight for emancipation from the influence of the dark ages than Geology. Neither has it yet shaken itself quite free from the ancient Babylonian and following Mosaic theories in the minds of many good people, notwithstanding the hard facts surrounding them on which has been built the modern science of Geology. Professor von Zittel in a masterly manner carries us step by step through the history, from the dim ages of antiquity and from the cuneiform inscriptions of ancient Nineveh, up to the end of 1899. We cannot help being struck by the fact of the recentness of intelligent thought in Geology. One may say that it was born no more than a century ago. There has been, nevertheless, so much accomplished within that hundred years that the modern student has ample basis on which to found a life's work. Like the rest of the volumes of "The Contemporary Science Series," of which this is one, it is well produced, and the portraits are admirable. We have the pleasure of reproducing, by permission of the publishers, one of Sir Charles Lyell, taken from a painting by G. Richmond, R.A., as an example. The frontispiece is an admirable portrait of Prof. von Zittel.



SIR C. LYELL.

(*From Professor Zittel's "History of Geology."*)

*The World of Animal Life.* Edited by FRED SMITH. vii + 416 pp., 8 in. × 6 in., with 217 illustrations. (London, Glasgow, and Dublin: Blackie & Son, Limited. 1902.) 5s.

As a "Natural History" book many young people would be proud to possess this stout volume. It is very popularly written and liberally illustrated. Some of the drawings are effective and good, but it is a pity to have admitted several that detract from the whole, as they appear to represent something else than that intended. As an example we may refer to page 208, where is shown an impossible long-tailed titmouse and nest, in improbable surroundings. On page 358 is a picture, inscribed "peacock butterfly," which if it represents a real specimen, one so abnormal would realise a high price at Stevens' auction rooms as a unique aberration. We can hardly understand any person, undertaking to edit such a book as this, passing for press drawings like those to which we have referred. The evil is, that youngsters who begin with such books have so much to unlearn.

*The Story of the Heavens.* By Sir ROBERT BALL, LL.D., D.Sc. New and Revised Edition. xii + 568 pp., 9½ in. × 6 in., with 24 coloured plates and 101 other illustrations. (London, Paris, New York, and Melbourne: Cassell & Co., Ltd. 1901.) 10s. 6d.

The new edition of this magnificent and popular book has been revised, and astronomical information included up to May 1st, 1900. There are also some new illustrations, including a brilliant plate showing in colours the aspects of the planet Jupiter on four occasions in 1897. We need not say anything to recommend a work so well known as Sir Robert Ball's "Story of the Heavens," and will only add that this edition has greatly improved the work, which should be in the hands of every intelligent young person and in every family library.

*A Manual of Botany.* By J. REYNOLDS GREEN, Sc.D., F.R.S., F.L.S. Volume II. Second Edition. xiv + 515 pp., 7½ in. × 5 in., with 1,244 illustrations. (London: J. & A. Churchill. 1902.) 10s.

This is a re-issue of Professor Green's "Manual of Botany," greatly altered, and, with regard to the flowering plants, made more readable and better adapted to the use of students to whom the British flora is available. There are some other improvements which make the volume one of the best popular manuals on Structural Botany.

*The Chemistry of Pigments.* By ERNEST J. PARRY, B.Sc., F.I.C., F.C.S., and JOHN H. COSTE, F.I.C., F.C.S. viii + 280 pp., 8¾ in. × 5½ in., with 5 illustrations. (London: Scott, Greenwood & Co. 1902.) 10s. 6d. net.

The work before us deals with the chemical relationships, composition, and properties of most of the better-known pigments. The plan has been to treat them in groups allied chemically rather than chromatically. The book should be useful to artists as well as chemists, as it describes analytical processes, which the authors have found suitable for tracing impurities, adulteration, and other causes of inferiority.

*Knowledge* for 1901. xii + 288 pp., 12 in. × 9½ in. Illustrated. (London: "Knowledge" Office. 1902.) 8s. 6d.

The bound volume for last year of our contemporary "Knowledge" is to hand. As usual, the chief feature is Astronomy, in which department there are some good articles well illustrated. Among other subjects that have received most attention is Microscopy, which has been extended. Ornithology is also interesting, as are some articles, chiefly relating to bird-life, written by the editor from the banks of the Soudanese Nile.

Among numerous books for notice in these columns we have received:—"Practical Enlarging," by J. A. Hodges, fourth edition. 1s. (London: Iliffes); "Photographic Cameras and Accessories," by Paul H. Hasluck. 1s. (Cassell & Co.); "Dulverton and District," by F. J. Snell, M.A. 6d. (St. Bride's Press); "Colour Photography," by A. E. Smith. 1s. (Hazell, Watson & Co.); "British Wild Birds," by David T. Price. 1s. 6d. (Gurney & Jackson); "Missouri Botanical Garden," Twelfth Annual Report; "Maryland Geological Survey" (Baltimore: Johns Hopkins Press); "Wild Animals of the Fish River Bush, South Africa," by W. T. Black (London: Young J. Pentland); "Engraving Metals," by Paul H. Hasluck. 1s. (Cassell.)


## FIELD BOTANY.

CONDUCTED BY JAMES SAUNDERS, A.L.S.

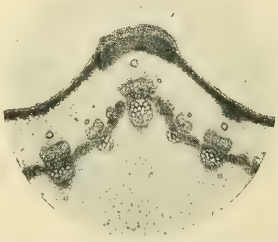
TORSION OF STEMS IN CHESTNUT TREES.—Those who live in districts where Spanish chestnuts are cultivated might find it interesting to notice whether this peculiarity is common to most or all of them. There is a grove of these trees in a park near Luton where every individual of the group exhibits torsion of the stem in a marked degree. In some cases the curves are carried up to a height of fifteen or twenty feet, which is considerably above the insertion of the lowest branches. The curvature is usually from left to right, rarely the reverse of this. Out of nineteen trees recently observed eighteen were the former and only one the latter. The only solution of the phenomenon that presents itself to my mind is that it is due to the unequal growth of the tissues. The cortex apparently grows more rapidly than the internal portion, so the former is compelled to assume a more or less spiral direction according to the amount of difference in the growth of the interior and exterior of the tree trunks. A few individuals of the horse chestnuts, which are of a widely different natural order, exhibit the same peculiarity, but in a much less conspicuous manner.—*J. S.*

PLANTS OF SUSSEX.—See page 263 *ante* for article on "Plants of Sussex."

## STRUCTURAL AND PHYSIOLOGICAL BOTANY.

CONDUCTED BY HAROLD A. HAIG.

PREPARING TISSUES FOR PHOTOMICROGRAPHY.—A good deal of care is required in staining tissues so as to differentiate between the various systems that occur in such a structure as a stem or



PHOTOMICROGRAPHS OF VARIOUS STRUCTURES.

FIG. 1. Transverse section across an umbelliferous stem.

root and in the choice of stains, so as to render the light coming through these parts sufficiently actinic for the photographic plate. Such stains as eosin are, of course, eminently suited for the

demonstration of such structures as the sieve-plates of sieve-tubes, but it is doubtful if the red light that comes through is very powerful actinically; and in cases such as these it would perhaps be more satisfactory to rely upon drawings taken

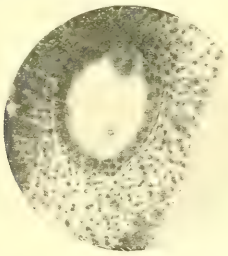


FIG. 2.—The embryo-sac of Caltha palustris, showing nucleus of embryo-sac, antipodals, and faint outline of egg-cell.

from actual observation than upon the photomicrograph. In the photography of most transverse sections of stems, roots, and many other botanical specimens we may use with advantage as our staining material either toluidin-blue, haema-

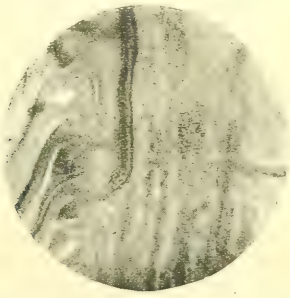


FIG. 3. Portion of trans. section lupulus, showing ring of cambium and young wood and phloëm.

toxylin, or both, for tissues stained with them turn a beautifully actinic blue on treatment with tap-water (not distilled water, because it requires the minute degree of alkalinity that tap-water possesses). We have obtained very satisfactory results with this

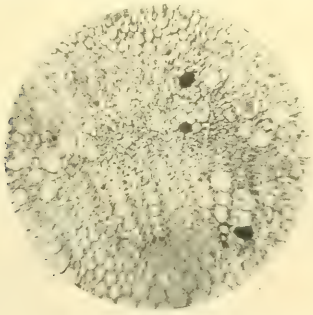
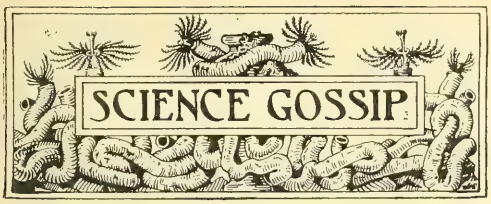


FIG. 4. Longitudinal section through bud of one of Abietineae (Pinus).

method. With regard to differential staining a combination of methyl-green and toluidin-blue, or separate staining with these two, would give good results, as the actinic power of the former is much less than that of the latter. Tissues stained with eosin or carmine will, of course, give a result; but it is difficult to obtain good definition, and the cell-walls, etc., only come out faintly, with somewhat blurred outlines. But a differential stain with eosin and toluidin-blue is quite satisfactory. The structures should be mounted so as to exclude all air-bubbles; a photomicrograph of delicate tissues in which a large bubble is incorporated is, as a rule, quite spoilt on account of the effects of reflection and refraction at the surfaces of the bubble. Styrax is a good mounting medium, Canada balsam being rather yellow even in thin films. I have to express my thanks to Mr. A. E. Powell for the photomicrographs (see figs. 1, 2, 3, 4), which were taken from specimens in my possession.

TRANSFUSION TISSUE.—In the central cylinder of the acicular leaf of many gymnosperms (stone pine) we find just internal to the endodermis a peculiar form of tissue the component cells of which have small bordered pits in their walls; these pits have the same structure as those met with in the tracheides of the stem or root xylem. In a good section one can make out that the phloëm portion of the two fibro-vascular bundles of the leaf is in intimate connection with this transfusion tissue, in fact the two gradually merge into each other. This is a very important point with regard to the translocation of proteid and carbohydrate elaborated food-material, from the cells of the mesophyll into the phloëm, and so to the stem and other parts of the plant. The presence of bordered pits renders the passage of aqueous solutions easy, but whether both colloids and salts pass, or only one, is a point difficult to decide; in the tracheides of the stem it is probable that only dilute salt solutions pass.

RECENT RESEARCH.—L. Guignard, in the "Jour. de Bot.," 1–9, 1901, has recently determined double fertilisation for *Thaias major*. One of the synergidae disintegrates soon after the entrance of the pollen tube; the other remains intact until after several divisions have occurred in the embryo. The oospore has no quiescent stage, but divides immediately after fusion. In all previous cases of double impregnation the definitive nucleus divides before it is fertilised, but here, many times, two embryos were seen lying side by side, with the definitive nucleus lying between them still unfertilised. The upper antipodal cell enlarges during a long period after fertilisation has occurred. B. E. Livingston, in "Bot. Gaz.," 30, 289–317, 1901, investigates the nature of the stimulus causing changes of form in polymorphic green algae; he believes the effect on the change of form of varying concentrations of Knop's Solution, a nutrient solution containing several salts, to be due to changes in the water contents of the cell. The "Journal of Applied Microscopy" lays stress upon the fact that we have in this consideration of the effects of osmotic pressure changes upon the form of cells, an entirely new field of physiological investigation. Observations on the Embryogeny of Nelumbo, a formerly supposed dicotyledon of somewhat hypothetical series, by H. L. Lyon, have determined the true monocotyl nature of the embryo, thus placing it in a sub-series co-ordinate with the Potamogetonaceae, Alismaceae, and Butomaceae in the series Helobiae, "Minnesota Bot. Studies." This is important both from the embryological and classification point of view.




CONTRIBUTED BY THE REV. J. M. COBBETT, B.A. OXON.

SOME of our readers are aware that a small limited company was recently formed to develop SCIENCE-GOSSIP, which has well responded to the introduction of capital. A portion of the money required was arranged for by an issue of debentures bearing 5 per cent. interest. Most of these bonds have been secured by those interested in the work of the journal, but a few remain unallotted. As it is advisable for the welfare of this magazine that the full issue should be subscribed, we invite others who value its pages to assist by taking as many as possible of the remaining debentures. Full particulars may be obtained on application to the Secretary, Research Publishing Company, Limited, 110 Strand, London, W.C.

THE Sir John Cass Technical Institute was opened last month, when Sir W. Roberts-Austen, chemist to the Mint, delivered the inaugural address, which dealt with the subject of metallurgy.

WE regret to hear the unfortunate accident that occurred to Professor Virchow in Berlin, when he fell from a tramcar, is of a serious nature. In addition to a broken thigh-bone, this eminent savant is suffering from general shock.

SOME interesting experiments have been carried out in Norway dealing with the resisting power of snow. It was found that a wall of snow four feet thick was proof at fifty yards distance against the bullet of the Krag-Jorgensen rifle, which is sighted up to 2,500 yards, and with a calibre of 6·5 millimetres has a velocity of 2,360 feet.

M. SIBILLOT, a Parisian aëronaut, has propounded a scheme by which he expects to solve the problem of aërial navigation. He has just deposited the plans of a new balloon that he maintains will be steerable in any weather. The proposal is to carry a refrigerator and a heating apparatus. By simply pressing a button of the former he thus reduces the temperature of the gas, and allows the balloon to descend; while on heating the hydrogen the effect is reversed.

AT the annual meeting of the Royal Meteorological Society held on January 15th the President, Mr. W. H. Dines, delivered an interesting address on "The Element of Chance applied to Various Meteorological Problems." He concluded that though for all practical purposes weather conditions might be looked upon as purely accidental, yet in reality there was a cause for each kind of weather, normal or abnormal. Weather cycles were also discussed, the speaker being of opinion that if there were any true cycle of a period of not more than ten or fifteen years it must have been discovered before now, for we had had about one hundred years' precise observation. During the meeting the first award of the Symons Gold Medal was made to Dr. Alexander Buchan for his work in connection with meteorology.

MR. G. METCALFE, of New South Wales, has put forward an interesting theory as to the method of reproduction of the duckbill (*Ornithorhynchus anatinus*). He believes the animal to be viviparous, and that the young are not, as generally supposed, hatched from eggs after they have been deposited.

AT the sixty-ninth annual meeting of the Entomological Society of London the President, the Rev. Canon Fowler, dealt with the question of protective resemblance and mimicry in the Coleoptera, a branch of entomology as to which little has been recorded, and, in view of the fact that large quantities of beetles were devoured by rapacious birds, urged that the indiscriminate slaughter of our few remaining birds of prey should be rigorously discountenanced.

WHILE our knowledge of cancer is still so indefinite, we feel that the state of things revealed in a recent letter to the "Standard" cannot be deprecated too strongly. The following extract needs no further comment:—"A farmer tenant of mine has been suffering from cancer in the lip. For months past he has been engaged in the daily work of his farm, milking his cows, assisting in the dairy, and handling his beasts, and all the time no more precautions have been taken to safeguard the public from the potential dangers of the case than if the man had simply cut his finger."

TWO experiments with the new manure, basic superphospate, have been carried out near Ipswich during the past season. Mr. E. Packard reports that he obtained $18\frac{3}{4}$ tons of swedes per acre from a plot dressed with 5 cwt. of basic superphosphate, as compared with $15\frac{3}{4}$ tons from one to which 5 cwt. of basic slag had been applied, and with $14\frac{1}{4}$ tons grown without manure. Mr. W. M. Cockrill grew four acres of white turnips with the help of 5 cwt. per acre of basic superphosphate, and another four acres dressed with an equal quantity of ordinary superphosphate, and his report is that the former were far superior to the latter.

AN article in "Nature" deals with an important investigation into the physiological effect on soldiers of route marching. We need scarcely say that the experiments were carried out in Germany. The aim of these experiments was to ascertain the effect produced by marching under conditions, more or less severe, on the various organs and functions of the body. Several of the results attained would be intelligible only to experts, but the more important can be readily understood. Some proved that the character of the food becomes a very important matter when heavy marching is undertaken, for then, as a result of respiratory changes, the consumption of carbohydrates is greater than the ordinary rations can supply, which leaves the fat of the body the only energy-producing material. So if the men are to be kept in good condition, one day of rest should follow three of heavy marching. The effect of the experiments on the excretory process was healthful, and the nervous system appears to have been undisturbed. The most important effects were those noted in connection with the heart. Its action was noted by the sphygmograph, and the curve produced was found to vary in proportion to the amount of weight carried. The investigators conclude that sixty-eight pounds is the heaviest weight that can be carried without the risk of permanent damage to the heart. It was found also that the right side of the heart became somewhat dilated, leading to a stagnation

in the venous circulation. This was noticed in only about half the observations when the light weight was carried, but it increased to fully eighty-seven per cent. with the heaviest one. This explains the disordered action of the heart, which is a frequent consequence of military training. Such investigations are of the utmost practical use, and we hope that our own Government will undertake a similar inquiry.

We received last month, too late for a notice in our January issue, the recent publications of Hull Museum. This pamphlet gives an account of an interesting discovery in the moors of a roughly carved model of a war-canoe, carrying four standing armed figures. The carving bears a striking resemblance to the canoes of the Andaman Islanders. There is also an account of what is known as the Ballachulish Image: a life-sized female figure, carved in wood, and evidently belonging to the same period.

The Zoological Society has sustained a serious loss by the death of "Charley," the young male giraffe. All visitors to the Gardens must have noticed a very decided "kink" in the neck of the animal, due to the fact that at least one of the cervical vertebrae had sustained a terrible wrench. The wonder is that it managed to survive so long with so serious an injury. We may still hope that a herd of giraffes may once more be reared in the Gardens, as a pair of the typical northern form (*Giraffa camelopardalis*) are now at Khartoum, whence they will probably be sent to England in the spring or early summer.

The Metropolitan Asylums Board has just published a report dealing with the present small-pox outbreak, and the effect of vaccination upon its victims. It demonstrates in a striking manner the value of vaccination, and especially shows how vaccination lessens the danger to life. We conclude from the report that the conscientious objector is much less common now than formerly. Of the unvaccinated persons over 50 per cent. have succumbed, as against a trifling percentage of the vaccinated. These latter include some who have been vaccinated during the incubation period, and at long periods before the attack. Another encouraging factor is the increased demand for lymph.

The result of the first detailed Government survey of the British portion of Lake Victoria Nyanza has added very considerably to our knowledge of the lake regions of Equatorial Africa. It has been found that an enclosed stretch of water, forty miles long, exists on the east side of the lake, and that outside its mouth a valuable tract of high country, with a large population, juts out into the lake, where previously there were supposed to be only a few islands. A much larger number of islands existed in the lake than were formerly marked on its map; some of them are over thirty miles from the shore. The lake is peculiarly liable to storms, in fact, a thunderstorm is nearly always in sight. Owing to this fact it was not thought advisable to visit three small islets which were visible far out in the lake, but with these exceptions every island has been visited and mapped by the expedition. During the journey, the expedition came across numbers of naked savage people, previously unvisited. All these, however, were friendly and amiable.

For some time past a recrudescence in the activity of Vesuvius has been noticed. At night, when the summit is not obscured by smoke, flames caused by the eruption can be distinctly seen arising from the crater.

The total destruction of a Russian house in six months is an alarming example of the ravages of the fungus *Merulius lachrymans*, otherwise "dry-rot." Even in England we have striking examples of the growth and destructive powers of this fungus. A wooden platform at the Oxford House, Bethnal Green, which was erected little more than a year ago, is now reduced to tinder.

At a recent meeting of the Entomological Society Mr. J. H. Carpenter exhibited a number of *Colias hyale* bred from ova laid by the parent butterfly taken at Sheerness in August 1900. Mr. Carpenter has cleared up a point in this insect's life history which was hitherto obscure, and has succeeded in showing that it hibernates in the larval stage and pupates and emerges in the spring.

There is in "Nature" of January 9th an interesting article on the work of Mr. W. A. Bentley, of Jericho, Vermont, U.S.A. Mr. Bentley has devoted twenty years to the study of snow crystals, with special reference to the relation between their forms and the atmospheric condition at the time of their fall. The article is illustrated by a number of beautiful pictures of snow-crystals reproduced from a summary of Mr. Bentley's work in the "Monthly Weather Review."

The "Globe" the other day had a rather amusing item of news in the "By the Way" column. We quote it at length. "The latest Parisian development of public utility is said to be a State-aided school for lion-tamers. We are not precisely informed in what way the State is to aid the scholars, nor yet in what state the majority of them are likely to find themselves after the first course of lessons; but as it stands the scheme seems worthy of the Academy of Lagado, where one of the philosophers kept a breed of hairless sheep."

On January 9th Professor Fleming, F.R.S., delivered the last of his course of lectures on "Waves and Ripples," and dealt with wave-motion in the aether. On the table were a radiator and receiver with a coherer, and the point to which the lecturer drew attention was that there were some things through which the radiations would pass freely and others through which they would not pass. This would lead to a widening of the meaning of the terms "transparent" and "opaque," so as to include all forms of radiation. The experiments showed that non-conductors were transparent, while conductors were opaque. These electric waves might be treated like light rays, and be reflected as they came from the radiator. Light travelled at the rate of 180,000 miles a second; the velocity of the electric waves was identical, and the difference between light and electricity was one of wave length. One of the most popular and instructive of the lectures was that dealing with the vibrations from which sound and music result, and with singing flames. An interesting experiment showed that the production of notes from a small organ was due to air vibration. The vibrations in glass plates were demonstrated by means of the well-known sand figures.

THE gift of £200,000 which Sir E. Cassel has placed at the disposal of the King is to be used for providing additional sanatoriums for the open-air treatment of tuberculosis. His Majesty is personally interesting himself in the work, and has also the assistance of an advisory committee.

"THE Utilisation of Exhaust Steam" was the subject of a paper read by Mr. John Buley some weeks ago at a meeting of the Institution of Junior Engineers. Mr. Buley urged that for heating circulations of buildings, such as hospitals, asylums, and public baths, exhaust steam should be made to play always an important part. In a discussion that followed reference was made to the difficulty of the presence of grease in exhaust steam and of scalding.

IN a lecture given to young people under the auspices of the Royal Geographical Society Dr. Vaughan Cornish dealt with the question of the length and speed of ocean waves. During storms waves with periods from eight to eleven seconds were observed with lengths from 328 feet to 620 feet, while a ten-second wave was 512 feet long. The sides of these waves had an average slope of not less than 1 in 10. A set of such waves would have a height of about 25 feet; but there was generally a swell running at the same time, which increased the total rise and fall of the water. It made the waves irregular, and caused waves of much larger size than 25 feet to recur not unfrequently. When, after a storm, the shorter waves had become no steeper than the swell, it was that which became in its turn the conspicuous thing at sea, and, instead of wave-crests separated from one another as far as the two ends of Burlington Gardens, we had commonly a wave of about 15-seconds period, with 1,150 feet between the ridges—that is, roughly, the length of St. James's Street. The lecture was illustrated by lantern slides and cinematographs.

DR. VAUGHAN CORNISH, whom we have mentioned elsewhere as lecturing to young people on ocean waves, read a most interesting paper at a meeting of the London Geologists' Association "On the Waves of Sand and Snow." Dr. Cornish explained that when the wind blows over the sea in the direction in which the waves travel it goes into eddies on the lee side, and the difference in pressure on the two sides increases the height of the ridge. In the case of waves of sand and snow there is the same distribution of eddies, but the action of the wind is somewhat different, the increase of ridges being mainly due to friction at the surface. Apart from this difference the two sets of phenomena were very similar. A large number of lantern slides from photographs were shown, which Dr. Cornish had taken on the coasts of Great Britain, in the Egyptian desert, and the prairies of Canada. The lecturer discovered a singular connection between the forms of snow-drifts and those of bodies that travel through fluids, such as fish, cetaceans, and among human inventions the Whitehead torpedo. The recent alterations in the form of the Whitehead torpedo made it more like the profile of the snow-drifts than was the case with earlier torpedoes. Among other interesting phenomena Dr. Cornish has been investigating tidal bores. The best example in Britain is afforded by the bore in the river Severn, of which he recently obtained a cinematograph picture.

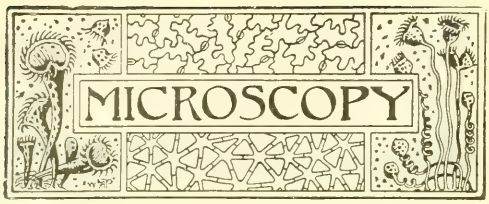
A CORRESPONDENT of the "Lancet" has in his possession a silver-plated copper figure of one of the numerous deities worshipped in India, which is no less than Amma, the goddess of small-pox. The curious point about the idol is that while its face is quite clear and clean cut, there fits on over it a sort of mask representing another face horribly swollen and deeply pitted with small-pox.

WE understand that Mr. A. E. Conrady has been appointed chief optician and adviser to Messrs. W. Watson & Sons, of London, Edinburgh, and Melbourne. His attention is to be given to a new series of astronomical telescopes, and to the Holoscopic Microscope objectives and condensers, also to the Holoscopic Photographic Lenses, for which Messrs. Watson & Sons have become so celebrated.

AN interesting experiment has been tried on one of the large American railways in order to ascertain how much an engine loses in weight through the wear of a known amount of work. The engine was taken to pieces and each separate part minutely weighed. It was then reconstructed and put back into active service. It was again taken to pieces and carefully weighed. The results when published should prove very interesting.

CAPTAIN BERNIER, the Canadian explorer, has already secured £20,000 out of the £30,000, at which he estimates the cost of his intended expedition to the North Pole. Wireless telegraphy will play an important part in this expedition, and will enable the explorers to be always in touch with their ship, a vessel of about 300 tons net, built specially for the purpose. Captain Bernier expects to be absent four years, and is confident that he will not only be able to reach the Pole, but also to secure the various scientific objects desired.

SCIENCE TEACHING.—The month of January was marked by several meetings of those interested in the teaching of science, and more particularly that teaching which is the giving of a training, and not merely the imparting of a series of facts. This, by the bye, with all due deference to the old-fashioned schoolmaster, is not worthy of being considered an education, nor, must we own, is a knowledge of scientific method without general culture. At the first meetings of interest—and these were the four held by the Conference of Science Teachers, the fourth arranged by the London County Council—such interesting subjects as hygiene (bodily and mental), natural history—meaning zoology—and nature study received attention. They were also supplemented by some detailed descriptions of what may be looked upon as an experiment, even though it be successful—the conduct of rural secondary schools, the one brought into existence by Lady Warwick being chiefly discussed. We may pass from it to the scheme now advocated by the same educationist for a representative nature study exhibition during the coming summer. The provisional committee met and co-opted a number of fresh supporters, and appointed a sub-committee to bring forward a scheme for consideration on the first of this month. The third point of interest was the Conference of Public School Science Masters, at which, after the discussion of the disadvantages of Army and University examinations, a new Association of Public School Masters was formed, with Professor Rücker as President.




CONDUCTED BY F. SHILLINGTON SCALES, F.R.M.S.

ROYAL MICROSCOPICAL SOCIETY. December 18th. —Wm. Carruthers, Esq., F.R.S., President, in the chair. Messrs. R. & J. Beck exhibited a new micrometer microscope, the body of which was made to traverse across a long stage by means of a fine screw, the milled head of which was divided so as to indicate a movement of $\frac{1}{100}$th millimetre. The body could also be placed in a horizontal position, when it could be used as a telescope to measure distant objects. Mr. F. W. Watson Baker exhibited a number of microscopic specimens illustrating the development and structure of eyes. They were shown under twenty microscopes, and were the most perfect sections that could be obtained from the best preparers in this country and abroad. Mr. E. M. Nelson sent three notes, which in his absence were read by the Secretary. The first was a description of Holtzapffel's microscope. The date of it is 1830, and in it are found four original devices: (1) It possesses a clamp foot for clamping the instrument to the edge of a table, predating a similar device of Varley's in 1831; (2) the back of the mirror is flat polished brass, so that monochromatic light may be reflected by it; (3) the stage is focussed by an eccentric which differs from and predates the somewhat analogous devices of Pacini and Plössl; (4) the movement of the lens-holder is by means of a steel tape and pinion. The second note was a description of the first English achromatic objective, made by W. Tulley. It was a triplet and was made at the suggestion of Dr. C. R. Goring, who paid £90 for it. The focus of the combination is 0·933 inch, initial magnifying power 10·72, N.A. ·259, and the O.I. the large amount of 24·2. Mr. Nelson then described the Chevalier-Euler achromatic objectives of 1823–24 and 1824–25. These were doublets, and in 1827 Mr. J. J. Lister put one of Chevalier's doublets as a front and a Tulley's triplet as a back lens. The focus of the combination was 0·52 inch: it was the finest microscopic objective that had up to that time been produced, and was, strictly speaking, the first really successful scientific microscopic objective. Lister's labours in perfecting objectives and the great use they had been to the leading opticians of the day were referred to. The third note was on "A Useful Caliper Gauge." It can be purchased at any watchmaker's tool-shop for three or four shillings, and is convenient for measuring the thickness of cover-glasses, and for low-power work the scale may be placed on the stage of a microscope and the constant of an eyepiece micrometer found by comparison with the mm. divisions. The President gave an account of some investigations which he had made in reference to a disease that had caused great mischief in cherry orchards in Kent. About fourteen months ago, when his attention was first called to it, the disease was prevalent over a considerable area, a noticeable feature in connection with it being persistence in the autumn of the dead leaves on the branches, instead of their falling off, as they would have done if the trees were healthy. The leaves of affected trees were pervaded by the mycelium of a fungus which destroyed them, and as the food of the tree was prepared by the leaves the growth of the tree would in consequence be arrested. The results of experiments in the cultivation of the fungus showed it to be one which belonged to the genus *Gnomonia*. Many of the fungi in this class passed through various stages in their life history; for example, the mildew on wheat, which was first developed on the berberry and then spread to the wheat, appearing originally as rust, and afterwards as mildew, from the same mycelium. The President referred to the absence in this country of any author competent to investigate cases such as this. On the Continent, however, the Governments had taken up the matter, and the experts who had examined into it had found that to check the spread of the disease it was necessary to collect all the dead leaves and burn them. The President had consequently urged upon the fruit-growers the necessity of following this recommendation, but had only been able to persuade two growers to do so. Both of these, however, had found it to be thoroughly effective. Professor A. W. Bennett in his remarks enlarged upon the absence in this country of investigations into such matters by State-paid establishments, and described what was being done in the United States, where every State had its own experimental station. The President announced that the next meeting would be the annual meeting, when the officers and council for the ensuing year would have to be elected, the nominations for which were then read.

QUEKETT MICROSCOPICAL CLUB. — December 20th, 1901, at 20 Hanover Square, W., the Right Hon. Sir Ford North, F.R.S., F.R.M.S., in the chair. Mr. Angus exhibited and described the use of two simple apertometers. The first was an ordinary semicircular protractor held at the middle of its periphery vertical to the stage; at the centre point was fixed a perforated film, mounted on glass, parallel with the stage. Riders or pointers slid along the arc, indicating the angle. The hole in the film was focussed by the lens to be tested, and the back of the lens examined with a low power, as when the Abbe apertometer is employed. The sine of half the angle indicated would be the numerical aperture. This appliance was valueless for measuring immersion objectives, as it only measured 180° in air. The second apertometer was merely a mm. scale placed in the turn-out ring of the condenser. The condenser and an objective of known aperture were focussed on the same plane, and the N.A. value of a division in the mm. scale was found by an examination of the back lens of the objective. When any other objective was employed the number of divisions visible at the back lens, multiplied by the determined value of one division, gave the aperture of the objective. Mr. Angus showed the value of such a quick method of measuring aperture by the ease with which the size of diaphragms and stops could be found; he also gave the proportions of stops to apertures which furnished the best dark-ground effects. Stops were shown that were made of black paper gummed to glass discs, cut to fit the condenser turn-out ring. The club's best thanks were accorded to Mr. Angus for his ex-

planations, which, it was hoped, could be put into a form suitable for publication in the journal. A sliding microtome by Reichert was exhibited by Mr. C. Lees Curties, and described by the Secretary. This machine was on the "Thoma" model, with mechanical adjustments to every part, even to the tilting of the knife. The micrometer screw was reversible, thus obviating tedious un winding. The instrument was very moderate in price. Mr. D. J. Scourfield, F.R.M.S., read a Paper on "The Ephippia of the Lyceid Entomostraca." The author originally intended to wait for sufficient material for a more comprehensive Paper, but in view of the wideness of the subject preferred to deal with a part which had been fairly well worked at. He described the principal features of the formation and casting of these particular ephippia; the curious membrane around the egg, the thickening of the posterior margins of the valves, the growth of the line of cells across the valve where the separation eventually takes place, and other apparently constant accompaniments. The author then showed the great variations in the sizes and shapes of the parts of the valves which were cast by different species, and stated his belief that such variations were of value in determining species. The real uses of the marginal thickenings of the valves and the membrane surrounding the egg were suggested. A Paper, by Mr. E. M. Nelson, F.R.M.S., "On the Black and White Dot," was read by the Secretary. The author asked indulgence for what might appear a puerile subject, but claimed that a proper understanding of the formation of the diatomic images must be the prelude to the acceptance of any theory of microscopic vision. He then proceeded to criticise the Papers read earlier in the year by Mr. Rheinberg and Mr. Stokes, rejecting the "special" theory of the formation of the "black and white dots" made out by the former, and, though agreeing with much that the latter had stated, putting forward evidence which he believed to be in opposition to some of Mr. Stokes's conclusions.

Abnormal Secondary Thickening in Climbing Plants.—In its summary of botany at the last meeting of the British Association, "Nature" mentions a paper by Miss A. M. Clark in which the author describes the process of formation of the abnormal secondary thickening in *Kendrickia walkeri*, a tropical epiphytic climbing shrub. The anatomy of the young stem is typical of the family Melastomaceae. At an early stage numerous small patches and several large wedge-shaped areas of thin-walled unlignified wood-parenchyma are cut off from the inner side of the completely circular cambium ring. Tylosis is of frequent occurrence, and the tylosed cells may develop into sclerotic cells inside the vessels and tracheids. At a later stage the unlignified wood-parenchyma cells, at the central margin of the wedge area, take upon themselves new growth accompanied by cell-division. The product of this new growth proceeds to split the axial woody ring into a number of portions, with subsequent destruction of the identity of the wood elements. Later, the quiescent cambium, lying between the original internal phloëm and the axial woody ring, takes upon itself new growth, and proceeds to lay down xylem on the one side and phloëm on the other. Some of our readers will remember the discussion in Science-Gossip (*ante*, p. 56, and vol. vii. pp. 372–4) on the abormal growth of the stems of Brazilian Lianes.

Method for Rearing Amoebae.—A contributor to the American "Journal of Applied Microscopy" gives the following simple method of securing Amoebae. A nutrient medium is made by boiling a lot of dead leaves. As soon as cool, both liquid and leaves are placed in an ordinary battery jar, and a lot of unboiled leaves, and enough water added to stand about one inch above the leaves. In two or three days a scum will form, and in from five to ten days, depending upon the temperature of the room, Amoebae will be found in the scum in large numbers, but somewhat small.

The Arrangement of Cilia on Paramecium.—The same journal contains a note on staining the cilia of *Paramecium*, which, in common with those of many others of the Infusoria, are so fine and so closely set as to make it difficult to determine their exact arrangement even by the most careful focussing. A drop of Loeffler's alkaline methylene-blue is mixed with a drop of water, in which the animalcules are swimming on the slide, and the cover-glass placed in position. Intra vitam staining takes place in many of the individuals; but they soon die, and the cuticle separates more or less completely from the cytoplasm and forms a halo round the deeply stained body. The perforations in the cuticle are thus brought very distinctly into view and the plan of arrangement of the cilia revealed. The stain is prepared as follows: Add 30 c.c. of a concentrated alcoholic (95 per cent.) solution of methylene-blue to 100 c.c. of a ·0001 solution of caustic potash. The caustic potash solution may be prepared by adding 1 c.c. of a 1 per cent. solution of potash to 100 c.c. of distilled water.

New Objectives by Otto Himmler.—By the courtesy of Messrs. W. Watson & Sons, of High Holborn, London, we have recently had an opportunity of examining two objectives by a comparatively new maker, Mr. Otto Himmler, of 9 Brandenburgstrasse, Berlin, that deserve more than passing notice. They were styled semi-apochromats, which implies only, we presume, that in them the newer Jena glasses have been used. Their corrections were exceptionally good, and showed once more how near the best and newest achromatic lenses come to the more costly apochromats. These particular lenses were $\frac{1}{8}$-inch and $\frac{1}{12}$-inch oil immersions, with N.A. 1·3. Both were excellent, but the $\frac{1}{8}$-inch was really one of the finest achromatic objectives we have seen, possessing brilliant definition, whilst the price was only £3 5s., and £4 10s. for the $\frac{1}{12}$-inch.

Immersion Oil in Collapsible Tubes.—The same writer alludes to the disadvantages attendant upon the use of the ordinary bottle for immersion oil, which it is impossible to keep clean, and which allows the oil to thicken, turn yellow, and become turbid through exposure to light and air, thus altering its refractive index. In consequence the use of collapsible tubes is suggested, similar to the tubes which are used for holding moist water-colour and oil paints. It is stated that this form of tube has been used to contain Canada balsam with satisfactory results, and the writer referred to determined to try how such tubes would do for immersion oil, although he was warned that the metal might have some deleterious effect upon the optical properties of the oil. After a year's experience he is able to state that the tubes have proved to be quite free from the faults which

characterise the bottles, and that the oil is as clear, colourless, and thin as when first made, and there is no indication of change in its refractive index. Which of our English opticians will be the first to put immersion oil and Canada balsam in this form upon the English market?

WATSON'S NEW "UNIVERSAL" CONDENSER.—The faults of the ordinary Abbe condenser are, as is well known, the imperfection of its spherical and chromatic corrections. The former in particular greatly reduces the value of the condenser for critical work. With a numerical aperture of from 1·2 to 1·4 the aplanatic aperture does not exceed ·65. There have been several achromatic condensers upon the market, but their aplanatic cones have but slightly exceeded the simpler Abbe form, whilst the mounting has been so cumbrous as to frequently interfere with the movements of the mechanical stage. Within the last year or two there have been put upon the market several condensers of large N.A. and almost equal aplanatic aperture, but their powers have been not less than $\frac{1}{4}$ inch, with a field accordingly too small to be advantageously used with low-power objectives. To Mr. Chas. Baker must be given the credit for first putting in the hands of microscopists a condenser with a N.A. of 1·0 and an aplanatic aperture exceeding ·9, and with a power of less than $\frac{1}{3}$rd inch (see S.-G. vol. vi. p. 374). Messrs. Watson & Sons, of High Holborn, have just brought out a similar condenser, which they have submitted to us for examination. Its N.A. is 1. and its aplanatic aperture is not less than ·95, whilst if the exact thickness of slip for which it is corrected be used its total aperture is aplanatic. The power is $\frac{4}{10}$th of an inch, and the mount is very compact. The corrections are excellent, and we can strongly recommend this condenser for almost all kinds of work and for photography in particular. The price of the optical part (which fits into the ordinary Abbe mount) is £2 7s. 6d., or with mount and iris diaphragm complete £3 7s. 6d.

CHARLES BAKER'S DEMONSTRATIONS OF MICROSCOPIC MANIPULATION.—We are glad to hear that this new departure (*ante*, p. 153) fully justifies itself, and that the attendance has steadily increased. Eleven demonstrations have been given up to the time of writing, and the total attendance has been 124, giving an average of eleven. Three persons attended the first demonstration, whilst eighteen attended the last—an increase which testifies to their value. We may remind such of our readers as live in London that these demonstrations are given at 244 High Holborn on the first and third Fridays and second and fourth Tuesdays in each month from 3 to 6 p.m., and that they are free to all comers.

## MEETINGS OF MICROSCOPICAL SOCIETIES.

ROYAL MICROSCOPICAL SOCIETY.—20 Hanover Square, W., February 19th, 8 p.m.

QUEKETT MICROSCOPICAL CLUB.—20 Hanover Square, W., February 7th, 7 p.m.; annual meeting, February 21st, 8 p.m.

MANCHESTER MICROSCOPICAL SOCIETY.—Grand Hotel, Manchester, February 6th, 7 p.m.; mounting section, February 20th, 7 p.m.

SUNDERLAND MICROSCOPICAL SOCIETY.—Subscription Library, Sunderland, February 18th, 7.30 p.m.

## ANSWERS TO CORRESPONDENTS.

F. A. H. (Epsom.)—A drop of water containing the Infusoria must be put on the centre of a perfectly clean slide, and the excess of water taken up with blotting-paper, care being taken of course not to disturb the Infusoria themselves. Fix by adding a drop of absolute alcohol, stain with picro-carmine, methyl-green, Bismarck-brown, or haematoxylin (some infusorians take one stain better than others), wash carefully first with dilute and then with absolute alcohol, and clear with a drop of turpentine or oil of cloves. Remove the excess of clearing fluid. Mount in Canada balsam. See also two notes on rearing Amoebae, and on staining Infusoria with Loeffler's alkaline methylene-blue in the present number of this magazine.

G. E. H. (Hornsey.)—You will find the above method suitable for mounting Amoebae, and perhaps preferable to that suggested in vol. vii. p. 372.

W. H. (Paisley.)—"C. Verick, élève spécial de E. Hartnack," means simply that the maker of your microscope is C. Verick, who styles himself, in addition, a pupil of E. Hartnack. I do not know much of Verick, but Hartnack was a well-known maker of high repute in Paris, whose microscopes and lenses have had great influence on microscopical progress, and whose business is still carried on by MM. Nachet et Fils, Paris. 1695 is most certainly the number of the microscope, not the date. If it were the latter the microscope would be worthy of a place in the collection of the Royal Microscopical Society. The data you give me are not enough for me to say whether your microscope is a good one or not. Has it a sub-stage condenser and good coarse and fine adjustments, showing few signs of wear? Is the screw in the bottom of the body-tube the R.M.S. universal gauge, so as to take modern objectives? If so your microscope is probably a good working instrument; but microscopes and objectives have undergone such great improvement during the last decade or so that an old-fashioned microscope is of little value in most cases.

[For further articles in this number on Microscopical subjects, see pp. 260, 264, 272, and 287.]

## EXTRACTS FROM POSTAL MICROSCOPICAL SOCIETY'S NOTEBOOKS.

[Beyond necessary editorial revision these notes are printed as written by the various members.—ED. Microscopy, S.-G.]

THE slides contained in this box [sections of stems] will hardly commend themselves as microscopic objects to the members of the P.M.S. They are intended as illustrations of the varieties that vegetable tissues take under the varying conditions of exposure to light, heat, and moisture, etc. Beginning with sections that illustrate the normal forms of the monocotyledon, the dicotyledon, etc., there follow modifications of these, some of which it would be difficult to assign to any of these groups did there not exist other means of classification than that of structural arrangement. To attempt to give any special notes on such a trite subject as the structure of vegetable tissues would be an insult to the members of the Society, so I send my

contribution unnoted, leaving the different slides to commend themselves to their observers, if for nothing else than for the elegance of form which they present.—*W. Pumphrey.*

It is evident that Mr. Pumphrey has lost sight of a very important factor in the P.M.S.—namely, the giving out of information which, however "trite" it may be to the senior members, is a necessity if the success of the Society is to be maintained. We must cater for the learners as well; and however excellent may be the dealer's slides which are at times furnished by members, they do not advance the best interests of the P.M.S. as slides of less perfect finish do, whose bona-fide touches and descriptions are instinct with the spirit of mutual helpfulness. Even quotations from books such as Carpenter's might form the groundwork of some interesting and practical communications. "Light, heat, moisture, etc.," in the formation of vegetable tissues, call up some of the most interesting problems connected with structural botany. For instance: What causes a

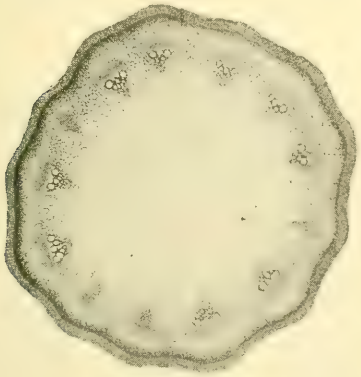


Fig. 1. Section of Stem of Aristolochia.

double, or even a multiple, succession of rings to occupy the place of a single one, as ascertained by transverse sections of wood?—*J. Birkbeck.*

The examination of these slides has given me much pleasure, but I nevertheless concur with the previous writer in his remarks respecting the absence of notes and the absence of any evidence of individual work. These slides should not be circulated merely as objects of beauty. They must convey instruction. We are never tired of having described to us the beautiful devices which Nature adopts to build up the various natural objects that surround us. There is, in truth, a very fine delight in the acquisition of scientific information new to ourselves, even if the information has been known for ages to others; and, further, those to whom these scientific facts may be well known never tire of having them brought fresh to their notice—especially if the old story be well told and well illustrated. I have photographed three of the slides and appended notes.—*J. R. L. Dixon.*

*Aristolochia clematitis* (fig. 1) shows the concentric and regular disposition of the vascular bundles in dicotyledonous stems. It will be observed that the stem is a young one, as evidenced by the amount of pith, which in the root may be so much checked, as almost entirely to disappear.

*Ricinus communis* (fig. 2) shows a hypocotyle of this dicotyledonous plant. The vascular bundles consist of phloëm externally and xylem internally, separated by a layer of cambium which is continued into the fundamental tissue lying between

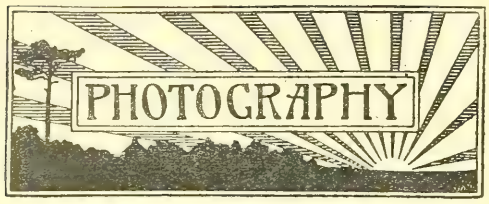

Fig. 2. Section of Stem of Ricinus.

the vascular bundles as interfascicular cambium. The xylem contains vessels with narrow pits and vessels with broad pits with wood parenchyma between them. The pith and primary cortex are also shown.

*Cyperus longus* (fig. 3) shows irregular disposition of vascular bundles in monocotyledonous stem. This arrangement of bundles is due to the

Fig. 3. Section of Stem of Cyperus.

obliquely radial course of the leaf-trace bundles These enter the stem from the leaves, run obliquely downwards into the stem, then bend again outwards and approach the surface. A transverse section may thus pass through different leaf-trace bundles at different heights in their course and show therefore bundles of different structure and size.—*J. R. L. Dixon.*




CONDUCTED BY B. FOULKES-WINKS, M.R.P.S.

## EXPOSURE TABLE FOR FEBRUARY.

The figures in the following table are worked out for plates of about 100 Hurter & Driffield. For plates of lower speed number give more exposure in proportion. Thus plates of 50 H. & D. would require just double the exposure. In the same way, plates of a higher speed number will require proportionately less exposure.

Time, 11 a.m. to 1 p.m.

Between 9 and 11 a.m. and 1 and 3 p.m. double the required exposure. Between 8 and 9 a.m. and 3 and 4 p.m. multiply by 4.

| SUBJECT | F. 5·6 | F. 8 | F. 11 | F. 16 | F. 22 | F. 32 | F. 45 | F. 64 |
|---|---|---|---|---|---|---|---|---|
| Sea and Sky .. | $\frac{1}{120}$ | $\frac{1}{60}$ | $\frac{1}{32}$ | $\frac{1}{16}$ | $\frac{1}{8}$ | $\frac{1}{4}$ | $\frac{1}{2}$ | 1 |
| Open Landscape and Shipping | $\frac{1}{60}$ | $\frac{1}{16}$ | $\frac{1}{8}$ | $\frac{1}{4}$ | $\frac{1}{2}$ | 1 | 2 | 4 |
| Landscape, with dark foreground, Street Scenes, and Groups .. | $\frac{1}{16}$ | $\frac{1}{8}$ | $\frac{1}{4}$ | $\frac{1}{2}$ | 1 | 2 | 4 | 8 |
| Portraits in Rooms .. | 8 | 16 | 32 | 1 | 2 | 4 | — | — |
| Light Interiors | 30 | 1 | 2 | 4 | 8 | 16 | 32 | 60 |
| Dark Interiors | 2 | 4 | 8 | 16 | 32 | 60 | 120 | 240 |

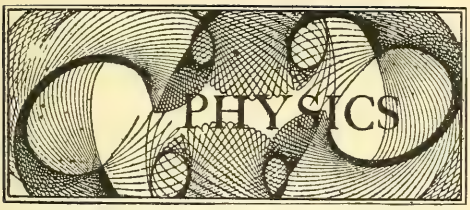
The small figures represent seconds, large figures minutes. The exposures are calculated for sunshine. If the weather is cloudy, increase the exposure by half as much again ; if gloomy, double the exposure.

PHOTOGRAPHIC YEAR-BOOKS.—We have received several photographic year-books, some of which are beautifully illustrated. These will be noticed at greater length in an early number.

PHOTOGRAPHIC AND OPTICAL TRADES EXHIBITION.—This exhibition, which promises to become an annual event, will be held as heretofore at the Portman Rooms, Baker Street, London, from the 11th to 19th of April, 1902. In looking through the prospectus and plan, we see that in addition to the photographic trade it is proposed to incorporate exhibits from the optical trade. This, we have no doubt, will make a more interesting and complete exhibition than previously. We congratulate Mr. Arthur C. Brookes, the promoter, and wish him good fortune in this case. If this exhibition proves the success we anticipate, it should be well worth while for everyone interested in photography and optics to make a point of attending at least once, and to allow plenty of time to examine and become acquainted with all the latest improvements in objects vended by the photographic and optical trades.

A NEW LENS.—By the courtesy of the editor of the "Photographic News," we have recently seen some very remarkable photographs taken by means of a new lens invented by Dr. Grün, of Brighton, and under circumstances which in the usual way would be absolutely impossible. For instance, one of the pictures submitted to us was a ballet at the Alhambra Theatre of Varieties, taken in the $\frac{1}{25}$th part of a second, whilst the performance was proceeding, and without the knowledge of the authorities. The photograph is a distinctly good one, giving an excellent impression of the performance, and we confidently assure the inventor that there is a great field before a lens that will accomplish such a result. From what we have been able to gather about this lens, it would appear to be a combination of glass and liquid lenses. Dr. Grün says it consists of the construction of what is practically a lens of crown glass of great thickness, accurately corrected and free from aberration. Dr. Grün claims for his invention that it is a quicker lens than any other of corresponding aperture. He further mentions that the lens can be made with a greater aperture than that attained by any lens yet known. We believe the one with which he took the photograph at the Alhambra had a 4-inch focus, with a working aperture of $2\frac{1}{2}$ inches on a $\frac{1}{4}$ plate used in a hand camera.

LIGHT IN DARK ROOMS.—We have often been asked to recommend a safe light to use in the dark room. To this inquiry there is only one answer possible. Such a thing as a "safe light" is unknown. All we can do is to find the safest light for each type of plate. For instance, a light that is quite safe for a wet plate is useless for an ordinary dry plate ; again, a light that is safe for an ordinary plate is no use for a specially rapid one, and so forth. It therefore follows that the photographer must have at his command a whole series of tinted glass panes for his lantern, each suitable for developing different plates. For this purpose we have found the most convenient method is to have a fairly large gas or oil lamp, arranged so that the glass through which the light passes can be readily changed and a series of different coloured glasses used. If possible we much prefer the lamp constructed with a glass tank, containing a saturated solution of bichromate of potassium. The space between the glasses of the tank should be at least one inch thick, and a gas lamp in which this tank can be inserted will give a most brilliant light all over the room. It will be quite safe for working bromide papers and slow ordinary plates. If it is proposed to develop medium speed plates, then a deep orange glass can be placed in front of the light ; and if extra rapid plates are used, a piece of ruby glass or fabric should be placed in front. Deep ruby colour should be used when isochromatic plates are to be developed. If it is not convenient to have the liquid tank lamp, then we should recommend a lamp with a series of glasses. There should be one yellow, one orange, one ruby, and one green: these can be used separately or together, just as required. We would suggest also that the glasses should be tested photographically by exposing a portion of a plate to the action of the light for two minutes, at a distance of, say, one foot. The plate should then be developed in darkness, when it will be at once seen, on taking the plate out of the fixing, whether that portion of the plate exposed to the light of the lamp is affected or not. Of the above series of glasses it will be found that the orange and green combined will give a most pleasing light, which is fairly safe for ordinary plates and papers.




CONTRIBUTED BY W. H. CADMAN.

DENSITY OF ICE.—A description is given in the "Phys. Rev." of recent determinations of the density of ice by weighing it in ice-cold water with suitable precautions. The authors find the density of old and new river ice is the same, and may be taken as 0·91661 ± 0·00007.

COLOURS OF BUTTERFLIES.—It is a common error to suppose that butterflies owe their beauty to diffracted light. W. B. Croft has recently examined a collection of British Lepidoptera and found no specimens that were coloured by wave interference. The colour effect is almost entirely due to coloured scales containing pigment.

IRON CASES FOR MAGNETS.—In the "Ann. d. Physik." for August 1901 an account is given of a series of experiments by I. Klemenčič upon the protective effect of iron cases for magnets. He observed the moments of three permanent magnets kept in iron cases and found that no change of moment occurred when the magnets in their cases were subjected to shock. The experiments prove the great advantage of keeping magnets in iron cases.

NEW SYSTEM OF SIGNALLING AT SEA.—Captain Brinkworth, of Gloucester, has invented a new kind of compass-card with the object of assisting fog-bound vessels. The card has a list of sound-signals to correspond with various points of the compass. It is claimed that if this system were adopted a ship in a fog could bellow out, on its fog-horn or whistle, a distinct intimation of the course it is steering. A timely warning would thus be given to any ships in the neighbourhood, and the risk of collisions greatly minimised. All will appreciate this invention who have had the experience of steaming in a thick fog at slow speed with the whistle sounding continuously, and answering signals coming from somewhere at hand, but in what direction it is often difficult to tell. It should prove a boon to captains, if practicable.

HEAT-PRODUCING CAPABILITIES OF COAL.—The "calorific power" of coal is determined experimentally by means of a calorimeter, which consists of a large vessel holding a definite quantity of water. A weighed amount of the coal to be tested is ground to powder and carefully mixed with a composition of saltpetre and potassium chlorate, about 1 part of coal to 10 parts of the mixture. This is placed in a copper cylinder enclosed in a second copper vessel, a fuse is inserted, and when lighted the copper vessels are put in the vessel of water. When combustion ceases a stopcock is opened, which allows the water to fill the copper vessels, and all the heat is absorbed. From the rise in temperature of the water and by means of a table supplied with the instrument the calorific power is determined, either in units of heat or evaporation.

MEASUREMENT OF ATMOSPHERIC PRESSURE.—The principle of the Cartesian diver has been put to a new use by G. Guglielmo for the measurement of atmospheric pressure and its variations. A great advantage is that it is possible to eliminate temperature effects altogether. The diver may be weighted so as to rise or sink at a certain pressure. By increasing the air space and the density of the liquid the sensitiveness may be increased almost indefinitely.

NOVEL USE OF THE GRAMOPHONE.—At the opening of the session of the Royal Geographical Society Sir Harry Johnson gave an interesting account of his recent explorations in Central Africa. The languages of the natives, as well as their musical abilities, were demonstrated by means of the gramophone. This instrument should prove a valuable aid in the scientific examination of the Dark Continent. The author is to be congratulated on the introduction of this novelty in the way of lecture illustrations.

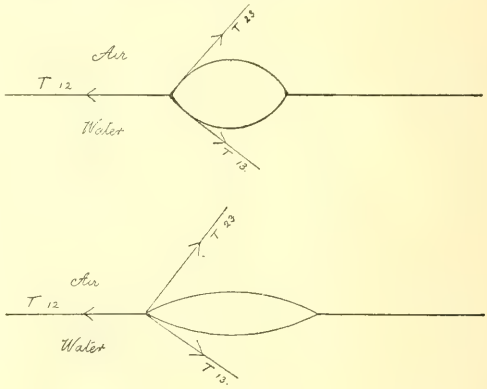
THE PRESSURE OF LIGHT.—In the January number of SCIENCE-GOSSIP a short account was given of Professor P. Lebedew's research by means of which he demonstrated experimentally the pressure of light. A remarkable case of simultaneous discovery is given in the "Physical Review" for November 1901, in which E. F. Nichols and G. F. Hull describe a preliminary communication on the pressure of heat and light radiation. This account was published almost on the same day as Lebedew's experiments proving the pressure of light. The American physicists used a bolometer of special construction to measure the energy of the radiation causing the pressure; whereas Lebedew used a calorimeter. In both cases a torsion balance and an arc-lamp were employed. Messrs. Nichols and Hull found that the measured radiation pressure is to the radiation pressure, which the theory applied to the bolometer measurements would require; as 78 : 100. They point out several sources of error. Professor Lebedew, however, obtained almost perfect agreement.

RADIATION AT LOW TEMPERATURES.—Many experiments have been made with the object of determining the relation between the rate of cooling of a body in a vacuum and the temperature of the body. Dulong, Petit, and Desains used a blackened copper ball, suspended by a thermocouple in the centre of a glass bulb. The most recent experiments are those made by M. Compan, who carried these experiments down to the temperature of liquid air. The bulb was exhausted by means of a mercury pump. The copper ball was then heated without being removed, by concentrating upon it the light of an arc lamp. The bulb was placed successively into melting ice and liquid air. Compan found that the formula proposed by Stefan, $R = E_1T^4$, agreed best with the experimental results, the rate of cooling being proportional to the fourth power of the absolute temperature of the cooling body and its envelope. The formulae proposed by other experimenters do not agree with the observed results at low temperatures.

OIL FILMS ON WATER.—In connection with the interesting note on this subject in the last issue (*ante*, p. 256), I may mention that many years ago attempts were made to distinguish between different kinds of oils by the difference in what

was termed the *cohesion figures*, which were formed when they were allowed to fall upon the surface of water. Thus olive oil first forms a disc with recurved edges, but spaces soon appear round these edges, and portions detach themselves from the main body to become united again in some places, enclosing polygonal spaces, over which is an almost invisible film of oil. In the case of sesamé oil the film contracts, and eventually a figure somewhat resembling a spider's web, with well-defined circular edge, is produced. Colza oil, again, forms a circle surrounded by a large number of minute drops, and poppy-seed oil gives a circle with serrated edge. In the case of mixtures the form of the cohesion figure varies with the proportion of the different oils, but little reliance can be placed upon the phenomenon as a test of the purity of any particular oil.—*C. A. Mitchell, London.*

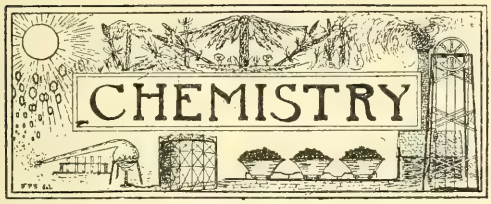
[The lucid account of *cohesion figures* given above by Mr. Mitchell is of more than passing interest. The writer has repeated some of the experiments with different oils, and obtained different shaped films for each kind of oil that had been dropped on the surface of water. The figures closely resembled those described. Applying the principle of the conservation of energy it will be seen that the potential energy of the system depends upon —(1) the action of gravity; (2) the mutual action of the liquid particles; (3) the action between the particles of water and the oil in contact with it. The condition of equilibrium is, that the potential energy shall be a minimum. M. Plateau got rid of gravity by forming a mixture of alcohol and water of the same density as olive oil, and then introducing a small quantity of oil into the mixture. The oil then assumed the form of a sphere under the action of surface tension alone. On altering the form of certain parts of the surface of the oil, the free portions of the surface assumed new forms depending upon the equilibrium of surface tension. In the case, however, of an oil-film on water one must consider three different fluids, and consequently three surfaces of contact. In the instance of three fluids which do not mix the three surfaces of separation meet in a line, straight or curved. Denoting the tensions of the three surfaces by $T_{12}$, $T_{23}$, and $T_{13}$, it is clear that there will be equilibrium if the sum of the components $T_{13}$ and $T_{23}$ equal $T_{12}$. When one force is greater than the sum of the other two, the condition of equilibrium no longer holds, and the wedge formed by the surfaces of separation of the oil with air and water becomes very narrow, causing the film to get thinner and thinner and spread out in the manner oil does on the surface of water, as in fig. 2, where $T_{12}$ is greater than the sum of $T_{13}$ and $T_{23}$, so that the oil spreads rapidly over the surface of the water, covering it with a thin film of oil, almost invisible. The values of the surface tension vary with time, so that it is probable a slight diffusion takes place. I consider that a film of a third liquid is formed from the oil and water by hydrolytic dissociation. The fatty oils, such as olive and linseed oils, are ethereal salts formed by the combination of the fatty acids with glycerine, which acts as a hydroxide or weak base. Hence, since weak acids and weak bases are in question, the chemical nature of water must be taken into consideration. It is usual to speak of water as a perfectly neutral substance, but this is far from being the case. Even distilled water must contain ions in moderate quantity, as shown by its electrical conductivity. If the conductivity is not due to dissolved impurity, the ions with which the electricity travels must come from the water itself. The chemical and electrochemical behaviour of water is accounted for by regarding these ions as hydrogen ions and hydroxyl ions. Hydrolysis can be completely explained by assuming that in water an equilibrium subsists between undecomposed molecules and ions. Since the conductivity of water is very small the amounts of ions present are extremely minute, but are sufficient to confer on water the properties of a weak acid on account of the hydrogen ions, and of a weak base on account of the hydroxyl ions. In the case of oil films on water, a decomposition of these ethereal salts by solution in water is almost certain to occur, and since both




the acid and base of the salts are weak the hydrolysis will be independent of the dilution. The reader will thus see that the subject of oil films on water presents several fascinating problems on chemical equilibrium in addition to surface tension and optical phenomena.—Ed. *Physics.*]

Surface Tension and Grease Spots.—The surface of a liquid is in a state of tension similar to that of a membrane stretched equally in all directions. This property of surface tension is useful in removing grease spots from cloth. If a drop of oil is placed on a glass plate, and a drop of alcohol be brought near it, the alcohol drives the oil along in front and appears to chase it. If a ring of alcohol is made all round the oil the drop stands up in a little compact mass like a lens. Hence to remove a grease spot from cloth, wet one side of the cloth with alcohol or benzol in a ring all round the spot, and then place a piece of blotting-paper near the centre to absorb the little mass of grease driven there. Another method is to heat the grease spot on one side, when the rise of temperature diminishes the surface tension, and so drives all the grease spot to one side, where it can be gathered up as before.

The National Physical Laboratory.—The formal opening of the new National Physical Laboratory at Bushey House, Teddington, is announced to take place on March 19th, when H.R.H. the Prince of Wales will perform the ceremony. We understand that the institution will be one of the most perfect of its kind.




CONDUCTED BY C. AINSWORTH MITCHELL, B.A.OXON., F.I.C., F.C.S.

SUPPOSED NEW ELEMENT.—Mr. C. Baskerville believes he has discovered a new element associated with thorium. He considers it probable that ordinary thorium is not the simple substance hitherto supposed, but is a mixture containing an element with an atomic weight lying between 260 and 280. If his results be confirmed he suggests the name *Carolinium* and the symbol *Cn* for the new element.

INCRUSTATION ON ST. PAUL'S.—A balustrade of Portland stone surrounds the stone gallery at the base of the dome of St. Paul's Cathedral. In certain places, and especially on the under side of the coping stone, there is a deposit of a grey or black substance, which here and there is three quarters of an inch in thickness. It can readily be powdered, and under the microscope shows no trace of organised growth. According to the analysis of Mr. E. G. Clayton, F.I.C., it has the following percentage composition:—Water, 24·54; carbon (soot), 1·10; calcium sulphate, 59·38; calcium phosphate, 2·22; calcium silicate, 1·63; magnesium silicate, 0·67; iron silicate, 2·40; and sand and uncombined silica, 8·06. The deposit, therefore, consists mainly of calcium sulphate hydrated, together with some siliceous matter. In Mr. Clayton's opinion this main constituent was chiefly formed by the action of the sulphuric and sulphurous acid in the smoke from surrounding chimneys upon the stone, assisted by action of rain.

BLEEDING BREAD.—If moist bread be exposed to the air it will speedily be covered with a growth of various moulds and bacteria, among which may possibly be small bright red patches. On inoculating a suitable culture-medium with the latter, a brilliant red growth of the *Bacillus prodigiosus* can be obtained. To the wholesale infection by this micro-organism must be attributed the mediaeval miracles of "bleeding bread." A similar infection of meat occasionally takes place, as in the instance mentioned by Dr. Klein, where the whole of the flesh in a shop in the City became scarlet. It is interesting to note that in this case the larder where the meat was stored overlooked a churchyard in which the graves had recently been disturbed. The *B. prodigiosus* is a short organism with rounded ends that occasionally forms filaments. It develops best in the presence of air, and when grown upon nutrient gelatin liquefies that medium. The red pigment, which appears to be an excretory product, requires oxygen for its production. It dissolves readily in alcohol and ether, but is insoluble in water. It appears to be of a similar character to the aniline dyestuffs. On the addition of acid the colour is changed to pale red, which on the addition of alkali is reconverted into the original colour. The writer has dyed white silk a beautiful pink colour by means of an alcoholic solution of a pure cultivation.

COMPOSITION OF MUMMY FISH.—In a recent number of the "Journal de Pharmacie et Chimie" M. Hugounenq gives an interesting account of his examination of mummy fish, obtained from the Pyramids of Sakkarah, near Memphis, and reputed to be at least 2,000 years old. Most of these fish belonged to a species of carp still found in the Nile. The animal debris of which they form part is so abundant that it is sold in large quantity for manure. The mummy fish were swathed, either singly or in groups, in linen, the space between being filled with a yellowish earthy matter. When pulverised the fish yielded a light yellow powder, which contained 8·47 per cent. of nitrogen, and on treatment with water, dissolved to a slight extent, and imparted an acid reaction to the solvent. On ignition the powder left 34·77 per cent. of ash, which had the following composition: Potassium chloride, 2·03; sodium chloride, 23·62; sodium sulphate, 8·57; calcium and magnesium phosphates, 5·81; iron oxide, 1·31; clay and other silicates, 57·93; and undetermined substances and loss, 0·73 per cent. This composition is similar to that of the sandy and clay deposits, impregnated with sodium chloride and sodium sulphate, which are formed naturally by the evaporation of the sodium salt lakes found in the desert parts of Egypt and other parts of North Africa. In the opinion of M. Hugounenq, the fish were probably first dipped into the saline waters of one of these lakes and then wrapped in a layer of the pasty deposit, the presence of the alkali salts effecting preservation.

SCORPION VENOM.—Only about a dozen of the numerous species of scorpions at present known are found in Europe, and their sting is much less venomous than those of the larger Indian and African species. The amount of venom secreted is comparatively small, at least in the European scorpions. Thus Jusset estimated that a specimen of *Scorpio occitanus*, which occurs in Southern Europe, contained about 0·03 grain, which amount, however, was sufficient to kill a moderately large dog. The venom itself is a clear, slightly acid liquid with a pungent smell. It is readily soluble in water, but does not dissolve in alcohol. Its specific gravity is somewhat greater than that of water. The fact of its being coagulated by alcohol points to the presence of albuminous substances similar to those that have been isolated from different snake poisons. The physiological effects of scorpion venom are local inflammation, convulsions, and paralysis, whilst, according to Jusset's experiments, it arrests circulation by causing the red corpuscles of the blood to adhere together. Bert, however, found that it was only a nerve poison, and had no effect upon the blood of animals killed by it. From certain experiments made by Valentin upon frogs, curare injected prior to the sting appears to be a possible antidote. When taken internally the venom is apparently without action, which is another point of resemblance between it and snake poison. The long-disputed question of the scorpion committing suicide when surrounded by a circle of glowing charcoal is *a priori* unlikely, since venomous animals are, as a rule, immune against the venom of others of the same species. Professor Bourne, who examined the evidence on the point, came to the conclusion that the real explanation of the so-called suicide is that the scorpion is extremely sensitive to heat, and that the effects attributed by certain observers to the venom were really due to the heat alone.


CONDUCTED BY F. C. DENNETT.

| 1902 Feb. | Rises. h.m. | Sets. h.m. | Position at Noon. R.A. h.m.s. | Dec. ° ′ ″ |
|---|---|---|---|---|
| *Sun* .. 9 .. | 7.29 a.m. .. | 5. 1 p.m. .. | 21.28.58 .. | 14.52.29 S. |
| 19 .. | 7.10 a.m. .. | 5.19 p.m. .. | 22. 8. 6 .. | 11.30. 6 S. |

| | Feb. | Rises. h.m. | Souths. h.m. | Sets. h.m. | Age at Noon. d. h.m. |
|---|---|---|---|---|---|
| *Moon* .. | 9 .. | 7.24 a.m. .. | 12.54 p.m. .. | 6.35 p.m. .. | 0 22.39 |
| | 19 .. | 2.12 p.m. .. | 9.55 p.m. .. | 4.48 a.m. .. | 10 22.39 |

| | Feb. | Souths. h.m. | Semi-diameter. | Position at Noon. R.A. h.m.s. | Dec. ° ′ ″ |
|---|---|---|---|---|---|
| *Mercury* .. | 9 .. | 1.11·2 p.m. .. | 4·2″ .. | 22.26. 0 .. | 7.34.48 S. |
| | 19 .. | 0. 4·0 p.m. .. | 5·2″ .. | 21.57.59 .. | 8.26.42 S. |
| *Venus* .. | 9 .. | 0.37·7 p.m. .. | 30·4″ .. | 21.52.26 .. | 4.42.22 S. |
| | 19 .. | 11.34·6 a.m. .. | 30·3″ .. | 21.28.32 .. | 5.51.19 S. |
| *Mars* .. | 19 .. | 0.47·2 p.m. .. | 2·0″ .. | 22.41.15 .. | 9.22.21 S. |
| *Jupiter* .. | 19 .. | 10.27·2 a.m. .. | 15·2″ .. | 20.21. 1 .. | 19.52. 9 S. |
| *Saturn* .. | 19 .. | 9.47·0 a.m. .. | 7·1″ .. | 19.40.42 .. | 21.19. 1 S. |
| *Uranus* .. | 19 .. | 7.26·4 a.m. .. | 1·8″ .. | 17.19.39 . | 23.11. 3 S. |
| *Neptune* .. | 19 .. | 7.59·4 p.m. .. | 1·2″ .. | 5.54.43 .. | 22.16.33 N. |

MOON'S PHASES.

| | | h.m. | | | h.m. |
|---|---|---|---|---|---|
| *New* .. | Feb. 8 .. | 1.21 p.m. | *1st Qr.* .. | Feb. 15 .. | 2.57 p.m. |
| *Full* .. | „ 22 .. | 1. 3 p.m. | | | |

In apogee on February 1st, at 12 p.m.; and in perigee on 16th, at 6 p.m.

METEORS.

| | | | h.m. | ° |
|---|---|---|---|---|
| Feb. | 5 to 16 .. | α Aurigids | Radiant R.A. 4.56 | Dec. 43 N. |
| „ | 15 to 20 .. | α Serpentids | „ „ 15.44 | „ 11 N. |

CONJUNCTIONS OF PLANETS WITH THE MOON.

| | | | | ° ′ |
|---|---|---|---|---|
| Feb. 3 .. | .. | Vesta .. | 11 p.m. .. | Planet 0.41 N. |
| „ 6 .. | .. | Saturn* .. | 1 p.m. .. | „ 4.46 S. |
| „ 7 .. | .. | Jupiter† .. | 5 a.m. .. | „ 5.26 S. |
| „ 9 .. | .. | Venus† .. | 5 a.m. .. | „ 3. 9 N. |
| „ 9 .. | .. | Mars* .. | 2 p.m. .. | „ 5.58 S. |
| „ 9 .. | .. | Mercury† .. | 9 p.m. .. | „ 2.23 S. |

* Daylight. † Below English horizon.

OCCULTATIONS AND NEAR APPROACHES.

| Feb. | Star. | Magnitude. | Disappears. h.m. | Angle from Vertex. ° | Reappears. h.m. | Angle from Vertex. ° |
|---|---|---|---|---|---|---|
| 2 .. | $\beta^2$ Scorpii | 5·2 .. | 7.10 a.m. .. | 123 .. | 8.29 a.m. .. | 242 |
| 2 .. | $\beta^1$ „ | 3·0 .. | 7.10 a.m. .. | 124 .. | 8.28 a.m. .. | 242 |
| 12 .. | ε Piscium | 4·5 .. | 7.40 p.m. .. | 87 .. | 8.18 p.m. .. | 162 |
| 14 .. | σ Arietis | 5·5 .. | 5.53 p.m. .. | 110 .. | 6.45 p.m. .. | 188 |
| 16 .. | *i* Tauri | 5·1 .. | 6.24 p.m. .. | 140 .. | 7.18 p.m. .. | 217 |
| 17 .. | *m* „ | 5·1 .. | 2.21 a.m. .. | 146 .. | Near approach. | |
| 21 .. | κ Cancri | 5·0 .. | 5.44 a.m. .. | 340 .. | Near approach. | |

THE SUN, although now usually free from disturbance, should be watched.

MERCURY is an evening star, reaching its greatest eastern elongation, 18° 17′, at noon on February 3rd, until 9 p.m. on the 18th, when, being in inferior conjunction with the Sun, it becomes a morning star. Its position is not very favourable for observation.

VENUS is an evening star until 11 p.m. on February 14th, when it is in inferior conjunction with the Sun, and afterwards becomes a morning star. The best time for observing Venus is in the daytime.

MARS, JUPITER, AND SATURN are too near the Sun for satisfactory observation, and the low altitude of URANUS is against successful telescopic vision.

NEPTUNE is above the horizon all the working hours of the night, and can still be well observed with sufficiently powerful instruments.

ZODIACAL LIGHT.—On sufficiently clear, moonless evenings, so soon as it becomes dark enough for observation, this conical brightening may be traced from the western horizon, following the course of the ecliptic.

MINOR PLANETS.—Three new planets were discovered at Heidelberg on December 4th, 5th, and 16th respectively. The new one mentioned *ante*, p. 248, although sufficiently remarkable, is not so near a neighbour as was supposed. It was first found on a plate taken with the 24-inch Bruce telescope at Arequipa on August 14th. Its great southern declination, over 62°, at once attracted the attention of Dr. Stewart. Several plates were taken and measured, and the positions sent to Professor Pickering at Harvard College. Professor Simon Newcombe was then visiting Boston, and, with the assistance of Miss A. Winlock, calculated its orbit. Its mean distance from the Sun was found to be 2·57, that of the Earth being equal to 1·0, and its period 4·13 years. The most remarkable feature is its eccentricity, 0·377, exceeding that of any other, except Aethra. When discovered it was travelling very rapidly towards perihelion, which it reached early in October, when its distance from the Sun was 1·60. At midnight on January 30th it will be situated in R.A. 0 h. 31·9 m., Dec. 3° 26′ N. close to the ecliptic in the constellation Pisces, some 4° south-west of the fifth-magnitude star delta.

GREAT METEOR.—On December 4th, at about 5.37 p.m., an exceedingly brilliant meteor was observed over the whole south of England. The area from which records come extends from Margate to Devonshire, and from Birmingham to Bournemouth. Mr. G. W. Valentine gives its colour as steel-grey, and its direction from N.N.W. to S.S.E., passing about 20° south-east of the beautiful double star, β Cygni. He writes from Bitterne Park, Southampton, describing the meteor as making a loud rushing noise. Its duration is variously reckoned as from 3 to 5 seconds, and a trail was visible for some time longer. It undoubtedly radiated from Hercules, apparently from near R.A. 17h. 32m., Dec. 35° N. All accounts describe it as of intense brilliance.

THE LEONIDS.—Professor E. L. Larkin announces the observation from the Lowe Observatory, California, of 661 meteors, 217 of which were as bright as or brighter than Rigel.

VENUS.—An announcement has been going the round of the Press concerning the abnormal brilliance of Venus on January 13th, after the Moon had set, as observed by M. Giacobini at the Nice Observatory. The only effect noted, is that it threw shadows on the wall of the observatory. This is, however, nothing extraordinary, as Webb long since mentioned the fact in "Celestial Objects for Common Telescopes." The first time we witnessed the phenomenon was so far back as 1876 or

1877, and as lately as in Christmas week 1901 whilst at Enfield. Perhaps the most interesting effect of the brilliance is, that Professor W. R. Brooks has actually succeeded in taking photographs by the light of the planet.

MONTHLY STAR MAPS FOR 1902.—These compilations by Mr. W. B. Blaikie have been sent to us included in the useful blotting-book issued by the Scottish Provident Institution. They are most interesting and useful for showing the varying positions of the constellations month by month, and the daily place of the Moon. The situations of Jupiter and Saturn, the only planets visible in the 10 o'clock sky, are shown on the maps. There is also a chapter explaining the apparent motions of Venus, besides an abundance of useful information for the amateur observer.

JOHN J. BRETT, F.R.A.S.—We are sorry to have to record the death of this well-known artist and astronomer of Putney. A fine lunar sketch from his pencil illustrated the first number of "The Observatory."

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MINOR PLANETS.—Print from Photographic plate showing Trail by which Svea, No. 329, was discovered.
*(By permission of Professor Max Wolf.)*

## CHAPTERS FOR YOUNG ASTRONOMERS.

BY FRANK C. DENNETT.

*(Continued from page 215.)*

### MINOR PLANETS.

BETWEEN the orbits of Mars and Jupiter lie the paths of an immense number of tiny planets, of which nearly five hundred have been discovered. The first, Ceres, was first seen by Piazzi at Palermo on January 1st, 1800, and three others were found —Pallas in 1802, Juno in 1804, and Vesta in 1807. Juno was discovered by Harding of Lilienthal with a very poor telescope of 2 inches aperture, and Vesta by Olbers with an ordinary night glass. The brightest of these, Vesta, never exceeds the 6th magnitude. At this time real hard work was necessary to find a planet; first star maps had to be constructed showing all stars down to about the 9th magnitude. These maps had to be continually compared with the sky, which meant a vast amount of patience. No further discoveries, however, were made until December 1845, when Hencke, of Driessen, who had been diligently searching for fifteen years, discovered Astraea. Since 1847 no year has passed without one at least of these pigmy worlds being found. Goldschmidt, labouring with a $2\frac{1}{2}$-inch telescope from a window near Paris, discovered fourteen. So far back as 1859 Mitchell, of Cincinnati, wrote:—"Could a daguerreotype picture of any region in the heavens be made to-night, and at the end of a year another picture of the same region could be taken, by comparing the number of stars in the one picture with that in the second . . . it would be an easy matter to ascertain" the coming or going of strangers. Not, however, was it until the end of 1891 that Professor Max Wolf, of Heidelberg, when photographing stars in the ecliptic, found amongst the stars two short lines or trails. One of these was proved to be produced by the planet Sapientia, already known, and the other by a new planet, No. 323, afterwards named Brucia. Since that time photography has almost entirely replaced visual searching for these little bodies. The photographs by Professor Max Wolf, taken with the 16-inch Bruce telescope on November 4th, 1901, and with the 6-inch portrait lens on March 21st, 1892, the former enlarged three and a half and the latter six times will show what these trails are like. In each case the plates were exposed for two hours. It was stated in the "Bulletin Astronomique" for October 1896 that, out of thirty-nine plates exposed, eleven showed no planets, whilst the rest contained the trails of no less than fifty-two planets—forty-six old, and six new discoveries. Sometimes several new ones have been observed on one plate, as, for instance, on October 31st, 1899, when three were so found, and on one occasion there were no less than five.

The orbits of these tiny worlds are often so inclined from the plane of the ecliptic that they are sometimes known as ultra-zodiacal planets.

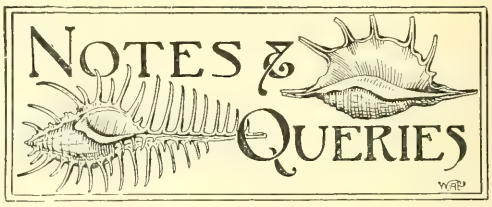
Pallas, for instance, has an inclination of 34°·7, but, on the other hand, Massilia is only inclined 0°·7. There is also considerable difference in the size and shape of the orbits, for whilst No. 330 is comparatively near the orbit of Mars, No. 380, shown, together with another newly-discovered planet, on the photograph of November 4th, 1901, is far out towards that of the planet Jupiter. All planets travel in paths more or less elliptical, Venus is most nearly circular amongst the major planets, the amount of its eccentricity being expressed as 0·0068. Among the minor planets the eccentricity of Europa amounts to only 0·004, whilst the object photographed at Arequipa on August 14th, 1901, is one of the most eccentric known, that element being expressed as 0·377. This means that when nearest the Sun its distance is only 148,800,000 miles, but when farthest 329,220,000 miles separate the two bodies; but this eccentricity is exceeded by Aethra. The nearest of the little planets has a year lasting, in extent of time, to about three of ours, but the most distant one occupies nearly nine years in travelling its path.

Professor Barnard's measures with the 36-inch Lick telescope in 1894 gave the actual diameters of Ceres, Pallas, and Vesta as 599, 273, and 237 miles respectively. The rest, excepting Juno, are all much smaller; it is doubtful if the greater portion of them do not vary between 15 and 5 miles in diameter, the figures given by Hornstein.

As telescopic objects, at least with all but the largest telescopes, they are a failure, appearing as tiny stars varying in size from 6·6 magnitude to the tiniest points, some shining with a ruddy, others with a bluish light. As objects on the photographic plates, it will be seen, by the examples here given, they are represented by thin lines of varying angles. These are caused by the motion of the planets among fixed stars during the exposure of the plates, which occupied, as already noted, two hours in both cases cited. The images from the stars are kept motionless on a photographic plate, by means of clockwork.

Quite separate from the other minor planets is Eros, having an orbit mostly within that of Mars. It was discovered August 13th, 1898, by Herr Witt, of Berlin, and is without doubt the most important of the minor planets from an astronomer's point of view. When nearest to the Earth its distance is only about 13,000,000 miles, or little more than half that of Venus when in transit. Its distance from the Sun varies from 1·1333 to 1·7828, taking the Earth's mean distance as 1·0. The most favourable oppositions of the planet during the near future will be in the years 1917 and 1924, when every effort will be made to determine with more exactness the actual distance of the Sun from the Earth, and also the relative masses or weights of these two bodies. When nearest to the Earth, Eros appears as a star of, say, sixth or seventh magnitude, but it is usually much smaller. The discovery of its variability within a period of about 2h. 22m. leads one to suppose from the nature of the variation that the planet is closely double, and that the components revolve in an orbit whose plane at times passes through the Earth. In the middle of February 1901 the variation was found to be from 9·3 to 11·0 magnitudes. Its revolution round the Sun is accomplished in 643·1 days.

(*To be continued.*)

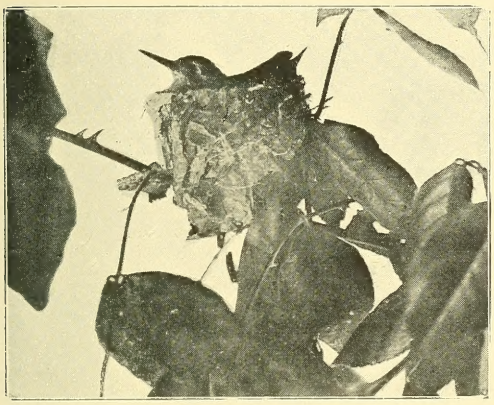



Evolution of Pain and Pleasure.—I am acquainted in a general way with the accepted principles of organic evolution, but I cannot remember coming across any discussion of the evolution of pleasure and pain in the works of Darwin, Wallace, Romanes, or Haeckel. There is a popular belief that low forms of life are not capable of much pleasure or pain. Can this view be justified from the Darwinian standpoint? Could it be argued with any force that, other things being equal, the animal that enjoys and suffers most is the fittest animal, and that consequently pleasure and pain are selected by nature in the same way as fleetness, strength, cunning, or other attributes of value to the existence of animals? Some observations on house flies which I made during the summer have led me to think that these creatures do not suffer, in an analogous way to man. I have found several times that a fly, immediately after one of its legs is pulled off, will proceed to devour sugar. I shall be very grateful if any of your readers can give me information on this subject, or can refer me to authors who treat it in a popular way.—*William Smith, Glasgow.*

Animals and Telegraph-poles.—The note in Science-Gossip, *ante*, p. 241, on the damage done to telegraph-poles by woodpeckers reminds me that at the Paris Electric Exhibition of 1881 specimens of portions of telegraph-poles were exhibited to show the damage done to them by woodpeckers, and also by bears. The birds seemed generally to attack the poles near the top, and in some cases holes had been made large enough to pass the hand through; but the bears had gnawed away the wood nearer the ground, thereby weakening the poles to such an extent that they broke off and fell under a very moderate wind pressure. It was clear neither the birds nor the beasts wanted to devour the wood, and it was explained that their attention was drawn to the poles by the humming noise produced by the vibrations of the wire, and communicated to the poles by conduction. Whilst, therefore, the woodpeckers endeavoured to get at the insects which they imagined were living somewhere inside the pole, the bears, under the impression that there must surely be a bees' nest inside, had made strenuous efforts to secure the honey, of which they are so passionately fond. The immunity of a majority of the poles, in contradistinction to the attacks upon others, was thought to be due to a fine sense of discrimination on the part of the animals, which induced them to trouble only about the poles that resounded with notes of precisely the same pitch as those naturally produced by the particular insects desired. No doubt painting the poles would tend to preserve the wood from the influences of the weather, but as this would not stop the humming, it is extremely doubtful if it would be to any extent a remedy for the mischief above mentioned. The cure seems rather to lie in the direction of insulating the wires in

some such way as that adopted by telephone companies to prevent the annoyance caused to inhabitants of houses on which poles are fixed from the Aeolian strains emitted by the overhead wires under the influence of a moderate breeze.—*R. T. Lewis*, 4 *Lyndhurst Villas, Ealing, W.*

NEST OF HUMMING-BIRD.—Enclosed I send you a picture of a nest of a humming-bird. It is represented half natural size, and the chief difficulty in taking the photograph was obtaining



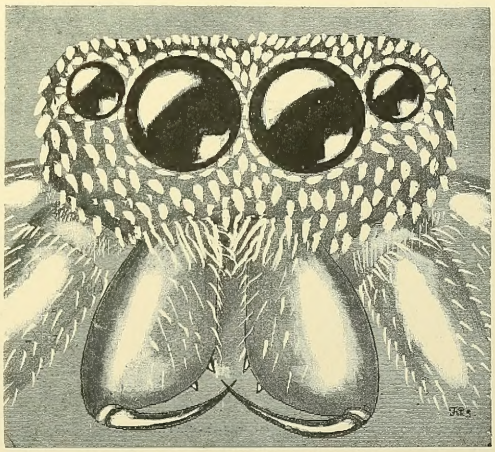
NEST OF HUMMING-BIRD.

the light necessary for a successful picture, as the subject was under the eaves of my verandah, where the light was shaded. To get over the difficulty I hung a sheet of cardboard to the left of the camera, and directed a ray of sunshine on it by means of a mirror standing on the grass some distance away. I may mention, as showing the tameness of the parent bird, that she fed the young ones in the nest several times during the operation of photographing, though the camera was not more than two feet distant from the nest. The parents began building on November 28th, 1900; the first egg was laid on December 9th. I did not get the date of the second egg, but they were hatched on December 25th, and the young birds were fledged on January 18th, 1901.—*E. Dukinfield Jones, Castro, Estado do Paraná, Brazil.*

THE MILD WINTER.—Since Christmas the weather in the West of England has been remarkably mild. During the week ending January 25th many evidences of an early spring were to be found, such as pollen-shedding male catkins of hazel (*Corylus avellana*, Linn.), some I found being upwards of three inches in length. The blooms of sweet coltsfoot (*Petasites fragrans*, Linn.) scented whole districts with their almond-like perfume; primroses were in bloom, and land mollusca active.—*John T. Carrington, Lynmouth.*

RUFOUS, OR MOUNTAIN PARTRIDGE.—Several specimens of *Perdix montana* Brisson, a variety of the common partridge, have recently occurred near Stone, Staffordshire, and others have been reported from Norfolk and different counties. I should be much obliged to any of your readers who will kindly supply me with particulars of instances of, or references to, this variety of the partridge which may have come under their notice, my object being to obtain as complete a list as possible of British examples. If any supposed or probable cause for the occurrence of this erythristic variety can be given, such as the importation of foreign partridges or their eggs, I shall be glad to have it stated.—*John R. B. Masefield, Rosehill, Cheadle, Staffordshire.*

WHAT THE FLY SAW WHEN THE SPIDER SPIED HER.—Among recent jokes there has been the riddle, "Why did the fly fly?" the obvious answer being, "Because the spider spied her." There is more at the back of this than appears on the face of the joke, for the front of the spider must be appalling to the vision of a fly. Having thought out the subject from the point of view of the wretched dipteron that has been so unfortunate as to become an object of attention of some rapacious arachnid, I have made a drawing of what the fly sees when one of our common species of spiders (*Salticus scenicus* Clk.) presents its frontal aspect. My sketch is taken from a photograph obtained by myself from a living specimen, and forms an accurate picture of the fly's bogey, excepting that the bright colours of the thoracic region are backed by the sombre tints of the body raised behind. We are given to understand that, as a rule, the visual powers of the diptera are comparatively well developed. If this be so, we may extend some sympathy towards these creatures when we consider the nervous shock they must experience upon being suddenly confronted with this ideal of



WHAT THE FLY SEES.

hideousness. Such an object would probably spoil the riddle, for one can hardly imagine the fly flying under such circumstances. This fascination may account for the obesity of some of our spiders.—*Frank P Smith*, 15 *Cloudesley Place, London, N.*

RAINFALL IN NORTH DEVON.—I have been informed that the rainfall in North Devon has been deficient for some years past. During the four years I have kept a daily record at this place it has annually varied to the extent of nearly nine inches, the highest being 44·27 inches in 1900, and the lowest 34·64 inches last year. The rainfall here has never at any one time during the four years been extraordinary, and on fourteen occasions only has it exceeded 1 inch in twenty-four hours. The heaviest fall was on December 12th, 1901, when the amount was 2·15 inches. My station is only 20 feet above the sea level, and

Mr. Ford, of Gwynallt, whose station is also at Lynmouth, and within a quarter of a mile away, but 300 feet above the sea level, generally records a heavier fall than at this lower station, though on December 12th last, as above referred to, he only recorded 1·94 inches. Lynmouth, however, is by no means the wettest place in the neighbourhood, as Ilfracombe, Martinhoe, South Molton, and Parracombe nearly always have much heavier falls. The two places, however, from which the heaviest returns come are Arlington Court, where the gauge is taken by Lady Chichester—the fall there last year was 52·33 inches—and at Simonsbath, nine miles inland from Lynmouth, where the Rev. N. L. Pigot recorded 63·74 inches. The heights above sea level of the last two stations are respectively 925 feet and 1,080 feet. In every year of which I have any note Simonsbath has always had by far the heaviest fall in North Devon. The past four summers have all been dry, with little or no midsummer rains. Two summers ago, some of the springs on the moors about five miles hence were running very dry, and I have been told that last year, which had the lowest fall of the four, other springs besides those on the moors were running very short, and in some places were absolutely dry. There is no apparent cause for this shortness of the rainfall, as surface draining is not extensively carried on near here, and there is not much cutting of woods or other alteration of the surface of the surrounding country.—*Thos. H. Mead-Briggs, Rock House, Lynmouth, North Devon, January* 1902.

## NOTICES OF SOCIETIES.

*Ordinary meetings are marked †, excursions *; names of persons following excursions are of Conductors. Lantern Illustrations §.*

NORTH LONDON NATURAL HISTORY SOCIETY.

Feb. 11.—† "The Progress made in Botany, Entomology, Ornithology, and General Zoology during 1901." Various Members.
„ 22.—Annual Exhibition.
„ 25.—§ "Mites." Rev. C. R. N. Burrows.

ROYAL INSTITUTION OF GREAT BRITAIN.

Feb. 4.—† "The Cell." Dr. Allan Macfadyen.
„ 7.—† "The New Mammal from Central Africa." Professor E. Ray Lankester.
„ 11.—† "The Cell." Dr. Allan Macfadyen.
„ 14.—† "Magic Squares and other Problems on a Chess Board." Major P. A. McMahon.
„ 15.—† "Some Electrical Developments." Lord Rayleigh.
„ 18.—† "The Cell." Dr. Allan Macfadyen.
„ 21.—† "Musical and Talking Electric Arcs." W. Duddell.
„ 22.—† "Some Electrical Developments." Lord Rayleigh.
„ 25.—† "The Temperature of the Atmosphere." W. N. Shaw.

SELBORNE SOCIETY.

Feb. 6.—§ "A Talk about the Solar System." H. Keatley Moore, B.A., B.Mus.

HAMPSTEAD SCIENTIFIC SOCIETY.

Feb. 7.—† General Meeting. "The Zero of Temperature." Walter Bailey, M.A.
„ 12.—§ Photographic Section. "Pictorial Photography."
„ 14.—Natural History Section. "Spiders and their Ways." F. P. Smith.
„ 28.—Photographic Section. Beginner's Evening. Criticism of Prints, Negatives, etc.

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WANTED: Termites (in spirit preferred). Would exchange microscopic slides to value.—R. Hancock, Thornhill Road, Handsworth, Birmingham.

OFFERED: "The Photogram," vol. 2; "Amateur Photographer," vol. 16; "Wide World Magazine" (Newnes), Nos. 1–14; all unbound. What offers in exchange?—Charles Mosley, Moor End, Lockwood, Huddersfield.

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