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See **IMPORTANT NOTICE** *on page 160.*

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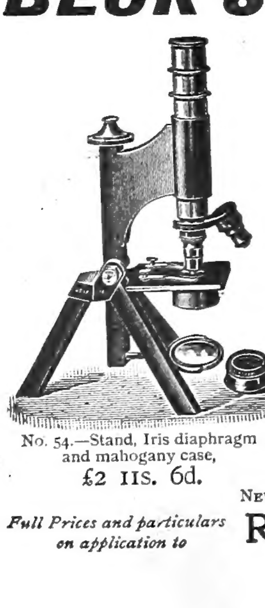

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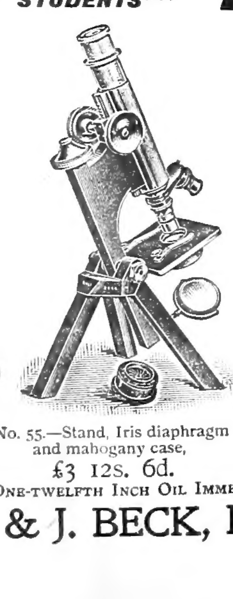

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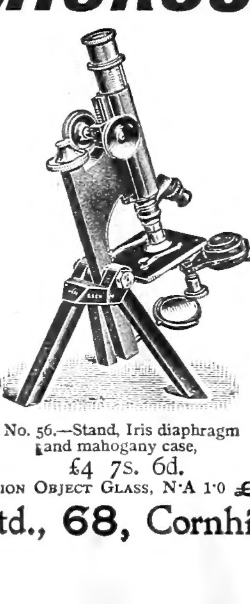

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A HERONRY IN ASIA MINOR.

By J. Bliss, F.R.M.S.

THE Cara Balkam is a shallow lake, varying in size, according to the season, from four to six miles long and two to four broad. It is overgrown with reeds and rushes, and is a hideous, pestilential place, reeking with malaria, alive with mosquitoes, swarming with leeches, unattractive in the extreme to any but a lover of birds. To him, if he escape an attack of fever, it is well-nigh a paradise, for wild fowl in immense numbers resort to it at all times of the year, its dense cover rendering them safe from disturbance, and its surroundings suiting their varied requirements. On one side it is bounded by a vast plain, on another by salt marshes leading to the sea, while on the third and fourth sides, it is close to the mountains and a deep lake of considerable size. It was during the winter of 1875, I first visited this place in search of some birds "as big as sheep," which the natives told me were to be found there. These proved to be pelicans (*Pelecanus onocrotalus*), and I still remember my excitement when I got within range of a large flock of them, also my pride, as I waded through the black vile-smelling mud dragging the great creature out, for I was then young and new to the country.

Cara Balkam.
General view of plain and tit with incomplete nest.

Later visits to the Cara Balkam gave me cranes, herons, egrets, swans, and spoonbills, as well as many species of ducks. In these excursions, however, I never penetrated more than a hundred yards or so into the lake, but in spring of this year, being in the neighbourhood, I determined to reach its centre, the real home of the birds. Starting early one morning in the last week of May, my wife and I, with a friend, reached the lake side before the forenoon was far advanced, and embarked in a couple of boats provided by some fishermen who gain a precarious livelihood from the river near by. These men waded alongside, dragging and pushing the boats, and we were soon in a dense growth of reeds and bulrushes, which rose to a height of eight or ten feet above our heads. The water lilies, of which there were two species, were beautiful. The numerous dragon flies, grey, steel blue, and bright scarlet, were flitting about in all directions, giving animation to the scene. In half-an-hour we reached a piece of open water about an acre in extent, and emerging from the cover of the reeds, we beheld such a sight as would delight the eyes of any naturalist. From the further side rose clouds of birds, hundreds circling round us, as though enquiring why we intruded on their domestic privacy. Hundreds more circled round their nests, which were so numerous and close together that we could proceed no further without destroying them, which we particularly wished to avoid. Nests were found which we believe belong to the large egret, they were composed of stalks and leaves of bulrushes, fitted into a clump of reeds, about a foot above water level, the eggs being of a bluish-green colour. The small egret (*Ardea garzetta*), with eggs and nests similar to the last-named, but smaller. The squacco heron (*A. ralloides*), eggs

Heronry in Cara Balkam with Nests of Small Egret rather darker in colour and smaller than the small egrets. The night heron. A cormorant was very numerous, but the species could not be identified. The eggs were bluish-white, with encrustations of white lime. The glossy ibis (*Falcinellus igneus*) nests were like the egrets, composed of bulrushes, and placed at the same height above the water; their eggs are bright blue. There were other species I could not identify whilst on the wing, and being the breeding season we did not wish to shoot any.

Towards the borders of the lake we saw several species of ducks, many reedwarblers, the pied kingfisher, and on a low tree near to where we disembarked were a pair of white tailed eagles (*Haliaetus albicilla*), which flew off on our approach. Immediately beneath the branch on which they rested we found the neat nest of one of the Paridae, on the construction of which the two tits were busily at work, taking little notice of our presence. Its framework was composed of long grasses, filled in with the down of bulrushes. When complete these nests are of the shape of a chemist's retort, and are generally found suspended to the outermost branches of willows overhanging a river. The eggs, five or six in number, are pure white, and usually laid early in May.

The odours of the decaying vegetation under the hot sun were sickening, and interesting as our visit to this swamp-like lake had been, we were not sorry to leave the boats, and mounting our horses proceed on our journey to the more healthful lake hidden in the mountains of the east.

Smyrna,

9th June, 1899.

IRISH PLANT NAMES.

By John H. Barbour.

IN popular magazines and papers one constantly sees references made to plants possessing names other than the usual English appellations. These names might be described as national, for they are only used locally, in one of the four sections of Britain. Many Welsh names of plants are so well-known as to be used continually, but generally in cases having reference to plants with some special interest in relation to Ireland, the Irish name is omitted, while the Welsh is given. Whether this is due to want of knowledge or access to works on the subject, I cannot say, but such a collection of names might prove useful, if published in a widely circulated magazine like Science-Gossip. I have therefore prepared a list of some of these, collected so far as I have been able up to the present time. They are entirely belonging to the Phanerogams, and the majority of the names are from old sources, and I believe correct. Some plants have one, others two or more Irish names, some include under one name more than one species of the same family, and in a very few cases, I have not been able to identify the Irish name and that corresponding in English, with any family or species, as will be seen by the occasional notes made in the list.

Clanabhar mona, Siodamona. *Eriophorum vaginatum.* cotton grass.

Biorrach Lachan. *Sparganium simplex.* reed grass.

Breallan, Raidhleadh. *Lolium perenne.* rye grass.

Onnakes. *Hordeum pratense.* meadow-barley.

Briumseau fiothran. *Triticum repens.* couch grass.

Leadan. *Dipsacus sylvestris.* teazle.

Wrachalach. Greim a diabhail. *Scabiosa succisa.* devil's-bit scabious.

Caba desan. *Scabiosa arvensis.* corn scabious.

Cruach phadruig. *Plantago major.* greater plantain.

Slan luo. *Plantago lanceolata.* rib-wort.

Balath Enis, Cuchullon. *Galium verum.* lady's bed straw.

Luso Garabh, Airmeirigh. *Galium aparine.* goose-grass.

Heathach buidhe. *Alchemilla arvensis.* lady's mantle.

Duileasgnahahhan, Liach Briada. *Potamogeton natans.* pondweed.

Cuilen. *Ilex aquifolium.* holly.

Lus mide. *Myosotis arvensis.* scorpion grass.

Teanga con. *Cynoglossum montanum.* hound's tongue.

Lusna Canabh brisde. *Symphytum officinale.* comfrey.

Barraiste, Bog-glas. *Borago officinalis.* borage.

Baine bo bleacht, Leichgheirgin. *Primula veris.* cowslip.

Bonain Ponra curraigh. *Menyanthes trifoliata.* buckbean.

Seamar muire. *Lysimachia vulgaris.* loosestrife.

Falcaire fiodhain, Falcaire fuar. *Anagallis arvensis.* scarlet pimpernel.

Cuineal muire. *Verbascum thapsus.* mullein.

Gaffan, Caoch na cceare. *Hyoscyamus niger.* henbane.

Slatgorum, Fuath ghorm. *Solanum dulcamara.* bitter-sweet.

Cas fachrann, Feathlead. *Lonicera periclymenum.* honeysuckle.

Eadhan Eadhadnan. *Hedera helix.* ivy.

Dreimire muire. *Erythraea centaurium.* common centaury.

Praiseach brathar. *Chenopodium bonus-henricus.* All-good.

An liubh Biatas. sea beet. Doubtful to what Latin order it belongs, probably *Beta vulgaris.*

Ailm no Crannailne. *Ulmus campestris.* elm.

Cuilcann tragha. *Eryngium maritimum.* sea-holly.
Lus na pingine. *Hydrocotyle vulgaris.* white-rot.
Reaga Maighe, Rema. *Sanicula europaea.* sanicle.
Fluellin, Seamar cré. *Veronica officinalis.* speedwell.
Biolar Muire, Biolar uisge. *Veronica beccabunga.* brooklime.
Fualachtar. *Veronica serpyllifolia.* thyme-leaved speedwell.
An Ulach. *Veronica chamaedrys.* germander speedwell.
Bodan Measgan, Uachdar. *Pinguicula vulgaris.* butterwort.
Feoran curraigh. *Lycopus europaeus.* water-horehound.
Garbh raitheoch, Praiseach fiadh. *Thlaspi arvense.* bastard cress or penny cress.
Staidin Lussa sparain. *Capsella bursa-pastoris.* shepherd's purse.
Biolar tragha. *Cochlearia officinalis.* scurvy grass.
Mael isa Garb raith-eath. *Sisymbrium officinale.* hedge mustard.
Bo Cuineall. *Sisymbrium alliaria.* jack-by-the-hedge.
Neal uisge, Fleann uisge. *Ranunculus heterophyllus.* water-crowfoot.
Bealtaine, Lus buih Bealtaine. *Caltha palustris.* marsh marigold.
Glassar heile. *Ajuga reptans.* bugle.
Cruba Leoin. *Verbena officinalis.* vervain.
Cartloinn. *Mentha aquatica* and *M. sativa.* water mint.
Athair Lus. *Nepeta glechoma.* ground ivy.
Neantog Mharabh. *Lamium purpureum* and *L. album.* deadnettle.
Neantog Chaech. *Lamium amplexicaule.* henbit deadnettle.
Grafar. *Ballota nigra.* black horehound.
Ceannabhar beag. *Prunella vulgaris.* self heal.
Ruisnin Raidhre lin Raidhre, Glan tuise. *Euphrasia officinalis.* eyebright.
Bodanae Chloign. *Rhinanthus crista—galli.* yellow-rattle.
Lus Baine. *Polygala vulgaris.* milkwort.
Gioleach, Shleibhe. *Cytisus scoparius.* broom.
Aiteann. *Ulex europaeus.* whin.
Screann Bo. *Ononis arvensis* var. *spinosa.* rest-harrow.
Pisbhuidhe. *Lathyrus.* everlasting-pea (species doubtful).
Pis Capuil, P. Phreachan. *Vicia.* vetch (species doubtful).
Plurin Seangan. *Trifolium meäium.* meadow clover.
Seamair bhan. *Trifolium repens.* white clover.
Seamair capuil. *T. pratense.* red clover.
Carthan curaigh. *Valeriana officinalis.* valerian.
Feleastar feleastrum. *Iris pseudacorus.* yellow flag.
Sibhne, seimhin. *Schoenus nigricans.* bogrush.
Buiguin, Bog sheimhin. *Scirpus lacustris.* bulrush.
Brodh. Bastard cyprus rush.
Praiseach buidhe. *Brassica oleracea.* wild cabbage.
Praiseach. *Sinapis arvensis.* charlock.
Gleoran, Billar Griagain. *Cardamine pratensis.* cuckoo flower.
Biolar. *Sisymbrium officinale.* hedge mustard.
Fineal muire. *S. sophia.* flix weed.
Raitheach, Tragha Praisseagh tragha. *Crambe maritima.* seakale.
Creachtach dhearg. *Geranium dissectum.* dove's foot.
Earbal Righ, Rial Cuil. *Geranium robertianum.* herb-robert.
Creachtach dhearg. *Geranium sanguineum.* bloody crane's-bill.
Lus na Miol Mor. *Althaea officinalis.* marsh-mallow.
Fuaima tsiorraigh, Caman Scarraigh. *Fumaria capreolata.* fumitory.
Lus riabdach, Lus an giolla. *Pedicularis palustris* and *P. sylvatica.* lousewort.
Sriumh na Saogh. *Antirrhinum orontium.* snap-dragon.
Fothrum, Dun lus. *Scrophularia nodosa.* figwort.
Mearacan, Seothan Mearacan na mna Sighe. *Digitalis purpurea.* foxglove.
Meastook reeil, Meastare alta. *Hypericum androsaemum.* St. John's wort.
Tutsan, Beahnoba taed, Coluim Kille. *H. perforatum.* perforated St. John's wort.
Baine Nuc, Fofannanmin. *Sonchus oleraceus.* sowthistle.
Bearnan Bearnach, Castsearbhan. *Taraxacum officinale.* dandelion.
Cluas Liath. *Hieracium* (species?) hawkweed.
Duilleog Bride. *Lapsana communis.* nipplewort.
Copog thnaithil, Cocoil. *Arctium lappa.* burdock.
Fothanan. feochadan.
Sgeachog muire. *Eupatorium cannabinum.* hemp agrimony.
Marbhe dhroighean. *Bidens tripartita.* bur-marigold.
Lusna Ffranc, Heanseadh. *Tanacetum vulgare.* tansy.
Bofu'an ban, Liath lus, Buachalan. *Artemisia vulgaris.* mugwort.
Caoil fhail, Neanta Neantog. *Urtica urens.* small nettle.
Neantog Leisnach. *Urtica dioica.* common nettle
Dair Crann Darrach, Farcan, Furran. *Quercu Robur.* oak.
Berth na meas. *Fagus sylvatica.* beech.
Leamhan bog. *Carpinus betulus.* hornbeam.
Coll. *Corylus avellana.* hazel.
Saileach. *Salix repens* and *S. caprea.* willow.
Biorraide. *Salix viminalis.* osier.
Sail Soileog. *Salix alba.* white willow.
Crann Crith. *Populus tremula.* aspen.
Creathramha, Praiseach mhin. *Atriplex patula.* orache.
Gorman. *Centaurea cyanus.* bluebottle.
Liath Lus roid. *Gnaphalium sylvaticum.* cudweed.
Sail Chuach. *Viola odorata.* sweet violet.

Fanaigse maigse. *V. canina.* dog violet.

Gorman Searaigh. *Viola tricolor.* pansy.

Magailin Meadbrach. *Orchis mascula.* purple orchid.

Gaoicin cuithigh, Tluaschaicin. *Arum maculatum.* cuckoo-pint.

Granhachan. Abhran donog Macgan athair. *Lemna minor.* lesser duckweed.

Bodan dubh. Toigeal na mban Sighe, *Typha latifolia*, Great reed-mace, Bodan. *Typha angustifolia.* lesser reed-mace.

Righ Seisg. *Sparganium ramosum.* Bur-reed.

Beith. *Betula alba.* birch.

Fearna Fiarnog. *Alnus glutinosa.* alder.

Fathan, Fothannan. *Tussilago farfara.* coltsfoot.

Piobol, Gallan. *Petasites vulgaris.* butter-bur.

Boglus, Buachalan na Leas-caran. *Senecio vulgaris.* groundsel.

Buidhe. *Senecio jacobaea.* ragwort.

Noinin. *Bellis perennis.* daisy.

Buachalan buidhe, Liathan. *Chrysanthemum segetum.* corn marigold.

Easpog beain. Noinin Mor. *Chrysanthemum leucanthemum.* ox-eye daisy.

Meadh duach. *Matricaria parthenium.* fever-few.

Coman Mionba. *Anthemis nobilis.* chamomile.

Athair talmhun. *Achillea millefolium.* yarrow.

Niansgoth, Nulaighe dubha. *Centaurea nigra.* knapweed.

Lamhan Cait Leacan. *Cotyledon umbilicus.* navelwort.

Grafan na Cclock. *Sedum acre.* biting stonecrop.

Seamsog, Samha Fearna. *Oxalis acetosella.* woodsorrel.

Cogal. *Githago segetum.* corn-cockle.

Coirearan Coilleach. *Lychnis diurna.* red campion.

Corranlin Cluanlin, Cabrois. *Lysimachia vulgaris.* loosestrife.

Marabh dhroighean. *Agrimonia eupatoria.* agrimony.

Gear neimh. *Euphorbia.* (species ?) spurge.

Finne Tinne. *Sempervivum tectorum.* houseleek.

Kran Airneadh. *Prunus communis.* blackthorn.

Sgeach, Sgeach gheal. *Crataegus oxyacantha.* hawthorn.

Abhall Fiadhan. *Prunus malus.* crab apple.

Airgiod Luachra. *Spiraea ulmaria.* meadowsweet.

Fora dhrios. *Rosa canina.* dog rose.

Dresog, Drios Sgeach talmhain. *Rubus fruticosus.* bramble.

Gealdruigh. *Drosera rotundifolia.* sundew.

Eapog shraide. *Rumex acutus.* dock.

Samha bo Sealgan. *Rumex acetosa.* sorrel.

Samha Cairach. *Rumex acetosella.* sheep's sorrel.

Tor Thopog. *Alisma plantago.* water plantain.

Fraochog, Crann Fraochain. *Vaccinium myrtillus.* bilberry.

Deagha buidhe, Dreimre buidhe. *Chlora perfoliata.* yellow-wort.

Glunach dhearg. *Polygonum persicaria* and *P. hydropiper.* bistort and water-pepper.

Glunach bheag. *Polygonum aviculare.* knotgrass.

Clabhras, Lus na laogh. *Chrysosplenium oppositifolium.* golden saxifrage.

Tur Sacain, Tur Sacainin. *Stellaria holostea.* stitchwort.

Min mhear. *Conium maculatum.* hemlock.

Geirgin, Grening. *Crithmum maritimum.* samphire.

Galluran, Gleoran, *Angelica sylvestris.* angelica.

Fualachtar. *Heracleum sphondylium.* hogweed.

Tathir Tathuban. *Oenanthe crocata.* water dropwort.

Toirearan, Coirearam mhuc. *Bunium denudatum.* pig-nut.

Luss aranum gran duh. *Smyrnium olusatrum.* alexanders.

Trom Crann trommain. *Sambucus nigra.* elder.

Flioch. *Stellaria media.* chickweed.

Lin. *Linum usitatissimum.* flax.

Lion La mhar sighe, Suth talmhan. *Fragaria vesca.* wild strawberry.

Brioschan. *Potentilla anserina.* silverweed.

Cuighnear muirre. *Potentilla reptans.* creeping cinque-foil.

Meanaidin, Benedin, Leamknacht. *Potentilla tormentilla.* tormentil.

Machall. *Geum urbanum* and *G. rivale.* avens.

Blaith na mbodager, Canleach dhearg, Paipin. *Papaver rhoeas.* field poppy.

Collaidin, Poipin. *Papaver somniferum.* opium poppy.

Cruba Lesin. *Aquilegia vulgaris.* columbine.

Cabhan Abhan, Liach Loghar. *Nymphaea alba.* white water lily.

Nead Cailleach. *Anemone nemorosa.* wood anemone.

Lassair Leana. *Ranunculus flammula.* lesser spearwort.

Grain Aigain. *R. ficaria.* lesser celandine.

Fearhan, Bairgin. *R. repens.* creeping crowfoot.

Tuile talmhan. *R. bulbosus.* bulbous crowfoot.

Torachas biadhain. *R. sceleratus.* celery leaved crowfoot.

Crann bann, Cranfionn, Firchrann. *Acer pseudoplatanus.* sycamore.

Crann. *Acer campestre.* Fruinseog, Crann fuinsean. *Fraxinus excelsior.* ash.

Ballyholme, Bangor, Co. Down.

ETON COLLEGE MUSEUM.—We have been favoured with "A Guide to the Museum of Eton College," to which are added descriptive catalogues and local natural history records. It is embellished with a frontispiece, a plate, and other illustrations. This is not intended to be by any means complete, for its object appears to be the foundation of a more elaborate handbook at some later period. It will, however, prove useful to the boys and visitors, and generally further the interests of the institution. The object of the collection is evidently of an educational character, and the guide is constructed with the same intention, as it is arranged with short notes, giving an indication of the various classes of animal life from unicellular animals represented by Protozoa up to Cephalopoda. The appendix deals with the birds and mollusca of Berkshire and Buckinghamshire.

RADIOGRAPHY.

By James Quick.

THE subject of the Röntgen Rays has, for nearly four years engaged, throughout the world, the attention of most people, whether scientific or otherwise. Never, probably, has there been such wondering enthusiasm and excitement over a discovery as there to see through opaque substances appeared too astounding to be credible; especially when the application extended to seeing through the flesh and blood of the body. The innumerable photographs and other records, however, proved conclusively the

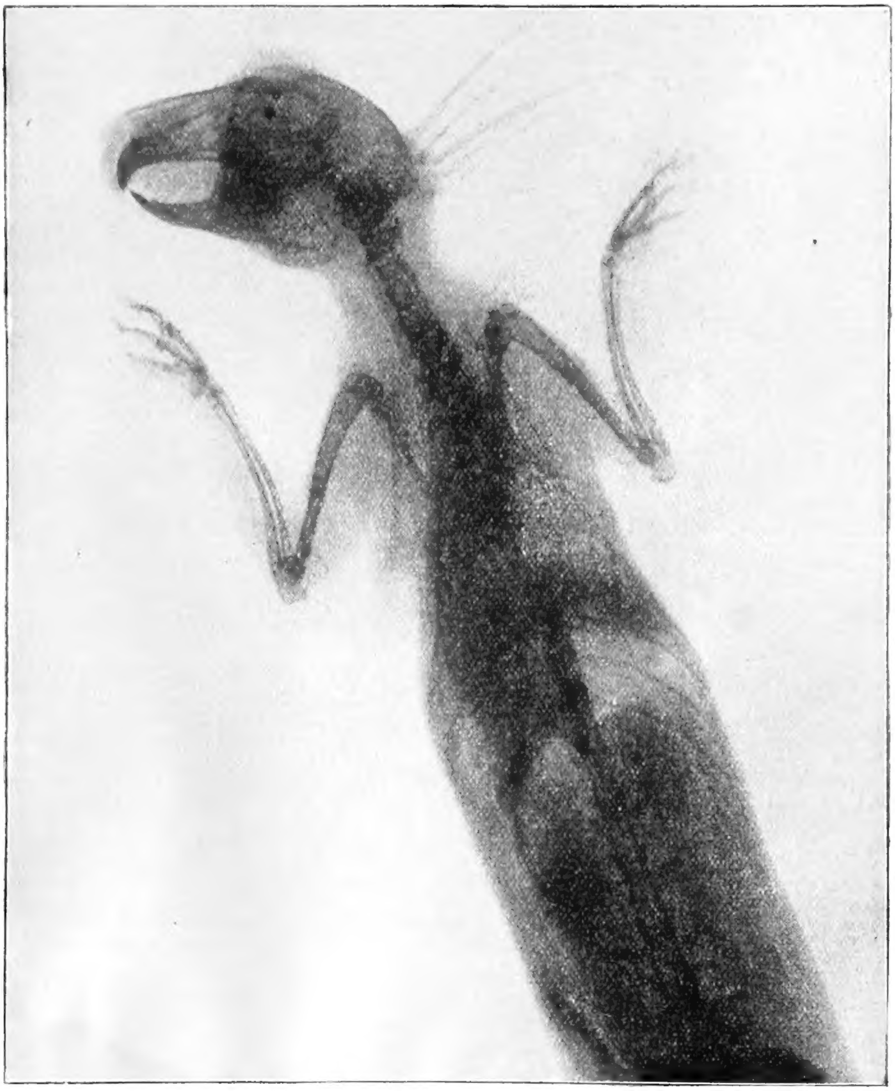


Fig. 1.—Rabbit, showing shots in the head.
Taken with a 3-inch Coil. Exposure 3·5 minutes. Distance from Tube 7 inches.

was when Professor Röntgen reported, in December, 1895, the results of his experiments in this direction. That one should possess a second sight, in being able

capabilities and properties of the rays, so incredulity gave way to awe and wonder.

Since then public excitement has abated, and lively interest is now only roused by some specially striking demonstration or a particularly useful application of the rays. To the scientific mind the subject is, nevertheless, continually presenting fresh points for investigation and research, either theoretically in endeavouring to solve the enigma as to the true nature of the rays, or practically in improving and modifying the various apparatus used for the purpose. It cannot be said that conclusive work has yet been done in the former direction, but certainly rapid strides have been made in practice. In the early stages of the work it was considered an achievement to produce a radiograph of the hand or foot, with an exposure of two minutes or upwards ; now such parts

FIG. 2.—RHEUMATIC GOUT IN HAND.

Prominently shown between the second and third rows of the phalanges, also between the third and fourth. Taken with a 3-inch Coil. Exposure 4 minutes. Distance from Tube 6 inches.

as these can be radiographed in as many seconds, and the whole body in a few minutes.

Probably some of our readers have been able to keep pace with the advances made in X-Ray work. There are others, however, who have had their attention called in different directions, but who wish to be acquainted with sufficient data and information to enable them to do some practical work upon the subject. Although these articles are written more particularly for the latter, it is hoped they will prove interesting to the former, inasmuch as some of the later improvements will be touched upon.

It is proposed therefore to first give a short summary of the work from 1895, then to discuss the more serviceable apparatus and arrangements of such for different requirements, and also to instance some of the results obtained with improved and enlarged apparatus.

Full credit is liberally given to Professor Röntgen for his wonderful discovery of the properties of the invisible rays emanating from his vacuum tube, when depending upon the proximity of the part in question to the skin, and therefore to the photographic plate. Not only has the body been thus examined in parts, but life-size radiographs of the adult frame have been obtained at one exposure, thus showing the remarkable help given to the medical profession. It is in the treatment of fractures and dislocations, and in the detection and removal of foreign bodies such as bullets, or of unnatural growths and deposits, like calculi, that the most useful work has been, and is now being, done.

At first difficulty was experienced in locating the exact position in the body of the abnormal substance. An ingenious instrument was, however, designed by Dr. Mackenzie Davidson, through the use of which, by taking two radiographs with the X-Ray tube in different positions, the exact spot was found. Recently a very simple and most compact instrument has been brought forward for the same purpose and called a "punctograph." It consists (Fig. 3) of a light but rigid frame of ebonite, with a brass washer M at one end.

FIG. 3.—PUNCTOGRAPH.

For arriving at the exact position, in the body, of a bullet or other foreign substance.

the latter was covered with an opaque substance. He found they were capable of exciting fluorescence in a specially prepared paper lying near the tube, and also of exerting a selective action upon photographic plates. The preceding work of Crookes, Hertz, Lenard and others upon electrical discharge and radiation in vacuo should not, however, be forgotten. These same invisible rays were probably generated in Crookes' classical vacuum tube experiments some twenty or thirty years ago, and were lying latent in the work of later experimenters. It was left to Röntgen to capture them as it were, to make the discovery that has brought his name before all the world, and to give us an invaluable method of examination of bodies, both in the medical and physical worlds.

There are very few hospitals at the present day which are not equipped with an X-Ray department, where cases can be taken and immediately diagnosed. Two methods of examination are available to the surgeon; firstly the radioscopic, that is the observation of the X-Ray shadow produced upon a fluorescent screen by a body placed between it and the source of the rays; secondly, the radiographic method which resolves itself into nothing more than exposing a photographic plate to the rays, the body being placed in contact with the film of the plate and between the latter and the X-Ray source. Both methods are extensively used in practice as occasion demands. The radiographic process has the advantage of producing a permanent record of the subject in question.

Every part of the human body has been successfully dealt with radiographically, the amount of definition

Running the length of the frame is a spring and trigger arrangement K G such that, when the latter is drawn, a small pencil is released and flies into the centre of the brass washer, thus making a mark upon whatever substance with which the instrument is in contact. Two punctographs are necessary for an observation. Suppose the thorax is being examined for a bullet; the patient is placed in position between the X-Ray tube and a fluorescent screen, the punctographs are placed in contact with the skin, one in front and the other at the back of the chest, and arranged so that the two holes in the brass washers, together with the bullet, are in one straight line. The triggers are then drawn, and the two pencil marks are made upon the patient. Exactly the same process is gone through with the punctographs in different positions, and again two marks made. From these four marks and their distances apart on the chest and back, it is only a matter of the geometry of similar triangles, to calculate the exact position of the bullet. The punctograph is only about twelve inches long, and is easily handled.

Two practical sources for the production of X-Rays are available and are used—the Induction Coil and the Wimshurst Electrical Machine. By far the greater work is being done with the former, although, when the advantages and disadvantages of the two methods under different conditions are considered, it is surprising that the Wimshurst machine is not more used. Especially would it be more advantageous to the army surgeon or to workers in some parts of India, China, &c., where there are no electrical generating stations, and where primary batteries are troublesome to keep going. While some such source of current is essential for the induction coil, the working of the Wimshurst machine resolves itself into turning a handle. There is a minimum limit to the size of the plates of a Wimshurst, if good work is to be done; they should not be less than 20 inches diameter. A compact six-plate machine of this size would however be more portable than, say, a 12-inch induction coil, with its necessary batteries.

In the earlier stages of the work small size induction coils were more generally used. These have, however, given way to larger ones, in order to obtain greater penetrative and other effects. More will be said upon this point later in these articles. That some useful work can be done with a small equipment is nevertheless seen from Figs. 1 and 2, the shot in the rabbit being clearly defined in the head and body.

The short exposures of photographic plates necessary at the present time compared with those required formerly, are due to four different causes. (1) The increase in the size of the induction coil used, (2) improvements in the form of the contact breakers for the same, (3), increased efficiency of the X-Ray vacuum tubes, and (4) the help given by what are known as intensifying screens. These latter are made of calcium tungstate which fluoresces blue and is therefore photographically active. The prepared surface is placed in contact with the film of the plate, so that the image produced upon the screen assists the action upon the plate. The time of exposure is by this means sometimes reduced to one-fifth of what it would be otherwise.

(To be continued.)

MANGANESE IN RIVER-GRAVELS.

By Martin A. C. Hinton.

In a paper which I recently read before the Geologists' Association of London ([1]), mention was made of certain occurrences of manganese in the Pleistocene deposits of the district therein described. During the discussion following the reading of that paper, Mr. Whitaker, F.R.S., alluded to the great interest of such occurrences which he had himself frequently observed when noting sections in the drift. He added that he was quite at a loss to explain them.

Manganese occurs in the gravels in the form of the di-oxide, staining seams with a black coating, and occasionally, on some of the larger stones, one finds well-formed dendrites of this substance. The remarkable point in connection with these stained beds is, that their occurrence is not governed by the porosity of the underlying strata, and hence in many cases they do not owe their origin to filtration. During the past few years I have made a great many notes and observations on these peculiar seams, and the following are the conclusions that may be deduced from them. In the first place, perhaps it ought to be mentioned, that in most cases chemical analysis of the black encrusting material is desirable, because two other substances occur viz., carbonaceous material and a black sulphide of iron, which may be confounded with manganese if field characters only are relied upon.

Gravels are almost invariably stained with a red or brown oxide of iron. Since manganese and iron occur together, the question arises as to which of the two oxides is the older. In nearly every case where stained pebbles occur it will be found on examination that dendrites of manganese overlie and repose upon a crust formed of oxide of iron. The small fragments of silica composing the sand or matrix, when encrusted with manganese will if examined show a similar state of affairs. This evidence tends to prove that iron occurring at the same horizon as manganese is the older of the two minerals.

There are apparently but two causes to which we can possibly refer the origin of the seams of manganese that occur in these beds, viz., (1) Filtration, and (2) Contemporaneous Fluviatile Deposition.

(1.) Filtration. Suppose water percolates down through the gravel, or other deposits, and imagine that this water carries a certain quantity of manganese in solution as the di-oxide. Assume also, that somewhere in this gravel there is a bed, which, from the character of its constituents or from other conditions, will act as a filter. When the water reaches this horizon, what happens? If the bed is not absolutely impervious the water will pass through it, but whether it does this or no it is forced to give up the soluble manganese which is deposited upon the surrounding detritus and thus gives rise to a black seam. If this suppositious case exists in nature, then we have an example of what I should term "Primary Filtration." Let us assume, in another instance, that we have a bed of gravel stained with di-oxide of manganese. How this seam originated does not for a moment concern us. If water is percolating through the beds, and if this water is in the chemical condition to take up the soluble di-oxide, on reaching the stained seam it will do so, and the result will be that the manganese is carried in solution to a lower level, either wholly or in part. The exact depth it is conveyed will, of course, depend upon the presence or absence of impervious material. In this suppositious case we have an example of what I should term "Secondary Filtration."

Does the field-evidence support the filtration theory as being the cause of these occurrences? It may be said with safety that it does not, and more particularly so with regard to "Primary Filtration." To support it, there is one condition that is fundamental, viz., the bed immediately underlying the seam must be of such

[1] "The Pleistocene Deposits of the Ilford and Wanstead District," by Martin A. C. Hinton, with an appendix on the Mollusca, by A. S. Kennard and B. B. Woodward, F.L.S., F.G.S. (In the press.)

constitution as will cause percolating water to deposit any material that it holds in solution. I may safely state that in no case where it is in the remotest contingency possible to refer the manganese to "Primary Filtration," do we find this essential condition present. Indeed, the only cases in which we find an impervious bed beneath the seams, are those in which such seams occur at the base of the gravel and the underlying deposit is clay. Such seams are of considerable thickness as a rule, and moreover extend over a considerable area. For instance, I recently traced one at the base of the High Terrace gravel of Acton for a distance of 250 yards. Such examples as this, clearly owe their position to "Secondary Filtration."

(2.) Contemporaneous Fluviatile Deposition. Let us suppose that we have a river flowing through an area in which ores of manganese, preferably di-oxide, occur in some abundance. During the denudation of such an area, the manganese, as successive deposits of it are attacked, will be carried down in suspension or chemical solution by the river. As the manganese from the various deposits will have approximately the same specific gravity, it will have a tendency to collect in certain places. If the water becomes supercharged with the soluble mineral, or if chemical change takes place either through some alteration in the constitution of the bed of the river, or through some influx of other matter; then the manganese will be precipitated and will encrust the sedimentary material forming on the bottom. There are three reasons why precipitated manganese will not penetrate the sediment to any great extent. In the first place if the bottom is argillaceous, then such non-penetration must obviously occur. When, however, the bed of the river is gravel or of similar porous material, some other reasons have to be found for the non-penetration. The chief, in such cases is that encrustation goes on almost simultaneously with precipitation; and secondly, the mineral now rendered insoluble meets with the resistance of the water that saturates the gravel which forms the bottom.

Adopting this theory we find that the field-evidence supports it in every respect. By it we can explain the occurrence of continuous seams in stiff impervious loams and clays, in gravels in which no impervious material underlies the manganese, and in which the seams of gravel so stained are not different from the other beds in their constitution or porosity, or if they are more impervious, essentially owe this character to the presence of the manganese. Furthermore, we can explain by it how the overlying and underlying beds are entirely unaffected by these seams, which would not be the case in the majority of instances, if filtration produced them.

There is one more point to which it is necessary to refer. Where is the source from which the manganese was derived? We, have in the Thames valley no manganese bearing strata other than the drift, or, at least, no deposit capable of supplying the quantity found in the drift. In the discussion following my paper, before alluded to, Mr. A. E. Salter, F.G.S., said that it was just possible that Wales was the parent source. The recent physiographical researches of Prof. Davis and Messrs. Buckman and White, have tended to show that the Thames once flowed from Wales across what is now the Severn valley. If this be the case, then we have a source for our manganese, and at present I can only adopt Mr. Salter's view. At all events, in the light of our present knowledge, it is impossible to offer a better one. In conclusion, our difficulties in this respect are enhanced because of the fact that we cannot base too much reliance, if any at all, on the manganese being in the position in which it was first deposited, after its derivation from the parent strata.

c/o J. C. Graham, 2, Garden Court, Temple, London, E.C.

CROMWELL ROAD MUSEUM.

THE collections in the Natural History Museum at South Kensington have lately been enriched by specimens obtained by various exploring expeditions. The zoological branch benefited greatly by the expedition to Sokotra, which was organised by Mr. W. R. Ogilvie-Grant, representing the British Museum, and Dr. H. O. Forbes, director of the Liverpool Museum, under the auspices of the Royal Geographical Societies and the British Association. The lepidoptera obtained are specially numerous some of the species being hitherto unrecorded. Eight new species of reptiles, twenty species of marine fish, large collection of shells and insects, and many other fauna were obtained.

Another expedition that has yielded results of considerable interest to the geological and zoological sections is the one from which Dr. J. W. Gregory, of the geological Department, has just returned. His object was to examine the geology of Antigua.

Some acquisitions of particular interest were obtained by means of the expedition sent out by the Hon. Walter Rothschild to the Galapagos Archipelago off the Coast of Ecuador. Amongst others was a fine example of the rapidly diminishing gigantic land tortoises, also a series of five hundred birds, and a large collection of reptiles.

Mr. Welt Blundell and Lord Lovat have presented to the trustees the fine series of birds made by them during their recent adventurous journey in Abyssinia. The collection, consisting of 530 specimens of 234 species, has not yet been thoroughly examined, but the ornithologists of the Museum are convinced it is of the greatest interest.

Since the departure of the mission dispatched to Sierra Leone by the Liverpool School of Tropical Diseases, for the investigation of malaria, hundreds of mosquitoes have been sent to the British Museum from every part of the British Empire, and it seems probable the museum will soon be in possession of an unique collection of the genus *Culex*. Mr. E. Austen, the dipterologist of the Museum, is a member of Major Ross' party, and will endeavour as far as possible to make collections of other groups.

BRITISH FRESHWATER MITES.

By Charles D. Soar, F.R.M.S.

(*Continued from page* 103.)

2. *Hygrobates reticulatus* Kramer, 1879.

Female.—Body: A broad oval, sometimes truncated on the anterior margin, length about 1.60 mm., width about 1.30 mm., colouring similar to *H. longipalpis*. The surface of the body skin is formed into a very fine network, which can be well seen under a ½-inch objective, if focussed on the margin of the body.

Legs.—First pair about 0.96 mm., fourth pair about 1.66 mm. They are slighter in make than in the preceding mite, and have a much weaker appearance. In colour, generally a pale yellow. The hairs are about the same as shown in fig. 1, but are not quite so vigorous.

Epimera.—This is so much the same as in fig. 2, that another drawing is not necessary.

Fig. 6. *H. reticulatus*, palpus.

Palpi.—It is in these organs (fig. 6) the great difference is seen. On the inner line of the last segment but one are two hairs, wide apart; in the last species (fig. 3) they will be found close together. Length of palpi is about 0.68 mm.

Genital Area.—(Fig. 7.) Shows no remarkable difference from fig. 4.

Male.—A little smaller than the female, with no difference in structure, except in genital area.

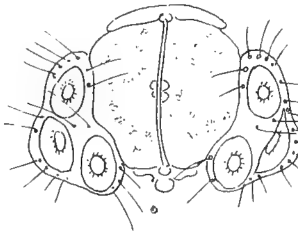


Fig. 7. *H. reticulatus*, genital area of female

Localities.—Common everywhere.

3. *Hygrobates nigromaculatus* Lebert, 1879.

Female.—Body: Oval slightly truncated on the anterior margin. Length about 1.20 mm. Width 1.8 mm. Colour yellow.

Legs.—First pair about 1.10 mm., fourth pair about 1.80 mm.

Epimera.—(Fig. 8.) Is very little different to the others of this genus.

Genital Area.—(Fig. 8.) Does not show any remarkable difference.

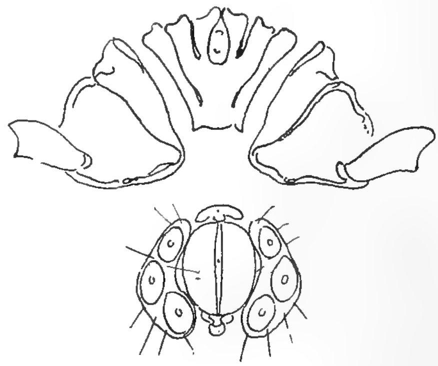


Fig. 8. *H. nigromaculatus*. Epimera and Genital area.

Palpi.—(Fig. 9.) Length about 0.52 mm. It will be seen the second joint is destitute of the peg or projection, so conspicuous in fig. 6.

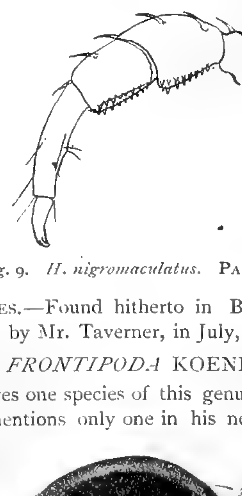


Fig. 9. *H. nigromaculatus*. Palpus

Localities.—Found hitherto in Britain only at Oban, N.B., by Mr. Taverner, in July, 1899.

GENUS *FRONTIPODA* KOENIKE, 1891.

Piersig gives one species of this genus as German, and Thor mentions only one in his new Norwegian

Fig. 10. *Frontipoda musculus*. Lateral view. Legs removed.

list. Koch gave four, but Piersig says they are all the same species. It appears to be the same species that has been found everywhere in Europe, though described by different names.

The chief characters of this genus are, hard skinned, 4th pair of feet without claws, swimming hairs to all legs, body compressed.

Frontipoda musculus Müller.

BODY. (Fig. 10.) Long and narrow, compressed so that it is very much arched on the back. It is

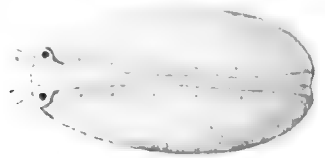


Fig. 11. *Frontipoda musculus.* DORSAL VIEW.

rather difficult to get it to stand in an upright position on the slide, for examination, as it prefers to rest on its side. This mite is about 0.80 mm. long, 0.46 mm. wide, and 0.70 thick. We have two distinct varieties as regards colour, the commoner one being green, and the rarer is red. Down the centre of the dorsal surface is a hollow (fig. 11) with hairs on each side.

LEGS. Are pale green in the green variety, and red in the other form. The fourth pair of feet are without claws, but they have a stiff bristle projecting from the end of the tarsi.

Fig. 12. *F. musculus.* VENTRAL VIEW.

EPIMERA.—This forms one group (fig. 12).

GENITAL AREA. Three discs on each inner edge of the plate.

LOCALITIES.—Common in England. Mr. Taverner has found it in Scotland, but I have not heard of its having been found in Ireland.

NOTE. Two figures were accidentally transposed on pages 79 and 80. Fig. 4 should be "Nymph, ventral surface," and Fig. 8 should be "Genital area of male."

(To be continued.)

FOSSIL RESIN.—At Cliffend, Pegwell Bay, Kent, some years ago I found on the shore a piece of fossil resin; it is dark brown in colour and much smaller than that mentioned in SCIENCE GOSSIP, Vol. vi., p. 119. Possibly it came from the chalk to the east of where it was washed up.—*J. E. Cooper, 68, North Hill, Highgate, N. 11th Sept. 1899.*

BRITISH ASSOCIATION.

SIR MICHAEL FOSTER delivered his presidential address before the British Association at Dover on Wednesday, 13th September. He may be said to have given the most popular address, yet by no means the least valuable of all the long series. His opportunities were great, as the close of the nineteenth century lent a splendid text. Sir Michael availed himself of it to the utmost, and gave an admirable summary of the scientific work done since 1799. When we look around and think what science has accomplished since that date for the comfort, nay, the necessities, of mankind, the lives lived by our ancestors no more than a hundred years ago seem to us wonderful in their incompleteness.

In opening his retrospect, the President reminded us of what was not, in 1799. How men in Dover, and elsewhere, groped their ways at night by the help of dim swinging lanterns, where now they are lit by electric light, and travel by electric tramcars. Then even sunlight struggled into the houses of the poorer classes through blurred glass. Now, the necessity of brightness and light, whether by day or by night, is recognised as absolute for vigour and health. Now, everyone has opportunity to travel cheaply and rapidly by the aid of steam power; and to be kept informed at an hour's notice of the welfare, or business progress at home. Again, he reminded us that but a generation before, 1799, did Priestley discover there was so important a gas as oxygen; while even in 1799 the fact was understood by but few of the better educated. That same year saw the birth of a knowledge of electricity which afterwards, in its infancy progressed so slowly.

So on, did Sir Michael carry his brilliant summary of the scientific work of the century. Touching on every department, each in turn showed a dazzling story of knowledge wrung from darkness, and applied to the uses of mankind; indeed, also to the relief of suffering of his fellow animals in their domestication, all have benefited.

What is the promise for the future? Compared with that done in this century what may we expect in the next? The earlier part of this was spent in stumbling with obstacles that are now past, prejudices that are overcome, and the opposition of dominant ignorance. For the future, science will rather have to put the break of caution on the speed of the wheels of public impatience for more and more knowledge. No longer does commerce sneer at science, but refers to its importance with many wise saws and much respect. The young are no longer warned about wasting time on scientific investigations, for is not systematic science taught in our schools day by day, the very rudiments of which, in 1799, would have been received with jeers?

LIVING AND PRESERVED MARINE SPECIMENS. We have received from the Marine Biological Association of the United Kingdom, a price list of marine specimens to be obtained from the Director of the Biological Laboratory, Citadel Hill, Plymouth.

THE BIRCH AND THE ALDER.

By P. Q. Keegan, LL.D.

THE natural order Betulaceae includes only the two genera *Betula* and *Alnus*, and these are taxonomically distinguished by some minor differences, with respect to the texture and durability of the scales of the female catkins. In the birch (*Betula alba*) the bark is smooth, silvery white, and scales off in transverse chips; the leaves are deltoid or rhomboid, and irregularly serrate; there are two folioles around the male flowers, and the fruit has broad membranous lateral wings. In the alder (*Alnus glutinosa*) the bark is dark brown and seamed with clefts; the leaves, when young, are obovate, blunt, wavy, serrate, and glutinous; the anthers are bilocular, and there are four folioles around the male flowers; the fruit is hardly winged. The main difference is, that in the birch the female catkins have thin, deciduous scales, while those of the alder are thick, persistent, and woody. As regards this special feature, it may be remarked that the scales are persistent, because they become woody, while the thin scales which never lignify are deciduous. Perhaps this very circumstance, trifling as regards morphology and taxonomy, may furnish the key to immense and very important differences in respect to chemistry and physiology. The object of the present paper is to endeavour to elucidate these relationships.

First, it will be advisable to inquire if the internal anatomy and histology of these arboreal organisms present similarities corresponding with the external morphology. The characters of the xylem of the birch are as follows: The vessels are very numerous, and either stand isolated or in a radial file, of rarely more than two or three together. The wood parenchyma is scanty, but occurs either in isolated cells or in very straight transverse bands. The fibres are radially disposed, and have a thick uncoloured wall. The medullary rays are numerous, straight, and consist mostly of one layer, sometimes two, of rounded or oval cells, which tangentially appear as pointed spindles. The limits of the annual rings of wood are clear, being formed of four or five rows of very flattened cells. The xylem of the alder differs from this only, in the following particulars. The vessels sometimes occur in radial files of as many as four together. The walls of the wood-fibres are not so thick, and the medullary rays are more numerous, crowded, and of a brown colour. With regard to the bast layers, a few bast-fibres are produced in both trees, in the first year, but none afterwards; hence the secondary bast from the second year onwards is composed of soft bast only. A considerable sclarification of the liber elements occurs, especially in the birch, where the soft bast is composed of sieve-tubes and of parenchyma cells. These describe concentric zones of a certain thickness, dividing with the medullary rays which are cut vertically or obliquely, the liber into rectangles or parallelograms. When these liberian zones have attained a certain age, the walls of their elements gradually thicken till their cavities are completely lost. These highly-lignified, but not suberified, walls then become pierced by a great number of pits, which mark the exterior orifices of so many canaliculi, radiating straight through their now amalgamated mass. At the same time, some of these modified cells are seen to be filled or inlaid with large crystals of oxalate of calcium. The whole tissue of parenchyma and sieve-tubes, however, is not entirely thus transformed. Frequently an area of active and living liberian tissue still arranged in concentric zones, remains behind, enclosed between the thick sclerified masses. A series of sieve-tubes remain intact in close proximity to the cambium, and the small medullary rays are quite unaffected by the extensive processes of lignification going on in their vicinity. The suber of the birch consists of alternate layers of thin-walled cells invested with a white resin and full of air; also of thick-walled tabular cells, which form in rapid succession. In the periderm of the alder the cells are thick-walled and of more uniform shape, the inner layer being composed of wavy-walled, more cubical, clear elements, while the external portions are early invaded by a homogeneous dark brown mass of phlobaphene, whereby the formation of rhytidome is more easily developed than in the allied species.

Neither of these trees has a tap-root, but both possess strong side roots penetrating to one foot in the case of the birch, and to about two feet in that of the alder. The latter requires more moisture, both of soil and of atmosphere, but is more liable to suffer from frost than the former. The evaporation per square foot of leaf surface has been calculated as 0.050 and 0.009 for alder and birch respectively. The alder wood, when green, is more easily worked than any other timber; it is not so durable in air as that of birch, but it lasts much longer in water. The mean specific gravity of its fresh wood is about 0.901, of the dried wood 0.551. It contains 41.6 per cent. of moisture when fresh cut, and is composed of 49.1 per cent. carbon, 6.1 hydrogen, and 44.8 oxygen; the amount of cellulose is reckoned as 54.62 per cent., with 31.33 incrusting matter. The mean specific gravity of fresh birchwood is 0.919, of the dried wood 0.664. It contains 30.8 per cent. moisture, and its ultimate composition is practically the same as that of alder, but the percentage of cellulose is 55.52, with only 28.21 incrusting matter.

It will be observed in view of the foregoing account, that the morphological features, and the physical characteristics of these trees are tolerably similar. There is, however, one eminent peculiarity possibly not sufficiently taken into account in taxonomy, viz., the very serious difference in respect to the leaf. That of the birch being pointed, much-notched, glossy, and in form of an isosceles triangle mounted on a slender, rather long, and not downy petiole. The leaf of the alder is roundish, with a wedge-shaped base, a wavy and only slightly-toothed margin, hairy and glutinous when young, but later a glossy, dark olive-green on both sides, and is mounted on a much shorter petiole. Both leaves develop one or two rows of palisade cells, the lacunar tissue is rather loose, and the cuticle comparatively thin, with little incrusting matter even in the autumn; but the transpiratory functions are evidently much better provided for in the case of the alder leaf than in that of the birch. On the other hand, judging from the amount of chlorophyll and carotin, the assimilatory functions are comparatively inactive. In fact, the chlorophyllian protoplasm produces in both cases more oil and less starch. According to Fischer, during December, January and February of each year, the whole of the starch in pith, wood, and bark disappears, most of it being transformed into a fatty oil, and a smaller portion in the rind into glucose. The fibre of the dry alder leaf is about 13.25 per cent., that of the birch is 18.10 per cent., while the amount of mineral matter, ash, is respectively 4.13 and 3.52 per cent. The proportion of lime, magnesia, phosphoric and sulphuric acids, is very considerable in both cases, but that of silica is comparatively small throughout the whole tissues of both trees. In fact, these organisms must be regarded as fastidiously and pronouncedly calcium-needing, with a very small prevailing siliceous content. Both species, again, with the exception of the allied hornbeam, contain a lower proportionate amount of albuminoids in their foliar organs than in those of any of our ordinary denizens of the forest. The proportion of non-nitrogenous extractive matter, on the other hand, is exceptionally great in the alder leaf; that of the hornbeam coming nearest to it. The amount of similar constituents in the birch leaf is, though still decidedly high, at least 6 per cent. less.

The serious differences, which have now been indicated, seem to furnish the key to the whole position. It is quite evident, as aforesaid, that the assimilatory functions of both organs are not eminently robust. The more fully and thoroughly the subjects are analysed, the more apparent it becomes that the counterpart thereof, viz., the de-assimilatory process is much more extensive and complete in the case of the alder than in that of the birch. If we examine a birch leaf at the period of its highest development, say about the end of July, we find that besides about 50 per cent. water, it contains wax, with a little fixed and volatile oil, also considerable resin, rutin, and very little tannin, much mucilage, about 2.7 per cent. nitrogenous matters, and 1.7 ash. The alder leaf at the corresponding period, contains a darkish brown fatty matter, no volatile oil, a little resin, considerable tannin, much mucilage, about 2.2 nitrogen, and 2 ash. It will be observed on close comparison, that while the former organ has advanced to the wax and resin-forming stage, the latter has overleaped this stage, and has produced a considerable quantity of a highly-carbonaceous and phlobaphenic tannin (C_{27}, H_{28}, O_{11}), with its attendant colorific consequences. The dark olive-green of the alder leaf is due, not to the predominance of chlorophyll and carotin, but partly to the darkish fatty matter, still more to the tendency which the tannin exhibits of readily forming high red-brown or muddy-shaded anhydrides, that forbid any change of colour in the autumn. The alcoholic extract of the birch leaf, even at the end of September, contains no phlobaphene, its tannin (C_{20}, H_{22}, O_{9}) is much less carbonaceous, and the brilliant golden yellow of its autumnal livery attests that the products of de-assimilation have not attained the utmost limits of transformation. As Grassmann remarked, "Wax is one of the ingredients of birch buds, and the sticky balsamic covering of these in the first period of development is formed very probably of plant wax, chlorophyll, ethereal oil, and some resin." All these ingredients, it may be noted, have been formed in the previous autumn.

What is true as respects the foliar organs holds good also in the case of the other tissues. Thus, while the bark of the alder sometimes contains as much as 20 per cent. of tannin, that of the birch rarely has over 6 per cent. of the same substance. On the other hand, it contains from 50 to 60 per cent. cuticular substance (suberin), with 33 per cent. of a white camphoraceous resin, to which it owes its silvery white colour, and only small quantities of bitter principle and mucilage. The same kind of conditions prevail in the wood. In the alder the cells of the medullary rays, the wood-parenchyma and pith, are richly charged with tannin, while in those of the birch it is decidedly sparse, there being none at all in the wood parenchyma. Hence, the wood of its ancient trunk, even when felled and exposed to the air, preserves, if it be still sound, a uniform lightish colour.

The volatile oils and resins of the birch are products that, themselves separate, are cast off outside the tissues. On the other hand, the lavish tannins and phlobaphenes of the alder are used in the formation of lignin, incrusting matter, heart-wood, and timber that stands moisture in an incomparable manner, but on exposure to the air almost instantly assumes a red-brown colour, thus showing the force and tendency which, in another region of its organisation, operates to hold out a sign and symbol of distinction from the taxonominally allied, but physiologically disparate. *Betula.*

Patterdale, Westmoreland.

A HISTORY OF CHALK.

By Edward A. Martin, F.G.S.

(*Continued from page* 117.)

HOMOGENEOUS as the Chalk is in itself, there have been found in various places, scattered through the mass, what are known as erratic boulders. Occasionally pieces of granite, greenstone, quartz, sandstone, schist, and even coal, have been found. When a tunnel was being pierced through Chalk, near Lydden Hill, on the London, Chatham and Dover Railway, a large block of coal or lignite was found embedded therein. It measured about 4ft. square, varying from 4in. to 10in. thick. A large block of syenite weighing 40 pounds, which has been thought to be of Scandinavian origin, was brought to light in 1857, from a chalk-pit at Haling, south of Croydon, and this has been described in some detail by Godwin-Austen. Beside the larger granite boulder there were pebbles of smaller dimensions, together with fine sand; and all of them were waterworn. "In common with the other specimens of the same rock, the largest boulder was much decomposed. The smaller pebbles were wholly decomposed, and readily fell to pieces, forming a sharp sand." In addition to this there was a fine waterworn beach sand, "derived from the waste of a coast-line of some crystalline rocks." These interesting erratics were found in the Upper Chalk, and as none of our English chalk-beds show any signs of the approach of shore conditions, their presence is not thought to be explicable, except by the agency of floating ice.

Amongst the fragments of foreign rocks which are occasionally found in the Chalk, rounded quartz pebbles are, perhaps, the most frequently met with. They have been found in the Upper Chalk of Charlton and Gravesend, in Kent. Prof. Seeley accounts for their presence by the habit which many marine animals possess of swallowing and re-depositing gravel. He cites the walrus, the larger fishes, and reptiles of the present day as possessing this habit. It is quite possible that in cretaceous times these pebbles may in part have been transported from districts where veins in crystalline rocks were exposed to denudation. The larger blocks of coal and granite may have been transported by ice-action, or may have been floated up by the action of living seaweeds, which carried them away and dropped them far out at sea. Where the blocks of coal come from is an exceedingly interesting and debateable question, but it seems very probable that some portions of the coal-seams which are now known to exist beneath the south of England, were at this age exposed to view, and to the denuding action of a neighbouring coast.

Other boulders of smaller size have since been excavated from the Chalk, the neighbourhood of Norwich having yielded various specimens. Among those more recently discovered are two which were obtained from the Middle Chalk of Betchworth, in Surrey, by Mr. W. P. D. Stebbing, F.G.S. The two boulders in question were of granite, although different in character, and were both very much weathered. They weighed 7 lbs. 7 oz. and 3 lbs. 12 oz. respectively, and measured, the one, 5·8 in. × 6·25 in. × 4·125 in., and the other, 3·6 in. × 5·8 in. × 4·5 in. The transportation of these boulders, which Professor Bonney judged might be of Scandinavian origin, was attributable to one of four causes: by adhesion to seaweed, driftwood, by marine animals, or ice. It was particularly interesting to notice that to the largest, valves of *Spondylus latus* and *Serpula*, were still attached. In the presence of these and other larger boulders in the Chalk, we have undoubted evidence that the sea in which was laid down the Middle Chalk was occasionally traversed by stray icebergs. The manner of formation of boulder clay is not thoroughly understood. If caused by land-ice, the thought at once arises that if there had been no land where now the boulder clay is found, possibly no deposit might have been laid down at all, and no evidence furnished of the glaciation for future geologists. In such a case, these boulders in the Chalk may be sufficient evidence of a veritable glacial epoch occurring even in Cretaceous times, although there is no Cretaceous boulder clay. They may show its principal effects on lands which have since suffered extreme denudation, or which are now still beneath the sea. Here, too, would be a satisfactory explanation of those puzzling bands of clayey-chalk which occur at all levels in the true Chalk, and to explain which, it is almost impossible to believe in repeated temporary shallowing of the sea-bottom. Icebergs from the nearest coast might be the bearers of fine clay frozen in its mass.

Breaking the continuity of the Chalk, in addition to the numerous bands of flint, with which we shall deal elsewhere, Jukes noticed in a cliff of Upper Chalk, east of Dieppe, a band of brown clay or marl, perfectly interstratified with the Chalk. It was not connected with any pit-holes, by which it could have been swept in. This band measured about eight inches thick, and was 20ft. in length. The pit-holes, or "pipes," here referred to, often consist of Eocene sands filling irregular-shaped hollows, formed since the deposition of the beds by the decomposition of the Chalk. These appear to be more prevalent where there is but a small capping of the Thanet Sands, since as a rule there is a hard-and-fast even line of division between the Chalk and the sands.

A peculiar feature of the Chalk at its junction with the Eocene Reading Beds, near Bedwins, in Wiltshire, is the occurrence of a bed of "Reconstructed Chalk." This bed, some 20 feet in thickness, consists of blocks of Chalk, with broken bands of flint, contained in a matrix of rubbly, chalky clay, under which is a confused mass of pieces of hardened Chalk. These pieces are said by Mr. W. Whitaker, F.R.S., F.G.S., to be as hard as most crystalline limestones. The same formation has been noticed in other places in the neighbourhood. The Chalk seems to have been broken up, and redeposited before the deposition of the overlying Reading Beds. A similar bed has been met with between Bradfield and Pangbourn; near Tilehurst, and also near Maidenhead. The raised beach at Kemp Town, Brighton has recently exhibited a similar bed in its eastern part, owing to falls of cliff. It lies between two beds of rolled beach.

The following are some measurements of the depths, in feet, at which the surface of the Chalk was found beneath the south side of London, each list representing a different direction.

I.

Mortlake, 315.
Kingston-on-Thames, 412.
Richmond (Star and Garter), 416.
Esher, 360.

II.

Vauxhall, 224.
Wandsworth Brewery, 274.
Wandsworth Prison, 357.
Mitcham, 189.
New Wimbledon, 193½.
Wimbledon Common, 465.
Wimbledon (Hospital), 567.

III.

Guy's Hospital, 197.
Southwark, 203.
Stamford Street, 210.
Charing Cross Bridge, S., 245.
Stockwell Green, 210.
Lambeth, South Lambeth Road, 187.
Champion Hill, 210.
Streatham, 241½.

IV.

Rotherhithe, 66.
Horselydown, 158.
Forest Hill, 300.

From this it will be noticed that the Chalk rises nearest the surface in the south-eastern corner of the London area, and is represented in List IV. as reaching within 66ft. of the surface at Rotherhithe, but there is a thickening of the overlying beds in a westerly direction. The Chalk is, indeed, exposed in the quarries at Loampit Hill, Lewisham.

(To be continued.)

Physical Apparatus.—Mr. T. M. F. Tamlyn-Watts, A.M.I.E.E., of Goldielands, Settle, Yorkshire, has favoured us with his catalogues of physical and electrical apparatus respectively. The former contains 880 items. They are both illustrated, and appear to include the most useful electrical apparatus for laboratory and student's use. Various materials are included, such as ebonite, vulcanized fibre, metals etc., together with different wires. There is likewise an improved form of tangent galvanometer and magnetometer. Both catalogues are furnished with an index.

LARVAE OF CAPRELLA.

Of the many curious forms of animal life to be found on the sea shore, there are few that for grotesqueness of form surpass the crustacean popularly known as the skeleton shrimp (*Caprella*). The most casual glance will assure the observer that the term has been well applied, for the body closely resembles the vertebral column of an animal, the pouch of the female bearing no small likeness to the bony framework of the chest. The hooks of the second pair of legs in the male are developed into enormous claws, or claspers, which are not unlike a man's clenched fist.

The *Caprella* belongs to the subclass Loemodipoda, a division of the sessile-eyed Crustaceae. The animals have seven pairs of hooked feet, but in this genus the third and fourth pairs are aborted, their place being taken by two oblong membranous sacs, which act as respiratory organs. Also placed here, in the females are the ovisacs, which are said to contain numerous good-sized eggs. This statement appears in all works on Natural History to which I have access. I had always received it without question, until some time since, whilst preparing sundry objects for the microscope, when upon pressing a specimen between two glass slips, to express the contents of the attenuated body and ovisac, I was greatly surprised at the extrusion, not of a mass of eggs, as I expected but of a veritable host of tiny Caprellae all perfectly formed, and exactly resembling the parent in every respect, except that the heads were larger than in the adult. The number of young was great, and how they, with their long legs, and two pairs of antennae, could have been all packed in the ovisac continues to be a marvel to me. From this single specimen, which improbably differs from other members of the family Caprellidae, it would seem that instead of being oviparous, as represented, it is really ovoviviparous, and the larval existence is passed in ovisac of parent.

This creature is by no means uncommon on the English coast, and wherever Pycnogons are to be found, there, almost certainly, will *Caprella* be associated with them. The best way to find them is to turn over flat stones and pieces of rock, at about low water mark, at spring tides, when amongst the miniature forests of zoophytes and immature seaweeds, particularly when dirty in appearance, these skeleton shrimps will soon be detected. They have a remarkable habit of clinging with two hind claws to the rock, and then incessantly swaying to and fro, as if agitated by some current in the water, but when kept in an aquarium, where the water is perfectly still, the movement hardly ever ceases. This action so closely resembles that of colonies of young zoophytes, when laved by marine currents, that I take it to be a protective movement, more particularly as in colour, and in their jointed body they so closely resemble the zoophytes. Combining the likeness with the movement, we have, probably, here an instance of protective mimicry highly conducive to the preservation of the creature.

Edward H. Robertson.

Painswick.

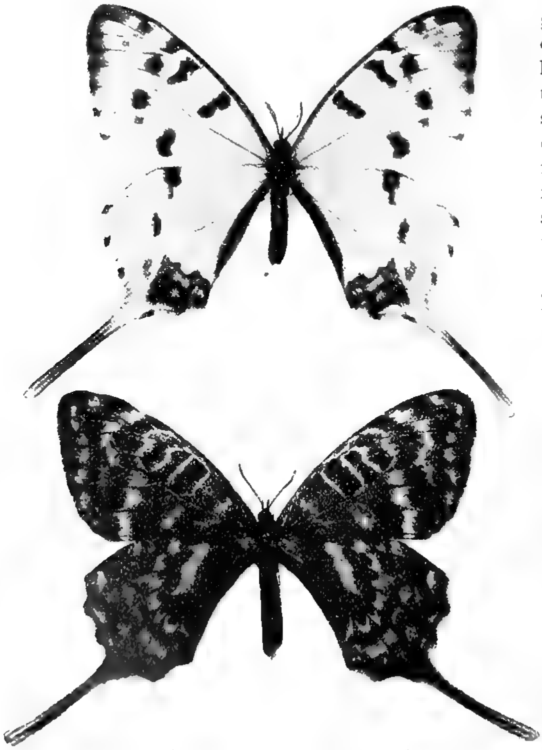
BUTTERFLIES OF THE PALAEARCTIC REGION.

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

(Continued from page 115.)

Genus 2. *SERICINUS* Westwood.

MEDIUM-sized butterflies, ♂ with whitish wings, spotted or banded with black, h.w. with a crimson blotch and some blue ocelli at an. ang., and some small red spots parallel with ou. marg. ♀ dull buff with black and dusky spots and bands extending over most of the wing area, h.w. with a more or less broken sub-marg. band of crimson and some blue spots along ou. marg. In both sexes the



Sericinus telamon. var. *amurensis.*
Upper fig. ♂ Lower fig. ♀

h.w. are slightly dentated and extended into a very long slender tail at the extremity of the median nervule. The antennae are short.

The larvae feed on *Aristolochia* and are said to resemble those of *Thais*, being black with tuberculous hairy projections, and with anterior retractile forks.

Pupae have a dorsal row of spines.

This remarkable genus seems to be very closely allied to *Thais* in all its states—but the long tails on the hind wings present a very striking character.

The genus *Sericinus* is confined to China, Corea and the Amur. but it is not represented in Japan. All the Palaearctic forms are considered by Dr. Staudinger to be varieties of *Sericinus telamon*, a species first described by Donovan in 1798. They are all certainly very closely allied and apparently local forms or seasonal varieties of one species; and are therefore thus treated here.

1. **S. telamon** Donovan.

52—60 mm.

♂ pale yellowish white, f.w. apices blackish, two costal spots as commonly seen in this and the allied genera, 3 blackish spots between the apex and the disc-cell, and one on in. marg. towards an. ang.; h.w. with red spots occupying the same position as those seen in *Hypermnestra* and *Parnassius*, small and surrounded by black, near an. ang. a patch of bright extending to the upper median nervule and surmounting a deep black patch marked with three indistinctly defined lunules of shining blue, the tail shading off into black towards the middle, but whitish at the tip. The general pattern of the wings reminds one somewhat of that of the ♂ of *Thais cerisyi*. ♀ yellowish buff with bands and blotches or black, recalling the pattern of *Thais rumina* but less defined. H.w. with a narrow sub-marg. band of crimson reaching from costa to an. ang.; external to this a marg. black band with 3 blue spots towards an. ang.

Hab., Mongolia and N. China. VI.

a. var. *amurensis* Stgr. 54—67 mm. Larger than type and with blacker and larger spots in ♂ and the entire pattern in ♀ darker and more strongly defined. In all other respects it resembles the type. Hab., Corea, Amur (Poltk). VI. and VIII. Larva on *Aristolochia.* V. and VIII.

b. var. *koreana* Fixsen. 40—50 mm. Rather smaller than type. ♂ f.w. with black markings more diffused and spread over a large part of wing area, base black, h.w. with a rather broad sub. marg. black band, black blotch in centre of disc-cell. ♀ duskier and less strongly marked than in type. Hab., Corea. VI. e. and VIII. (R and H.)

c. var. *fixseni* Stgr. Rather smaller and darker than the foregoing. A variation of 1st brood. Hab., Corea, VI. e.

d. var. *telemachus* Stgr. 37—40 mm. Resembles var. *amurensis* but smaller. ♀ has the ground colour clearer yellowish, giving it at first sight very much the appearance of a *Thais*. The black markings are more defined and separated, and the red band of h.w. narrower. A var. of 1st generation. Hab., S. Amur. Corea. VI.

Genus 3. *LUEHDORFIA* Crüg.

The single species which constitutes this genus was originally included in the next (*Thais*), to which it

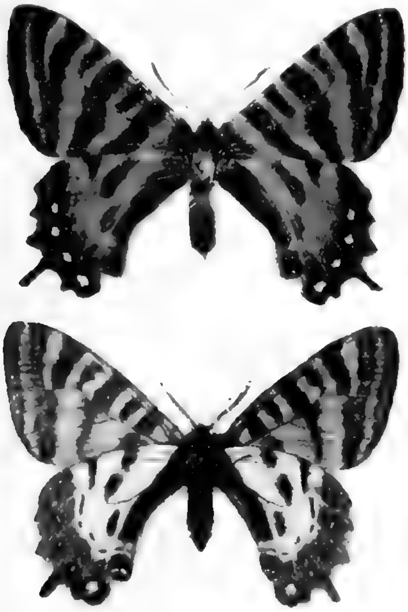
bears some superficial resemblance in the imago state. The palpi, however, are shorter than in *Thais*, and the antennae longer. The expanse of the wings is somewhat greater, the f.w. more triangular in shape, and with an extra nervule not found in *Thais*. H.w. more distinctly caudate.

♀ with an abdominal pouch as in *Parnassius*.

1. **L. puziloi** Ersch.

54 60. mm.

♂ Bright ochreous yellow, ♀ lighter. F.w. with long and short bands of deep black starting from the costa, h.w. with a sub-marginal row of black lunules with blue centres, with basal and costal black dashes, and a bright carmine blotch near an. ang. U.s. paler, especially h.w. which have the cent. area nearly white, the outer third of wings is occupied by a triple band of red, blue and yellow, at an. ang. a blue spot.



Luehdorfia puziloi, upper and under sides.

Antennae black, and head, thorax and abdomen black with yellowish hairs longer than in *Thais*.

The pattern of the f.w. recalls that of *Papilio alexanor* and *P. podalirius*. That of the h.w. is like the pattern of *Thais*; in fact, its external appearance is an index to the composite character of this interesting and beautiful species.

HAB., Amur (Wlad., Ask., Baran., Suif.) IV. V.

LARVA on *Asarum* (R. and H.), ? *Aristolochia*.

GENUS 4. *THAIS* F.

Middle-sized butterflies having the head and eyes of moderate size, palpi straight, passing beyond the head. Clubs of antennae curved. Wings opaque but sometimes with a small transparent patch on fore wings. All the known species have black spots on costa of f.w. H.w. dentated and often subcaudate, and sometimes caudate at ou. marg. generally with a sub-marginal row of red and black spots. The ground colour of the wings is yellow, varying from whitish to deep orange ochre.

The larvae are cylindrical, rather short and are [illegible] with spines, which are set at the extremity of tubercular elevations. A small Y-shaped process posterior to the head. They feed on various species of *Aristolochia*.

This small but beautiful generic group is confined, except in the case of one species, to the immediate neighbourhood of the Mediterranean, on the European, Asiatic, and African sides.

There are three distinctly marked types, *T. cerisyi*, *T. polyxena*, and *T. rumina*. Some of the forms that were formerly accounted varieties of these, seem to deserve specific rank, which will be here accorded.

The species that are most easily found by British collectors are *T. polyxena*, which occurs in the South of France, and in Canton Tessin in Switzerland, also *T. medesicaste*, which is common in many places in S.W. and S.E. France. *T. cerisyi* is an eastern species, occurring in Bulgaria, Greece, and Asia Minor. *T. deyrollei* is found in the neighbourhood of the Sea of Marmora, and *T. caucasica* in the Western Caucasus and Armenia. The well-marked and very beautiful aberration of *T. medesicaste* named *honoratii* is absolutely confined to the neighbourhood of Digne in the Basses Alpes. It is strange that its area should be so limited, and I cannot help thinking that it may some day be found in other localities in the same part of France. Up to the time of my now writing, however, it has only been taken in the locality above indicated where a few specimens are found every season, chiefly by the native collectors, who send them to the dealers, by whom they are offered for sale at about £2 each. It is to be obtained by collecting large numbers of the larvae of *T. medesicaste* and rearing them on the chance of obtaining var. *honoratii*, but I do not think that this wholesale method is to be commended, as it is likely to lead to the extermination of the species in the particular locality in which *honoratii* has hitherto occurred. For my own part, during two

Thais [illegible] ab. [illegible].

visits to Digne I found *T. medesicaste* far from common, and only saw one specimen of *honoratii*. Fortunately great numbers of the larvae must feed in inaccessible places, yet it is very desirable that entomologists should bear in mind that *honoratii* might be exterminated by over collecting.

The species of this genus must be looked for in the early part of the year, nowhere later than June. *T. rumina* appears as early as January in Algeria, and a few stragglers of *T. medesicaste* may be seen at the end of June in S. France, though April and May are the most usual months.

1. **T. cerisyi**, B. Lg. B. E., p. 9, pl. II., fig. 2. 58—62 mm.

♂ wings very pale yellow, black at base. The fore wings with 5 black costal spots, apex with a blackish band, internal to this a short interrupted band of same colour. H.w. with one red costal spot and a sub-marginal row of the same colour, external to these some black spots, *very rarely*, with indistinct blue centres; ou. marg. strongly dentate, with one tail.

♀ generally somewhat larger than ♂. Ground colour more ochreous yellow, pattern more strongly marked, central area of h.w. with two rows of black dashes, the lower ones extending to inner marg. Head, antennae and thorax black, abdomen black with reddish orange lateral stripes. U.s. lighter, especially h.w., which are white with central spots marked with greenish.

HAB., rocky places and mountain passes in Bulgaria, Greece, Turkey, Asia Minor, and Palestine. I., II., and VI.

LARVA, greyish black, with yellow dorsal and lateral spots. On *Aristolochia clematitis* and *A. hastata*. III. and VIII.

2. **T. deyrollei** Oberth. = *T. cerisyi* var. *deyrollei*. Lg. B.E., p. 10, pl. II, fig. 3.

55—60 mm.

Rather smaller than *T. cerisyi*. Lighter in colour, especially ♀, which has the ground colour nearly white, and is of more slender appearance. Both sexes with three tails on ou. marg. of h.w.

HAB., Coasts of Sea of Marmora, Aintab (Asia Minor). IV., V.

LARVA, greenish yellow or reddish, with sharp black short lines and dots, prickles yellowy green, smaller than the red spines of *T. cerisyi* and *T. caucasica*. On *Aristolochia hastata* from V. m.

Several aberrations of ♀ have been named by Dr. Staudinger, from whom I have received specimens of each form.

a. ab. *obscurior* Stgr. in litt. Wings strongly suffused with dusky shading, especially towards base. HAB., Armenia.

b. ab. *albidior* Stgr. in litt. A larger form, with a nearly white ground colour. HAB., Armenia.

c. ab *pallidior* Stgr. in litt. A large form, wings somewhat dusky, ground colour pale ochreous. HAB., Armenia.

d. ab. *ochracea* Stgr. in litt. A smaller form, wings not dusky, and with the ground colour ochreous. HAB., Antioch (Syria).

3. **T. caucasica** Ld. = *T. cerisyi* var. *caucasica*, Lg. B.E. p. 10, pl. II, fig. 4.

Smaller than *T. cerisyi*, wings longer in shape. Ground colour distinctly ochreous; general pattern resembling that of *T. cerisyi*, but more strongly marked, h.w. without tails, and with a distinct row of blue spots external to the red ones. Seems to approach the next species.

HAB., Caucasus and Western Armenia. V.

LARVA, "Dark, almost completely suffused (with black) with red spines, two entirely black dorsal spots in front of the prickle." H. and R. 701. On *Aristolochia hastata*.

4. **T. polyxena** Schiff. Lg. B. E. p. 11, pl. III., fig. 1.

50—55 mm.

Wings light yellow, variously spotted and banded with black. Margins of all the wings with a strongly indented blackish band producing the effect at first sight of a deeply incised ou. marg., though in reality the ou. marg. of f.w. is entire and that of h.w. but slightly dentate. F.w. somewhat elongated, with 5 deep black costal spots, the outermost containing a red dot, h.w. with 5 or 6 red spots parallel to ou. marg. and one near the costa, beneath each red spot is a small blue one placed on a marginal black band. Abdomen with reddish lateral spots.

♀ larger and somewhat more strongly marked than ♂.

HAB., S.E. Germany, Tessin, Tuscany, near Naples, Riviera, Vienna, Albania, Greece, S. Russia, Buda, Bithynia, Armenia. IV. and V. It is usually found in marshy places.

LARVA, yellow with a black dorsal band and six rows of spines bordered with black and with a lateral series of black points. On *Aristolochia clematitis* and *A. rotunda*. VII.

a. ab. *ochracea* Stgr. Ground colour rich ochreous yellow. HAB., S.E. Europe and Asia Minor.

b. ab. *bipunctata* Cosm. F.w. with two red spots instead of one. HAB., Turkey.

5. ? **T. cassandra** Hb. = *T. polyxena* var. *cassandra*. Lg. B.E., p. 12, pl. III., fig. 2 (figure incorrect).

Slightly larger than *T. polyxena*. Ground colour of wings lighter, marginal dentations broader and less acute, f.w. with no red spot.

HAB., S. France, Cannes, Hyères, Digne and other places in Basses Alpes, Savoy, and Piedmont.

LARVA, pale reddish spotted with black. On *Aristolochia*. III. and IV.

a. ab. *flavomacula* Schilde. H. and R., p. 90. Yellow spots on the hind wings in place of yellow. HAB., S. France.

6. **T. rumina L.** Lg. B. E. p. 13, pl. III, fig. 3.

47—58 mm.

Ground colour of wings bright yellow, f.w. with marginal indentations shallower than in the last, with a transparent patch near the apex, three of the costal spots marked with bright red and sometimes a fourth red spot near in. marg., the nervules are strongly marked with black. H.w. marked somewhat as in the last, but there is often a red basal spot as well as that on the costa, and there are no traces whatever of blue ones. Marginal indentations deeper than in f.w. U.s. h.w. with pearly white basal and ante-marginal spots. Abdomen with white and buff lateral spots.

HAB., Gibraltar, Granada, Setubal, and other places in Spain, Portugal, and North Africa. I. IV., according to latitude.

LARVA (Lg. B. E., pl. V., fig. 5), greenish grey with black dorsal lines, and orange lateral spots, dorsal projections orange with black spines. On *Aristolochia pistolochia.* VI., etc.

a. ab. *canteneri* Heydr. Ground colour of a rich ochreous yellow. HAB., Andalusia, Portugal (Setubal), North Africa.

7. **T. medesicaste** Ill. Lg. B. E., p. 14, pl. III., fig. 4.

Smaller than the average *T. rumina.* Ground colour pale straw-yellow, black markings not so strong, red spots larger in proportion but paler, hind marginal dentations much shallower than in *T. rumina,* especially on h.w., markings of u.s. paler and less strongly marked.

HAB., Provence and Languedoc, frequenting rocky gorges and hill sides. Avignon, Nimes, Arles, Hyeres, Cannes, Casqueiranne, Digne, etc. IV. VI.

LARVA, on *Aristolochia pistolochia.* VI., VII. Lighter than that of *T. rumina.*

a. ab. *honoratii*, Bdv. Lg. B. E., p. 14, pl. III., fig. 5. Size of the smallest specimens of *T. medesicaste*, differs from it in having the red spots immensely enlarged so as to occupy the chief area of the wings. The f.w. have three large costal blotches of red narrowly edged with black and one near in. marg. The h.w. may be described as red, with a pale yellow patch in the discoidal cell and a marginal band of light yellow with a black indented pattern. In fresh specimens the red is a fine rose colour. HAB. This beautiful and rare form may be found at Digne in rocky situations, where *Aristolochia* grows, Montaigne de St. Vincent, la Collette, the right bank of the Bleone, etc. V. e., VI.

(*To be continued.*)

ARMATURE OF HELICOID LANDSHELLS AND NEW SECTIONS OF PLECTOPYLIS.

BY G. K. GUDE, F.Z.S.

(*Continued from p. 77.*)

THE genus *Plectopylis* was established by Mr. Benson in the "Annals and Magazine of Natural History" (3), v., (1860), p. 244, and in the preceding volume of the same publication (3), iv., (1859), p. 95, he described the external characters of the animal of *P. achatina.* Mr. Stoliczka, however, was the first to examine some species anatomically (Journ. Asiat. Soc. Bengal, 1871, p. 217), the forms investigated by him being *P. achatina, P. cyclaspis, P. pinacis,* and *P. macromphalus.* He states that on the whole the form of the body closely resembles that of *Clausilia,* and that a comparison of the interior organisation of the two genera also indicates their close relation. On comparing the jaw of *Plectopylis* with that of *Clausilia,* he found both similar in structure, but the shape different and the transverse sulcation only indicated in the latter genus. Much greater, he continues, is the similarity of the *Plectopylis* jaw with that of *Cylindrella,* with the exception that the median projection is wanting in the *Cylindrella* jaw. The arrangement of the teeth of *P. achatina* and *P. cyclaspis* he also found to agree with that of *Cylindrella* in the very small size of the centre tooth, but this was not found to be a constant character. In *P. pinacis* the centre tooth was larger and more of a shape similar to that of the lateral teeth, which, however, in all the species he found to retain distinctly the helicoid character.

The true systematic position of *Plectopylis* still seems uncertain. Mr. Pilsbry doubtfully places it in the family Helicidae—between the groups Macroogona and Teleophallogona (Manual of Conch. ix., Index to the Helicidae, 1895, p. 124). He includes two Chinese groups of uncertain affinities, Traumatophora and Stegodera, each containing one species, but as nothing is known of their anatomy, and as, moreover, they are devoid of the armature characteristic of *Plectopylis*, I consider it expedient, for the present, to exclude them.

The shells of *Plectopylis* are characterised by a more or less depressed discoid form, with a flat or conical spire and a large open umbilicus (narrow in the section Sykesia), the upper surface is usually sculptured with spiral lines, and the immature shells are hirsute. The aperture is semi-circular or lunate, the peristome somewhat expanded and generally thickened, its ends usually united by an elevated ridge on the parietal callus, which has often an entering fold. The armature consists of a vertical or transverse plate or plates with accessory horizontal or oblique folds on the parietal wall; and transverse, horizontal or oblique folds and denticles on the palatal wall. "When the animal retracts into its shell, the passage through the folds is generally found to be filled up with mucous secretion, but the body itself mostly retracts one-half of a whorl further inwards. During hibernation the aperture is besides closed with the usual calcareous lamina, as in the other *Helicidae.*" (Stoliczka, Journ. Asiat. Soc. Bengal, 1871, p. 218).

Mr. Benson[1] noted that *Plectopylis achatina* was ovo-viviparous, and this was found to be the case with all the species examined by Mr. Stoliczka. One specimen of *P. cyclaspis* he found to contain three well-developed embryos, each consisting of three convolutions, regularly coiled in and enclosed in a thin soft sac of calcareous granules, loosely joined together.[2] I have also observed this fact in a specimen of *P. lissochlamys* in Mr. Fulton's possession.

Mr. Benson divided the genus into three sections; the typical section comprising *P. achatina* and *P. cyclaspis*; the second section consisting of *P. refuga* and *P. leiophis*, while the third section contained *P. plectostoma* and *P. pinacis*. The great number of species discovered since Benson's time necessitates still further division, and I propose the following synopsis.

I. Section ENDOTHYRA, n. sec. Type *P. plectostoma.* (Third section of Benson). Sinistral. Umbilicus moderate. Palatal folds horizontal or oblique.

Habitat: Sikkim, Assam, Burma.

1. P. minor, G.A. Darjeeling, Sikkim; Naga Hills, Assam.
2. P. hanleyi, G.A. Sikkim.
3. P. blanda, Gude. Naga Hills.
4. P. macromphalus, W. Blf. Darjeeling; Khasia Dafla and Naga Hills.
5. P. sowerbyi, Gude. Khasia Hills.
6. P. plectostoma, Bens. Darjeeling, Sikkim; Dafla Khasia and Naga Hills, Sylhet, Kohima, Assam; Cherra Poonjee, Munipur; Bassein, Arakan. Pegu.
   prodigium, Bens.
   v. tricarinata, Gude. Khasia Hills.
7. P. affinis, Gude. Khasia Hills.
8. P. pinacis, Bens. Darjeeling, Bungmaval, Sikkim.
   pettos, Mts.
9. P. fultoni, G.A. Khasia Hills.

II. Section CHERSAECIA, n. sec. Type *P. leiophis.* (Second section of Benson). Sinistral or dextral. Umbilicus wide. Palatal folds horizontal or oblique. Sometimes with one oblique or vertical plate.

Habitat: from Assam through Upper Burma and Laos to Tenasserim.

10. P. muspratti, Gude. Naga Hills, Assam.
11. P. austeni, Gude. Diyung Valley, Singpho, Assam.
12. P. oglei, G.A. Sadiya, Assam.
13. P. serica, G.A. Naga Hills. North Cachar.
    sericata, Hanley and Theob.
14. P. munipurensis, G.A. Munipur. N.E. Frontier, Bengal.
15. P. nagaensis, G.A. Naga Hills.
16. P. pseudophis, W. Blf. Thayat Myo, Pegu.
17. P. leiophis, Bens. Thayet-Myo, Kivadouk, Akoutoung, Pegu.
    refuga, auct.
18. P. refuga, Gould. Tavoy, Tenasserim. Pegu.
19. P. perrierae, Gude. Thayet-Myo, Pegu.
20. P. shiroiensis, G. A. Shiroifurar, Munipur.
21. P. perarcta, W. Blf. Mya Leit Doung, Ava. Hlaindet, Upper Burma.
22. P. brachydiscus, G. A. Moulmain, Tenasserim.
23. P. dextrorsa, G. A. Tenasserim.
24. P. shanensis, Stol. Pegu; Shan states.
    trilamellaris, G. A.
25. P. brahma, G. A. Brahmakhund, E. Assam.
26. P. andersoni, W. Blf. Bhamo, Ava, Upper Burma. Hoetone, Yunnan.
27. P. laomontana, Pfr. Luang Prabang, Laos.

III. Section ENDOPLON, n. sec. Type *P. brachyplecta.* Dextral. Palatal folds horizontal, oblique, or almost vertical.

Habitat: Tonkin, Burma.

28. P. smithiana, Gude. Attaram, Burma.
29. P. brachyplecta, Bens. Moulmain.
30. P. giardi, H. Fischer. Cao-Bang, Tonkin.
31. P. congesta, Gude. Tonkin.
32. P. françoisi, H. Fischer. Deo-Ma-Phuc, Tonkin.
33. P. jovia, Mab. Halong, Tonkin.
34. P. schlumbergeri, Morlet.[1] Halong, Elephant Mountain, Nuy-Dong-Nay, Tonkin.
35. P. villedaryi, Ancey. Lang-Son, Bac-Ninh, Tonkin.
36. P. phlyaria, Mab. Tonkin.

IV. Section PLECTOPYLIS, s. s. Type *P. achatina.* (Typical section of Benson). Sinistral. Shell flattened. Palatal armature: one vertical plate with three horizontal folds above, one below.

Habitat: Burma.

37. P. ponsonbyi, G.A. Hlaindet, Burma.
38. P. lissochlamys, Gude. Moulmain.
39. P. magna, Gude. Moulmain. Taunghu, Pegu.
40. P. woodthorpei, Gude. Fort Stedman, Burma.
41. P. leucochila, Gude. Burma.
42. P. feddeni, W. Blf. Prome, Pegu.
43. P. cairnsi, Gude. Burma.
44. P. cyclaspis, Bens. Moulmain; Tenasserim.
    catinus, Bens.
    revoluta, Pfr.
45. P. karenorum, W. Blf. Arakan Hills; Henzada; Pegu.
    burmanica, Bens, M.S.
46. P. linterae, Mlldff. Pegu.
    v. fusca, Gude.
47. P. anguina, Gld. Tavoy, Tenasserim.
48. P. achatina, Gray. Moulmain: Tavoy.
    v. repercussoides, Gude. Burma.
    v. infrafasciata, Gude. Moulmain.
    v. castanea, Gude. Burma.
    v. obesa, Gude. Moulmain.
    v. venusta, Gude. Burma.
    pachystoma, Theob. M.S.
    v. breviplica, Gude. Burma.
49. P. repercussa, Gld. Moulmain. Tavoy.

V. Section SINICOLA, n. sec. Type *P. fimbriosa.* Dextral. Palatal folds horizontal.

Habitat: China; Tibet 1 species.

50. P. emoriens, Gredl. Hoo-Nan.
51. P. azona, Gredl. Badung, Hoo-Pé.
52. P. pulvinaris, Gld. Canton; Hongkong.
53. P. fimbriosa, Mts. Kiang-Si.
    v. nana, Mlldff.
    v. continentalis, Mlldff.
54. P. reserata, Heude. Tchen-Keou. Badung, Hoo-Pé.
55. P. laminifera, Mlldff. Hoo-Pé.
56. P. jugatoria, Anc. Kouei-Tchou.
57. P. diptychia, Mlldff. Kouei-Tchou.
58. P. biforis, Heude. Ta-Kouan-Tchen.
59. P. stenochila, Mlldff. Hoo-Pé.
    v. basilia, Gude. Badung, Hoo-Pé.

60. P. alphonsi, Desh. Moupin, E. Tibet.
61. P. murata, Heude. Tchen-Keou.
62. P. cutisculpta, Mlldff. Fud-Shien.
63. P. invia, Heude. Tchen-Keou.
64. P. secura, Heude. Kouang-Si.
65. P. multispira, Mlldff. Hoo-Nan.
66. P. schistoptychia, Mlldff. Hoo-Nan.
67. P. vallata, Heude. Tchen-Keou.

VI. Section ENTEROPLAX, n. sec. Type *P. quadrasi.* Dextral.

Habitat: Philippine Islands.

68. P. trochospira, Mlldff. Cebu; Siquior.
    v. boholensis, Gude. Bohol.
69. P. quadrasi, Mlldff. Luzon.
70. P. polyptychia, Mlldff. Cebu.

VII. Section SYKESIA, Gude (1897), SCIENCE-GOSSIP, N.S. iii., p. 332. AUSTENIA, Gude *ib.*, p. 300, pre-occupied by Nevell (1878). Type, *P. clathratula.* Dextral, shell translucent, acutely keeled.

Habitat: Southern India. Ceylon.

71. P. retifera, Pfr. Nilgiri and Shevroi Hills, So. India.
72. P. clathratuloides, Gude. Anarmalai Hills, So. India.
73. P. clathratula, Pfr. Ceylon.
    puteolus, Bens.
    puteolus, Bens.
    v. compressa, Sykes. Ceylon.
74. P. caliginosa, Sykes. Ceylon.
75. P. biciliata, Pfr. Ceylon.

I strongly suspect that when the anatomy of the Philippine species (Section Enteroplax) is investigated the group will be found to differ so widely from typical *Plectopylis* that it will have to be raised to the rank of a separate genus. The same may prove to be the case with the section Sykesia. It is somewhat difficult to hazard an opinion as to the primordial form from which the present species of Plectopylis have been evolved as no fossil forms are known, and likewise it is almost impossible to judge as to which of the known forms are the most archaic, for the armatures of immature specimens, as far as they have come under my observation, throw no light on the subject, as they did in the case of Corilla (c.f. SCIENCE-GOSSIP, N.S. iii., 1896, p. 128); except in size and in the lengths of the folds, the barriers of mature and immature shells of Plectopylis are almost identical. There is one exception in this respect, i.e., *Plectopylis woodthorpei*, in which, as I pointed out (*ante* p. 16), the palatal folds of the anterior series are only found in mature shells. It may, however, be assumed that the simple armatures preceded the more complicated, and on this assumption *P. achatina* and its allies, with their complex parietal barriers, must be regarded as the most recent; while in another direction, *P. plectostoma* and its congeners, with their biserial palatal folds, have presumably been evolved from some monoserial predecessor, of which *P. sowerbyi* may be taken as a less modified representative.

(*To be concluded.*)

BOOKS TO READ

NOTICES BY JOHN T. CARRINGTON.

The History of the European Fauna. By R. F. SCHARFF, B.Sc., Ph.D., F.Z.S. vii. + 364 pp., 7½in. × 5in., illustrated. (London: Walter Scott, Ltd., 1899.) 6s.

This is one of the Contemporary Science Series, edited by Havelock Ellis. The study of the European fauna is no new subject with Dr. Scharff, as he has already written upon it, been criticised, and acknowledges the value of criticism. The plan of the work is not so much an attempt to demonstrate the origin of various animals occupying the European region, as to draw the attention of those students working in the several branches of the fauna, to the geographical distribution of the European animals. This is very necessary, as of the two classes of natural science students one meets, whether those working at histology or others on the identification of species, the knowledge of local distribution with consequent geographical variation, is often singularly limited. The author adopts the useful custom of giving at the end of each chapter a summary of its contents, thus directing attention to the more salient points. There are eight chapters, the first forming the "Introduction," followed by "Preliminary Considerations." Chapter III. is devoted to the "Fauna of Britain," then comes the consideration of the "Arctic Fauna," "Siberian," and "Oriental Migration," "The Lusitanian Fauna," and the "Alpine Fauna," the whole concluding with an extensive bibliography. The illustrations are useful, as are the maps. In fact, the book cannot fail to extend the knowledge of many amateur students of natural science.

Laboratory Manual. By H. W. HILLYER, Ph.D., vi. + 200 pp., 9¼in. × 6in., with diagrams. (New York and London: Macmillans, 1899.) 14s.

Dr. Hillyer, who is assistant professor of organic chemistry in the University of Wisconsin, has written this book for the use of college students of general chemistry. His sub-title indicates "experiments to illustrate the elementary principles of chemistry." He divides his work into a treatise on manipulation, preparation, and properties of elements and their compounds, which constitutes Part I. Part II. is devoted to verification of quantitive laws. There is an appendix upon gas volumes and aqueous vapour. A feature of the book is that it is printed only on the left hand pages, those to the right being blank for notes.

South Coast Quarterly. Edited by PERCY LINDLEY. 32 pp., 10in. × 7½in., illustrated. (London: 30, Fleet Street, 1899.) 2d.

This elegant magazine is issued under the auspices of the London, Brighton and South Coast Railway Company. It is doubtless intended really as an advertisement of the many beautiful places to be reached by that line. The illustrations are superbly printed. Mr. Percy Lindley the editor, who is already known in connection with tourists' guides, writes descriptive matter with a light touch and pleasant manner. We would advise our readers to obtain the back numbers, two of which are already issued, as they possess distinct artistic value.

The Arithmetic of Electrical Measurements. By W. R. P. HOBBS, R.N. 112 pp. $7\frac{1}{2}$in × 5in., with diagrams. (London: Thomas Murby, 1899.) 1s.

The general idea of Mr. Hobbs' little work is to be commended and the book is useful as far as it goes, especially as regards the more important applications of Ohm's law and the numerous examples giving very good practice in the different measurements of current, etc. It is a pity, as this is a new edition, that some loose points in the book were not revised as they should have been, as also one or two incorrect statements. It would have been better had more explanatory matter been given upon various points, as the work is intended for young students. The tendency is to give examples without explanation of various terms. For instance on the first page the resistance of a conductor is stated to be directly proportional to its length, and inversely to its cross-section. This is certainly an incomplete definition, as nothing is said about the resistance depending upon the material of the conductor, *i.e.*, "Specific Resistance." It is not, apparently, until p. 83 that the term specific resistance is used, and then it is inserted without the slightest explanation. On pp. 49 and 51 reference is made to Poggendorff's method, and Clark's Potentiometer without any explanation. The worked example at bottom of p. 52 is obviously wrong since $\frac{E_1}{E_2} = \frac{\tan 30^\circ}{\tan 40^\circ}$ E_2 cannot be $= E_1 + \frac{\tan 40^\circ}{\tan 30^\circ}$ but is $= \frac{E_1 \times \tan 40^\circ}{\tan 30^\circ} = \frac{1 \times \cdot 8391}{\cdot 5774} = 1 \cdot 4$. The author gets the same result, but his working is wrong. Still, as we have said, there are many good points about this work and it is worth its published price.

Essays and Nature Studies. By W. J. C. MILNER, B.A. xv. + 220 pp., $9\frac{1}{2}$in. × $6\frac{1}{2}$in., with portrait. (London: Eliot Stock, 1899.) 10s. 6d. net.

This is a reprinted collection of essays and articles written by their late author, and now edited with an introduction by Mr. H. Kirke Swann. They have been collected from various sources, and are of a popular, chatty nature, appealing more to the lover of country lore than to the student of science. In addition to articles of that character, others are included dealing with literary subjects.

Directory of Booksellers. Edited by JAMES CLEGG. 367 pp., $7\frac{1}{2}$in. × 5in. (Rochdale: James Clegg, Aldine Press, 1899.)

This useful little book of reference was founded in 1886 with seventy-two pages, and has gradually grown to its present proportions. In addition to the more important booksellers of the world ranged alphabetically under the towns of residence, the book contains much useful information, including the addresses of some publishers at home and abroad, a list of public libraries in Britain, North and South America, Africa, Asia, Australasia, and Europe, a bibliography of works of reference, of book plates, and Ex-Libris Societies. There are also notes on copyright, instructions for cleaning old prints, and much other general information.

Nursery Handbook. By J. MACLEAN CARVELL, M.R.C.S. 70 pp., $8\frac{3}{4}$in. × $5\frac{3}{4}$in. (London: George Barber, 1899.) 1s.

This work consists of a variety of "hints, plain, homely and practical for the nursery and for the rearing and hygienic directions of precautionary treatment amongst young people." The pages are full of practical advice for young parents. There is an appendix of recipes which will also be useful. The book has been beautifully produced, printed on one side only on superfine paper with gilt edges, making a pretty gift book for a young mother.

The Logic of Vegetarianism. By HENRY S. SALT. 121 pp. $7\frac{1}{4}$in. × 5in. (London: Ideal Publishing Union, Ltd., 1899.) 1s.

This is a series of papers reprinted from the "Vegetarian." In the preface the author confesses a doubt as to the general acceptance of the book, for he says:—"If this book were some strange tale of outlandish cannibalism one might not despair of its acceptance; but when the cannibalism is the everyday habit of the reader himself, can one hopefully invite him to discuss it?" We may answer him in saying "By all means." Although he has not yet converted us, we having still the memory of uncomfortable feelings of vacua after vegetarian meals, the theoretical arguments contained in the pages before us are well worth the expenditure of a shilling.

A Practical Introduction to the Study of Botany. By J. BRETLAND FARMER, M.A. viii. + 274 pp. $7\frac{1}{2}$in. × 5in., with 121 illustrations. (London, New York, and Bombay: Longmans, Green and Co., 1899.) 2s. 6d.

Professor Farmer deals in this volume with flowering plants only, and he does so in a very practical manner, as may be expected from a Professor of Botany in the London Royal College of Science. The author divides his work into four parts, dealing with general morphology, internal anatomy and minute structure, physiology, and examples of Natural Orders. The figures, which have been specially drawn for this work by Mrs. Farmer and Mr. W. C. Worsdell, are well chosen and excellently drawn, even if a little diagrammatic. As a guide for any person wanting a knowledge of structural botany, there could be no better beginner's book.

The Flowering Plants, Grasses, Sedges and Ferns of Great Britain. By ANNE PRATT. New edition revised by EDWARD STEP, F.L.S. Vol. I. xiv. + 269 pp., 10in. × $6\frac{1}{2}$in., with seventy-seven coloured plates. (London: Frederick Warne and Co., 1899.) In 1s. parts net.

In re-issuing Anne Pratt's well-known popular description of the British Flora, Messrs. Warne and Company have taken the opportunity of examining and revising the coloured plates. We observe much improvement in many of them, which have been redrawn for this edition. The work being now published at weekly intervals, at the low price of one shilling, the publishers are placing before the lovers of our wild flowers an excellent opportunity for obtaining an illustrated work with coloured plates. Part I. contains a number of descriptive outline drawings for the better explanation of such technical terms as will be found in the descriptions. There are four plates of these sketches bearing English inscriptions. Each nine parts constitute a volume to which title page and index are appended. The text of the total work will occupy about eleven hundred pages and has been reset in new, and larger type. The book will be complete in thirty-six parts, or four volumes, including three hundred and fifteen coloured plates.

Glossary of Popular Names of British Birds. By CHARLES LEWIS HETT. xiii. + 26 pp., $6\frac{1}{2}$in. × 4in. (Brigg: Jacksons, 1899.) 6d.

This is the glossarial portion of Mr. Hett's "Dictionary of Bird Notes" which we noticed, S.-G., Vol. v., p. 120. The author does not claim that his list is absolutely complete and invites further additions, although he has given some two thousand names.

PHYSICS

CONDUCTED BY JAMES QUICK.

Physics at the British Association.—In referring to Physics in his eloquent Presidential address, Professor Sir Michael Foster reminded us that the year 1799 saw Volta's far reaching discovery, that electricity could be produced by the simple contact of two metals. It was only then that modern electricity, vast as now are its applications, had its birth. After Volta, came in 1819, Oersted, showing the remarkable relations of electricity to magnetism; whence, by the labours of the many illustrious physicists of the present century, has the knowledge of electricity advanced by leaps and bounds, into the supreme position it now occupies. As Sir Michael Foster said: "Those early ideas developing during the years of rest of the century with an ever accelerating swiftness, have wholly changed man's material relations to the circumstances of life, and at the same time carried him far in his knowledge of the nature of things." Professor Poynting's presidential address to the Mathematical and Physical section, was also a brilliant résumé of the thoughts of scientific minds, during the present century. Using an old metaphor, the physicist, he said, is examining the garment of nature, learning of how many, or rather, of how few, different kinds of threads it is woven, finding how each separate thread enters into the pattern, and seeking from the pattern woven in the past to know the pattern yet to come. So far, we have recognised some eight or nine threads of nature, these being the different forms of energy which we are still obliged to count as distinct. Coming to the constitution of matter, Professor Poynting dilated upon the atomic and molecular hypothesis. "For ages this hypothesis hardly went further than to explain the phenomena of contraction and expansion, and of solution, . . . while light was regarded as corpuscular, the molecular hypothesis served as the one foundation for the mechanical representation of phenomena. When, however, it was shown that infinitely the best account of the properties of light could be given on the supposition that it consisted of waves, something was needed to wave, both in the interstellar and in the intermolecular spaces. So the hypothesis of an ether was developed, a necessary complement of that form of the molecular hypothesis in which matter consists of discrete particles with matter-free intervening spaces." What, however, constitutes ether, and what atoms? Many theories have been brought forward, but Lord Kelvin's vortex-atom theory gives us the simplest. Here all space is filled with continuous fluid, and the atoms are mere loci of a particular type of motion of this frictionless fluid. Where there are whirls, we call the fluid matter; where there are no whirls, we call it ether. A similar simplification is given by Dr. Larmor's hypothesis, in which again, all space is filled with continuous substance, all of one kind, but this time solid rather than fluid. The atoms are loci of strain instead of whirls, and the ether is that which is strained. These two delightful addresses should be read in extenso. They are very exhilarating and more interesting to the general scientific mind than is sometimes the case. Reference will be made next month of the other Physics work done at the meeting.

Restoration of Photographic Plates. Some recent experiments have been made, based upon an observation recorded by Professor Emerson Reynolds, to the effect that when an exposed undeveloped photographic plate was submitted to the action of ozone, the image could not be developed, but that the plate was available for re-exposure. If ozone is thus able to destroy a latent image, it was thought that it should be able to restore a fogged plate, the assumption being that ozone oxidises the silver compounds, which light has reduced. Two dry plates were wrapped one half of each in tinfoil, and then exposed to brilliant sunlight for two seconds. They were then taken into the dark room and ozonised for four minutes. They were then used, with the tinfoil removed, to obtain a radiograph. The image was visible on the whole surface; the two halves of the plate were, however, not equally transparent. These experiments should prove very useful at times to photographers, who find they have a batch of fogged plates to deal with, for it is so easy now-a-days to obtain ozone, either from an electrical machine or from a proper ozone tube.

Electrically Operated Drawbridges.—A very successful electrical engineering feat was accomplished in electrically operating a 450 ton drawbridge over the Passaic River in America. The drawbridge was opened in February, 1898, and has given entire satisfaction. The contractors were required to furnish power which would open or close the bridge in thirty seconds, this power not to be available until the wedges and locking device had been withdrawn. Further the wedging and closing arrangements were to be automatically cut off, so they could not be used till the bridge was closed. These conditions have been successfully met, and the bridge operated by three unskilled men, on their regular trips. The conditions laid down to the contractors necessitated intricate electrical circuits for working contact shoes, wedges and other devices. They are all, nevertheless, held under perfect control. The drawbridge structure is 720ft. long, while the draw proper is 227ft. in length and 67ft. wide. It is suggested that the numerous bridges close to one another over the Harlem River in N.Y. City, should be electrically operated from one central electrical station which would radiate power and precede a ship in its passage through the successive draws. All the bridges could then in turn be worked from the one source—which need not then be capable of generating more power than is necessary for one structure.

Meteorological and Magnetic Phenomena. There seems to be some common cause which rules the various meteorological and magnetic phenomena observed in Europe, and which influences them all in a similar way and almost simultaneously. Numerous observations have now been recorded of the annual range of temperature, the rainfall, the barometric pressure and also the magnetic elements, viz., horizontal force, declination and the vertical force. Curves of all these observations have been plotted and a marked similarity has been found between them. From a consideration of the temperature curves for the various stations in Europe, particularly of the minimum in June and the maximum in July, it is concluded that the former is due to some disturbing cause travelling from the West Coast of Scotland southwards, and that the latter appears to be due to a similar disturbance approaching Europe from the South.

SCIENCE GOSSIP.

PROF. B. ETHERIDGE read a paper at the first meeting of the Geological section of the British Association, on the relations between Dover and Franco-Belgian coal basins. He showed that Professor Prestwich was probably correct in his opinion that the Dover field was one of a chain of isolated coal basins extending from Prussia to the south of Ireland and passing under the straits of Dover.

SIR GEORGE KING, the president of the Botanical section of the British Association, devoted his address to a sketch of the history of Indian Botany. In the course of his remarks he spoke very strongly on the absence of botanical knowledge among the ordinary forest officers in India. The majority of them, if they love their trees, are content to do so without knowing their names or relationships. He attributes this, somewhat, to the general decadence in the teaching of systematic botany in England during the past twenty years.

THE Anthropological section turned its attention on Saturday, 16th inst., to General Archaeology. The attendance was large, including many members of the French Association. Dr. Alfred Eddowes gave a paper entitled "Stonehenge: Some New Observations and a Suggestion," illustrated by several good lantern slides. His suggestion was that the "grooved stone" which is best steeled and worked stone in the whole ruin, was used for supporting a pole. Such a pole would form the frontier of a sun dial for daily observation, or an indicator of the time of year by the length of its shadow. Mr. J. Allen Brown spoke on the discovery of stone implements in Pitcairn Island. Dr. Hany, Keeper of the National Museum of Ethnography in Paris, spoke on the specimens found, and asked Mr. Brown to give casts of the implements to the Museum in Paris. Many other papers of interest were read by French and English students of Ethnography and Archaeology.

MR. C. H. Read, the President of the Anthropological section of the British Association, drew attention in his opening address to the small amount of work which is being done in this country to further our knowledge in this vast field of inquiry. He suggested that Government should take over the rest of the Imperial Institute and make a great anthropological and ethnographical collection, and at the same time establish a chair of anthropology in the London University. Some interesting papers were read the following day by members of Professor A. C. Haddon's recent Cambridge expedition to the Torres Straits and New Guinea, which started in the autumn of 1897 and continued during two years. Mr. Ray spoke on "The Linguistic Results of the Expedition." Professor Haddon gave some particulars as to the habits and customs of the Yaraikanna tribe, Cape York, North Queensland.

THE chemical section of the British Association opened with a Presidential address from Dr. Horace T. Brown, F.R.S., on "The Assimilation of Carbon by the Higher Plants." Sir William Crookes read a paper on "The Solidification of Hydrogen," written by Professor Dewar, F.R.S., in which he stated that solid hydrogen presents the appearance of frozen water; its temperature when solid is 16° absolute at 3.5 mm. pressure, and it melts at 16° or 17° absolute, the practical limit of temperature that could be obtained by its evaporation being 14° or 15° absolute. Sir William Crookes also announced that Professor Dewar had succeeded in liquefying helium by means of liquid hydrogen.

IN the zoological section of the British Association Mr. J. J. Lister read a paper describing a new form of sponge obtained by Dr. Willey from the Loyalty Islands, named *Astrosclera willeyana*. It differs from all other sponges in its stretetal element and appears to form the type of a new family the Astroscleridae. Prof. Lankester stated that he considered the discovery one of the most remarkable of the year in biological science. The Presidential address in this section was by Professor Adam Sedgewick, F.R S., the subject being "Variation and some Phenomena connected with the Reproduction of Sex."

THE meetings of the British Association were at their best on Saturday, September 16th, when the members of the French Association paid their visit. In the geological section Sir Archibald Geikie gave his presidential address, which had been deferred in order that the geological members of the French Association and those of the Belgian Geological Society might have an opportunity of hearing it. The subject was "Geological Time," and the question was discussed, how far geological authorities deserved the reproach so often brought against them, that they deal vaguely and recklessly with time, as a factor in geological history. In the course of his remarks Sir Archibald Geikie said that it was difficult at present to establish a definite time for the history of the earth, and that it was necessary for geologists and palaeontologists to work together for this end. His opinion was that 100 million years would suffice for that portion of the history, registered in the stratified rocks of the crust. If, however, palaeontologists found such a period too narrow for their requirements, there was no geological reason why they should not enlarge it.

THE Chemical and Botanical sections met jointly on Saturday, Mr. Horace T. Brown being in the chair. Professor Hanriot spoke in French on the "Excretory Products of Plants." He stated that he had observed asparagine among the secretions of plant roots. This when discharged into the soil becomes oxidized into nitrates and passes agan into the plants. A discussion on symbiosis was opened by Professor Marshall Ward, F.R.S. Professor Armstrong, F.R.S., contributed a paper on "Symbiotic Fermentation; its Chemical Aspects." He advanced arguments in favour of the purely chemical character of symbiosis.

AN important Meeting has been held in the Council Chamber of the City of Belfast, the Lord Mayor presiding, with the object of offering to the British Association the hospitality of the City for the annual meeting in 1902. The proposal was influentially supported by all parties. It is about twenty-five years since the Association visited Belfast. The Belfast Naturalists' Field Club Committee has been quietly moving in this direction for more than a year past, and we feel sure that the Society and citizens generally will offer a cordial welcome and have much to show. The other cities competing with Belfast for the Associations' Meeting in that year, are Birmingham and Cork. The former of these will, we imagine, prove a serious competitor.

The death is announced of Lady Prestwich, who had only recently published a comprehensive biography of her husband. She died at Parkstone on August 26th, at the age of 66.

The Rev. Canon Beachey, rector of Hilgay, All Saints, Norfolk, died on August 19th. He was a skilled electrician, and did much work in astronomy, in an observatory he had erected in his own garden.

The Birkbeck Institution opened its winter session on Monday, September 25th. More than 200 Evening Classes meet weekly, in about 70 different subjects, including biology, physics, physiology and other scientific subjects. Prospectus of this successful college may be obtained on addressing to Bream's Buildings, London, E.C.

We regret to note the announcement of the death at the age of 50, after a long illness, of M. Gaston Tissandier, the well-known aeronaut, and the founder of the excellently managed French Scientific Journal, "La Nature."

The new art studios, physical and biological laboratories and additional class rooms are now in use at the City of London College, White Street, Moorfields, London. Mr. David Savage, the Secretary, will furnish particulars of classes and fees.

The Civil Service authorities have done well to extend the term of service for another two years from this month, of Dr. Henry Woodward, F.R.S., keeper of the Geological Department of the British Museum. This is the second extension that has been accorded to Dr. Woodward.

Dr. Mond, whose munificence in endowing and equipping a physical laboratory for the Royal Institution, has conferred an inestimable benefit on Scientific research, has now presented a complete chemical laboratory to the Victoria Technical Schools, at Middlewich, Cheshire.

We have received from Friedlander and Sohn, of Berlin, their extensive list of books for sale on Natural History and the Applied Sciences, which includes all issued in 1898. The price of the complete catalogue is four shillings. It is divided into several sections, which have been compiled from catalogues in many languages. The value is much increased by an index of subjects and authors.

We have received from Mr. Arthur Bennett a reprint of his paper read before the Norfolk and Norwich Naturalists' Society on *Senecio paludosus* and *S. palustris* in East Anglia. He says that he cannot find any trace of *S. paludosus* having been found in West Suffolk later than 1817, in East Norfolk later than 1860. In Cambridgeshire only a few specimens have occurred since 1857. *S. palustris* was first recorded in East Anglia in 1660, but since the early part of this century it has rarely been found in Cambridgeshire, though in varying quantities in East and West Suffolk and East and West Norfolk.

Sometime ago we made an effort to encourage the more general application of photography in the study of Natural History, but though we received a few replies and photographs of plants growing in their natural stations, the result was not encouraging. We observe in the "Photogram" for August, some illustrated notes on the best method of photographing plants and flowers. The camera should neither look up to, nor down upon, a plant, but the focus should be taken on a level with the object, even though this may necessitate the photographer lying prone, and craning or twisting his neck. A quiet day is also necessary, as a wind however slight, is likely to spoil the picture. An artificial background behind the plant is advisable. A sheet of brown paper or a rug will answer the purpose, but care must be taken that there are not any creases.

Arrangements are being made by the American Government to send an official delegate to the Malarial Commission now in West Africa. This is in response to an invitation from the management of the Liverpool School of Tropical Diseases.

Dr. R. H. Traquair, F.R.S., will commence on the second of this month, a course of twelve lectures on "Pleistocene Mammalia," at the Museum of Practical Geology, Jermyn Street, London. They will be continued on Mondays, Wednesdays, and Fridays at five o'clock in the afternoon, concluding on the 27th of October. Admission will be free.

By the sad Alpine accident of August 30th, on the Dent Blanche, a science teacher of much promise, Mr. O. G. Jones, lost his life. He was B.Sc. of the University of London, and a first-class in honours in Physics. Whilst studying he held scholarships at the Finsbury Technical College and Central Technical College, South Kensington, and had been Physics Master at the City of London School since 1892.

In a communication to "Nature," Prince Krapotkin suggests that the movements of sea-gulls along the British sea coasts may indicate impending weather changes. On August 26th, he noticed off Broadstairs several flocks of gulls flying along the coast towards Dover. The wind was then blowing from north-east as had been the case throughout the month. An old fisherman told the Prince that the gulls were going to the south coast to meet a south-west wind, which was sure to come: as indeed it did, the day following. We have heard of this piece of weather lore on former occasions, and it seems to be worth systematic study.

News has been received from the Polar regions of Lieut. Peary, who has completed the first season of the four years he proposes to spend in the Arctic. He appears to have reached an altitude of fifty miles north of the point gained by the Fram. Unfortunately Lieut. Peary is said to have been severely frost-bitten, and to have lost seven toes. Otherwise it is probable he would have travelled still further north. Neither his expedition nor the Danish one under Lieutenant Amstrup, nor indeed any other Arctic travellers have yet reported news of Andrée and his companions.

The American Association for the advancement of Science, held its Annual Congress from the 19th to the 26th of August, at Columbus, Ohio. The President for the year is Dr. Orton, of the Ohio State University. Two hundred and seventy three papers were submitted to the various sections, and upwards of three hundred and fifty members and associates were present. Prof. Fred. Ward Putnam, the retiring President, read an interesting address, largely devoted to American anthropology. Next year, the meeting will be at New York, with Professor R. S. Woodward, of Columbia University, as President.

We have on previous occasions drawn attention to the importance of skilled and properly instructed persons acting as vendors of spectacles. We are glad to observe that this feeling is spreading, and far more attention is being paid to the scientific aspect of aids to human sight. We have received a leaflet written by Mr. W. T. Overstall, F.S.M.C., of the firm of Messrs. Horne & Thornwaite, London, which contains some useful information and instruction with regard to the eyes. The writer especially refers to the importance of watching the progress of the sight in growing children, when early attention may avoid much future misery.

CONDUCTED BY F. C. DENNETT.

1899 Oct.	Rises. h.m.	Sets. h.m.	Position at Noon. R.A. h.m.	Dec. ° ′
Sun ... 4	6.7 a.m.	5.30 p.m.	12.41	4.22 S.
14	6.24	5.8	13.17	8.10
24	6.41	4.47	13.55	11.47

Oct.	Rises h.m.	Souths h m.	Sets h m.	Age at Noon. d h. m.
Moon 4	5.52 a.m.	11.28 a.m.	4.52 p.m.	29 8 27
14	2.51 p.m.	8.13 p.m.	0.21 a.m.	9 16 46
24	8.58	4.16 a.m.	0.29 p.m.	19 16 46

	Oct.	Souths h.m.	Semi-Diameter	Position at Noon. R.A. h.m.	Dec. ° ′
Mercury	4	11.59 a.m.	2.4″	12.51	4.28 S.
	14	0.21 p.m.	2.4″	13.52	11.39
	24	0.38	2.5″	14.51	17.43
Venus	4	0.8	4.9″	13.0	5.11 S.
	14	0.15	5.0″	13.47	10.5
	24	0.24	5.0″	14.34	14.35
Mars	14	1.22	2.0″	14.54	16.54 S.
Jupiter	14	1.17	14.5″	14.48	15.18 S.
Saturn	14	3.42	7.3″	17.14	21.53 S.
Uranus	14	2.44	1.7″	16.15	21.10 S
Neptune	14	4.1 a.m.	1.3″	5.47	22.8 N.

MOON'S PHASES.

		h.m.			h.m.
New	Oct. 4	7.14 p.m.	*1st Qr.*	Oct. 12	6.10 a.m.
Full	,, 18	10.5 p.m.	*3rd Qr.*	,, 26	9.40 a.m.

In perigee, October 16th, at 10 a.m., distant 226,300 miles; and in apogee on 28th, at 5 a.m., distant 251,500 miles.

CONJUNCTIONS OF PLANETS WITH THE MOON.

				° ′
Oct. 5	Mercury†	6 a.m.	planet	5.56 N.
,, 5	Venus*	11 a.m.	,,	6.5
,, 7	Mars†	6 a.m.	,,	3.15
,, 7	Jupiter*	10 a.m.	,,	4.14
,, 10	Saturn†	2 a.m.	,,	1.27

* Daylight. † Below English horizon.

OCCULTATIONS AND NEAR APPROACHES.

Oct.	Star.	Magnitude.	Disappears h.m.	Angle from Vertex. °	Reappears h.m.	Angle from Vertex. °
10	4 Sagittarii	4.6	7.3 p.m.	74	8.10 p.m.	211
21	56 Tauri	5.4	6.42	205	Near Approach.	
21	κ^1 ,,	4.6	8.37	118	9.35 p.m.	303
21	κ^2 ,,	5.5	8.38	139	9.34	282
22	τ ,,	4.4	6.2 a.m.	321	Near Approach.	

THE SUN is now in a very quiescent state, faculae appear from time to time, but dark spots are much less frequent.

MERCURY is in superior conjunction early in the month, after which this planet is an evening star, but it is not well placed for observation. At 11 a.m. on October 10th Mercury is in conjunction with Venus, the former being 23′ to the south. At 4 p.m. on 25th it is in conjunction with, and 2° 20′ south of, Jupiter.

VENUS is an evening star all the month, but never well placed for observation. At 6 p.m. on October 26th, Venus will be only 6′ north of the third magnitude star α Librae, and at 1 a.m. on 30th she will be in conjunction with Jupiter, which will be only 33′ to the north.

MARS and JUPITER are also evening stars, too near the sun for observation. At 5 p.m. on 11th Mars is in conjuction with, and 1° 11′ south of, Jupiter.

SATURN and URANUS are too close to the sun for observation.

NEPTUNE is a morning star to be observed before sunrise.

METEORS may be specially looked for on October 13th, 15th, 17th, 18th, 22nd, 24th, and 29th.

METEOR.—"On the night of Sunday, the 27th of August, at 10.15 I saw a very brilliant Meteor, resembling a fireball, pass through Auriga, not far from Capella, towards Perseus. The night being cloudy its direction could not be accurately made out. In passing from cloud to cloud it was visible about four seconds, and it moved rather slowly. There was no sign of its being extinguished as it passed out of sight." *J. P. H. Boileau, M.D., Lieut.-Colonel, A.M.S. Trowbridge, Wilts, August* 30th, 1899.

POTSDAM OBSERVATORY.—On August 26th the new cupola on the Telegraphenberg, with its great refractor was formally inaugurated in the presence of the Emperor William.

A NEW MINOR PLANET was discovered by M. Jean Mascart, of the Paris observatory, on the 26th of August.

HOLMES' COMET is too faint to be seen, except by very large apertures. Its orbit is more nearly circular than that of any other known comet, and lies wholly between those of Jupiter and Mars. It is thought that its abnormal brightness at the time of its original discovery, must have been owing to some catastrophe. When re-discovered by Perrine, on June 11th, with the 36-inch Lick achromatic, it was very faint and round, with little central condensation. Its diameter was about 30″. Notwithstanding its cometary appearance, the orbit is more nearly allied to those of the minor planets.

POLARIS.—A paragraph is being circulated that this star has been discovered by Professor Campbell, with the spectroscope attached to the 36-inch Lick refractor, to have a close companion, which, together with its primary, make a revolution round the common centre of gravity in four days.

THE PARIS OBSERVATORY.—The annual report for 1898 contains as a frontispiece, a fine heliogravure of the moon taken from a plate of September 19th, 1894, obtained by M. M. Loewy and Puiseux, with the equatorial coudé of the Paris Observatory.

A NEW EQUATORIAL HEAD to carry telescopes up to $3\frac{1}{2}$ inches aperture, has been introduced by Mr. J. H. Steward. It can be set to suit any latitude, almost from the Equator to the pole. It is moderate in price and appears to be very well constructed, and has a revolving hour circle. The same makers have also introduced a capital driving clock for use with this, or almost any, equatorial stand. It is very neat in appearance, efficient in use, excellent in workmanship and moderate in price. There is also an adjustment enabling its employment over a considerable range of latitude, so that it would not break down, as did the clock taken by the Russian eclipse expedition to Nova Zembla, in 1896.

WRAY'S SCIENCE-GOSSIP TELESCOPE.—We are pleased to announce that SCIENCE-GOSSIP has acquired one of Mr. Wray's best telescopes for the use of the Departmental Editor for Astronomy. It will in future be known as Wray's Science-Gossip Telescope, and be solely used in the interests of this Journal. We hope from time to time to give reports of the work done by this instrument, which cannot fail to be of more than passing interest. It has an object glass of 3 inches clear aperture, eyepieces, of 75 and 130 diameters, and also a star diagonal. The preliminary trials encourage the hope that it will in no way fall below the standard of high excellence borne by the work of this maker. It is mounted on a well-made alt-azimuth stand, and is figured upon page v of our advertisement columns.

CHAPTERS FOR YOUNG ASTRONOMERS.

By Frank C. Dennett.

THE SUN.

The great ruler of our system, which sheds both light and heat throughout its family of large and small planetary spheres, claims very special attention.

It is so great in size that if 1,300,000 globes the size of our earth were made into one world, it would be no more in bulk than the sun. The density of the sun is however much less, for 330,000 globes of the same mass as the earth, would just about balance the scale with the sun, so that it would take nearly four cubic feet of the sun's body to equal one cubic foot of the earth's.

The marvellous brilliance of the disc renders the utmost care necessary in taking observations with the telescope, the objective of which really acts as a burning glass. So great is the amount of heat that I have had an ordinary dark glass blistered, and spoiled, through the heat condensed by an object-glass only 2⅞in. aperture. The sun's altitude did not at the time exceed 20°, and was therefore shorn of much of its heat. Dawes considered that 2in. aperture, of 30in. focus, was as large as could be safely employed with dark glasses. These small glasses will show much detail, still every increase of aperture enlarges the amount. Some observers have sought to put a dark glass a distance up the tube, so that the rays may pass through it before reaching the focal point. This plan is however not good, because of the difficulty of obtaining these glasses sufficiently perfect to be thus used. The solar reflector alluded to in the last chapter is much better. It is, however, necessary to remember that a single reflection reverses the image in one direction but not in the other. Another capital device for reducing the light is a Barlow lens, having a thin film of silver deposited upon it, which reflects much of the light and heat back up the tube. Sir W. Herschel used to reduce the light by permitting it to pass through a vessel containing filtered ink and water. Cooper, of Markree Castle, used a "drum" filled with alum water to get rid of the heat when employing his 13·3in. achromatic, whilst dark glasses reduced the brilliance. Dawes' method of using minute apertures in the diaphragm is not to be recommended. Many observers, including Professor S. P. Langley, the late Miss E. Brown, Captain Noble, and the Rev. F. Howlett have frequently used the telescope as a camera lens, and focussed the image upon a disc of paper or plaster of Paris. This method removes all danger during the general examination of the surface, but direct observation is better for the more minute structure. The illustration given shows the method of fitting the white screen on the telescope. There must, however, be some method employed to prevent the sun from shining directly on the paper. A large disc of cardboard with a central hole just large enough to slip on tightly in the place of the object glass cap, is of use, but still better is a light "camera" of aluminium or cardboard, fitting round the eyepiece and disc. This should be pierced with a hole through which observation can be made. Many other devices have been tried, but for the practical purposes of the amateur these three, the solar reflector, the silvered Barlow lens, and the projected image, are the only ones available. The best tint for dark glasses is either green, or a neutral tint; but never red or yellow. Where expense is no object, and a telescope can be set apart for solar work, Messrs. Horne and Thornthwaite have fitted up a 6in. Newtonian reflector with unsilvered glass mirrors, the bottom surface of the large speculum being curved so that there are no troublesome reflections. This method, whilst it reduces the light and heat very greatly, still makes a large aperture available. Whatever arrangement is adopted, do not attempt to look directly at the sun through a telescope of any size, with only dark glasses. This indiscretion cost Sir W. Herschel the sight of one eye. Only recently I saw a dark glass which had simply been "burned up" with the solar rays, condensed by the 6¾in. Sheepshanks telescope at Greenwich observatory.

Solar observation, to be thorough means close work, because of the great rapidity with which changes take place. If it be possible to observe several times a day, the astronomer's labours will be rewarded.

An equatorial mounting, and cross lines in the eyepiece, render observation very much more easy, because the exact position of a spot on the sun's disc can be more readily determined; a point of very considerable importance.

The general surface of the sun is not, as it may seem at a first glance, of even brilliance, but is more like the face of a liquid covered by closely packed flocculent-looking patches which it would be almost impossible to faithfully reproduce in an engraving. Amongst these "flocks" there occasionally appear duller patches, whilst singular patterns sometimes seem to be formed amongst them, as was long since pointed out by Sir William Huggins. Nasmyth thought the appearance was brought about by the interlacing of multitudes of elongated bodies, which he considered were best described as "willow-leaves," but later observations have not verified this proposition.

The solar atmosphere, if it may be so described, makes its presence very visible by reducing the brilliance of the edges of the disc, as compared with the centre. This effect is readily seen on many photographs, and also is very visible when the image is projected on the screen above described.

Even before the invention of the telescope, from time to time when the sun was very low down, it was noticed that occasionally dark spots were present on the disc. Records of such spots are to be found as early as among the writings of the ancient Chinese. These were of course observed without optical aid. The dark spots may often be seen with the naked eye when the sun is low, and has lost his brilliance. If the spots are frequently observed it will soon be noticed that they are never seen near the poles nor on the equator. It will also be noticed that the spots often appear round the eastern limb, and then from day to day to get further from the eastern and nearer the western limb. The complete transit across the disc occupies about twelve days. It will be noted that the transit does not always occupy the same time, in other words all parts of the disc do not revolve in the same time, so demonstrating that the visible surface of the sun has not a solid surface as has our own world.

(To be continued.)

MICROSCOPY

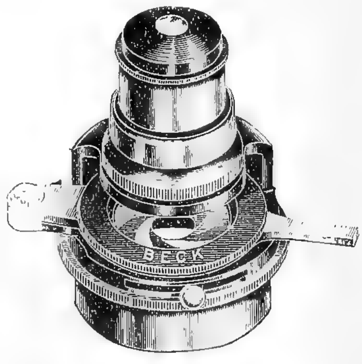
CONDUCTED BY F. SHILLINGTON SCALES, F.R.M.S.

THE RICHMOND PARK PONDS.—I am glad to see attention drawn to these ponds and pools, as, personally, I have found them especially productive in one branch of Pond Life, Freshwater Algae. To mention the algae to be found here, would be to enumerate the chief forms of these plants. They occur in the Pen ponds and smaller ponds and pools:—*Chara*, *Nitella*, *Coleochaete*, *Aphanochaete*, *Chaetophora* (several species), *Draparnaldia*, *Stigeoclonium* (several species), *Hormiscia*, *Oedogonium*, *Bulbochoete*, *Cladophora*, *Microspora*, *Enteromorpha*, *Vaucheria*, *Spirogyra* (several species), *Zygnema*, *Mesocarpus* *Pandorina*, *Volvox* (both *globator* and *minor* with ripe oospores on one occasion), *Pediastrum*, *Apiocystis* *Botryococcus*, *Mischococcus*, *Scenedesmus*, *Nephrocytium*, *Gloeocystis*, *Pleurococcus*, *Rivularia*, *Tolypothrix*, *Anabana*, *Oscillaria*, *Cosmarium*, *Closterium*. As regards other forms of Pond Life, I have met with *Hydra* of a dull brown colour, and also of a rich orange-buff. That peculiar condition of *Euglena*, during which the individuals are aggregated together and are invested with cellulose cell-walls through which they break away, sometimes forms a thick grey-green scum on the surface of the Pen ponds. From what I have seen when collecting Algae, it would appear that the ponds and pools of Richmond Park would well repay systematic investigation in all branches of Pond Life. In conclusion, it will be of interest to mention, that in the neighbourhood occur two such interesting Algae as *Batrachospermum* and *Chantransia*.—*C. E. Britton*, 35, *Dugdale Street*, *Camberwell*, *S.E.*

MANCHESTER MICROSCOPICAL SOCIETY.—We have received from the Manchester Microscopical Society their Annual Report and Transactions for the year 1898, and heartily congratulate the members not only on their numerical and financial position, but on the good and practical work that their Society is evidently doing. The transactions themselves are interesting reading, even to non-members of the Society, and most of the papers are well illustrated with excellent plates. We may mention specifically papers by Mr. A. T. Gillanders on "Scale Insects," by Mr. W. H. Pepworth on "Myxomycetes," by Mr. W. Moss on "The Genitalia of the British *Hyalinia*," by Mr. Chas. Bailey on "Maize," by Mr. Frank Paulden on "*Peripatus leuckarti*," an Australasian form, and by Mr. Wm. Blackburn on "*Myriothela phrygia*." The annual address by the President, Prof. Weiss, of Owen's College, is also printed in full, the subject being "Life." Besides the usual field-work the Society has a sub-section for practical work in mounting and technique. It possesses a library, instruments, and a cabinet of micro and lantern slides. The Society has recently extended its usefulness by organizing lectures with demonstrations for the benefit of outside societies and institutions. Eighteen such lectures have been given in the Manchester district during the past twelve months and we are not surprised to learn that the scheme has been eminently successful. The report and transactions can be obtained from the Hon. Secretary, Mr. E. C. Stump, 16, Herbert Street Moss Side, Manchester, post free for one shilling and eightpence. We commend it to the notice of other societies engaged in similar work.

NEW $\frac{1}{12}$IN. IMMERSION OBJECTIVE.—Messrs. R. and J. Beck have sent for our inspection a new $\frac{1}{12}$in. immersion objective with a numerical aperture of 1.4 and an aplanatic cone of 1.35 N.A. It is perfectly achromatic, and the makers modestly and rightly claim no more than this, but we can speak highly of the performance of the lens. It is exceptionally free from colour, the definition is excellent, and the increased quantity of light passed is most noticeable. It bears comparatively high eye-piecing well. The working distance is of course rather less than in objectives of lower aperture. The price brings it within the reach of all workers requiring an objective of this description, being £8, or £9 10s. with correction collar.

NEW IMMERSION CONDENSER.—Competition between the opticians grows apace and the worker and the amateur benefit accordingly. Messrs. Beck have brought out a new immersion condenser, which we illustrate herewith, with a numerical aperture of 1.36 to 1.4, and an aplanatic cone of 1.3 N.A. The combination consists of four systems of lenses, the front of which is a hemisphere with three combinations behind, and constructed on the principle of an oil-immersion objective. By the courtesy of the makers



we have had an opportunity of testing this condenser in connection with the objective 1.4 N.A. above described and are much pleased with its performance. The working distance is 0.6in. By an ingenious arrangement the optical part of the condenser can be reversed in the mount so that it may be used with microscopes fitted with under-stage fitments instead of the usual focussing substage. The top lens is also removable. The price of the optical part is only £2 15s.; of the mount, with iris diaphragm and carrier for stop, £1; the stops and coloured glasses in brass box, 12s. Total, £4 7s.

NEW CATALOGUES.—We have received catalogues of microscopes and apparatus from Mr. J. H. Steward, of 406 and 407, Strand, and 7, Gracechurch Street, and from Messrs. A. Clarkson & Co., of Holborn Circus. The former contains several microscopes of excellent design, and a full list of accessories, but is cumbered, as is too often the case, with types of microscopes of antiquated patterns long since superseded, which, we think, would be better deleted, as they do not enhance the reputation of the maker, and are likely to mislead beginners. Messrs. Clarkson's catalogue is almost entirely devoted to second-hand instruments, all offered at moderate prices, and nearly all are of good and recent models.

MICROSCOPY FOR BEGINNERS.

By F. Shillington Scales, F.R.M.S.

(Continued from page 125.)

It will have been noticed that the stands we have mentioned are quoted with an inch and a ¼ inch or ⅙ inch objective. It generally pays to make the whole purchase at once, as the makers charge a little less in such cases than if the items are bought separately.

It may be as well to state that the terms 1 inch, ¼ inch, etc., do not represent the distance between the under side of the lens and the object. The tendency of the day is to increase the aperture, bringing the lenses closer and closer to the object, and the designations referred to may be taken practically as representing approximate magnifying power. Taking the inch as a standard, we may say that without any eyepiece it gives in a 10 inch tube a magnifying power of approximately 10 diameters. A ¼ inch gives 40 diameters, a ⅙ inch 60 diameters, a 2 inch 5 diameters, and so on. To get the actual magnification one must know the magnifying power also of the eyepiece, and the length of tube. If the eyepiece magnifies 6 times, then an inch objective with this eyepiece and a 10 inch tube, will give a total magnification of 60 diameters; a ¼ inch will magnify 240 diameters, and so on. With a 6 inch tube the magnification will be only $\frac{6}{10}$ of the foregoing, and this must be borne in mind. Opticians have a tendency, however, to give rather larger magnifications than those we have mentioned, owing to the difficulty of making low power objectives of as wide aperture as the taste of the day demands, and this should be noted when purchasing. The higher the aperture the better should be the definition, but the higher also is the price, and there is the additional disadvantage to many workers, that anything out of the exact plane in focus is practically invisible. Most workers use objectives of both high and low aperture and each have their advantages.

Theoretically objectives should have .26 N.A. for each 100 diameters of combined magnification, but in practice very much less than this suffices. Messrs. Beck for instance make most of their objectives of comparatively low aperture, not only because they are less expensive, but because they give more of what is known as "penetration," or the power of seeing more than lies in the one actual plane. Moreover a high aperture reduces the working distance. The tendency of the day, however, is to insist on high apertures, and each maker tries to outdo his competitors in this respect. Our advice to beginners is to be content with moderate apertures, at any rate at first, but, above all, to get objectives made by first-rate houses only. If of other than English make see that the screw is of the "society" gauge.

We had perhaps better say a word or two here on the subject of Numerical Aperture, or, as it is generally written, N.A. For a full discussion of the Abbé theory of microscopic vision and the use of immersion lenses we must refer the reader to the standard text-books, such as "Carpenter on the Microscope." If the reader will, however, bear in mind the well-known law of physical optics, *i.e.*, that rays of light passing from a denser medium into a rarer one are refracted *from* the perpendicular and *vice versâ*, he will understand that terms representing "angular aperture," or the cone of light embraced by the objective in *air*, could not be used to represent the aperture of lenses that had a drop of liquid of high refractive index, such as water or oil, between them and the coverglass. In fact a water immersion of 97° and an oil immersion of 82° are each equivalent to an air lens of 180°. Accordingly a formula has been universally adopted by which 1 N.A. represents an angle of 180° in air, which is rather higher than any air lens can grasp in practice, and in estimating the numerical aperture of objectives cognizance is taken not only of the angle of aperture of the objective but also of the refractive index of the medium in which it is designed to work, whether air, oil, or water. The formula is, multiply the sine of half the angle of aperture by the refractive index of the medium. Therefore, according to this formula, 1 N.A. will represent a corresponding angle of 97° in water and 82° in oil. The maximum theoretical angle for water is 1.33 N.A. For oil of the same refractive index as a crown glass cover it is 1.52. With special immersion medium and glass, Messrs. Zeiss have made a lens with an aperture of no less than 1.6 N.A., but it is of course proportionately costly and can only be used for special work.

Before leaving the subject of objectives we must touch briefly on what are called their "corrections." An objective at the present time is a very complicated affair. It is composed of two or more lenses of certain carefully calculated and definite curves, set at equally definite distances. Most of the individual single lenses that go to make up the combination are made of two different glasses, such as crown glass and flint glass, joined together, in which the curves of the one correct certain aberrations in the other. These aberrations are of two sorts, "spherical aberration," or the non-coincidence of the marginal and central light rays in the objective, causing a curved field, and "chromatic aberration," or the non-coincidence of the colours that the lens, acting as the prism of a spectroscope acts, has fanned out and failed accurately to re-focus and combine again. This leads to outstanding colour, and though no achromatics are quite free from this fault it should be only perceptible on critical tests. A portion of the outstanding colour is got rid of by means of the diaphragm, which cuts off the ill-corrected marginal rays.

Now, we need scarcely say that an objective that has been corrected for air cannot satisfactorily be used as an immersion lens, and *vice versâ*, but it may be necessary to point out that an objective is likewise corrected for a certain length of tube and cannot be used critically for any other length of tube. This, whilst showing the advantage of having a draw-tube that will enable either short or long tube objectives to be used at will, shows also the limitations of variation of magnification by the simple device of drawing out or closing up the draw-tube. There seems to be an increasing tendency amongst English opticians of repute to correct their objectives for the short or continental tube length. This we regret for many reasons, one of which is that an objective corrected for the 10 inch tube performs better on a 6 inch tube, if necessary, than in the reverse case. And we especially protest against the practice of certain makers of quoting their objectives as giving certain magnifications with a 10 inch tube, but refraining from adding the necessary qualification, that the said objectives are in reality corrected for the 6 inch tube only. Further, objectives are corrected for a certain uniform thickness of coverglass, though there is, unfortunately, no uniformity amongst opticians in this respect, and any alteration in either tube-length or coverglass thickness upsets these corrections. Of course, this is only noticeable with what is called a "critical image," which the eye needs educating to perceive.

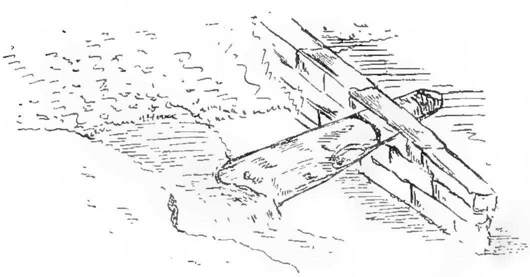
(To be continued).

GEOLOGY

CONDUCTED BY EDWARD A. MARTIN, F.G.S.

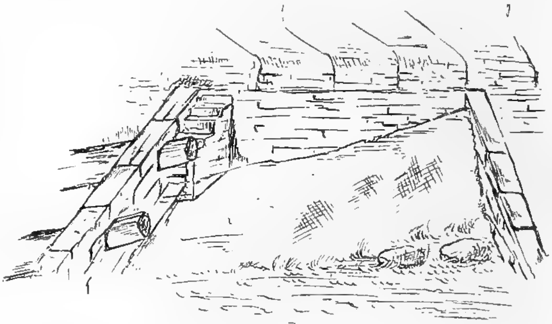
SECTIONS ON THE BRIGHTON LINE.—A geological section well worth visiting just now, is that which has been exposed in cutting the new line from Croydon to Red Hill, through the North Downs. Where the line emerges from the new tunnel at Merstham, the deep cutting that has been made can be viewed from the bridge which carries the road from Merstham Church over the railway. At the side of the road, running east and west, impure sandstone layers may be observed resting horizontally. These as seen down the cutting, north and south, dip at a considerable angle, and finally pass beneath the chalk at the mouth of the tunnel. The material quarried from the cutting has been carried south to form the embankment between Merstham and Red Hill. In some places masses of Gault Clay, in others Chalk have been thrown down, and on exposure to weathering, have split up into thin laminae. By this means, blocks of tough chalk can be opened with but little assistance from the hammer, and occasional fossils found. Nearer Red Hill, the Lower Greensand series has been cut into, and the rise in the ground which usually betokens the outcrop of these strata, is here visible. The new rails will apparently be carried through this formation in a short tunnel.

CURRENT BEDDING.—There is much that can be learnt in elucidation of geological problems by watching the action of the sea as it eddies around piles of piers or the ends of breakwaters at the seaside. The way in which the sand is carried down by



little streams, emerging from pools that have been left by the retiring tide, is pregnant with lessons to the physical geologist. I remember watching such action going on by the side of a groyne at Kemptown, Brighton. The tide had retired, and the water, which was still issuing from beneath the gravel on to the wide stretch of sand, made a miniature river, and hurried along the side of the groyne. At a certain point it reached a huge boss of wood, that was imbedded in the sand, and whose upper end was fixed in the wooden groyne by way of support thereto. In passing round this huge trunk, the velocity of the stream appeared to have been checked, perhaps in the first place by the fact that the trunk projected above the sand, and caused the energy of the stream to be lost in carving a new and more sinuous passage around it. The result showed itself by a deposition of the sand which had been held in suspension by the stream, and the stream then passing on, fell over the miniature fall made by the projecting boss. Another result then showed itself. The force of the fall caused a pit to be excavated at its base, which gradually deepened, and increased the amount of the fall. As fresh material was brought down by the stream, it was pushed over the shallow edge of the trunk of wood, and then slid down, at an angle of about 30 degrees, a declivity formed of ever-thickening strata. Here, then, was an example of the manner in which "current-bedding" is formed. All the little stratula of sand were pointing the same way, that is, away from the source of the current. They would all be wedge-shaped, the points of the wedges being determined down the declivity at the furthest point to which the sand travelled at each fall. The sand was prevented from accumulating in the hollowed-out pit, by the fall of the water.—*Edward A. Martin.*

STRIAE AS EVIDENCE OF ICE-ACTION.—The old theory that striae upon rocks show, without any other support, evidence of ice-action, has received various



shocks during recent years, and it is not now safe to rely too much upon such markings as proof of glacier action. I have recently noticed similar markings on loose, wet sand, after it has been left by the receding tide. Standing on the rocks facing a sea-wall, and between two breakwaters, I noticed that the sand stood very much higher against the eastern groyne than against that to the west of me. Each powerful wave that came in and ascended the sand swept over and across the shelving bank, and returned to the sea in a direction almost at right angles to that of its incoming. The result was a series of fine groovings, like striae, and under certain circumstances it can be imagined that these might be rendered permanent.—*Edward A. Martin.*

A PLEA FOR PIECES.—It is not given to every collector to obtain the best specimens. These, as a rule, fall only to the hammer of the professional geologist. Those who can only devote their Saturday afternoons to study in the field, or are otherwise limited in the time they can spend on the subject, have frequently to be content with incomplete specimens. Many practised geologists look scornfully upon such as these, but there is really a good deal to be said on their behalf. When one considers the building-up of reptiles and mammals which has resulted from a few fragmentary bones, jaws and teeth, or incomplete casts artificially obtained in the case of the pliocene Lenham Beds; the leaf fragments that have served in the cases of the Bovey Tracey and the Bournemouth Beds, it is unwise to cast aside the unsymmetrical and fragmentary, because at first sight they may appear to be valueless. There is, besides, the advantage in testing the knowledge and acumen of the student by these, when complete specimens would present no difficulty.

NOTES & QUERIES

Duckweeds in Essex. A friend and I were botanising at Danbury in Essex last August, and on examining a pond we found that it contained three species of duckweed, viz., *Lemna minor* L., *L. polyrrhiza* L., and *L. gibba* L. This last is a rare and local species, but easily recognised by its tumid cells underneath the leaves.—*Edwin E. Turner, Coggeshall, Essex.*

Fasciated Orchid.—As Mr. Cooper states (*ante*, p. 91) that he found what was to him the first fasciated specimen of an orchid. I presume that he means a British species. It may interest him to know that I found a specimen of *Epipactis* having a bifurcated spike forming a fork some halfway up the inflorescence, both stems being clothed with flowers in the usual manner. It was growing by the side of a road adjoining the undergrowth of a wood, and had made its way through a heap of road-scrapings.—*Edwin E. Turner, Coggeshall, Essex.*

Leersia Aryzoides, Unusual Form.—I send you a specimen of European cut-grass, that appears to have developed an unusual growth. In various botanical manuals the British form of this plant is said to have the panicle included partially within the sheath of the last leaf. This is, I am aware, the form generally found in Britain. The example enclosed is one of some gathered within the last few days at Amberley Wildbrooks, West Sussex. You will note that the panicle has grown more than two inches clear of the last leaf. Possibly this is due to the recent hot weather.—*Thomas Hilton, 16, Kensington Place, Brighton, 25th August, 1899.*

Black-Veined White Butterfly.—Although many of the present generation of lepidopterologists are inclined to imagine that *Aporia crataegi* is practically extinct in Britain; such is by no means the case. I have it on excellent authority that this interesting butterfly is common in a limited district in East Kent, where last summer, hundreds might have been taken. Several specimens were submitted in confirmation, out of a couple of dozen that were taken and set. They occur in fruit orchards and gardens. We have an invitation to visit the locality next season, when we hope to report further on this butterfly.—*John T. Carrington.*

Twisting of Lepidopterous Pupa. I have been watching the curious twisting habit of some pupae of butterflies belonging to the genus *Vanessa*, and note that they do not appear to be capable of effecting this motion until about thirty-six hours after becoming pupae. They seem to lose the power again about forty-eight hours before emergence. I presume they possess the twisting motion to dislodge insects, especially ichneumon flies, and various predatory enemies. I have seen a caterpillar which had crawled on to a *Vanessa* pupa not only dislodged but actually thrown some distance by the vigour of this twisting motion. Many lepidopterous larvae possess this habit, but few to the same extent as some of the Vanessidae which, hanging head downwards by the apex of the last segment, twist round and round with remarkable rapidity.—*R. J. Hughes, Norman Court, Southsea, September 11, 1899.*

An Early Meal.—A curious, to me unexplainable incident came under my notice a year or two since, when clearing a bush infested by gooseberry caterpillars. Suddenly in the warm sunshine I found a specimen of green sawfly, which had, apparently, but just issued from its chrysalis case, as it was in a most soft and pulpy condition, almost transparent, and with its wings still unexpanded and crumpled. Yet, upon preparing this seemingly helpless creature for the microscope, I was surprised to find that its stomach and intestines were filled with the remains of an insect or insects, the chitinous portions being as hard and as sharp in outline as they would have been in a living state. The softer portions nearest the exit were, however, fully digested, those about midway partly so, the remainder, as already mentioned, filling up the space between the partially digested and the oesophagus. How did a creature apparently so helpless and unprotected contrive to capture and devour the fly or beetle, which had evidently been invested in a chitinous integument? It is highly improbable that the fly had gnawn its way out of its case and swallowed a portion of the cocoon, indeed the contents of the stomach clearly indicate that they belonged to an insect, and not to a mere structureless case. Perhaps some keen observer of these hymenopterous flies, may be able to afford me an explanation of the curious circumstance. The object I consider one of the most remarkable in my cabinet.—*Edward H. Robertson, Woodville, Greenhouse Lane, Painswick, Glos.*

Habits of Common Mantis. In a work by Miss L. N. Badenoch recently published, she describes the habits of the common mantis. I should like to mention two points in which the Australian species seems to differ from that described by Miss L. N. Badenoch. I have watched large numbers of these insects, for long periods. In all instances when a mantis saw a fly within easy distance, it would commence to sway itself gently from side to side, and so swaying would gradually move to within striking distance. Then stop perfectly still, and remains so for a few seconds. Having carefully measured the distance, it rapidly darts out both forelegs, grasping the fly round the head with one leg and over the wings with the other. Miss Badenoch says that it only darts out one leg, and that the fly is crushed between shank and thigh My observations do not confirm her observation by any means. I have never seen a fly crushed when caught by a mantis. As to the mode of eating the fly, I have always seen them commence to feed on the body at the junction of the head with the thorax. The head is quickly severed and the mantis eats down into the centre of the body. Miss Badenoch says that the body is torn into pieces and devoured in a moment. This has never happened in any I have observed.—*Frank M. Littler, Launceston Tasmania, June 1899.*

Viper and Grass Snake Fraternizing.—Some time ago, while gathering violets on a hill near Bath, I observed a curious association of snakes, which I should hardly have believed had I not myself made the observation. A common grass snake and a viper were lying together intertwined, the coils looking as one snake, excepting for their difference in pattern. They were basking in the sun, and I watched them for some time, but on being disturbed they uncoiled and disappeared among some bushes.—*A. E. Burr, Bath.*

Albinism in Flowers.—I can add another rare plant to the list of white varieties of inflorescence. In a wood about five miles north of Bath, I found a fine plant of *Daphne Mezereum* with white flowers which, I believe, is a rare form.—*A. E. Burr, Bath.*

CORRESPONDENCE.

At the suggestion of several correspondents we open with this volume a department in which our readers may address the Editor in letter form. We have pleasure in inviting any who desire to raise discussions on scientific subjects, to address their letters to the Editor, at 110, Strand, London, W.C. Our only restriction will be, in case the correspondence exceeds the bounds of courtesy; which we trust is a matter of great improbability. These letters may be anonymous. In that case they must be accompanied by the full name and address of the writer, not for publication, but as an earnest of good faith. The Editor does not hold himself responsible for the opinions of the correspondents.—*Ed. S.-G.*

Science Appointments.

To the Editor of SCIENCE-GOSSIP.

Sir,—In answer to the question raised under this heading in your correspondence column, I may say that the smallness of the number of openings alluded to in your July number, is ever before the younger biologists. In some notes which I put together, I went so far as to discuss the prospects before one of these enthusiasts and with the exception of additional work in connection with the Science and Art Department, and a few schools, which I have included, my list differs but little from that given by your correspondent.

I think however that there is rather too much fetish worship about the way in which the B.Sc. degree is looked upon. It simply shows that its possessor, having the necessary ability and luck, has been able to sacrifice a considerable amount of time upon the altar of an unknown god, while others have not reached the shrine.

Experience is still lacking and a London B.Sc. certificate is no proof of originality or culture. There is no influence of the past or present behind it that may be looked for in the case of a degree, taken at a teaching university like Oxford.

Nobody should know better the need for adaptation to circumstances in the struggle for existence than the naturalist, and although your second correspondent has found it necessary to fall back upon other knowledge for a time, yet, considering how the various brandes of the broad subject, of biology may be turned to advantage, it may be possible for a man to stick to the science of his choice, and earn a living at the same time. If there are more appointments on the other subjects, there are also more candidates. That it is harder work than reading for examinations, is the experience of,

Yours faithfully,

Biologist.

Transactions of Societies.—In consequence of pressure on our space, notices of transactions of Societies have been lately omitted, these will again appear next month, and Hon. Secretaries are invited to send them as usual, but only to include notes of general interest. [Ed. *S.-G.*]

NOTICES OF SOCIETIES.

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

North London Natural History Society.
Oct. 5.—+Pocket Box, Microscope and Lantern Exhibition.
,, 7.—*Kew Gardens. L. B. Prout.
,, 19.—+Notes and Echoes. F. W. Frost.
,, 21.—*Cycle run to Coopersale, Essex.

Yorkshire Naturalists' Union.
Oct. —+Annual Meeting at Harrogate.

Nottingham Natural Science Rambling Club.
Oct. 28.—+Annual Meeting, Natural Science, Laboratory University College.
W. Pickerton, Hon. Sec., 187, Knowle Street.

North Kent Natural History Society.
Oct. 4.—+Breathing Organs. C. Dyes.
,, 7.—*Field Ramble.
,, 18.—‡Microscopic Wonders from Ponds and Ditches. T. W. Brown.
T. W. Brown, Hon. Sec., Rosemount, 80, Church Lane, Old Charlton.

IMPORTANT NOTICE.

The Proprietor of Science-Gossip having decided to manage the business department from independent offices at 110, Strand, London, W.C., all subscriptions, advertisements and payment for advertisements must in future be sent to that address, and no longer to the Nassau Press, which latterly managed the commercial department for the proprietor.

Subscriptions (6s. 6d.) for Vol. VI. are now due. The postage of Science-Gossip is really one penny, but only half that rate is charged to subscribers.

NOTICES TO CORRESPONDENTS.

To Correspondents and Exchangers.—Science-Gossip is published on the 25th of each month. All notes or other communications should reach us not later than the 18th of the month for insertion in the following number. No communications can be inserted or noticed without full name and address of writer. Notices of changes of address admitted free.

Business Communications.—All Business communications relating to Science-Gossip must be addressed to the Proprietor of Science-Gossip, 110, Strand, London.

Subscriptions.—Subscriptions to Science-Gossip, which may commence with any number, at the rate of 6*s.* 6*d.* for twelve months (including postage), should be remitted to the Office, 110, Strand, London, W.C.

Editorial Communications, articles, books for review, instruments for notice, specimens for identification, &c., to be addressed to John T. Carrington, 110, Strand, London, W.C.

Notice.—Contributors are requested to strictly observe the following rules. All contributions must be *clearly* written on one side of the paper only. Words intended to be printed in *italics* should be marked under with a single line. Generic names must be given in full, excepting where used immediately before. Capitals may only be used for generic, and not specific names. Scientific names and names of places to be written in round hand.

The Editor will be pleased to answer questions and name specimens through the Correspondence column of the magazine. Specimens, in good condition, of not more than three species to be sent at one time, *carriage paid*. Duplicates only to be sent, which will not be returned, unless accompanied by return postage, and then at owner's risk. The specimens must have identifying numbers attached, together with locality, date, and particulars of capture.

The Editor is not responsible for unused MSS., neither can he undertake to return them, unless accompanied with stamps for return postage.

EXCHANGES.

Notice.—Exchanges extending to thirty words (including name and address) admitted free, but additional words must be prepaid at the rate of threepence for every seven words or less.

British Dragon Flies. Wanted all species of British Dragon flies, state name if possible, and condition. Name requirements.—H. D. Gower, 55, Benson Road, Croydon.

Four Cornish Chough's eggs offered for books.—T. Stock, Frome Hill, Radstock, Bath.

Vertigo Moulinsiana (British) Borus popelaisianus, Strophocheilus sangoâ, and Str. bitaniatus from Pem, for rare foreign Helicidae.—J. W. Horsley, S. Peter's Rectory, Walworth, S.E.

"Wanted living foreign spiders, larvae of Eumeta moddermansia, and locusts in exchange for macro-lepidoptera, fossils, etc."—Fredk. Bridgman, 'Kenmore,' Avenue Road, Crouch End, N.

Diatom slides in exchange for other objects, or books on Microscopy.—H. Platt, Priory Villa, Victoria Road North, Southsea.

Offered, *V. moulinsiana*, etc. Wanted, *V. minutissima*, *S. oblonga*, *H. revelata*, *L. involuta*, and other rare shells.—Fred Taylor, 38, Landseer Street, Oldham.

Wanted in exchange for about Seventy Old English and Foreign Coins, a Modern Bee Hive and accessories or some foreign Postage Stamps.—J. Sugden, "Ryarsh," Kingston Crescent, Portsmouth.

Offered. Duplicate Foreign Postage Stamps. Wanted Foreign Marine Shells or Stamps not in collection of 2,000.—Jas. S. Wood, Wood's Buildings, Walker Gate, Newcastle-on-Tyne.

Fossiles, minerals, shells, plants, etc., offered in exchange for others.—Monsieur P. Rousseau, La Mazurie, par Aizenay, Vendée, France.

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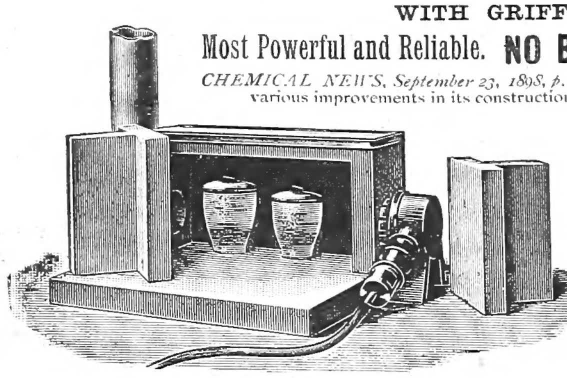

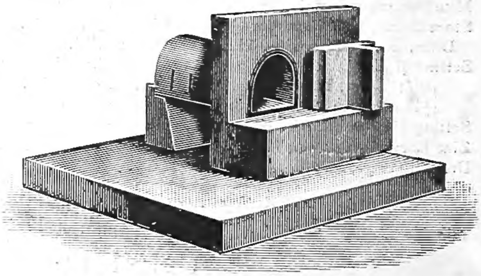

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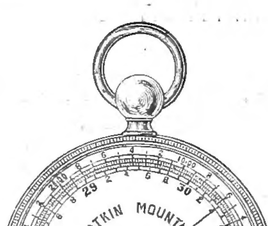

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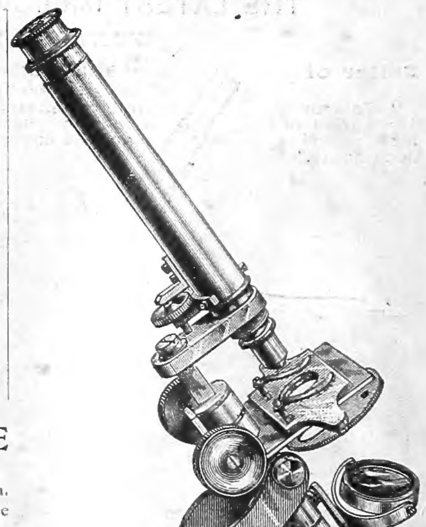

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