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On the Discovery of a Nototherium in Tasmania.

BY H. H. SCOTT & K. M. HARRISSON.

Notes upon the Locality of the Discovery.

BY K. M. HARRISSON

TOWARD the far north-west of Tasmania, within twenty-five miles of Cape Grim, is the prosperous little township of Smithton, situated three miles from the waters of Bass Strait on the banks of a small stream, named the Duck River, some eighty or ninety years ago, by Henry Hellyer, the pioneer surveyor and explorer of that point of the island.

Perhaps the most consistent feature of this part of the coast as viewed either from sea, or from the main roads which are close to the sea, is the long stretch of low foreshore extending from the high cliffs of Cape Grim to the isolated basaltic hills of the Circular Head peninsula with the striking 'nut' rising sheer from the sea to a height of over 450 feet.

To seaward the water is also consistently shallow and the rise and fall of ten or twelve feet of tide exposes wide mudflats and permit of such islands as Robbins and Perkins being easily reached on horseback at low water. Inland the low country varies in width from two to ten or twelve miles, being met on the south by the low hills usually basaltic that extend back inland, reaching a maximum height of about 800 feet.

The small streams issuing from these hills, or from low basins among them, flow sluggishly through flat valleys with occasional swamps, usually low areas of land having ample fall for artificial drainage, and almost dry in summer, but generally covered with an inch or two of water in winter, owing to the heavy rainfall of about 50 inches, combined with the dense vegetation, and retentive nature of soil. These swamps have apparently been formed by the overflow of the rivers, the decay of the dense vegetation, or by the material deposited by the numerous springs that exist in many of them. One spring noted about a quarter of a mile from where the bones were discovered in the Mowbray swamp had raised a mound about half an acre in extent and thirty feet in height.

Stretching back from Smithton, almost due southerly, is a long valley, bounded on each side by hills several hundred feet in height. The Duck River, and its southern branch the Rogers, runs through 12 or 15 miles of the northern portion of the valley which ranges from a mile to several miles in width, but the valley extends on beyond where these streams enter it from the east, and after travelling three miles further over low and occasionally swampy flats some more streams are met with running down southerly to the Arthur River, a fine stream from two to three chains in width, running parallel with the north coast and entering the sea nearly 30 miles south of Cape Grim. As this 'valley' extends from Bass Strait right through to the Arthur, there would seem to be good grounds for supposing that in some past age the latter river found its way into Bass Strait by way of the 'valley' and thus formed the Mowbray swamp and other swamps along the route. Mr. E. W. Stephens, engineer in charge of the Balfour-Smithton railway survey, which runs through portion of this valley, has ascertained that the height of the Rogers, where the line crosses is 116 feet above sea level, and the Arthur crossing ranges from 90 summer level to just the same height as the Rogers at flood time, whilst the highest point of the intervening five miles of railway line only rises 60 feet above the Rogers, and yet he believes that a much lower line could be located, and considers that this theory in connection with the valley is probably correct.

Another fact that strongly supports this view is, that the Arthur River is the only stream in Tasmania in which the common black-fish is indigenous, and does not flow into Bass Strait.

The best known swamp in this district is in the parish of Mowbray, from which it takes its name, and comprises about seven thousand acres of selected land on the west side of the Duck River, near its junction

with the sea, and just south-west of the township of Smithton. Like most of the swamps it is covered with dense vegetation, consisting chiefly of blackwood, ti-tree (Melalenca), sassafras, dogwood, cutting grass of several kinds, and almost every fern found in the State.

At the end of July, 1910, a settler in the Mowbray Swamp, Mr. E. C. Lovell, was engaged upon draining his selection, which is situated about three miles from the coast and from Smithton, and about a couple of miles from the Duck River, very nearly in the centre of the swamp, and fifty-five feet above sea level.

While working near the bottom of one of his drains, and about four feet from the surface, his spade struck some bones, which he at first supposed to be the remains of a bullock, although he was at a loss to understand how they had become embedded so deeply, but a little further examination showed they belonged to some other species of animal.

The bones were in a rather wet portion of the swamp, and although they all appeared to be at about the same level, and were lying together, some of the back bones were in front of the head, and some of the bones of the fore leg were behind it, as though they had been slightly scattered by some preying animal. The soil in which they were found appeared to consist almost entirely of dead vegetation and peaty mould, full of dead roots and decaying wood, which changes to sand at a depth of about seven feet. About three feet from the surface, and scattered over an area of at least 250 yards in width, the drains prove the existence of a small lake or pond, which has left a deposit of a few inches of mud mixed with freshwater shells. Although the shells are in a fair state of preservation the more delicate parts have worn away, and although they appear to present but little difference from similar shells of the present day, it would be difficult to prove it on this account.

No shells were found within twenty feet of the bones, but they were found in every direction from them, and although it would appear that the average depth of the shells was somewhat less than that of the bones, it would be a question difficult to solve after the bones had once been removed.

As many miles of drainage has been carried out through the Mowbray swamp, and only one find of prehistoric bones has been made, it cannot be claimed as a rich field for naturalists. However, the drains will have to be excavated both in larger numbers and to a greater depth before the undertaking will be quite successful; so there is every hope that other remains will be found even in the Mowbray swamp, while some of the other swamps throughout the district may yield better returns when drainage is undertaken.

Natural History and Osteology

By H. H. SCOTT

(Curator, Victoria Museum, Launceston).

Part I.

Nototherium tasmanicum

(SP. NOV.)

Habitat: Tasmania. Extinct.

Order: Marsupialia. *Family:* Nototheriidæ.

Genus: Nototherium.—OWEN.

AS the conditions under which the remains of this animal were discovered have been so graphically depicted by my colleague, Mr. Harrisson, it will be quite unnecessary for me to enlarge upon that part of the subject; but for reasons that the classification make apparent, I am obliged to add this introductory note.

When first called upon to express an opinion respecting the bones —upon the strength of Mr. Lovells' description—I stated they were, without much doubt, those of an extinct Marsupial Diprotodent, and leaned to the conviction of their being the 'Diprotodon' of Owen.

Later on, I saw parts of the skull and one vertebra, and from the evidence thus supplied retained my original conviction. At this time the anterior part of the skull had not been unearthed, and was not recovered for nearly six weeks, and it was also a month, or more, before I had a chance to examine the humerus, with its convincing proof of the presence, or absence, of an '*Entepycondylar foramen.*' Consequently, my classification was, more or less, tentative and provisional.

The discovery of the anterior part of the skull and the arrival of the humerus at the Museum set at rest, once and for all, the question of classification, it being at once evident that the extinct pachyderm was the 'NOTOTHERIUM,' and not the DIPROTODON. It may be said here that the skull was recovered in thirty-two pieces, and the animal, being an aged one, such teeth of the cheek line as came to hand, with the *original fragments*, furnished little evidence of taxonomic value. With the later find—more perfect, and therefore less worn—specimens were available, retaining the characteristic crowns of the Nototherium. When I had time to go into the question of the osteology of our specimens, I quickly found that it departed so much from Owen's 'Nototherium mitchelli' that the idea of a new species occupied my mind, and having made as exhaustive a comparison with the descriptive types, as was, and is possible, I am convinced that it deserves to rank as specifically distinct from the mainland form, and therefore propose the name—'Nototherium tasmanicum.'

In this connection it is of interest to note that the existing wombat of Tasmania has recently been determined by Professor Baldwin Spencer of the National Museum, Melbourne, as a specifically distinct form, with osteological characters that separate it from the Australian animal; and, therefore, it is of importance to find that the extinct Gigantic Wombat also differed from the mainland congener of its day. In justice to myself and others, I must say that I strongly opposed the idea of the wombat under review being so specifically separated, and for some time collected evidence with a view to refuting any such classification—as is noted by Professor Spencer in his 'Memoirs of the National Museum, Melbourne,' No. 3—so that no one can charge me with being a rabid species maker. My conviction of the specific distinction of this Nototherium came slowly, and was quite at variance with my co-existing belief; but I now feel sure if every bone of the animal were laid side by side with the type specimens, they would show departures equally significant with those detailed below.

To be historically recapitulative, I must say that Professor Owen created three species of Nototheria, the first and best defined being 'Nototherium mitchelli,' which, according to Richard Lydekker—Cat. Foss. Mam., Brit. Mus., Vol 5, page 162—is the only true species, and is made by that osteologist to include 'Inerme' and 'Victoriæ,' which were Professor Owen's second and third species.

As 'Inerme' was founded upon what appears to be an immature skull, its inclusion into the list of typical species is hardly a loss, but it still remains for palæontologists to fight the question of the second species —namely, 'victoriæ;' and if it can be shown that this actually was a good species, a comparison of the three extinct species with existing wombats will furnish some interesting evidence for the biologist. The species 'victoriæ,' as detailed by Owen, owed its existence to certain minor skull characters only, but the other bones of the skeleton, if recovered, might reveal additional characters of sufficient importance to re-establish the species, and, personally, I should like to see 'victoriæ' again elevated to the rank of a true species.

Skull.

As the skull of this specimen is so very fragmentary, and needs such careful restoration before it can be exhibited, I have thought it best to delay the description of its osteology in detail until a later date, and will therefore proceed to the study of the mandible.

Lower jaws.

The lower jaws of our specimen were recovered in several pieces, but can now be practically restored in toto, and when compared with the type give the following results:—

The symphysis of N. tasmanicum is of much greater extent than that of 'Mitchelli,' being in the proportion of eighty to sixty-five. The jaws are longer, and slightly wider, with a dental canal proportionately farther removed from the tooth line. The tooth line itself instead of being longer, as might have been expected, is shorter, in the ratio of seventy-seven to ninety-four. In a general way the former specimen seems to approach the proportions of the modern wombat more than 'N. mitchelli' does.

In his great work upon the Extinct Animals of Australia, Professor Owen details the character of the mandibular symphysis, as found in the British Museum specimen, No. 43,088, and remarks (Page 260, Loc. Cit.), 'The symphysis is in a vertical parallel with the back lobe of the third molar (M.I.), but not quite extending to the interspace between its socket and that of the fourth molar (M 2).'* In N. tasmanicum it reaches to the middle of the next tooth. With the exception of one measurement of depth, I refrain from giving such data for various parts of the ramus, as the upturning of the alveolar ridges make it possible to vary the results. In the modern wombat the mandible shows the bony substance surrounding the roots of the incisor teeth to be so compressed so as to exactly fit the finger and thumb, seeming in fact to have been moulded out of plastic materials, which, under the compression, formed two bony ridges raised slightly above the floor of the median plane of the symphysis. In the present specimen a similar result is noted, the ridges being raised 10 M.M., and arched inwards, thus forming with the floor of the diastema, a tube three-fourths completed with bone.

Comparative measurements.

	N. MITCHELLI	N. TASMANICUM.
Length of the symphysis ... ... =	130 M.M.	160 M.M.
Antero-posterior length of the tooth line =	188 ,,	155 ,,
Width of mandible anterior to coronoid process ... ... =	194 ,,	203 ,,
From back of last molar to entry of dental canal ... ... =	68 ,,	83 ,,
Thickness of mandible below molar 2 (Owen) ... ... =	62 ,,	54 ,,

From 'Nototherium victoriæ' the mandible of 'N. tasmanicum' differs in the greater width of the coronoid regions; in the ascending

* Professor Owen's figure also agrees exactly with his descriptive note upon the extent of the symphysis.

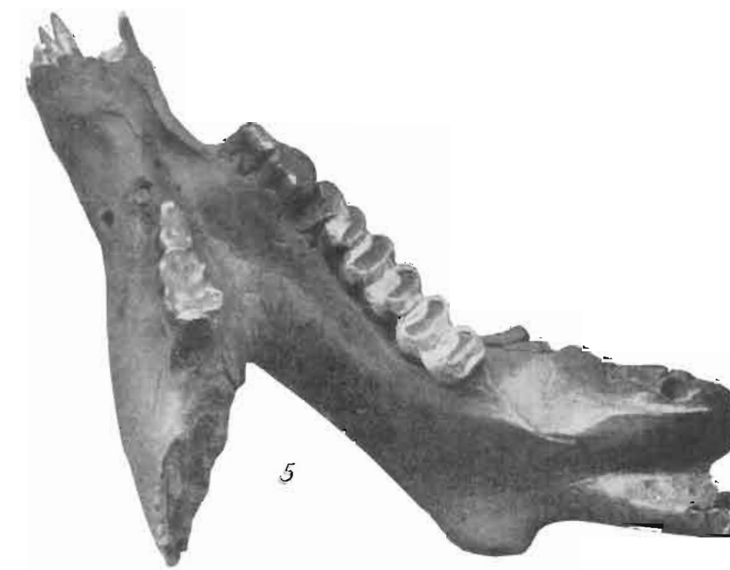

Fig. 5.—View of Mandible of Nototherium tasmanicum, showing the extent of the symphysis.

process, sloping backwards to a greater degree than Owen's figure (Ext. Animals of Aust., Plate 41, Figs. 1 and 2); and in the oriface of the dental canal, being raised 25 M.M. above the alveolar border, and therefore approximately on a level with the crown of molar No. 3—in its present worn state. It also differs in the regions of the symphysis. For the proof of mandibular departures from Owen's types compare his figures with the photograph illustrating this paper.

Humerus.

As the humerus is the most important bone in the body of a Nototherium, from the standpoint of an osteologist, Professor Owen laid the weight of his taxonomic characters upon that bone, and his published figures, given upon plate 127 (Ext. Ani. Aust.) detail the humerus very exactly to the scale of one half the full size. Our photographs make it possible to comparatively study the humerus of 'N. tasmanicum' with Owen's types of 'N. mitchelli'; while the scale of measurements given hereunder supply the information to those who have no access to Professor Owen's plates, and are therefore unable to conduct such a comparison.

TABLE OF COMPARATIVE HUMERI.	N. MITCHELLI	N. TASMANICUM.
Total length of humerus ... =	400 M.M.	467 M.M.
Proximal width ,, ... =	122 ,,	125 ,,
Distal ,, ,, ... =	224 ,,	175 ,,
Least width of shaft ... ... =	80 to 82 ,,	62 ,,
Greatest width at unciform process of the supinator ridge ... ... =	140 ,,	90 ,,
Length from unciform process to deltoid process ... ... =	60 ,,	35 ,,
Length of pectoral ridge from the ecto-tuberosity to the pectoral process =	234 ,,	238 ,,

A glance at these measurements will show that the humerus of the Tasmanian animal is not only *much longer* than that of the mainland, but is distally much narrower and constricted at the region of the unciform process. Another most striking character in the Tasmanian bone is the manner in which the 'unciform' and 'deltoid processes' approach one another, in spite of the extra length of the shaft as a whole. The Tasmanian humerus also differs in the region of the entepycondylar foramen; for if it is placed upon a flat surface with the thenal side upwards, the actual bony bridge overlaps the edge of the shaft, which latter is 'under cut,' or bevelled away at a steep angle, thus differing materially from Owen's figure. Lastly, in the humerus of N. tasmanicum the bridge itself is narrow and of almost equal width throughout, while that of the type is proximally more massive.

In these several characters we have the material for the construction of a humerus that is intermediate between 'Nototherium mitchelli' upon the one hand, and an enlarged addition of the modern wombat upon the other.

The only other bone figured by Professor Owen in illustration of his type of 'Nototherium mitchelli' is the Atlas Vertebra, and if this bone is compared with that of N. tasmanicum, it will be found that the latter is rather more depressed than the former, in the proportion of 45 to 57.

COMPARATIVE VERTEBRÆ.	N. MITCHELLI	N. TASMANICUM.
Width across articular surfaces of neurapophyses ... ... =	112 M.M.	113 M.M.
Depth from neural spine to a line drawn across the tuberosities (of the unfinished bony ring) ... ... =	115 ,,	91 ,,

The osteology is otherwise similar in the several foramina, articular surfaces, and muscular tracts.

Sex of the Specimen.

As these animals are extinct, and their remains rare, little or nothing is known upon the characters that determine sex, but a hint is thrown out in the case of this animal, which, however, must not be pushed to an extreme, and is only recorded for what it is worth.

Near the bones unearthed by Mr. E. C. Lovell, upon the Mowbray Swamp, there was found the mutilated shaft of the femur of a young Nototherium, both proximally and distally imperfect, and although careful search was made nothing else came to light. The thought suggests itself, was not the animal a female, with a calf at foot (or otherwise)? Mr. Lovell, in a letter to me, states that the way in which the bones were scattered about in the matrix led him to conclude that the dead body of the animal had been preyed upon by some carnivorous creature. If such were the case the loss of the small bones of the larger Nototherium, and those of the calf, might in part be accounted for, although water may have removed many to a distance, particularly as the site was liable to be flooded I must just add to these brief notes that the animal was aged, the crowns of most of the teeth being well worn down. At a later date I hope to detail the rest of the skeleton, and figure it in outline.

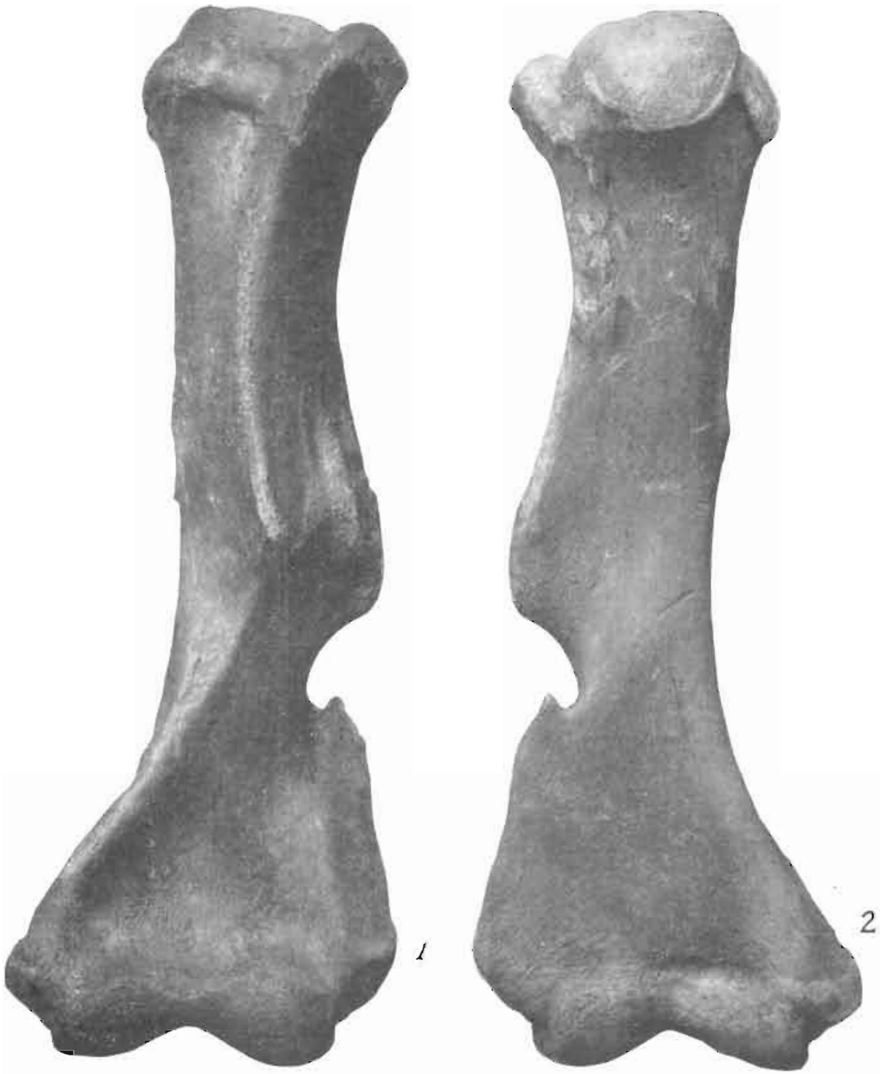

Fig. 1.—Thenal view of Humerus of Nototherium tasmanicum.
,, 2.—Anconal view of Humerus.

Fig. 3.—Ulnar view of Humerus of Nototherium tasmanicum.
,, 4.—Radial view of Humerus.

Notes on Plant Classification

By L. RODWAY (Government Botanist).

II. FERNS.

THE common way in which a fern is often recognised is by observing that its leaves are relatively large and often much divided. It is not at all unusual to find people calling the deadly hemlock a fern and growing it in a garden, simply because it looks like one. This is an unfortunate mistake, and sometimes results in the death of a cow, which is inconvenient. For this reason alone, it is well to know what really is a fern. Besides, a naturalist should have some better reason for saying what is a fern, and what not, than general resemblance.

We should note, firstly, that a fern never bears flowers and fruit. If a plant looking like a fern develops flowers, it belongs to the group of flowering plants and not to the ferns. This brings us to an important detail. Plants may vary extraordinarily in general appearance, but their method of producing is very constant. Each natural group has its own method, and by it we know them. The result of profound study and research for many generations has led to this conclusion—that if we wish to group plants according to their true relationship, we must overlook general appearance, and pay attention to their modes of reproduction.

If you examine the leaves of a fern you will find—at least upon some of them, situated upon the back, or close to the margin, or in others in little pockets—brown markings, which can readily be seen to be of a powdery nature. If some of this powder be removed and examined by the aid of a strong lens, or better still, under a microscope, it will be found to consist of beautiful little bags, each one full of spores. These bags are called sporangia, and it is as well to remember this name, for its use will be very necessary in our papers on other groups of plants. Well, a fern is a plant that bears numerous sporangia upon relatively large leaves. Because ferns bear sporangia upon their leaves, it was once considered that these organs were something more than leaves, and they were called fronds. This is now pretty generally abandoned, and the name frond is only used for bodies which may be leaflike but are not leaves, as, for instance, the expansions of many seaweeds.

When these sporangia are ripe, and weather conditions are favorable, they burst and scatter their spores. These bodies being very small are carried often to some distance by currents of air. Now comes an important feature in the life-history of a fern. When a spore finds itself in suitable conditions it germinates, but instead of growing into a fern like the one from which it arrived, it assumes a different state altogether. It grows into a little flat green plate, generally heart-shaped, and seldom a quarter of an inch long. This it would be most unwise to call a fern; it has received the name of a prothallium. In any conservatory where ferns grow these little prothallia may be found in quantity on damp bricks, flower-pots, wet tree-fern stumps, and such like place. You must not be too hasty in finding prothallia; for all conservatories are infested with a flat, pale green liverwort, Lunularia, which may be mistaken for them. In Lunularia the substance is not very thin, is pale green, and dotted with minute white spots; prothallia are very delicate, and darker. When a prothallium has reached sufficient age it develops on the under surface the essential organs of reproduction, the antheridia and archegonia.

The archegonia should be understood, as we shall require to refer to them again. An archegonium is a flask-shaped thing containing a single little body destined to become an egg. In prothallia of ferns the archegonia are sunk in its substance. When one of the eggs has become fertilised all further development of the prothallium ceases, and the whole available energy is turned to develop the embryo. This embryo now grows into a fern like the one from which the spore was shed. This alternation of fern and prothallium always continues, and is commonly spoken of as the alternation of generation The fern only bears spores, and is the spore-bearing generation or sporophyte; the prothallium only bears sexual organs, and is the sexual generation or gametophyte. These names also it is desirable to remember for future use.

Here we have a rough life-history. Not only do ferns bear many sporangia on large leaves, but they live two independent existences, of which the sporophyte is the more important. In dealing with other groups of plants we shall meet with the same details only under various modifications. The sporangium is an organ old as the hills, and far older. It appeared first in almost the most primitive of plants—to run through the whole series of groups, even to the modern flowering plants. However it may be modified and thrust about to different parts of a plant, it is always truly the same. Archegonia are not of so ancient a lineage, and do not extend to the highest group, but they first appear in a primitive condition in some algæ, extend through mosses, ferns, lycopods to conifers, after which they vanish.

The alternation of generations is also far-reaching. It appears at least in the red sea-weeds, and may be traced right through the other groups to the flowering plants Further details will be enlarged upon when we discuss other groups.

An Elementary Review of Marine Invertebrate Animals

(For Young Students)

BY T. THOMPSON FLYNN, B.Sc.

LIVING things as a whole are grouped into one or other of two great kingdoms; one including animals, the other, plants. As we see them in the higher forms, these are easily distinguished from one

another, but in the lower microscopical groups there is often some difficulty in deciding whether certain small creatures are plants or animals.

Both of these great kingdoms can be divided up into lesser groups and in the case of animals, some are distinguished by the fact that they possess a particular part of the skeleton known as the backbone or *vertebral column*, which is made up of a number of bones joined together in such a way as to form a firm but flexible axis. Such an animal possessing a backbone is called a *vertebrate* or backboned animal. Animals which do not posses a backbone at any time either when young or grown up are called *invertebrate* animals. Of the kingdom *Animalia* (animals) then, we have two large divisions or sub-kingdoms the *Vertebrate* and the *Invertebrate*.

We have, now, in a brief space, to deal with the main groups of invertebrate animals. When we come to look at these animals as a whole, we find that they can be gathered together into various large groups, *e.g.*, all animals which have rings running round their bodies (worms) can be brought together into a group by themselves, and these called *Annulata* (ringed) Again, there is an enormous number of animals which among other things, resemble one another in the possession of long, many-jointed legs. Such animals are crabs, crayfishes, lobsters, insects, spiders, centipedes, scorpions, &c., and these are included in the group known as *Arthropoda* (animals with jointed feet, Gk. *arthros* a joint, *pos.* a foot). Each of these large groups is called a *phylum* (pl. phyla).

The lowest phylum of invertebrate animals is the Phylum *Protozoa*, every animal in which consists of a single small portion of a substance called protoplasm in which is a small central condensed portion, *the nucleus.* Such a portion of protoplasm with a nucleus is called a cell, and the phylum Protozoa consists of animals which are made up of one cell or are *unicellular*. All the other phyla consist of animals made up of many cells *(multicellular)*.

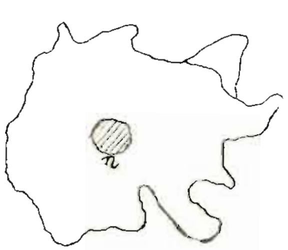

FIG. 1

FIG. 2

FIG 1.—*Amœba.* A unicellular animal, consisting of an irregular piece of protoplasm with a nucleus (*n.*)

FIG 2.—A sponge (*Sycon*). At the ends of the cylinders are the apertures (*o*) by means of which the water leaves.

As the Protozoa are almost entirely quite minute and require a microscope we will leave them and pass to the next Phylum, the *Porifera* (pore bearing animals) or sponges. It must be borne in mind that the ordinary bath sponge is not an entire sponge but merely the silky skeleton of one. Living sponges all agree in having a means of compelling a currant of water to enter into their walls by means of a number of pores, the water current then traverses a series of canals in the wall of the sponge and finally leaves by a series of larger pores. By means of this current of water small animals are taken into the body of the sponge, and in addition the animal obtains the oxygen necessary for its existence.

Some young sponges are very simple, consisting of a cylinder fastened to a rock at one end and with an opening at the other end. The water current passes directly through the wall of the cylinder into the internal cavity and out by the opening at the upper end.

In a sponge found near Hobart *(Sycon gelatinosum)* the water current has to pass through two sets of canals before reaching the internal cavity as shown in Figs. 2, 3 and 4. In the ordinary bath sponge, when alive, the canal system is very much complicated.

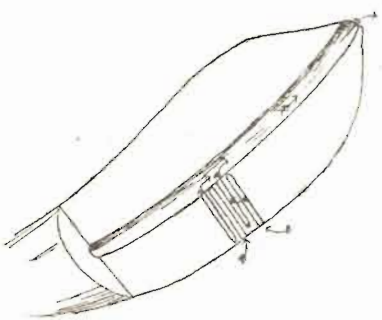

FIG. 3

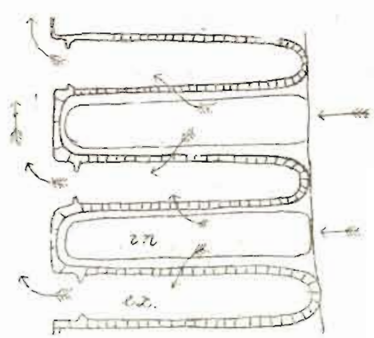

FIG. 4

FIG 3.—A cylinder of *Sycon*, cut to show the internal cavity and the direction of the water current. Some of the canals are shown.

FIG. 4.—The canals in the wall of *Sycon* much enlarged. The water enters the canal (*in*) from the exterior, then passes through pores in the wall by the canal (*ex.*), then to the cavity within the sponge, and thence to the exterior again.

Sponges have a peculiar supporting skeleton, consisting sometimes of fibres, sometimes of small bodies called spicules made of silica or lime. Sometimes the skeleton is made up of a mixture of fibres and spicules. According to the character of the skeleton sponges may be said to be calcareous, silicious or horny. The spicules are often of very egular shape as seen in Fig. 5. The skeleton of some silicious sponges

is very beautiful as in the sponge called *Venus' flower basket*, and in the *Glass rope sponge*, both of which can be seen in the Tasmanian Museum.

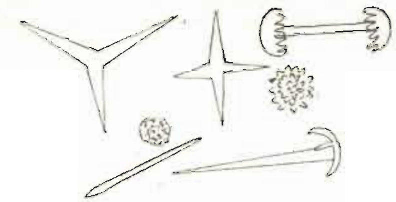

FIG. 5—
Sponge Spicules.

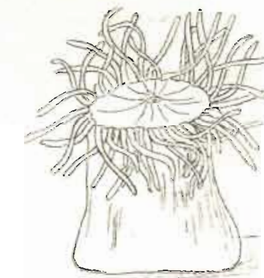

FIG. 6—
Sea Anemone.

The next large group is the phylum *Coelenterata*, which means animals containing a simple internal cavity. This internal cavity serves for digesting the food of the animal. The group includes quite a number of very different animals as will be seen below. A convenient large but simple member of the group is the creature known as the *sea anemone* (Fig. 6), common on the rocks at low-tide at Bellerive Point and other places. They are easily noticeable from their high colour and their habit of contracting themselves suddenly when touched. A vertical section or cut through one is shown in Figure 7. Each animal is really a cylinder attached to the rock at one end and leaving at the other a ring of arms or tentacles in the centre of which is the mouth. This leads to a short tube called the 'gullet' hanging within the animal. Any particle of food reaching the mouth passes into the gullet and from thence is transferred to the internal cavity where it is digested. The common sea anemones live a solitary life but some of their relatives, habitually, live attached to one another in large congregations called 'colonies,' and each anemone-like animal is called a *zooid*. Coral is the result of numerous colonies of some relatives of the anemone which manufacture a lime skeleton from the lime in sea water. Sometimes the colony becomes branched and the zooids are fastened here and there to a branched stalk. These are called zoophytes (animal plants). In many of these there is a partition of the work of the colony; some of the zooids have the function of procuring and digesting the food for the colony; others again have the duty of reproducing the colony; still others are intended to serve as tactile zooids, feeling the presence of any large object near the colony. As an example of this we may take the Portuguese 'man of war' *(Physalia)* which floats on the surface of the water. This consists of a number of zooids attached to the under surface of a rather large football-like float which is merely the expanded end of the hollow axis connecting them. Some of the zooids procure the food for the rest, some act as feelers and some have connected with them long fine strings which contain stinging cells. When these strings come in contact with an object they discharge minute arrow-like darts which are capable of producing a somewhat painful sensation as many surf-bathers know to their cost.

FIG. 7 FIG. 8 FIG. 9

FIG. 7.—Vertical section of sea anemone showing mouth (*m*); gullet (*g*); internal cavity (*c*), and a tentacle (*t*).

FIG. 8.—Cross section of sea anemone showing the twelve vertical partitions (*m*) inside. Up one side of each of these runs a muscle which serve to contract the body of the animal.

FIG. 9.—A Jellyfish.

Rather different externally from the rest of the phylum are the members of the group *Scyphozoa*, or jelly fishes. Here the animal is like a zooid which has become flattened out and curved into an umbrella shape (Fig. 9). In centre of underneath surface of the umbrella is the mouth which leads as in all other Coelenterata to an internal digestive cavity. The tentacles hang round the margin of the umbrella. The margin of the umbrella is turned in to form a flange or rim which contracts rhythmically and causes the jelly fish to move through the water.

The next Phylum is that including a great number of flat worm-like animals called the *Platodes* (flat-worms). This group includes certain peculiar worms found in the sea, on damp ground, and as parasites in or on various animals, but as they are not of great importance from the point of view of the young field naturalist we will not discuss them further.

A very important, large and common group of animals is included in the Phylum *Echinodermata* (spiny skinned animals). In this group we include starfishes, brittle-stars, sea-urchins ('sea eggs') feather-stars and 'sea cucumbers.'

Each of these groups of animals forms a part of the phylum *Echinodermata* known as a class. We will consider first the class *Asteroidea* (star fishes). These are very common in the Derwent Estuary, two of the commonest being *Pentagonaster australis* and *Asterina exigua*, found at low water mark nearly everywhere. For description we will take the former (there are some specimens in the Tasmanian Museum). The starfish is a flat, five-armed animal, which creeps on the surface of rocks, stones, &c. In the middle of the creeping surface is the mouth, and from this opening radiate five grooves along the centre of each arm. If one of these grooves be examined in a living starfish it will be found to contain two rows of moving tube-like processes, each ending in a swollen sucker-like extremity. These are the tube feet. By means of

these the starfish moves. By a special contrivance in the interior of the animal the tube foot can be lengthened in any direction until they meet some firm body, the suckers then take hold, the tube feet shorten and so the animal is pulled along. The starfish is enclosed in a firm skeleton made up of a number of plates fitting together so that the whole body is flexible. Most of these plates have spines connected with them, especially along the tube feet grooves. The stomach of the starfish can be protruded through the mouth to enclose any piece of food and then withdrawn into the body.

Asterina exigua is a small starfish, common on the rocks along the Domain near Government House.

Another common starfish near Hobart is *Asterina calcar*, which has eight arms instead of five.

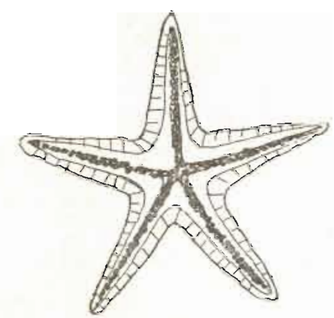

FIG. 10.—
A Starfish, from the lower side.

FIG. 11.—
A Sea Cucumber.

The second class includes the sea urchins class, *Echinoidea*. These are also common about Hobart. These differ from the starfishes in being globular in shape. They are covered with spines. When we remove the spines we have a somewhat ball-shaped body left called the corona, which is perforated by two large holes, a lower larger one, the mouth, and an upper smaller one. The corona is formed of plates tightly fitted together. Altogether there are twenty rows of these plates, each row extending round the corona, from the lower to the upper opening. All the plates are studded with rounded elevations or tubercles, to which the spines are fitted by ball and socket joints. If we carefully examine the plates we find that some of them are perforated by minute holes. These holes are for the protrusion of tube fee'. Two rows of these perforated plates are together, then occur two rows of unperforated plates, then two rows of perforated plates, and so on. Thus there are five perforated regions and five unperforated regions.

Another peculiar feature about the sea urchins is the presence of a set of five teeth, the points of which are seen to project through the mouth in the living specimen. These teeth are not firmly attached to the skeleton of the animal but may be easily removed if the shell be broken. The five teeth together with the small bones connecting them, form an arrangement somewhat like a lantern, and it is, therefore, often called *Aristotle's lanterns*.

A common sea urchin, near Hobart, found often thrown up on the beaches is *Salmacis*, while a very common large one on the East Coast is *Strongylocentrotus erithrogrammus*.

Some sea urchins are, instead of globular, heartshaped (heart urchins); there is a common one in the waters of the Derwent *(Echinocardium)*. Others are so flattened as to become pancake-like ('cake' urchins).

The members of the class *Ophiuroidea*, including brittle-stars, also exist plentifully around Hobart (Fig. 12). They are much like starfishes but their arms are much longer and can move about fairly quickly to allow them to creep over the sea bottom. When caught, most of them have a habit of breaking off their arms. If placed in fresh water however they die painlessly without injury. They never have more than five arms.

Class *Crinoidea*, or feather stars, consist of animals which were much more common in past geological ages than now. They look like a brittle-star or starfish whose arms have been very much branched. They are not common in the Derwent.

In the Derwent are found a number of peculiar animals known as *Holothuroidea* or sea cucumbers (Fig. 11). They are easily recognised by their cucumber-like shape. They are related to the starfishes and sea urchins, but to a young field naturalist the relation would not be very evident. The commonest is probably the bêche-de-mer.

There are a number of different sea cucumbers in the Tasmanian room of the Hobart Museum, all of which have been found in the Derwent or close to it.

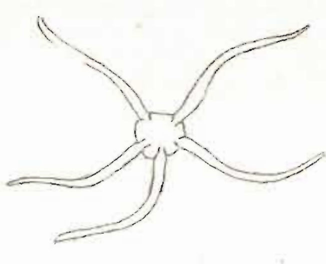

FIG. 12.—
A brittle Star.

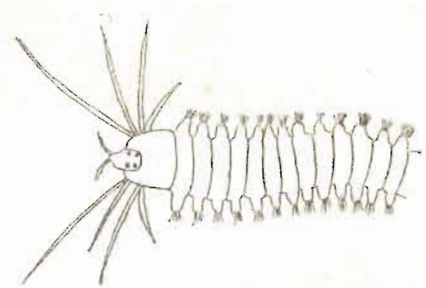

FIG. 13.—
Nereis (head end).

Every field naturalist knows that it is hardly possible to move a rock on the shore or dig in the sand without finding a number of worms besides crabs and other crustacea; these worms are among the commonest inhabitants of the shore. Perhaps the easiest to obtain is the common 'sand' worm or 'lob' worm (*Nereis*), and a description of this will serve to introduce the reader to other more complicated species.

The sand worm (Fig. 13) is found between high and low tide, below stones or burrowing in the sand. It varies a great deal in length, from ½ inch up to 3 or 4 inches. It is very active and wriggles in the hand tremendously. A cursory examination of the body shows that it is in the shape of a long cylinder, somewhat flattened from above down. A close look brings forward the fact that this long body is made up of a great number (about eighty) of rings running right round the body and separated from one another by grooves. Each of these rings bears a part of legs which are much like the legs of a caterpillar, except that instead of the hooks or claws of the caterpillar, the legs of *Nereis* bear each a bundle of hairs; hence these animals allied to Nereis form a class called *Chaetopoda* (hairy-footed). To examine *Nereis* properly, it would be as well to put a large specimen in a saucer of sea water and look at it with a magnifying glass. You will, then, see that the head end bears a number of feelers, six on each side, while the tail end only has two of these (if by any means a portion of the tail of the 'sand' worm is broken off it does not die but is able to repair the damage done and still live on). Close watch kept on the living animal will show, also, very probably the thrusting out of the jaws. The mouth is an opening on the lower side of the head and it opens into a long tube running right through the animal. Instead of the jaws being a part of the mouth, they are set far back in this tube, and when wanted to seize upon food, a portion of the tube is turned inside out like a stocking, and pushed through the mouth until the jaws lie outside. They can then be brought back to their former position. Each jaw is hook-shaped and made of a brownish, horny substance *Nereis* is a quite highly organised animal. It has a brain and nervous system, and a system of blood vessels filled with red blood. The main blood vessels can be easily seen; one runs along the upper side, another along the lower.

There are numerous relatives of *Nereis*, some of which swim or crawl freely, while others live in tubes. There is a common worm near the Hobart wharves, called *Terebella*, which live in a tube made of mud from which it merely projects its head. On the head is a great number of feelers and tentacles, while the legs and hairs, through the animal living in a tube, have become useless and reduced merely to a few bristles.

Another member forms the hard limy little tubes found on rocks, and which almost cover them sometimes. A worm which causes disease in oysters also belongs to this group of hairy footed worms.

The common earth worm is also nearly related to *Nereis*. This creature agrees in a good many points with *Nereis*, but its habit of crawling through narrow tubes in the ground has rendered legs useless and unnecessary to it. All that represents the legs are a few hairs or bristles scattered over the body, and these enable the worm to obtain a purchase on the sides of the tube in which it lives.

Leeches (*Hirudinea*) are a peculiar group of worms, some of which live in the sea and live on the blood of fishes and other marine animals. They all have, in connection with the digestive system, a large crop which is capable of being greatly enlarged with the blood obtained.

The next phylum is probably the largest of all, including as it does all the crabs, crayfishes, lobsters and other relatives, insects, millipedes, centipedes, spiders, scorpions, ticks, &c.

The whole phylum is included in the name *Arthropoda*, and is divided into classes as follows :—

Crustacea : lobsters, crayfishes, crabs, shrimps, &c.

Myriapoda (many footed animals) : centipedes and millipedes.

Insecta : insects.

Arachnida : spiders, scorpions, ticks.

Of all these classes two have already been described in the society's journals ; the *Crustacea*, by Mr. Geoffrey Smith, and the *Insecta*, by Mr. A. M. Lea. Of the other two classes there is nothing much to be said ; they are not as a rule sea animals, and the only time any of them are found in the ocean is when they may be blown there by wind or reach it by some other mishap. We will, therefore, leave these and pass to a large and important group of animals, a great proportion of the members of which are marine, the *Mollusca* or soft bodied animals.

In the phylum *Mollusca* are included quite a number of different animals from the fresh water mussel and sea mussel, through the various kinds of snails up to the highly developed cuttlefish and nautilus.

A simple but thorough review of the mollusca has already been given in this journal, by Mr. W. L. May, and in view of that article we need here only attempt a very short description.

Besides the shell a characteristic structure in the *Mollusca* is the arrangement known as the 'foot,' and it is on the development of this that the main division of the phylum *Mollusca* are founded. For example, we have first of all those members in which the foot consists of a wedge-shaped body which may or may not be pushed out of the shell (mussel, scallop, and others) ; secondly, there are those animals whose foot consists of a flat expanded portion of the body on which they crawl (snails, slugs, tritons, &c.) ; thirdly, we find a number of animals who have the foot extended forward past the head of the animal and divided up into a number of tentacles (cuttlefish, octopus, nautilus, &c.)

It is in the first of these groups, the class *Pelecypoda*, including mussels and scallops that the foot is least developed. It is used mostly for moving through mud and sand. In the scallops, however, movement is caused by flapping the two shells. In oysters, which are incapable of movement, the foot is absent. To see the foot in a scallop, separate the two shells, and the foot is visible as a plough shaped structure hanging from the centre of the body.

As regards the shell the above three divisions vary greatly. In the *Pelecypoda* the shell is in two parts or valves, in the snails and allies (*Gastropoda*) the shell is single and usually consists of a cone which is spirally twisted. In the *Cephalopoda* (cuttlefish, octopus) the shell is usually quite or nearly enclosed in the body, and is merely the remnant of a beautifully constructed shell possessed by the ancestors of these animals. As regards internal structure the *Mollusca* are very highly developed. They have excellent digestive systems, well developed nervous systems, and possess in many cases eyes, balancing organs, and means of testing the quality of the water in which they live. The eyes of the cuttlefish are as good as the same organs in many of the higher vertebrates.

In the digestive system, most of the higher Mollusca agree in having in the mouth a peculiar ribbon, studded with teeth like a rasp, by means of which they grind up their food or even bore holes through the shells of lower Mollusca to get at the animal inside.

Note on Voluta mamilla.—*(Gray)*

BY W. L. MAY.

I WISH to place on record the capture of a magnificent specimen of this fine shell. It was taken on the 16th of January last on our beach, immediately South of May Point, by my son. The shell which contained the living animal, was in the edge of the water. I kept it alive for several days, but it did not expand to any extent. The shell which is quite adult, with the thickened and expanded lip, measures eleven and a half inches in length, and weighed, with the animal, five and a half pounds ; the shell alone weighs one pound fifteen ounces.

This specimen is one of the largest on record. The species must be extremely rare here, as I have never before seen even a dead, or broken one during over thirty years observation, and it is a shell that could not easily be overlooked.

SANDFORD,

March, 1911.

Certificates of Membership

THESE Certificates have been issued, and any Member whose subscription is paid to date, and who has not received a Certificate, is requested to communicate with the Secretary.

New Lantern

THE Committee decided that an up-to-date lantern is necessary for throwing microscopic slides, &c., on the screen, and have therefore ordered a B. and L. portable Balopticon, model C, with electric lamp, projection lenses, microscopic attachment, opaque projective, rheostat, and switch, at a total cost of £20 7s. 6d. A subscription list has been opened, and all Members are invited to forward contributions. The following have already done so :—Miss W. S. Ross, Messrs. J. W. Beattie, R. A. Black, A. L. Butler, W. C. Cato, W. H. Clemes, E. A. Elliott, C. H. Elliott, T. Thompson Flynn, Robt. Hall, C. T. Harrisson, A. M. Lea, C. E. Lord, E. Maxwell, C. A. Pitman, C. B. Pitman, A. R. Reid, L. Rodway, W. Smithies, R. Stops, J. W. Tarleton, W. E. Taylor, W. T. Todd, A. R. Tucker, A. E. Wadsworth, B. R. Walker. Total amount donated is £9 5s.

Easter Camp-Out

DEEP HOLE, near Southport, has been decided upon as the site of the Camp for 1911, and the s.s. Togo has been chartered to convey Members there. Several launches will be in readiness to convey Members to places of interest, and a very successful Camp is assured. The site chosen is within easy reach of the famous Ida Bay Caves, the picturesque Southport Lagoon, and the noted site of George III. wreck, and other shipwrecks. Deep sea dredging and fishing, it is hoped, will be a feature of the Camp.

J. Walch & Sons, Printers, Hobart.

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