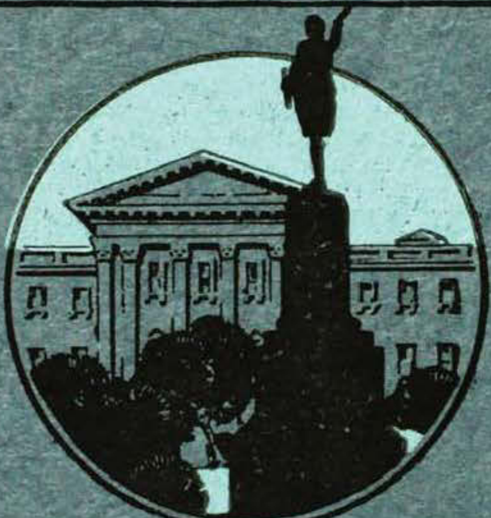
The AUSTRALIAN MUSEUM MAGAZINE

EDITED BY C. ANDERSON, M.A., D.Sc.



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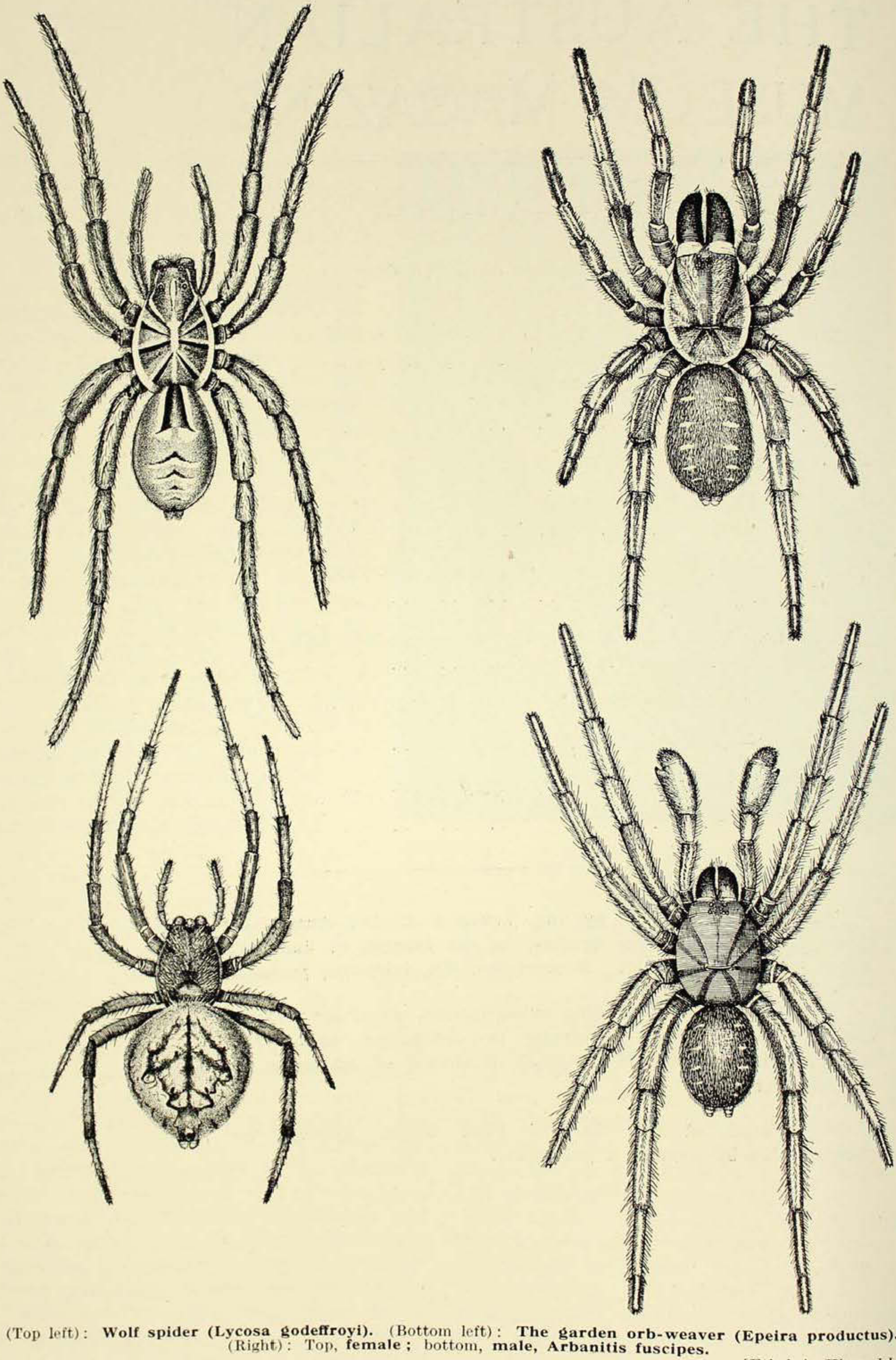

(Top left): **Wolf spider (Lycosa godeffroyi).** (Bottom left): **The garden orb-weaver (Epeira productus).**
(Right): Top, **female**; bottom, **male, Arbanitis fuscipes.**

[Ethel A. King, *del.*

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VOL. IV. No. 5. January–March, 1931.

Restored Head of a Large Extinct Australian Lizard

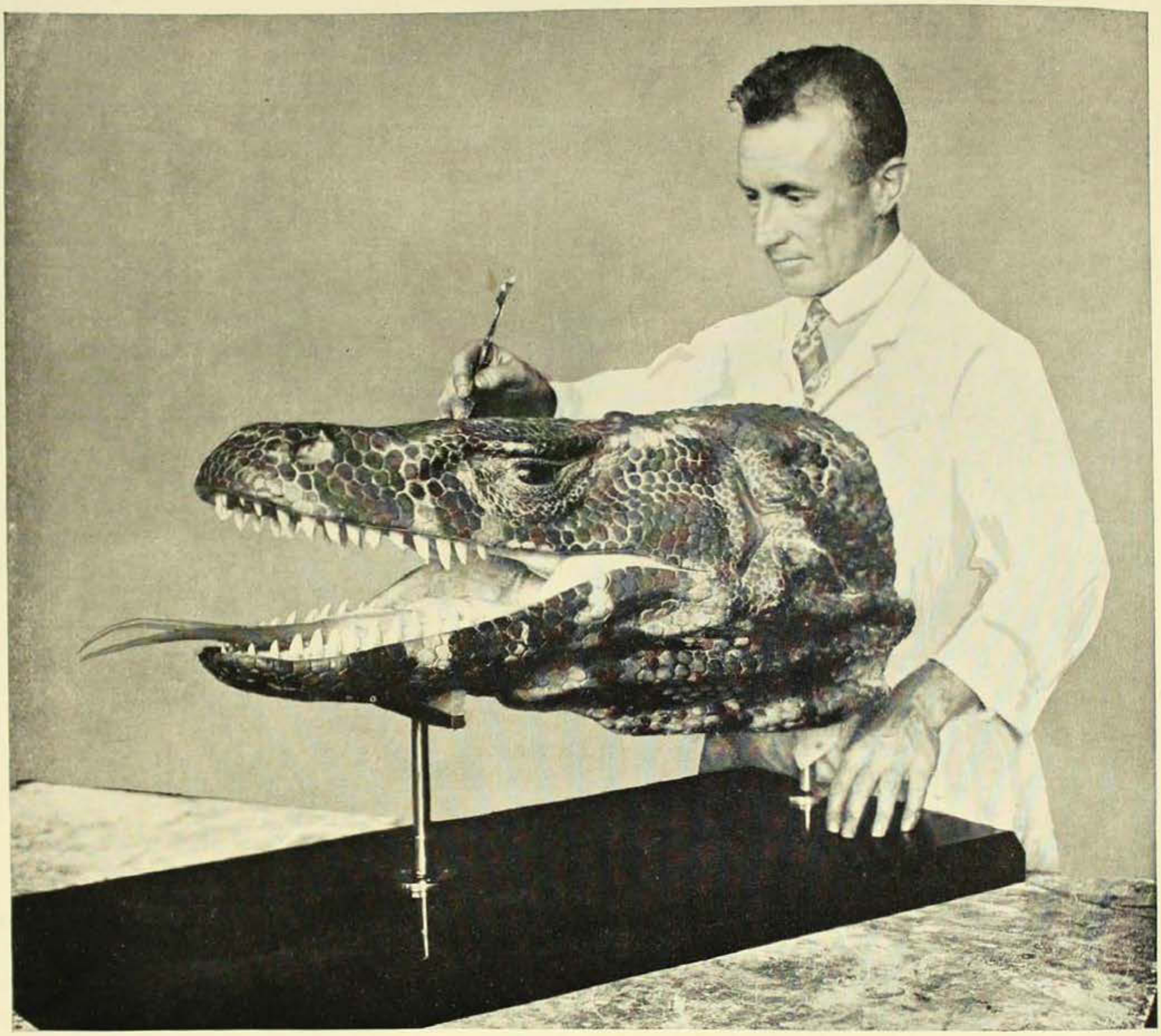
By C. Anderson, M.A., D.Sc.

In a previous article[1] a short description was given of *Megalania prisca*, an extinct lizard related to the Goana (*Varanus*) but of much larger dimensions. Since then we have been fortunate enough to receive, through the generosity of Professor Sir Edgeworth David, some teeth of this animal discovered on Rosella Plains, near Cairns, Queensland, by Mr. Bram Collins. Previously the teeth of *Megalania* were known only from stumps, which gave no information regarding the form of the crowns; the Rosella Plains teeth, however, are beautifully preserved and typically varanian in character, compressed from side to side, sharp-pointed, and serrated on the front and back edges. As some of the blade-like saw-toothed teeth reached a length of at least one and a half inches, they must have been very efficient in killing prey and tearing it to pieces.

The Komodo lizard (*Varanus komodoensis*) found on some of the islands of the Dutch East Indies is the largest surviving member of the Varanid family, reaching a length of about ten feet. As *Megalania* was fifteen to seventeen feet in length and, as is evident from its vertebræ and leg bones, far more strongly built than the Komodo animal, we may be certain that it was a much more formidable creature, the terror of the bush in the days of its prime. The smaller Komodo animal is described as preying on deer, wild pigs, and water buffalo, and even as attacking horses. *Megalania*, which was comparable in weight and strength with a large crocodile, could no doubt attack and kill the biggest of its contemporaries in the Australian Pleistocene period, even the bulky *Diprotodon* and *Nototherium*, the largest of our extinct marsupials.

No complete skeleton of *Megalania* has ever been discovered, but evidently it was fairly abundant and widely spread in the Australian Pleistocene, and it is possible that material may yet be found which will make it possible to reconstruct the entire animal. Meantime,

[1] Anderson: A Gigantic Extinct Lizard," The Australian Museum Magazine, III, 4, 1927, p. 132.



Restoration of the head of Megalania prisca, an extinct Australian lizard. Mr. Kingsley, who made the restoration, is seen giving the exhibit the final touches.

[Photo.—*G. C. Clutton.*

Mr. J. Kingsley, preparator, has modelled its head, basing the work on the skull fragments and teeth in our collection, and using the living Goana and photographs of the Komodo lizard as guides. The result, shown in our illustration, is a fine piece of work, and conveys, far better than verbal description, some conception of the size and menacing appearance of this reptile, which in its time played in Australia the rôle of the large mammalian carnivores, the lions and tigers, of other countries.

The head has been coloured by Miss E. A. King, following the pattern exhibited by the Goana, and, although the colouring is conjectural, there can be no doubt that the finished model is wonderfully life-like. The animal is shown with its mouth partly open, displaying its sharp recurved teeth and a long forked tongue.

The model has been placed on view in the Museum, where it forms a striking and instructive exhibit.

Nature Rambles at Trial Bay

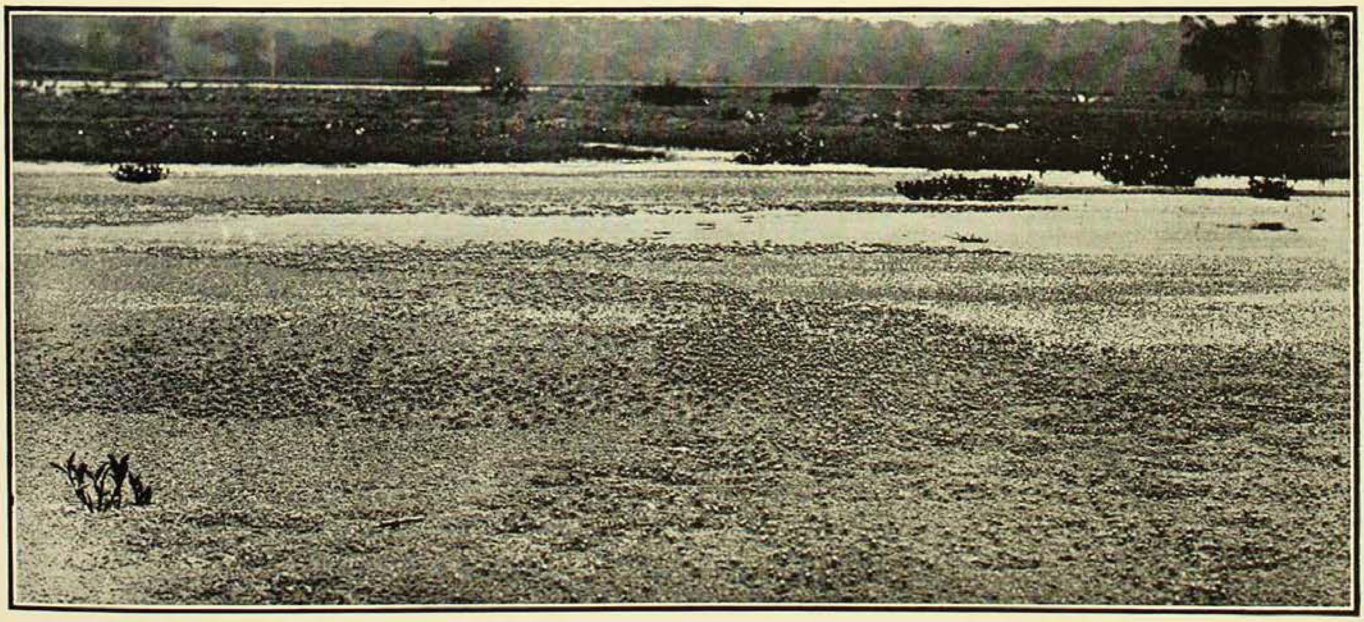
BY A. MUSGRAVE and G. P. WHITLEY.

THE little township of South West Rocks, on Trial Bay, North Coast of New South Wales, is a seaside resort, and enjoys great popularity during the summer months. Here last summer, we spent some enjoyable weeks, and, in this article, we propose to give a necessarily brief sketch of the natural history of the Trial Bay district as observed during our stay.

Our surroundings were typical of New South Wales coastal scenery. Long sandy beaches, eminently suitable for surf-bathing, alternate with rocky headlands, whilst here and there lagoons or creeks penetrate the sand-dunes behind the beaches. The Macleay River, after winding its way through magnificent mountain and forest country, reaches the sea by an artificial rock-lined entrance on one of the beaches, some miles south of its original mouth, which is now closed; the bar at the New Entrance calls for careful navigation. Between the New Entrance and South West Rocks, behind the beach, is an extensive mangrove swamp with sand and mud flats, the tidal waters flowing under a wooden bridge near the South West Rocks end. Elsewhere the country is covered with scrub, similar to that about Sydney, or is cleared timber land. At one time forests of eucalypts adorned the surrounding country, but most of these are now gone and the paddocks of dairy-farmers stretch over acres of low-lying country, through which the Macleay River curves like a giant silvery snake.

South West Rocks derives its name from some conspicuous rocks at Trial Bay, the name being applied to them by whalers, who built a pier there many years ago. Cook probably saw them after he had passed "Smokey Cape" on May 13, 1770. The last-named spot is a spur of the Big Smoky Range, and a lighthouse set in a superb position in cabbage-tree country now adorns the Cape and commands wonderful views over land and sea.

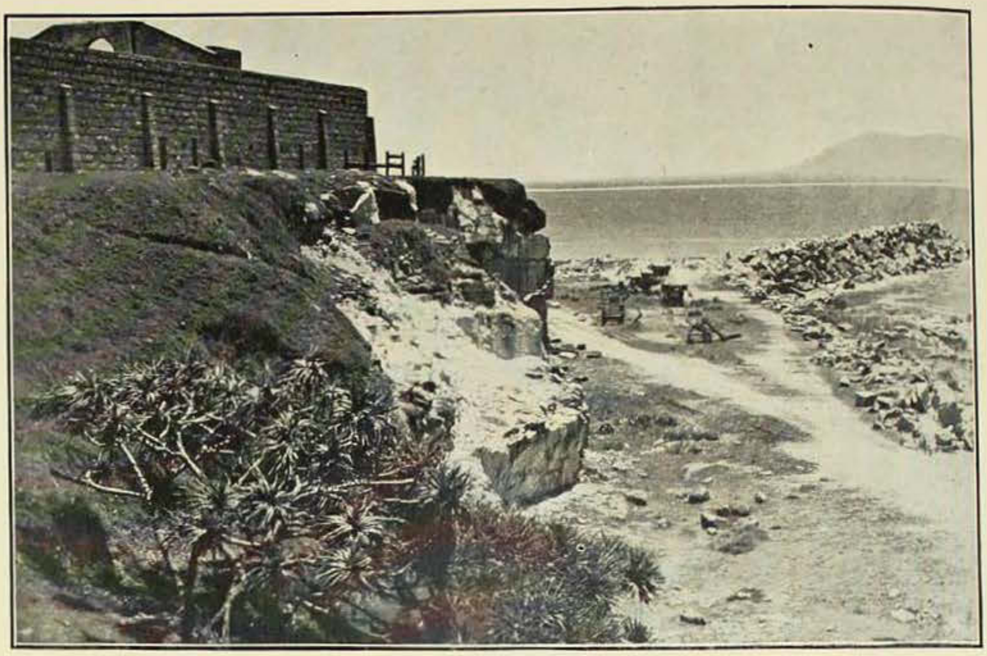
At the southern end of Trial Bay, on Lagger's Point, is a large gaol with relics of former convicts and of later German internees who spent the years of



Soldier Crabs or Blue Bottles (Mictyris longicarpus) move in vast armies over the sand flats when the tide has ebbed.

[Photo.—*A. Musgrave.*

the Great War there. Near the gaol were also a number of trucks which had been used for constructing the breakwater by carrying stones from the nearby quarry. These trucks, lying half-buried in sand or tumbled on their sides, were in the last stages of desuetude, the woodwork cracked and splintered, and the iron-couplings, bolts, and wheels flaking away under the action of the salt spray. In their heyday they must have been capable of carrying enormous weights, to judge by the appearance of the huge blocks of stone which form the breakwater. We were informed that the effect of the construction of this breakwater, owing to its being placed at a wrong angle, was to cause the bay near the pier to silt up, thus undoing the work for which it was intended.



The old penitentiary at Trial Bay, pandanus tree in foreground, trucks and breakwater in mid-distance, with Mount Yarrahappini in background.
[Photo.—*A. Musgrave.*

THE OCEAN BEACHES.

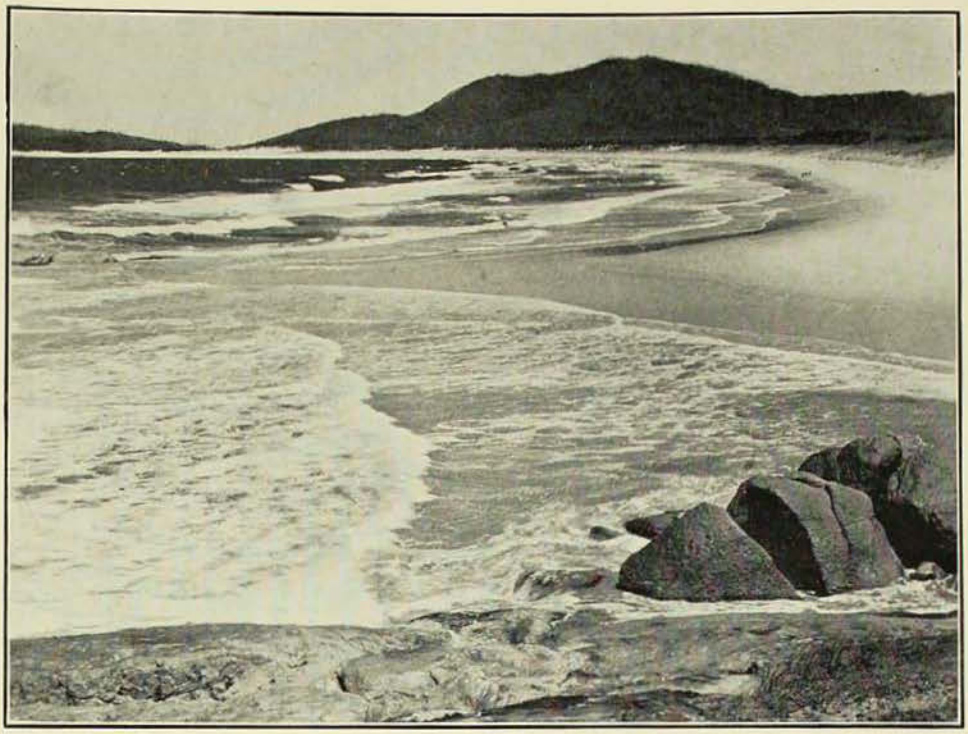
A walk along the surf beaches was rarely unproductive of some interesting marine animals. A very beautiful brown and white striped shell (*Zebramoria zebra*) was picked up frequently, as were also many other shells, mostly bivalves, cuttle bones, and even worn pieces of coral perhaps washed down from tropical waters. Beach Crabs (*Ocypoda ceratophthalma*) were very common, especially at night, when their white bodies hurried ghost-like across the sands or they would raise their long eye-stalks like rabbits' ears as they inspected the intruders upon their realm. The surf beaches are long, gently-sloping, broad areas of hard packed sand. The surf breaks close inshore and pipis (*Plebidonax deltoides*) live in the sand at the water's edge. Around Sydney, surf-bathers have almost stamped them out of existence.

A common insect inhabitant of the wet sand zone of the beaches was the Cicindelid or Tiger Beetle (*Cicindela ypsilon*), a species occurring in Eastern and South Australia. It was difficult to catch without the aid of a net.

If we took a transverse section of one of these beaches, we would find the animal life distributed as follows. In the wash of the wavelets we would meet with the pipis, then the active Tiger Beetles and beach flies would be encountered. Passing over the beach litter of shells, cuttle-fish bones, and seaweed, we would arrive at high water mark where the ocypode crab makes its burrow, then, proceeding up the slope of the sand hills, we would first meet with the beach grass, and then at the summit would encounter the curious Screw Pines (*Pandanus pedunculatus*). Such are very briefly the faunal and floral zones of a sea-beach at Trial Bay.

No sharks have been reported from the Trial Bay surfing areas, but Blue Whalers are said to be common at the New Entrance of the Macleay River, where they are sometimes seen leaping from the water. Fishermen catch various kinds of rays from the sandy shallows of the surf beaches. The Guitar Fish or Shovel-nose Ray (*Aptychotrema rostrata*) was the commonest, and a series of females and embryos was studied and photographed from life in the field, as were also those of the Common Stingaree (*Urolophus testaceus*). The Blue Spotted Stingaree and the Fiddler (*Trygonorrhina fasciata*), a ray whose colour markings and shape recall the purfling and holes in a violin, were also landed.

A lookout was kept for Gannets and Frigate Birds, as it was thought that some might be wandering southward from the tropics, but none were observed.



The surfing beach at South West Rocks, Trial Bay.
[Photo.—*A. Musgrave.*

FAUNA OF THE ROCKY FORESHORES.

The grass-capped rocky headlands are not of Hawkesbury sandstone as they are around Sydney. Here the north-west point upon which the Pilot Station stands is of basaltic conglomerate, whilst, just opposite, on the south-east point, where there is a white and red light, the shore, like the South West Rocks themselves, is formed of granite. The headlands do not form cliffs, but slope obliquely into the sea with practically no rockpools.

Above high water mark, small whelks (*Nodilittorina* highest, then *Melaraphe*) are dotted over the rocks. Lower down, the Black Nerite (*Melanerita melanotragus*), limpets, and univalve shells (*Bembicium* and *Morula*) are found with a few sea-anemones, sessile barnacles, and tube-worms (*Galeolaria*). Near the wave-edge these animals are more numerous, and there is a broad belt of sessile barnacles, some large limpets (*Cellana*) and reefs of tube-worms. The common Rock Crabs (*Leptograpsus variegatus*) are here seen scrambling over the granite just as on the Sydney sandstone and the Lord Howe Island basalt.

When one considers that Trial Bay is so far north of Sydney and correspondingly nearer to the tropics, it is disappointing to the marine zoologist to find such a poor assortment of species on its rocks and beaches. One misses the rockpools and loose stones of the Hawkesbury sandstone foreshores and the dense animal population of rock and coral reefs. Here at Trial Bay there is no hormosiretum and apparently no littoral sea-urchins or starfishes in their accustomed places. Probably all the Sydney rock molluscs occur here, but many old friends need searching for. Thus a few Zebra Periwinkles (*Austrocochlea obtusa*) turned up in a small pool apparently suited to their requirements, and in other situations the Chiton (*Sypharochiton septentriones*) and some rock oysters were also found, but might easily have been overlooked.

THE MANGROVE SWAMP.

At the margin of the mangrove swamp, between South West Rocks and near the *Avicennia* trees, platoons of juvenile Soldier Crabs (*Mictyris longicarpus*) are the first objects to attract the attention of the naturalist. The whole surface of the swamp in places is covered with the castings from their burrows. Many shells lie about on the ground, notably the large Hercules Club Shell (*Pyrazus herculeus*), also called the Sydney Whelk.

Burrows riddle the ground in places and are found to be the homes of various kinds of crabs, although sometimes fishes of the goby family are also found therein. On the sandy foreshores of the large tidal creek near its outlet at South West Rocks, at low water may be seen great numbers of the remarkable burrows and pellets of the Sand Bubbler Crab (*Scopimera inflata*). As the tide ebbs, Sand Snails (*Natica*) and Sydney Whelks make long grooves as they move feeding over the sand flats.

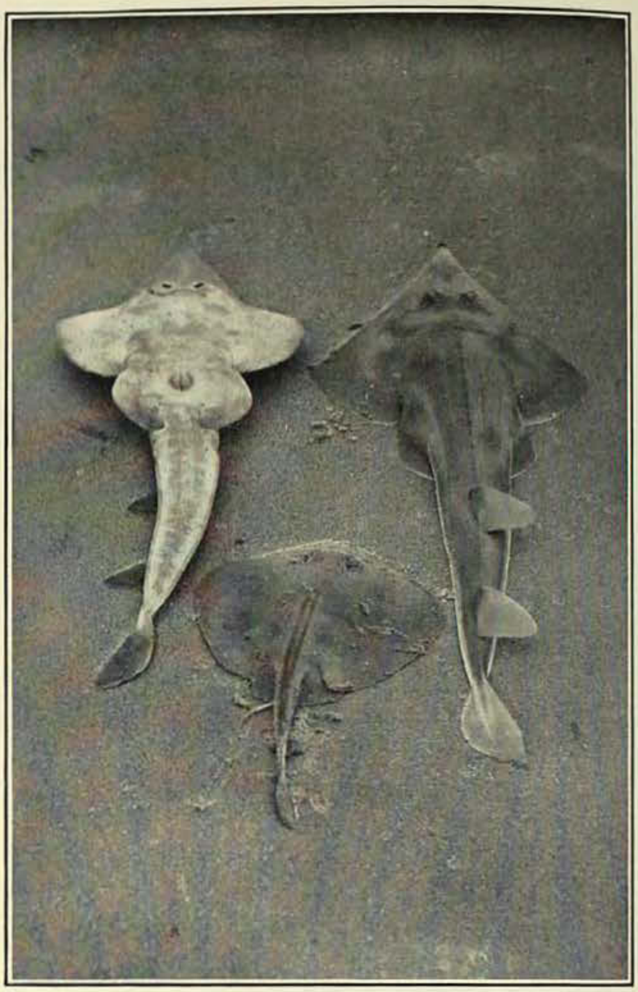
The piles of the bridge crossing the tidal creek are thickly encrusted with oysters, and tiny limpets may be observed living solely upon the empty oyster shells.

CRABS.

In studying the mangrove crabs, we followed in the footsteps of our friend Mr. J. R. Kinghorn, who knew them of old and wrote an account of them in an earlier number of this MAGAZINE.[1]

The best place for crabs was near an old quarry adjoining the mangrove swamps. Here, in a little tidal rivulet running by the side of the line which carries the stones to the breakwater at the New Entrance, we met with the interesting tropical Fiddler or Beckoning Crab (*Uca marionis*), which is here at the southernmost extension of its range. These crabs have one nipper much larger than the other and coloured creamy yellow or brilliant orange, so that their owners, when seen from a distance, dotted about the dark brown mangrove mud, resemble the fallen petals of some great exotic flower. The conspicuous nipper, which is possessed only by males, is waved about as a signal to other crabs or used for fighting. *Uca* stands with eyes erect like the antennæ of an insect, and, with the enlarged nipper held across its front, shovels food into its mouth with the other little nipper. It was interesting to observe that the Beckoning Crabs always kept the small undeveloped leg in continuous motion when feeding, or when on the move. These crabs were shyer than the other species.

[1] J. R. Kinghorn: THE AUSTRALIAN MUSEUM MAGAZINE, Vol. ii, No. 1, p. 30.



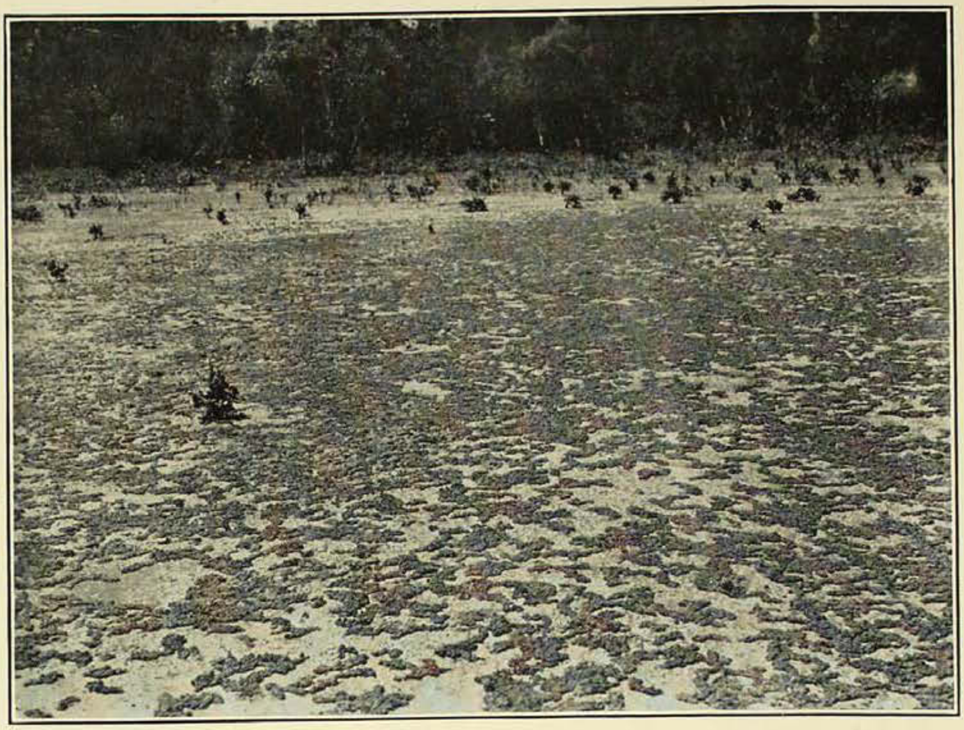
Two Shovel-nosed Rays (Aptychotrema rostrata) and a common Stingaree (Urolophus testaceus) caught from the beach at Trial Bay.
[Photo.—*A. Musgrave.*

In association with the *Uca* party, one saw commonly the purplish-coloured Semaphore Crabs (*Helœcius cordiformis*) with long eye-stalks. These buried themselves in the mud and sometimes made a clicking noise, and put food daintily into their mouths with their hand-like nippers. When danger threatened they would walk away on stately stilt-like legs, or else extend their nippers to their widest stretch, at the same time almost falling backwards in their agitation.

With these crabs occurred also a little Red-handed Crab (*Sesarma erythrodactyla*), which holds its eyes erect and, like the Semaphore Crabs, uses left and right nippers alternately for feeding. This crab is common on mud flats amongst the mangroves, but large emerald or "greenbottle" specimens are also found under logs and hidden amongst dead tree trunks.

A curious species with a bluish back margined with white fed with the Beckoning, Semaphore, and Red-handed crabs along and in the tiny gutter of salt water. Here, too, we met with the quaint eyed slug *Onchidium* in fair numbers. It crawls along the mud and slime, and, though related to marine molluscs, appears to be evolving into an air-breathing terrestrial animal.

Many kinds of fishes were noticed in the creeks, notably mullet (*Mugil dobula grandis*), Chanda Perch (*Priopis ramsayi*), whose spines get caught in the fishermen's nets, and sand eels (*Ophisurus*).



The workings of Soldier Crabs (Mictyris longicarpus) on sand flats near mangroves at Trial Bay.

[Photo.—*A. Musgrave*.

THE LOWER MACLEAY RIVER.

One day we had a most interesting trip in a ramshackle rowing boat with a sackcloth sail, travelling from Rainbow Reach to the Old Entrance of the Macleay River and back. On some of the sand flats near Shark Island, Soldier Crabs (*Mictyris longicarpus*) were so common and in such dense armies that the noise they made when walking away from us was a veritable roaring. At the mouth of Ball's Creek a large flock of pelicans delighted us with various manœuvres and finally flew away, a dazzling spectacle of white wings against a blue sky.

Mangrove trees are here being cut down to make sticks for oyster culture. A thousand sticks, worth about seventeen shillings and sixpence, can be cut in one day. This work, of course, is also helping to deplete the trees of this district, and it seems a pity that apparently no effort is being made to conserve the wonderful natural resources available in the land and water timber. The old saying that an Australian cannot endure the sight of a standing tree seems, unfortunately, still true.

INSECTS AND SPIDERS.

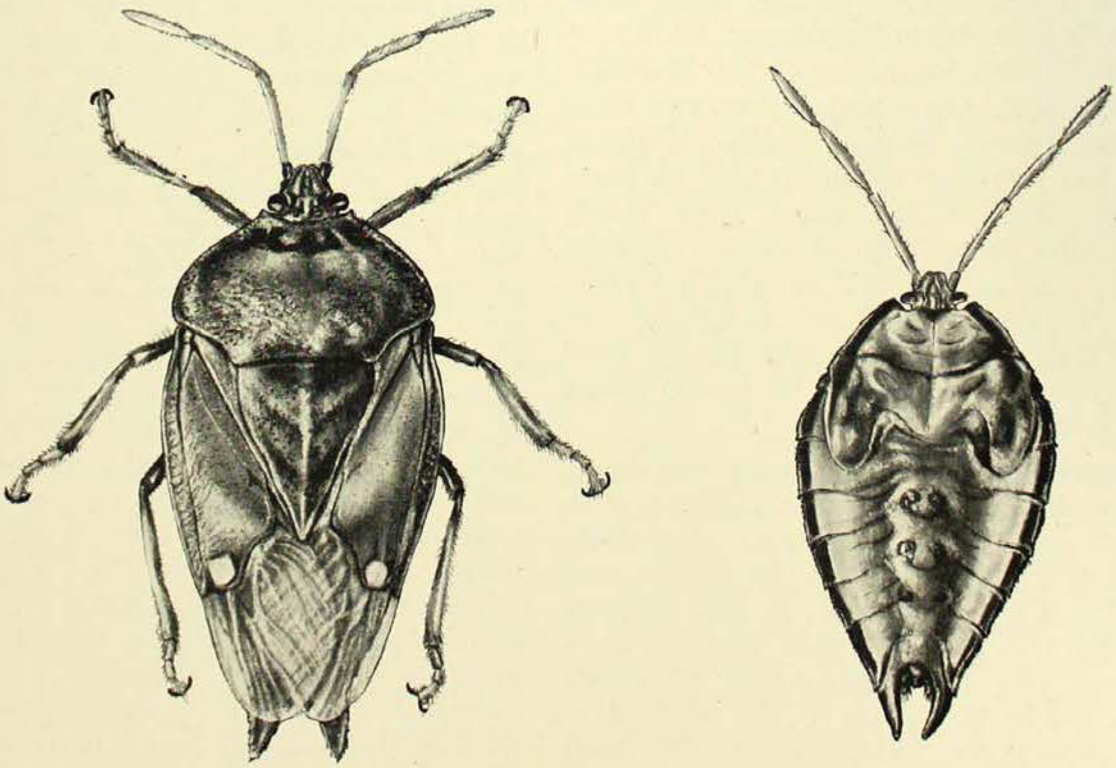
Insects and spiders proved to be in abundance, and among the banksias (*Banksia integrifolia*) near the small lagoon at the back of the main surfing beach we found shelter from the nor'easterly breeze in a spot which yielded some interesting cicadas. One species (*Psaltoda harrisii*) was extremely common, though hard to catch, and it was remarkable for the curious whirring note of the male, like that of some clock-work mechanism being wound up and then released. A male was observed in full concert pitch clinging to the trunk of a banksia. It would draw up the terminal segments of the abdomen for the space of a second, and would then exhale, as it were, for several seconds, the noise being deafening the while; the winding up and releasing notes are different to the ear. The silvery patches on the sides of the black abdomen render this insect conspicuous. The species was described in 1814 by Leach in his *Zoological Miscellany* under the name of *Tettigonia Harrissi*; he states, "it is very common in New Holland. It was first sent home by the late G. P. Harris, Esq., who informed

The Beckoning Crab (Uca marionis) whose large red or yellow nipper makes it a conspicuous object of the mud flats.
[Photo.—*M. Ward.*

me that it was named by the colonists (from the noise it made whilst on the wing [*sic*]) the Razor-grinder." With his description he gives a very poor figure of the insect. Two cross-veins near the tips of the wings in the specimens secured by us at Trial Bay, were free from smoky markings, but some specimens from the Sydney district in the Museum collection have the wings clear or infuscate. On the trees on the tops of the sand-dunes, we captured a species larger than *Psaltoda harrisii* and the cross-veins near the wing tips were infuscated. In general appearance it much resembled the smaller and noisier species occurring so commonly near the lagoon.

Among the trees near the public reserve at South West Rocks we found two large interesting Shield Bugs of the family Pentatomidæ. These plant bugs also rejoice in the vernacular name of Stink Bugs, a term which the South West Rocks specimens did not belie. One of the species, the Bronzy Orange Bug (*Rhœcocoris sulciventris*) occurred on a citrus tree, and is well-known as an orange orchard pest. It measures about an inch in length and is dark brown in colour. It occurs in northern New South Wales and southern Queensland and is common in collections.

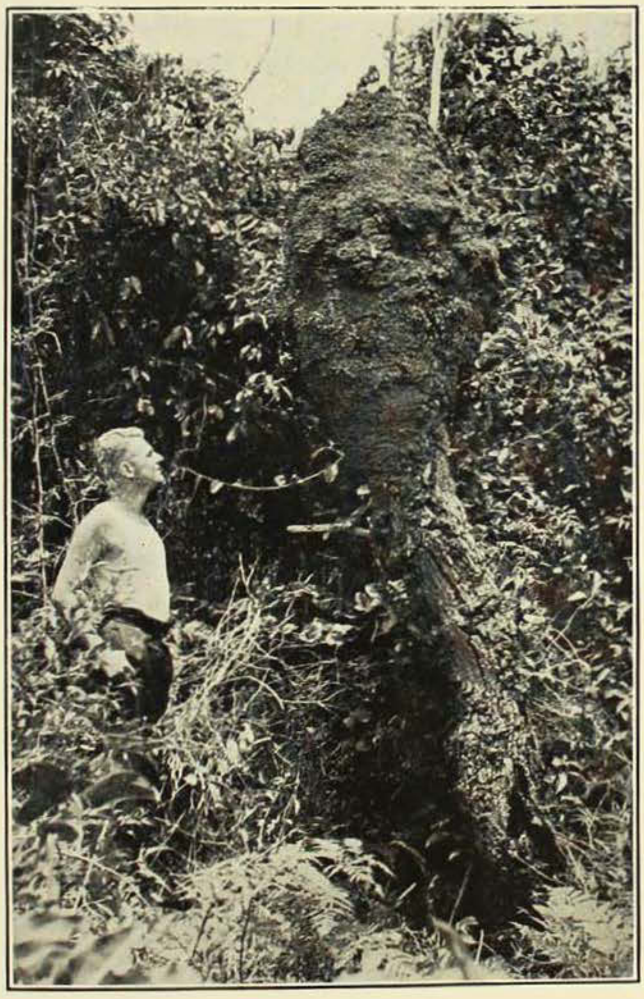
Another species, *Lyramorpha rosea*, which we found commonly on a beach plant (*Synoum glandulosum*), up to the time of our visit had been rare in the Museum collection. Here we came across them in all stages, from the eggs on the leaves to the curious flat yellowish nymphs, each with the tip of the abdomen ending in a curious pair of spines giving it a forked



A Shield Bug, (Lyramorpha rosea). (Left): **A female showing the two yellowish spots on the hemelytra; the males are without this character.** (Right): **A nymph showing stink-gland openings in centre of back.**
[Joyce K. Allan, *del.*

appearance. The adult bug measures about an inch in length, and is yellowish-green in life, but fades to a brownish-yellow after death. The species is easily distinguished by the presence of a pair of pointed curved chitinous appendages, which render it conspicuous among other plant bugs. The horny part or corium of each of the fore-wings (or hemelytra) terminates in a yellow spot. Ventrally the body is keel-shaped, and gives off anteriorly a curved spine between the bases of the two hinder pairs of legs.

Near the golf links, in a swampy situation, occurred a number of bushes of *Leptospermum juniperinum* in full bloom, the creamy-white flowers attracting numbers of insects such as Thynnid wasps, large metallic or drab Dexiid flies, and beetles of many kinds. Here we captured a number of the large and handsome yellow and blue-barred Jewel Beetle (*Stigmodera spencii*), described in 1841 by Count Castelnau and Gory, and which was unrepresented in the Museum collection. The insects were easy to capture, and we often noted them battling against the nor'easter until they came over the bush of their choice, when they would suddenly alight and we were then able to secure them.



Arboreal termites' nest near beach at South West Rocks.
[Photo.—*A. Musgrave.*

Collecting at this spot, though profitable in one sense, was extremely unprofitable in another, as we were driven nearly demented by myriads of flies and hundreds of mosquitoes, which cost us much in loss of blood and patience.

Near the beach we came across several arboreal termite nests on old trunks among a riot of vines and beach plants. Here, too, the spiders stretched their tough orb webs everywhere among the banksias, and some we captured proved to be the common Eastern Australian species, *Epeira productus*.

South West Rocks, with its pandanus-crowned sand-dunes, hard sandy beaches, and mangrove swamps, reminded us of sunny days spent in Queensland; the ruined gaol set on the headland of Lagger's Point revived memories of the Tasman Peninsula and its historical associations, while in other parts we could readily recall Lord Howe Island, that elysium of naturalists. So having been afforded every facility by residents during our pleasurable stay, we came to the unanimous decision that nature has indeed harmoniously blended the choicest of her lights and shades at Trial Bay.

Sea Slugs

By JOYCE K. ALLAN.

KNOWN generally as sea slugs, the nudibranchs or naked molluscs strongly belie in appearance any suggestion of the drab or sombre colouring which the far from complimentary name "slug" may imply. On the contrary, it is chiefly the vividness of their brilliant and variable colouring, coupled usually with a quaintness and attractiveness of shape, that so delights the collector who is fortunate enough to find them, and who is well repaid for any difficulty he may have experienced in obtaining them.

It is surprising that creatures so interesting both in appearance and habits should be so seldom collected or so little known, but lack of literature dealing with them, especially those found in Australasian waters, makes the classification and identification of any but the commonest and best known extremely difficult.

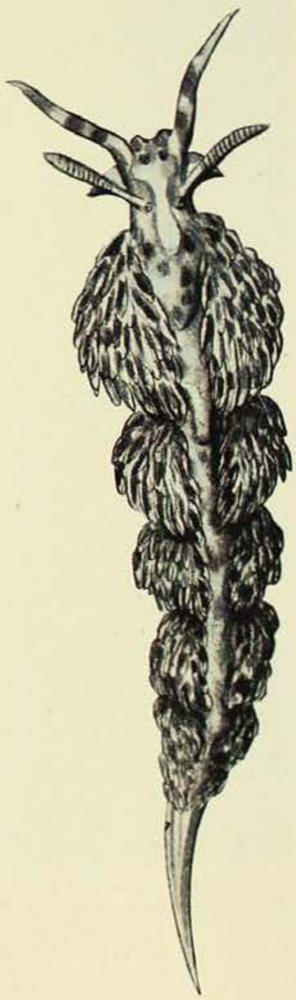
Without material to work upon, the literature dealing with such a subject must naturally be scanty, and until recent years the collections made of nudibranchs have been very small, even in museums, which reacts on scientific research, as much of the work done is based on museum collections. This lack of literature, the fact that sea slugs have no shell to collect (which is incidentally the reason why they are called naked molluscs), and that preservation, necessary for such soft-bodied and perishable animals, soon reduces the once vividly coloured and ornamental creature to an almost shapeless and colourless mass, and furthermore, their ability to hide themselves away from the searching glances of collectors, are the main reasons why the group has been so sadly neglected.

As there must be a great wealth of nudibranchs still undiscovered in the seas, especially in Australasian waters, there is always the chance, probably greater than in the case of any other marine group, of a new-found treasure being a rare, or better still, a new species.

CLASSIFICATION.

Strange as it may seem to some people, the nudibranchs are a division of the Gasteropoda, one of the main divisions of the mollusca in which the shell consists of a single piece or is "univalve." The class Gasteropoda consists of two subclasses, in one of which the sexes are nearly always separate and in which there is one pair of tentacles, the other having the sexes united in one individual (hermaphrodites) and having usually two pairs of tentacles.

The latter subclass is divided into two orders, Opisthobranchiata, having aquatic respiration, and Pulmonata or air-breathing, such as the garden snails and slugs. The former is again divided into two sections, the Tectibranchiata or sea hares, and the Nudibranchiata or sea slugs. The latter, with which we are dealing, are therefore Opisthobranchs, but, unlike the sea hares, have not a shell, except in the larval stage, where it is present, accompanied by an operculum.



When disturbed or alarmed, this Aeolid (Flabellina ornata Angas) throws off the numerous gills arranged along the sides of the body. It is the species most frequently found round Sydney.

[Joyce K. Allan, *del.*

HABITS.

The sea slugs are soft, marine, hermaphrodite animals, ranging from less than an inch to over six inches in length. They are found in all seas, in all climates, wherever the coastline is firm and rocky, and hide away in rock crevices, under stones or on algæ and seaweeds in rock pools. Like other molluscs they are more abundant and more vividly coloured in the warmer seas.

Plentiful in depths where seaweeds and corallines are thick, they are found at low tide under stones or are even left high on rocks or mud flats by the receding tide, where they remain almost motionless, awaiting the incoming tide to cover them again.

A few are dredged in deep water, usually coming up on algæ, and some are pelagic, living in the open sea and crawling on stems and fronds of floating seaweeds.

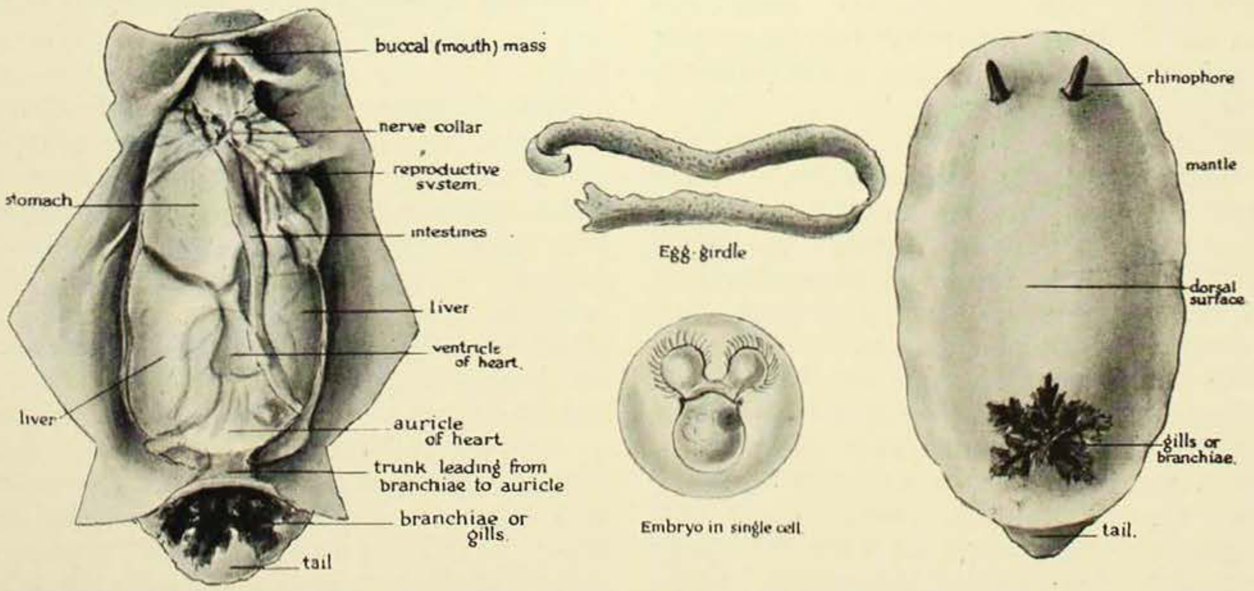
Except in the larval stage the sea slugs have no shell to protect their soft bodies, and, according to some authorities, for this reason they find it necessary to hide from their enemies in rock crevices or to take on a resemblance to the area on which they spend their lives, such as rocks and corals.

Feeding chiefly on sponges and zoophytes, and when no food is available on the weaker of their own kind, they appear periodically in fairly large numbers for about one to three months, usually in the spring and early summer, coming into shallow water. This is probably the breeding season, as it is about the time when their eggs are often found, and after the trek to the shallow water they usually disappear. It is generally considered that they then die, as research has shown that their life span is very short, lasting only about a year, and terminating soon after breeding. I have noticed on several occasions when I have had sea slugs in captivity in the Museum Aquarium, that after egg-laying they have disappeared, and have concluded that they died and their bodies decomposed, as no traces of them could be found. Their life in captivity is short at any time, the longest period I have been able to keep one being three months.

Crawling like a snail is their chief means of travelling, though some have an almost swim-like movement, and all seem very partial to floating in an inverted position, especially in captivity. When in this position the animal is able to give out a mucus which forms a track along which it walks. They are most sensitive to any external influences and, if alarmed, are able to drop instantly from seaweeds to the bottom of the rock pools.

STRUCTURE.

Their elongate symmetrical bodies bear on the upper surface plumes and other appendages which assist them in



Diagrams showing the external and internal structure of a typical Dorid, its egg-girdle and an embryo. In the internal structure the compact liver will be noticed occupying a large area. The embryo assisted by two ciliated lobes whirls furiously round in its cell before emerging.

[Joyce K. Allan, *del.*

respiration, and are ornamented with a great variety and range of gorgeous colourings, bright red, blue, green, orange, purple, and brown, which are very striking once the animal is removed from its natural home and exposed to the light. The upper or dorsal surface is attached to a foot and extends round it forming a mantle, which sometimes reaches well beyond the anterior and posterior ends of the foot. It may be covered with minute pustules or ridges, large blister-like tubercles or is smooth. At the anterior end are two cavities each containing a retractile rhinophore and varying in shape, size, and colour.

The rhinophores are the chief organs of sense, testing the quality of the water, sensing the presence of each other and waving furiously at the sign of approaching danger. The gills or branchiæ, the chief means of respiration in nudibranchs, are also found on this dorsal surface, and also vary in colour, size, and number.

Sometimes they are situated like plumes in a ring at the posterior end of the central line, or are arranged in rows as tufts or papillæ along the sides of the upper surface.

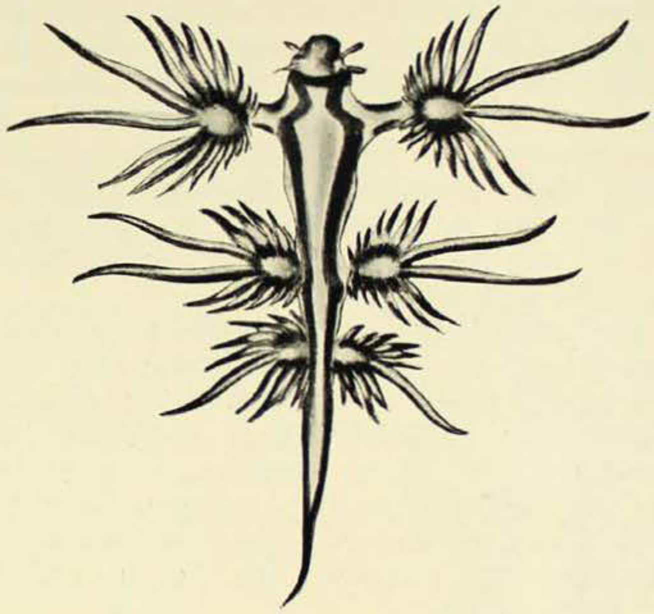
They are very sensitive and the animals soon become aware of any foreign element near, and show their alarm by waving or retracting their gills. The species having them as papillæ along their sides are able to cast them off when danger approaches, but fortunately they are capable of soon repairing this loss and do not appear to suffer any inconvenience while others are growing.

When arranged as a circular plume the gills are protected sometimes by a cavity into which they can be partly or completely withdrawn through muscular movement in the dorsal and lateral surface, and can emerge again assisted by a flow of blood in the blood glands.

The foot extends along the body, and is used for crawling. It is either broad or narrow, the animals with the narrow foot being more active than those with the broad foot, the latter being heavy and sluggish as a rule, rarely moving from their settled home or exerting themselves except to find food. At the anterior end of the foot is the head with a mouth and two oral tentacles, which vary in size and shape and are organs of sense. The mouth varies in size from large to a minute pore.

Should a cut be made down the centre of the dorsal skin of a sea slug and the skin folded back, the internal structure of the animal can be seen packed within in a more or less symmetrical line, and consisting of nervous system, stomach, intestines, heart, kidneys, liver, and reproductive system.

Behind the rhinophores are situated the eyes, which are small, covered with the dorsal skin, and only useful for distinguishing light and dark.

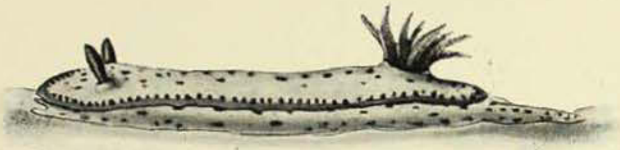


The blue and white sea-lizard (Glaucus sp.) is found floating on the surface of the open sea with its branched arms of varying length extended in the manner illustrated.

[Joyce K. Allan, *del.*

Though most attractive and brilliantly coloured, the nudibranchs do not appear to have any uses except as food for other animals. Without much intelligence and their eyes incapable of watching for danger, they depend largely on their colouring for protection, their surface often resembling the pitting of the coral on which they live; by hiding under or between rocks they are able to maintain a partly peaceful existence. Some distasteful to fish have warning colours and others have the power to eject from their papillæ an unpleasant mucus or throw off their appendages. When handled certain species which have a widely extended mantle are able to discard it in a complete ring, only the central dorsal portion of the body remaining living for some time without this cast off piece. These interesting species also grow in shape to resemble the irregular-shaped crevices in which they spend their lives tightly wedged.

Though so often resembling the area on which they live, unlike the octopus which is able to change its colour at will, from that of the lightest sand shade to the dark green of the seaweeds, the nudibranchs have not this power of self-camouflage, and the colouring in them is largely due to the food they eat, which accounts for the brilliancy of the tropical sea slugs compared with that of those from colder waters. The latter are usually much paler with the contrasting colour in scattered spots, whereas those from the warmer seas have their body colour as a rule richer, with other colours forming large pigmented areas.



The commonest member of the genus Chromodoris found round Sydney, this sky-blue species (C. bennetti angas) is easily recognized by the orange border on the mantle and blood red spots scattered over the surface.
[Joyce K. Allan, *del.*

Their eggs are laid in spiral coils or ribbons on suitable spots such as algæ, and when in captivity on the glass of the aquarium. Taking about one and a half hours to lay, the eggs are contained in a perfectly transparent mucus envelope and are produced in enormous quantities, though all do not reach maturity; they hatch about fifteen to twenty days after laying.

The larvæ develop very rapidly, and on extrusion from the egg-girdle, the embryos swim freely through the water by means of two ciliated lobes, the body being covered with a small shell and an operculum, through which they break very early in their existence, continuing to grow without a shell.

Unable to swim, the sea slugs find it necessary to make their first excursion to the surface of the water with the aid of an outside agency such as a piece of seaweed, but, once established there, they are able to move freely through the use of the mucus given off by them, which forms communication between the surface of the water and the seaweeds or other supports.

Roughly they are in two divisions, those in which the liver forms a compact mass, the Holohepatica, and those in which the liver is much branched or divided, the Cladohepatica. The animals of the latter group are extremely active and slender, with brightly coloured protective body appendages of varying shape and size, and their liver extends up into the numerous gills arranged along the sides of the dorsal surface of the body.

The former group contains the largest number of families and genera, and the animals are (with the exception of the members of the genus *Polycera* which are extremely active) more or less sluggish animals of oval shape, rarely possessing body appendages.

Among the Holohepatica the best known are those of the family Dorididæ, which is incidentally the largest family of nudibranchs, the species being usually spoken of as Dorids. The Dorids are found all over the world, and are the most symmetrical in shape and the largest in size of the sea slugs; they are moderately flat, soft-bodied, elliptical animals.

The rhinophores and branchiæ are usually conspicuous, the latter being either retractile or non-retractile into a rounded cavity at the posterior end of the dorsal surface, the edges of which are often raised and divided into lobes which are able to converge and afford protection when the branchiæ retract; the number of these lobes corresponds to the number of branchiæ within the cavity. The mantle, either wide or narrow, forms a cloak round the animal. They are sluggish animals growing to quite a large size in some tropical species, and rarely move but spend their existence wedged in between rocks and under stones. One particular species of the genus *Doridopsis*, a soft, rich velvety blue-black animal, about two to three inches in length, with large blister-like pustules covering the dorsal surface, is found at certain times of the year, usually early summer, in large numbers on the mud flats at Gunnamatta Bay, Port Hacking, and at the head of the Parramatta River, left there by the outgoing tide, where they burrow into the wet mud to keep themselves moist until the tide returns.

Those found most abundantly in New South Wales are the members of the genus *Chromodoris*, small slender-bodied brightly coloured animals, usually margined with a contrasting colour and spotted with still another colour, with the tail extended and showing when crawling and the head exposed; the margin of the mantle is usually wavy. They are found between tide marks in shallow water under stones or in rock crevices. Probably the commonest member of the genus found round Sydney is a beautiful little sky-blue slug, with a deep orange border on the mantle and blood-red spots scattered over the whole surface; the rhinophores and branchiæ are pink and rose respectively. Found crawling over stones or algæ, a small red Dorid with tiny black spicules scattered over its surface, closely resembles in colour, if not in structure, the fruit from which it derives its common name of *Strawberry Dorid*.

A large tropical group which agrees in many respects with the Dorids is *Hexabranchus*, but these have their large, extremely conspicuous branchiæ each retractile into a separate cavity, the whole arranged in a fairly wide circle on the posterior dorsal surface and each capable of withdrawing nearly to the level of the back of the pocket. The animals, quite the most distinguished looking and largest of all the sea slugs, are usually rich red in colour, with a very wide mantle with undulated edges, and are frequently found swimming at some distance from the shore, their widely extended mantle aiding them in this swimming or rather flapping movement.

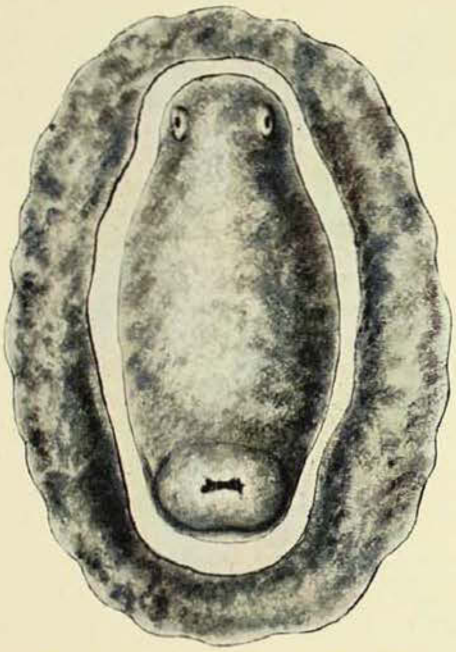
During the last few years a particularly active little sea slug has made its appearance in Sydney Harbour, and its gymnastic movements, as it actively crawls round the algæ on which it lives, using its tail-tip as an axis to swing itself round, has delighted those who have accidentally come upon it. Usually brought up on wharf piles or on algæ in dredges and nets, it has a slender translucent body tapering to a long thin tail, with a frontal veil armed with six bright yellow appendages, which probably serve as a protector for the branchiæ. A larger yellow appendage is situated on each side of the rich velvety black ever-waving branchiæ, and a broad black band extends down each side of the body and along the central dorsal line

Quite the most conspicuous sea slug to make its appearance in Sydney Harbour during the last few years is this species of the genus Polycera. It is extremely active and, though small, its body appendages and striking colour make it very noticeable both in and out of the water.
[Joyce K. Allan, *del.*

from the head to behind the branchiæ. The rhinophores are black tipped with white and, like the branchiæ, are most conspicuous against the faint colour of the body. The heart, situated just in front of the branchiæ, can be easily seen beating under the skin in the live animal. An active animal, it seems to like the sunlight, and by bringing the edges of its extremely narrow foot together it is able easily to clasp the stems of the algæ on which it browses.

Another very attractive little creature which always arouses great interest is the blue and white sea lizard, sometimes found washed up on beaches, named after *Glaucus*, a sea god. They are sea-wanderers of which little is known, but are easily recognized by their brilliant blue and white colouring and the branched arms of varying size on either side of their long narrow body; these they are able to discard on the approach of danger, and for this reason are most difficult to preserve. Common in the Atlantic Ocean, they spend their life in the open sea upon floating seaweeds, feeding on any small jellyfish they meet. The particularly bright blue colouring, practically the same as that of the sea in which they spend their life, protects their slender but at the same time conspicuously shaped gills from being nibbled away.

The *Cladohepatica*, or those having their liver divided and extending up into the gills, which are arranged along each side of the body, are extremely active animals, showing great variety of form and colouring, with brightly coloured dorsal appendages. The largest group of these is the Æolids, frail pellucid animals, probably more numerous than



The habit the slugs of this genus (Discodoris) have of discarding their mantle in a ring, makes them difficult to collect and preserve.
[Joyce K. Allan, *del.*

they appear to be, owing to the difficulty experienced in obtaining and preserving them, as they invariably discard their branchiæ when handled or when in captivity or preservation. Very little is therefore known of these small elongate narrow animals, with their body extending to a thin tail, and the brilliantly coloured branchiæ arranged either as dorsal papillæ or tufts along each side of the body; these they erect when alarmed, move convulsively and throw off when danger threatens. This does not hinder or distress them and they are able to carry on quite well till others grow and replace them. Added to this habit they are able to give off a distasteful mucus from them which is very offensive to fish. The Æolids are found in fairly deep water among seaweeds, where they are fond of remaining in an inverted position and are extremely hard to see. They feed chiefly on zoophytes, but, when deprived of these, they eat the weaker of their own kind.

As the beautiful colouring of the sea slugs is so quickly lost in preservation, and the rhinophores and branchiæ may retract, it is always wise to make, if possible when any are found, a colour sketch, or, if that is not possible, colour notes of the live animal. These take only a few minutes to make, and are of the utmost value scientifically, as colourless specimens are practically invaluable for identification. So far no really successful method of preserving them with the rhinophores and branchiæ fully extended and the colour retained has been discovered; many methods have been tried, but I have found that if they are kept in captivity till they are weak and listless and almost incapable of moving their tentacles, and then dropped into a weak solution of formalin or spirit, they do not have the energy to withdraw their appendages or curl up so completely, and are preserved in more or less the same state as they were in before being dropped into the preservative.

The External Structure of Birds

By K. A. HINDWOOD, R.A.O.U.

BIRDS differ from all other forms of life by the exclusive possession of feathers, which are, in reality, modifications of the epidermal cells of the skin. The oldest feathered creature yet discovered is *Archæopteryx;* this strange beast was about the size of a crow and may be rightly called a lizard-like bird, for it possessed both reptilian and avian features. The enormous space of

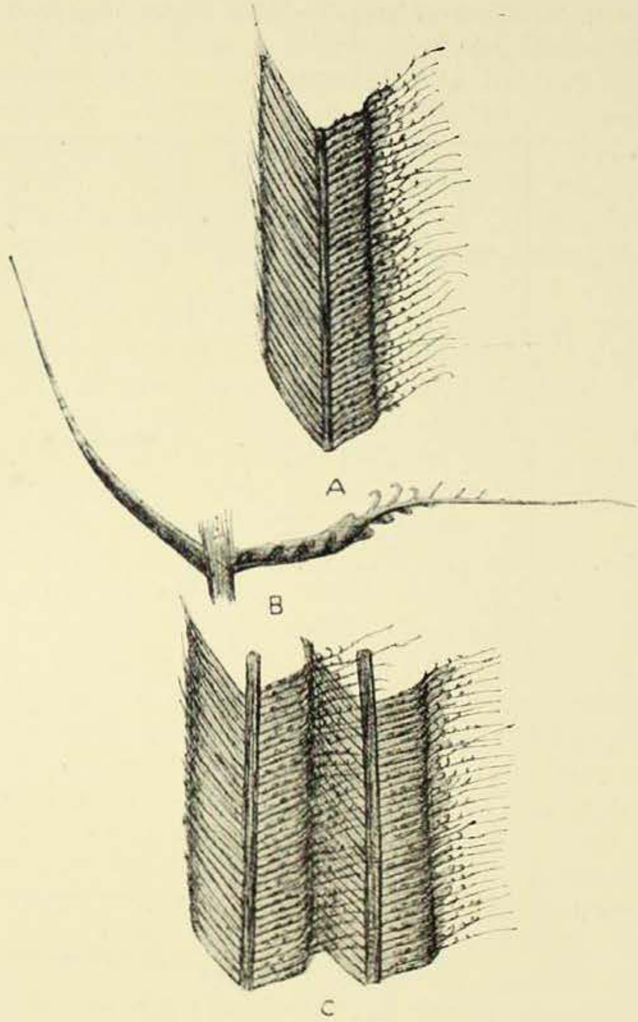
Archæopteryx, the Jurassic lizard-like bird.
[As restored by *R. W. Shufeldt.*

time since they ceased to live is evident from the fact that the two known fossils were secured from the Lithographic Slate of Solenhofen in Bavaria, which dates from the Jurassic system of the Secondary or Mesozoic era, that is about two hundred million years ago.

Feathers differ greatly in size and appearance according to their function. The most satisfactory way of gaining a knowledge of the formation of such a singular structure is to examine the wing feather of some common bird. It will be seen to consist of a strong central axis, sometimes called the main stem, the base of which is the barrel or quill; this is hollow and transparent, and a small aperture will be noticed at the end where it was implanted in the skin of the bird. The part above the quill is opaque, being filled with a pithy substance; this is the shaft which has a longitudinal groove along its inner side, or that part towards the bird's body.

Attached to the shaft on either side are the webs, together constituting the vane. Each web consists of elongated, closely arranged laminæ called barbs, the number of which depends chiefly upon the length of the feather. Growing from the barbs in two opposite directions are the barbules. These are very numerous. Newton (*Dictionary of Birds*) estimated that each barb of the primary feather of a certain species of crane bore about six hundred pairs, and that the total for the whole feather was more than a million barbules. Even smaller outgrowths are the barbicels, appearing only on the barbules looking towards the tip of the feather. Such a marvellously complex structure is not yet fully described, for, with but few exceptions, the barbicels of the remiges or wing feathers are furnished with minute hooks or hamuli. The hamuli are of the utmost importance in regard to the powers of flight, for they are really the locking device binding the entire web, thus forming an almost air-tight surface without which birds could not fly. Considerable moisture on the wing feathers of many birds causes them temporarily to lose the power of flight; excepting, of course, sea-birds and the water-loving ducks which, to combat the effect of dampness, anoint their feathers with a secretion pressed from the oil glands. This habit has given rise to the saying, a truthful one in this instance, that water "will run off a duck's back."

Generally a second feather is present growing from the main shaft; this is known as an aftershaft, and usually it is smaller than the main shaft, though in the emu it happens to be as long.



(A) A barb.
(B) A pair of barbules showing the barbicels and their hooks on the one nearer to the tip of the feather.
(C) Two barbs showing interlockings.
A and C magnified × 90 diameters.
B magnified × 250 diameters.
[After *Headley*.

The type of feather described is characteristic of the contour feathers, that is, those feathers which are outwardly visible on birds, though even contour feathers are capable of considerable variation, as can be noticed in the beautiful tail feathers of the male lyre-bird, the plumes of the egret or the ornamental feathers of birds of paradise; in certain species of these gorgeous birds some of the contour feathers consist of a shaft alone, the webs being entirely absent.

Briefly, the other kinds of feathers are "downs," fluffy feathers mostly concealed by the contour feathers; degenerate "hairlike feathers" which invariably grow at the base of the contour feathers; and, finally, the *neossoptiles*, the first plumage of nestling birds, which may bear a resemblance to the down feathers of adult birds.

world's birds. It is possible to tell fairly accurately the mode of life of any bird from a specimen. Thus most wading birds have long necks and correspondingly long legs; aquatic birds, webbed or partially webbed feet; seed eaters, short, stout and strong bills, whilst those of birds of prey are strongly hooked. The feet and claws of scratching birds are well developed and powerful. Whereas we may classify their habits, in a general manner, according to certain external characters, the possession of similar peculiarities by different birds does not

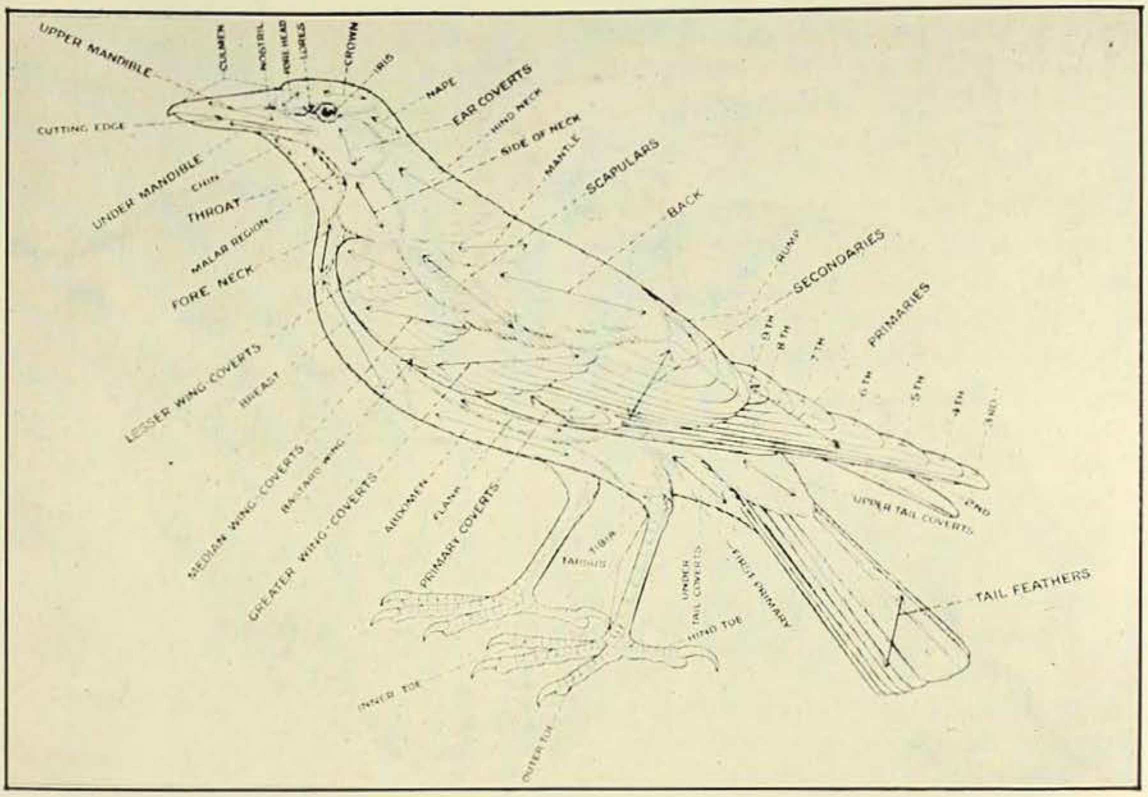


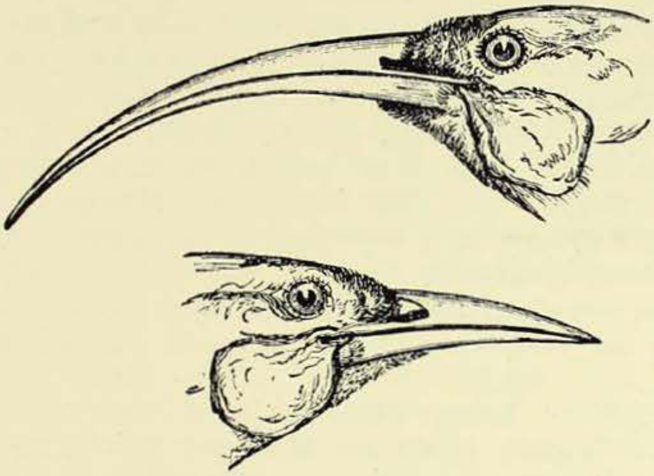
Diagram of a bird illustrating the terminology of the plumage and limbs.
[*Neville W. Cayley*, del.

Having broadly considered the formation of feathers, we pass now to other external parts of a bird's body. Whatever may be its size or shape, a normal bird possesses a beak, in which the nostrils are situated, two eyes, two ears, which are usually covered with feathers and not noticeable outwardly, two wings, a pair of legs, and a short solid tail. So great are the variations of these members, due to specialized habits and the moulding forces of nature, that an almost endless field for research is opened by the study of the always denote a genetic affinity. Often such resemblances are accidental, having developed independently.

Perhaps of all external structures the bill or beak is the most variable in shape amongst the thousands of species of birds inhabiting the world. This extremely important appendage consists of an upper and a lower mandible; both are covered in almost every instance with a hard horny sheath, though in ducks the bill is somewhat leathery in texture. That of the woodcock, a bird inhabiting the

Northern Hemisphere, is long and slender and is used to probe the mud or soft earth for food; the tip of the upper mandible is provided with nerves, giving it a delicate sense of touch; moreover, it is capable of slight movement independently of the rest of the bill, so that when buried in mud the end of the bill feels and grasps worms and insects.

Generally the upper mandible is curved more or less downwards, and in many instances both are, as in the curlew. Avocets have beaks with a distinct upward curve. This is noticeable to a much lesser degree in the sitellas or tree-runners. A singular bird inhabiting New Zealand, the wrybill, derives its



Huia. Female and male.
[After *Buller*.

name from the unique shape of its beak, which is unlike that of any other species, being bent in the middle and diverted to the right side. When feeding, the wrybill is said to move from left to right, and by the shape of its bill it more easily secures its food, chiefly arthropods, that lurk under stones. New Zealand is a place of rare and interesting birds. One of the most outstanding species is the huia, in which the difference in the bills of the male and female is so marked that, when Gould described them in 1836, the sexes were considered distinct species. According to the personal observation of Sir W. Buller, its favourite food is the grub of a timber-boring beetle, and the male bird with his short stout bill attacks the more decayed portions of the wood and chisels out his prey, while the female with her long slender beak probes the holes in the sounder part, the hardness of which resists his weapon; or when he, having removed the decayed portion, is unable to reach the grub, the female comes to his aid and accomplishes what he has failed to do.

The beak of a bird serves the same purpose as the hands of man. With it birds are enabled, not only to take their food, but to tear, crush, or cut their prey. Also it is, in the majority of cases, the organ mainly used in the construction of the nest. One marvels at the great skill shown by many small birds in building closely woven and intricate homes, especially those of the tailor birds, which cover the outside of their nests with a few broad leaves, the edges being sewn together by threads made by these master builders.

The nose consists always of a pair of nostrils, mostly appearing on each side of the upper mandible, though in the petrels they may open above as one tube; those of the pelican do not open externally. The position of the nostrils varies considerably; often they are covered by an extension of the frontal feathers of the head or by feathers growing on the cere. Undoubtedly the most unusual position appears on the Kiwis of New Zealand, their nostrils opening near the extremity of a long bill.

The eyes are placed on either side of the head; the owls, mopokes, and nightjars form an exception, inasmuch as in these species both eyes look forwards. Birds of nocturnal habits have larger eyes than those that feed during the day. The upper and lower eyelids are folds of the skin; a third eyelid, known as the *nictitating* membrane, is present within the other eyelids, where it moves across the eyeball, appearing as a whitish film. It is especially noticeable in the cuckoos and hawks, in fact if almost any bird is watched closely this third eyelid will be noticed rapidly covering and uncovering the eye.

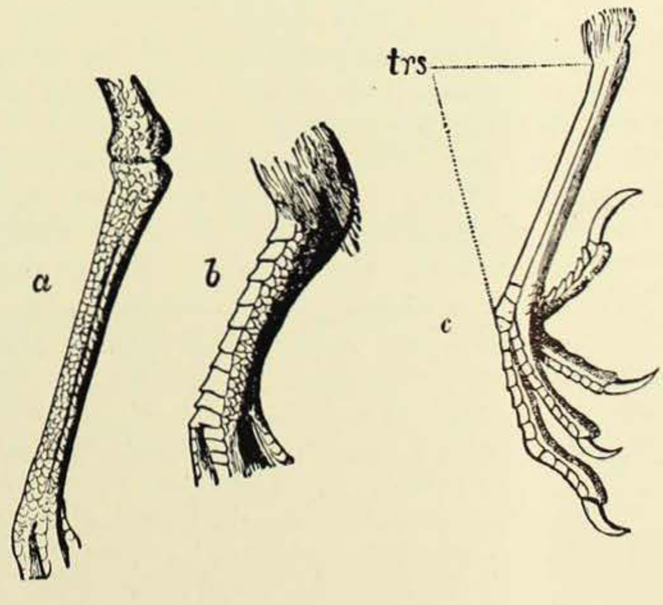
There are but few birds incapable of flight, even species which are now flightless were once able to fly and still possess wings, though in some instances these are scarcely noticeable. The loss of such a wonderful and efficient attribute is more noticeable amongst birds inhabiting old and isolated continents or small islands, and is due mainly to two things: the absence of dangerous terrestrial enemies, and a plentiful supply of ground food. The introduction of a disturbing element often means the extinction of these degenerate forms.

The wing of a bird corresponds to the foreleg of a lizard or the human arm. However, in birds the "hand" or pinion has been considerably modified, and only two fingers and the thumb are now present. The fingers, together with what answers to the middle part of our hand, are enclosed in a continuous pad. Some species still have minute claws on one or both of these digits, indicating a lizard-like ancestry. The pollex or thumb is a separate part of the pinion; when fully developed, it sometimes bears a horny claw as in the Spur-winged plover. From the base of the pollex grow small feathers which comprise the *ala spuria* or "bastard wing," forming one of the three divisions of the wing feathers. The effective feathers of flight, the primaries and secondaries (*remiges*), may vary from about sixteen to more than fifty in number in the various species; they form the second group. The primaries are always implanted in the pinion or hand, and the secondaries spring from the arm. The feathers that cover, outwardly, the basal portions of the *remiges* are separated as a third association, and are known as wing coverts or *tectrices*.

The wings of penguins are quite different from those of other birds, being covered with scale-like feathers and having the appearance of flippers. It may be said of penguins that they actually fly under the water.

The fact that the leg of a bird is analogous to the lower limb of man is not at first apparent; only by studying the internal structure of this appendage can the similarity be understood. However, the leg is divided into three distinct parts: (1) that corresponding to our thigh, (2) the leg, and (3) the foot, which includes the straight and at times long upper part called the tarsus. The thigh is relatively short, always covered by the feathers of the body and often enclosed within the skin of the general envelope of the trunk, so that the knee is never externally apparent. What at first appears to be the knee-joint is really the ankle-joint.

The true leg, or crus, is thick at the knee tapering towards the ankle; it is invariably covered partly or entirely by a continuation of the body plumage. The division below this, the tarsus, or more correctly the *tarso-metatarsus*, which is generally thought to be the true leg, is actually part of the foot formed by the fusion of the bones between the ankle and the toes. Though mostly naked, it is in certain birds entirely covered by small feathers as in the barn owl and some eagles, or it may be partly invested by feathers. When the tarsus is devoid of feathers, a condition existing amongst the great majority of birds, it is usually covered by horny scale-like segments that vary in shape with the different species. If very small they are said to be reticulate, when square in form scutellate; should the covering be contiguous then it is said to be booted. There is much variation in the length of the whole limb, the extremes being observable in the swifts and frigate birds on the one hand, and the cranes and stilts on the other.



The horny scale-like covering of the tarsus.
a. Reticulate form.
b. Scutellate form.
c. Booted form.
trs. Tarsus.

[After *Couse*.

With the exception of the penguin, all birds walk on their toes. This has caused the belief that these digits themselves constitute the foot. We must include the tarsus, itself often greatly elongated and seemingly a different part, as portion of the foot of a bird. The number of toes varies from four, which are present in most birds, to two, a number occurring only in the ostrich.

The hind toe or hallux answers to the great toe in ourselves. The second digit is named the index and corresponds to our second toe; the third, the medius; the fourth toe or annulus is comparable with that member of our foot. Our little toe is not represented in birds. Should a bird possess three toes only, it is generally the hallux which disappears, and when but two are present, as in the ostrich, the hallux and index are absent.

Mostly birds have three toes turned forwards, and one, the hallux, directed backwards. The parrots and cuckoos have the first and fourth digits reversed, that is, their foot is zygodactyle or yoked-toed. In the swifts all four toes are turned forwards, an adaptation enabling them to cling with ease to the vertical face of a cliff or the upright trunk of a tree, their usual resting-places.

Every toe is provided with claws; these vary in length and strength and are especially strong in predaceous birds, which use them in grasping their prey.

A bird's tail has a bony basis and is surrounded by flesh. It is shaped not unlike a heart, is quite small, and is that part which in the chicken is called the "parson's nose." In the fleshy tail are implanted the tail feathers or rectrices, which are at times wonderfully developed. The gorgeous and so-called "tail" of the peacock is composed mainly of the feathers of the back; the tail feathers proper are not nearly so well developed and merely support the lovely display plumage. Whilst the penguins may possess upwards of thirty rectrices, most birds have but ten or twelve. Of all birds our tiny emu-wren has the least number, just six very long filamentous tail feathers.

At the December meeting, Dr. G. A. Waterhouse resigned from the office of President of the Board of Trustees, and Mr. F. S. Mance, Under-Secretary for Mines, was elected President for 1931.

The following were elected to serve on Committees during the coming year:

Scientific and Publication Committee.—Drs. T. Storie Dixson, G. A. Waterhouse, B.E., F.E.S., C. G. MacLeod, M.A., Mr. E. C. Andrews, B.A., F.G.S., and Professor W. J. Dakin, D.Sc., F.L.S., F.Z.S.

House Committee.—Drs. T. Storie Dixson and G. A. Waterhouse, B.E., F.E.S., Messrs. G. M. Blair, H. B. Mathews and H. M. Hawkins.

Finance and Publicity Committee.—Messrs. Jas. McKern, H. M. Hawkins and the Hon. Dr. F. E. Wall, M.L.C.

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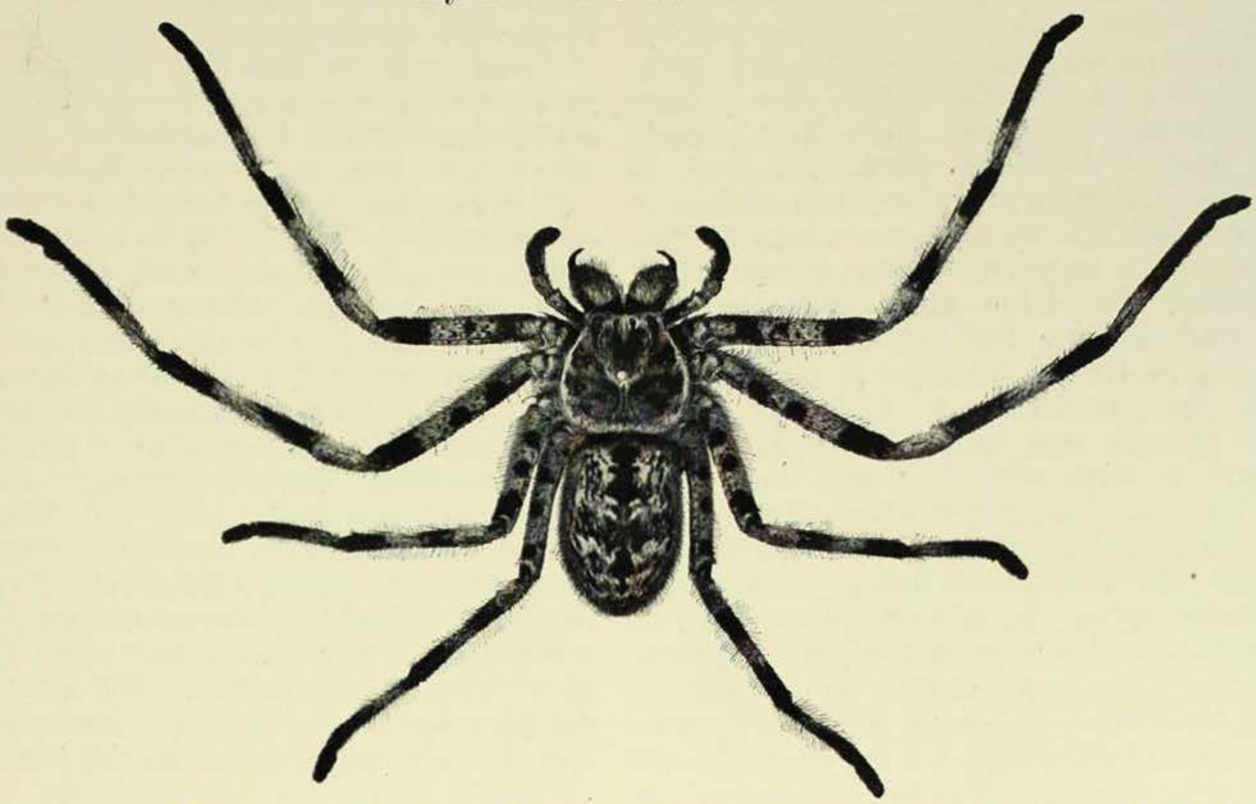
Mr. K. A. Hindwood was appointed Honorary Ornithologist at the December meeting of the Board. Mr. Hindwood is an enthusiastic student of Australian birds and several articles of his, accompanied by excellent photographs taken by himself, have appeared in THE AUSTRALIAN MUSEUM MAGAZINE.

Some Common Spiders of the Sydney District

By ANTHONY MUSGRAVE.



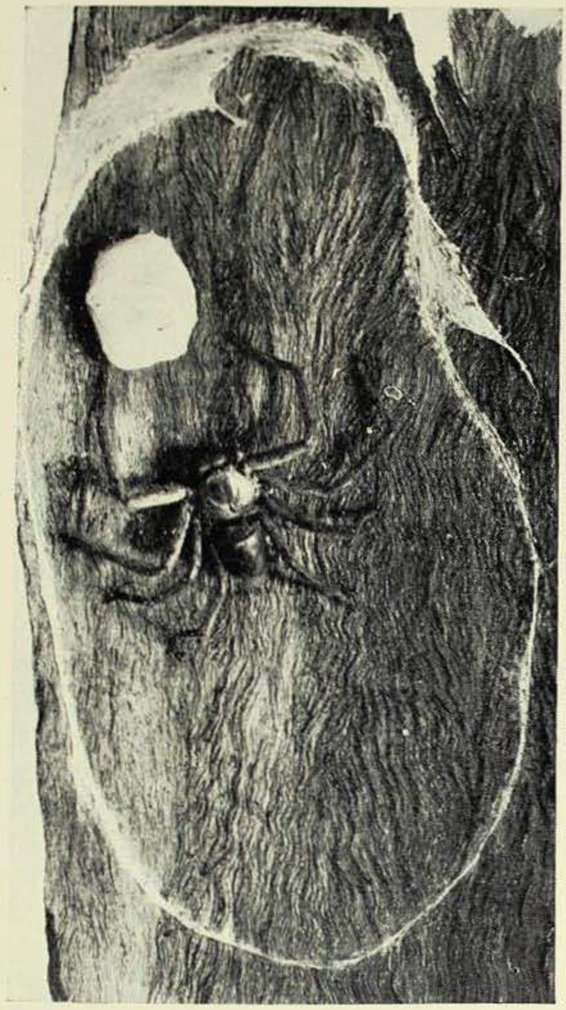
Triantelope, or Huntsman spider (Isopeda villosa), a common species found under the bark of trees.
[Photo.—*G. C. Clutton.*

THE announcement in the press of a a death from spider-bite poisoning invariably results in large numbers of spiders being forwarded to the Museum, with anxious inquiries as to the possibly venomous nature of the captives forwarded. While many of these on examination have proved to be species of the genera *Atrax* (Funnel-web spiders) and *Latrodectus* (Red-spot spiders), the majority forwarded are those of which we have no records of "bites," and which we believe to be quite innocuous to man. It must be remembered that the only spiders in Australia of which we have authentic records of their possessing "bites" likely to cause a fatal issue to man, are those in the genera enumerated above. In the present article I propose to deal with some of the local spiders which are frequently sent in to the Museum for identification. Before dealing with the spiders themselves a few words about their classification may assist in future identifications.

The order Araneida, which includes all kinds of spiders, is subdivided into three suborders—the first, the Liphistiomorphæ, the members of which have the abdomen segmented; this group is not represented in Australia. The second suborder, the Mygalomorphæ, includes nine families, of which the trap-door spiders, the bird-catching spiders, and the funnel-web spiders are representatives. In these the abdomen is not segmented in the adult, the chelicerae are so articulated that the fangs move up and down, and there are two pairs of lung books or breathing organs visible as reddish patches at the base of the under side of the abdomen. In the third suborder, the Arachnomorphæ, which includes all the true spiders, the cheliceræ are so articulated that the fangs move in and out pincer fashion and the breathing organs vary.

THE MYGALOMORPHÆ—TRAP-DOOR SPIDERS AND THEIR ALLIES.

We will now deal with the first of these suborders to be considered, the Mygalomorphæ. The family Ctenizidæ included in it embraces a number of interesting



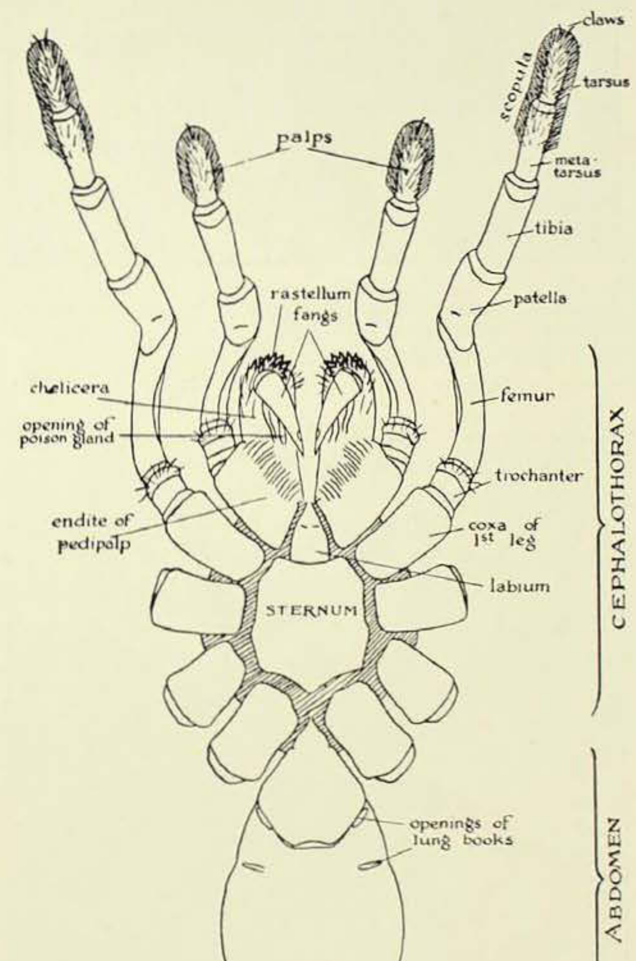
Huntsman Spider (Isopeda immanis), a not uncommon species in the Sydney district, which is identified by the black line down the centre of the abdomen.

[Photo.—*G. C. Clutton.*

species which are characterized by the cheliceræ being furnished with a rastellum; the spinnerets are comparatively short and four (rarely six) in number. One of the commonest and most interesting spiders of this group is *Eriodon occatorium*, a comparatively large bulbous-headed spider which has the eyes widely separated. It is said to be one of the first known of our Australian spiders, having been described in 1805 by Walckenaer, from specimens brought back to France by Baudin's Expedition. The ships of that expedition, the *Geographe* and *Naturaliste*, were at Port Jackson in 1802, and it was here that Péron the naturalist doubtless collected the species. The female is quite common in our collection but the male is rare, being represented by only one specimen.

Another species of the same genus often sent to the Museum for identification is *Eriodon rubrocapitatum*, a small spider with the cephalothorax half red and black, and the abdomen blue. The female is exceedingly rare, but males are common.

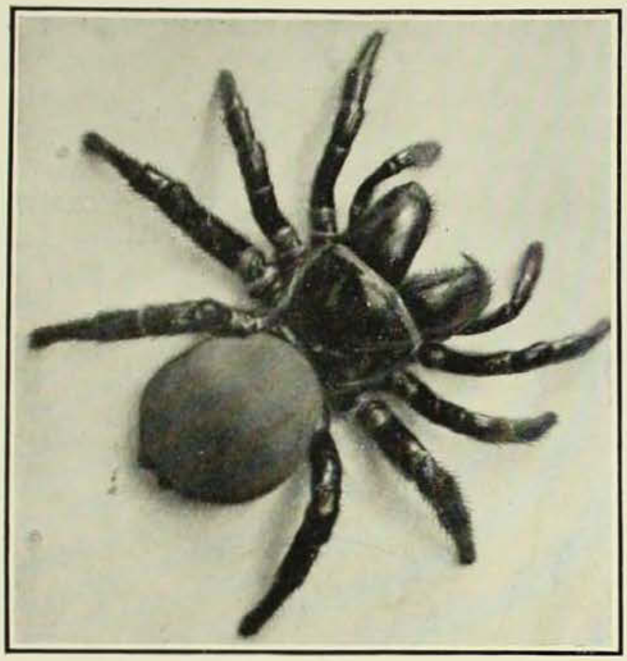
Perhaps the commonest Mygalomorph or "trap-door" spider to be met with about Sydney is *Arbanitis fuscipes*, a fairly large spider which constructs a burrow in the ground which it lines with web but to which it does not construct a lid. The male, measuring about three-quarters of an inch in length, has the palps swollen so that they somewhat



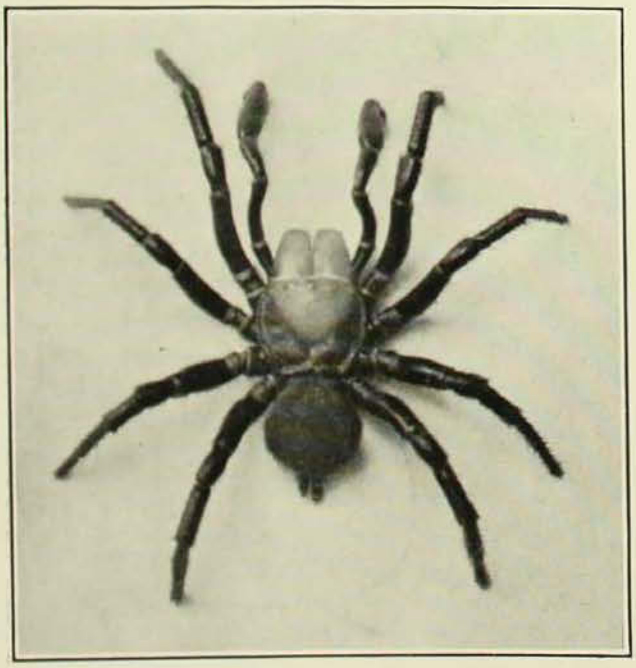
External anatomy of under-surface of Mygalomorph spider of the genus Arbanitis. The endites of the pedipalps are often termed maxillæ.

[Nancy B. Adams, *del.*

resemble boxing gloves, and has small spines forming an apophysis on the inner side of the first pair of legs. The female measures about an inch in length and is thus slightly longer than the male. The reddish-brown abdomen is banded with narrow, transverse, light-yellowish bars above in both sexes, though these bands are frequently so indistinct as to be almost invisible. The species was first described in 1914 by the late W. J. Rainbow from a female specimen collected at Willoughby, North Sydney. This species has sometimes been taken indoors, one specimen being secured under a man's pillow. No cases of "bites" have been recorded.



Eriodon occatorium, female, a large bulbous-headed Mygalomorph spider not uncommon in New South Wales.
[Photo.—*G. C. Clutton.*



Eriodon rubrocapitatum, male, is a very small scarlet-headed spider also commonly met with in New South Wales.
[Photo.—*G. C. Clutton.*

In the family Dipluridæ we have some of the most interesting forms of Mygalomorphæ. These spiders have the cheliceræ without a rastellum, the tarsi have three claws, and the posterior spinnerets are very long. They are called "funnelweb tarantulas" in America, according to Comstock's *The Spider Book*. In this family is placed the genus *Atrax*, of which *Atrax robustus* is the local representative, its poisonous qualities having already been discussed in this MAGAZINE.[1]

A beautiful though somewhat small species of "trap-door" spider belonging to this family is *Aname decora*, which was first described in 1918 by W. J. Rainbow and Dr. R. H. Pulleine from specimens secured at Clifton Gardens, and has since been captured at Cremorne in moss. It is a yellowish species, with the "abdomen yellow with brown spots and median and lateral markings, the latter broken and forming a rather ill-defined pattern."

THE SUBORDER ARACHNOMORPHÆ—TRUE SPIDERS.

In this group are placed the remaining forty-six of the fifty-five families of spiders, and, though not all these families are represented in Australia, a great percentage of them do occur here. It would be impossible however, in the brief scope of an article such as this, to deal with all the spiders of this suborder found in the vicinity of Sydney. Only those conspicuous forms which appear to the uninitiated to be the "deadly trap-door spider" of the daily papers are here dealt with, for all sorts of spiders labelled "trap-door spider" are sent to the Museum, from small shrivelled specimens of orb-weavers to the large Huntsmen spiders.

[1] Musgrave: THE AUSTRALIAN MUSEUM MAGAZINE, Vol. III, No. 4, October–December, 1927, pp. 134–138.

FAMILY LYCOSIDÆ—WOLF SPIDERS.

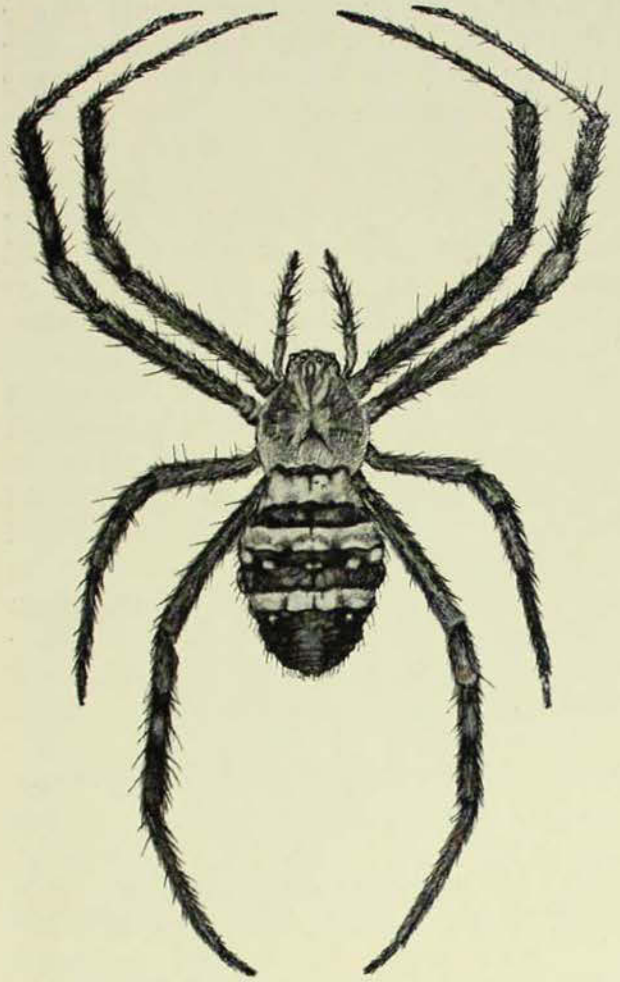
The members of this family have habits somewhat similar to those of the trap-door spiders in that they tunnel in the ground and line the tube with silk. One or two forms even attach lids to their burrows, a local species having this characteristic. This leads to confusion, for readers of the daily papers read of the evil ways of the "trap-door" spider, and surmise that the Wolf spider they have captured in their gardens is an *Atrax*. When it is pointed out that the local poisonous "funnel-web" spider of the genus *Atrax* does not make a lid to its burrow but attaches instead a funnel of silk, and that the term "trap-door" spider is applied loosely to members of the suborder Mygalomorphæ, they appear incredulous. This is only natural. The trouble lies in the looseness of the vernacular terms, or the lack of popular names for the animals. The term "tarantula" is a case in point. Comstock, an American arachnologist, writing on American spiders in his work *The Spider Book*, uses the term for Mygalomorph spiders. In Australia it is frequently applied to the Huntsmen spiders, though elsewhere it is used as a term to denote all large spiders. The famous *Lycosa tarentula*, which derives its name from the town of Tarentum in Southern Italy, and is the "Tarentula" of legendary fame, doubtless has had much to do with the confusion, while to make matters worse there exists a genus of tailless Whip-scorpions called *Tarentula*.

Wolf spiders are identified largely by the arrangement of the eight eyes. There is a front row consisting of four small eyes behind which is a posterior row of four larger eyes arranged in so strongly recurved a manner as to form two rows. The pattern on the thoracic part is very similar throughout the genus *Lycosa*, which contains a large number of species in Australia. The egg bag is globular and the female attaches it to her spinnerets and carries it about with her. When the spiderlings emerge from the bag they climb on the back of their mother and are carried about by her. The Wolf spider (*Lycosa godeffroyi*) is the common grey garden spider of the Sydney district and probably the commonest ground-frequenting spider in Australia. It is a large spider measuring about an inch in length, with a rather distinctive pattern on the upper surface of the abdomen, as is shown in the accompanying figure. The underside of the abdomen is quite black, a character which readily separates it from other local members of the genus. This spider is frequently mistaken for *Atrax robustus*, a species which it in no ways resembles either in structure or habits. *Atrax* does not tunnel directly into the ground but constructs its retreat under logs, in stumps, by fence posts or in any natural crevice, to which it attaches its funnel of white web. Moreover, it differs from *Lycosa godeffroyi* in its larger size when mature and by its shiny-black or reddish-black cephalothorax and rugose black abdomen.

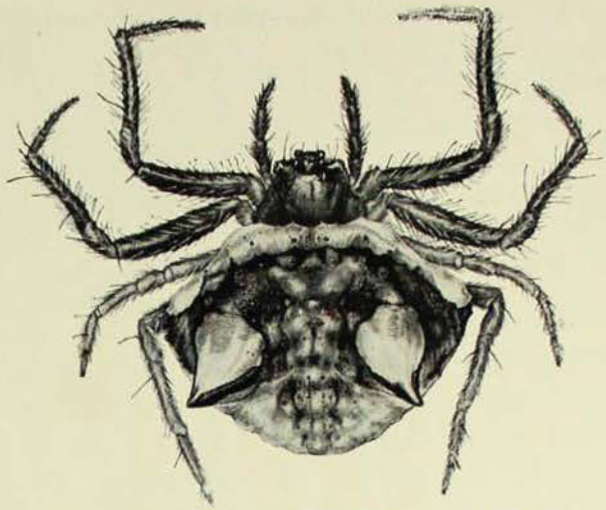
FAMILY ARGIOPIDÆ—THE ORB-WEAVERS.

The family Argiopidæ contains a very large number of forms, the majority of which are orb-weavers, building large circular webs in which they lurk to catch their insect prey. To Sydney residents the best-known example of this group is the Garden spider, *Epeira productus*, a very variable species which occurs abundantly in gardens about Sydney. Its habit of constructing its web about dusk in verandahs and doorways is also well-known to many a late home-comer, who has suddenly found his head thrust into the spider's parlour to the embarrassment of both parties. The Museum possesses the record of a "bite" from this spider; the "victim" was a servant in a well-known Club in the city, who was bitten by a male spider in the neck, but the pain was gone in a few hours and she suffered no serious effects.

A beautiful member of this group is the St. Andrew's Cross spider, *Argiope aetherea*, a species described by Walckenaer in 1841 from Dorey, New Guinea, but which extends down the coast of Australia to Sydney. It constructs in the centre of its orbicular snare a white silken cross termed a stabilimentum, or support for strengthening the web. Behind this the spider hangs head downward with its arms placed in pairs along the arms of



The St. Andrew's Cross or X-ray spider (Argiope aetherea), a common Sydney spider ranging to New Guinea.
[Joyce K. Allan, *del.*



The small two-spined spider (Pœcilopachys bispinosa), which occurs in the vicinity of Sydney.
[Joyce K. Allan, *del.*

the cross. The spider is reddish-brown with yellow bands on the abdomen.

One of the most beautiful members of this family is the dainty little spider, *Pœcilopachys bispinosa*. This little spider measures only about a quarter of an inch in length, and its two yellowish abdominal spines render it an easy species to identify. The legs are reddish in colour. During life the colour of the spider has been observed to undergo changes similar to those in an octopus, the colour flowing along the fore-border of the abdomen and the abdominal spines and producing a definite flush. The abdominal spines, too, undergo a change, being quite smooth at times, while at others they are papillose. The species is not uncommon in the vicinity of Sydney, the specimen figured by Miss Allan coming from the Lane Cove River, and it has been recorded from Gayndah, Queensland, and from the Island of Upolu, Samoa.

HUNTSMEN SPIDERS.

The Huntsman spiders of the family Sparassidæ are popularly termed Tarantulas or Triantelopes. The latter term is in more general use than the former, and in 1872 a British entomologist, resident in South Australia, summed up the matter as follows: "The spiders in Australia are very large and savage: they are called by everyone Tarantulas—at least they *mean* Tarantulas. 'Triántelopes" is the general pronunciation, which everybody, from a plough-boy to a 'J.P.', will persist in giving the word!"[1] The large, hairy, uncouth-looking creatures which constitute the members of this family are, nevertheless, timid, and make every effort to escape on the approach of man or woman. They frequently invade houses when wet weather threatens, and there they may be seen roaming crab-fashion over the walls and ceilings. Such an invasion brings them into conflict with the women of the household, who invariably issue the universal command when one appears, "Oh kill it, and throw it outside!" I have heard of a Queensland girl who allowed one of these spiders to roam at large within her mosquito net, in order that it might feed on the mosquitoes which found their way in during the night and disturbed her slumbers. This useful creature was slain eventually by a servant,

[1] H. Ramsay Cox: "Entomological Notes from South Australia," *The Entomologist*, VI, No. 109, p. 207.

unacquainted with this practical method of mosquito-reduction, and thus it escaped the fate, which doubtlessly awaited it, of being overlain. In their natural state, "Triantelopes" may be found under the bark of trees or old logs, the female mounting guard over her white cushion-like egg-sac. A large number of species have been recorded from Australia, and several species are commonly met with about Sydney. Perhaps the best-known is the widely-distributed *Delena canceridus*, a species described by Walckenaer in 1805, from specimens collected by Péron, and which is noted for its extremely flat cephalothorax. It ranges over Australia, and occurs in Tasmania.

The genus *Isopeda* contains a number of species. One of the handsomest is *Isopeda immanis*, a large species about one and a half inches in length and measuring about five inches across the outspread legs. The legs are broadly ringed with black and white bands, and down the centre of the abdomen is a black stripe, which renders it readily identifiable. *Isopeda villosa* is a common dark-brown species smaller than the preceding and with four pairs of black spots on the back of the abdomen.

Hints on the Preservation of Insects and Spiders

By NANCY B. ADAMS,
Assistant, Entomological Department.

DURING the summer months a great many inquiries are sent in to the Museum regarding the setting and mounting of insects. The following notes may perhaps be of some value to the amateur collector. The process, though tedious, is simple, and very few appliances are required. The following articles are all that are necessary:

- A strong pair of forceps with curved points.
- Several kinds of entomological pins, Nos. 1, 3 and 19 made by Kirby, Beard & Co., and a box of steel Lills pins.
- A tube of seccotine.
- A reel of cotton.
- Thin white cardboard, hog's bristles, polyporous pith, tracing paper, flat corked setting boards with grooves of various widths.

After collecting specimens mount them as soon as possible, otherwise they become dry and brittle.

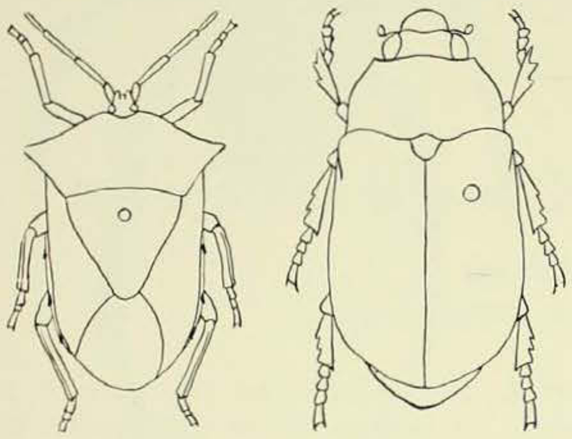
SETTING.

Butterflies and moths should be set on a flat spreading board with a groove down the centre. Pin the specimen through the middle of the thorax and place it in the centre of the groove with the bases of the wings just level with the surface of the board on each side. The pin should slant forward a little. Cut four narrow strips of tracing paper. Tie a piece of cotton to a strong pin, place the pin well in front of the specimen, and stretch the cotton across one pair of wings, pressing them flat on to the board. Bring the wings into position with a pin, or a needle set in a long handle, and arrange them so that the hind margin of the fore wing is exactly at right angles to the body of the insect and the hind wing rests in a natural position. Hold the wings in place with the cotton and fasten them firmly down with two slips of tracing paper. Place one strip across the wings close to their bases, and the other covering the outside edges. Arrange the second pair of wings in the same way, taking care that the margins of both pairs are exactly in line. Place two pins crosswise under the abdomen and two above, and fix the antennæ in position by cross-pinning.

Specimens should be left on the setting boards at least a week, then, if the bodies are perfectly rigid, they may be removed and put away in store boxes.

Specimens which are dry and brittle must be relaxed by placing them in a glass jar half filled with wet sand, to which a little carbolic acid has been added to prevent mould ; the lid should be tightly fitting. In about twenty-four hours the insects should be sufficiently relaxed to set.

Set dragon-flies and lace-wings in the same way, but first support the abdomen by inserting a long hog's bristle between and slightly in front of the middle legs. Run the bristle almost to the hind end of the body and cut off the projecting piece.



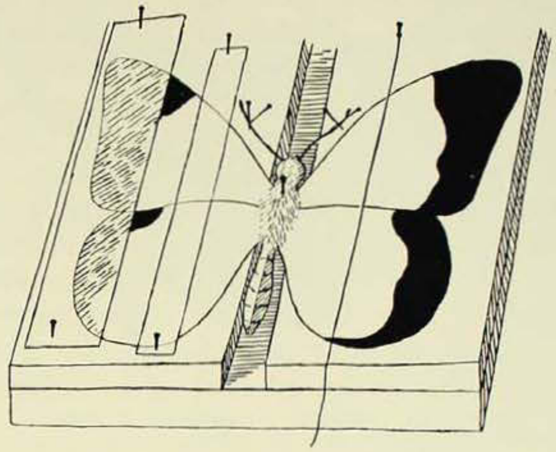
Showing method of pinning of bug (left) **and beetle** (right).
[Nancy B. Adams, *del.*

Grasshoppers, locusts, phasmids or stick-insects, and mantids should be pinned through the thorax and placed on a setting board with the legs and antennæ cross-pinned in a natural position. The spreading of the wings of these insects adds greatly to their appearance, but the practice is not recommended if space is limited.

Very thick-bodied insects, especially large moths and grasshoppers, discolour and grease badly unless the contents of the abdomen are removed before they are mounted. Slit the under surface of the abdomen with a pair of sharp-pointed scissors, remove the contents, stuff the body with a thick wad of cotton wool rubbed in magnesia or powdered chalk, and leave the specimen to dry.

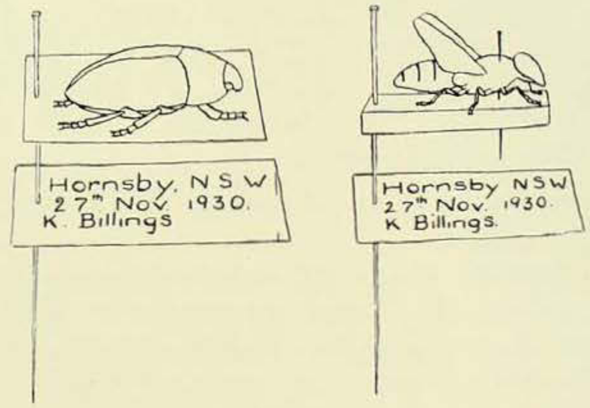
To mount large beetles insert a No. 1 or No. 3 pin in the anterior part of the right wing cover, so that the point emerges between the middle and hind legs. Push the specimen up to within about $\frac{1}{4}$ inch of the head of the pin.

Bugs should be mounted in the same way, except that the pin must be inserted in the middle of the scutellum.



Butterfly on grooved cork setting board, showing method of holding down wings by means of a piece of cotton prior to placing braces of tracing paper.
[Nancy B. Adams, *del.*

Beetles and bugs too small to be pinned, and all ants should be mounted on white cardboard. Cut a piece of cardboard the required size and mount it on a No. 3 pin. Then fix the specimen to the cardboard with seccotine, spreading out the legs and antennæ.



Staging insects. (Left): **Beetle mounted on cardboard.** (Right): **Fly pinned and mounted on polyporous pith. Note method of labelling and particulars given.**
[Nancy B. Adams, *del.*

Tiny moths and flies should be placed on pieces of polyporous pith. Mount the insect on a No. 19 pin, push the pin through the end of a small strip of pith, and mount the pith on a No. 3 pin. If the specimen is very small and delicate push the tiny pin through the pith with the point upwards and impale the insect on it. This method has proved particularly satisfactory in mounting mosquitoes, as the head of the pin does not interfere with the examination of the specimen.

The method of mounting insects on elbow pins is not used to any great extent in Australia, but is popular with entomologists in Europe. It is a complicated and not very satisfactory method.

LABELLING.

Specimens are of little value unless properly labelled. A very small label stating the locality and date of capture, and the collector's name should be placed on every pin, together with a second label bearing any additional information, such as the name of the host if the specimen is a parasite.

Spiders, larvæ, and soft-bodied insects should be preserved in 70 per cent. alcohol. Glass tubes with well-fitting corks can be obtained for the purpose.

Entomological cabinets for storing the collection are beyond the purse of most collectors. Specimens may be preserved in specially constructed store boxes. Powdered naphthalene, or paradichlorbenzine, should be kept in every box to exclude mites and other pests.

All boxes should be periodically examined for any signs of the Museum beetle, *Anthrenus*. This insect is the most serious pest of collections and is unaffected by naphthalene. The larva eats the inside of specimens and leaves only a hollow shell. Destroy any affected insects and fumigate the store boxes with a wad of cotton wool soaked in carbon bisulphide or carbon tetrachloride. The latter is quite as effective and has a very much less unpleasant odour. Mould on specimens should be removed with carbolic acid, verdigris with benzine.

Ants' Cows and Cow-Sheds

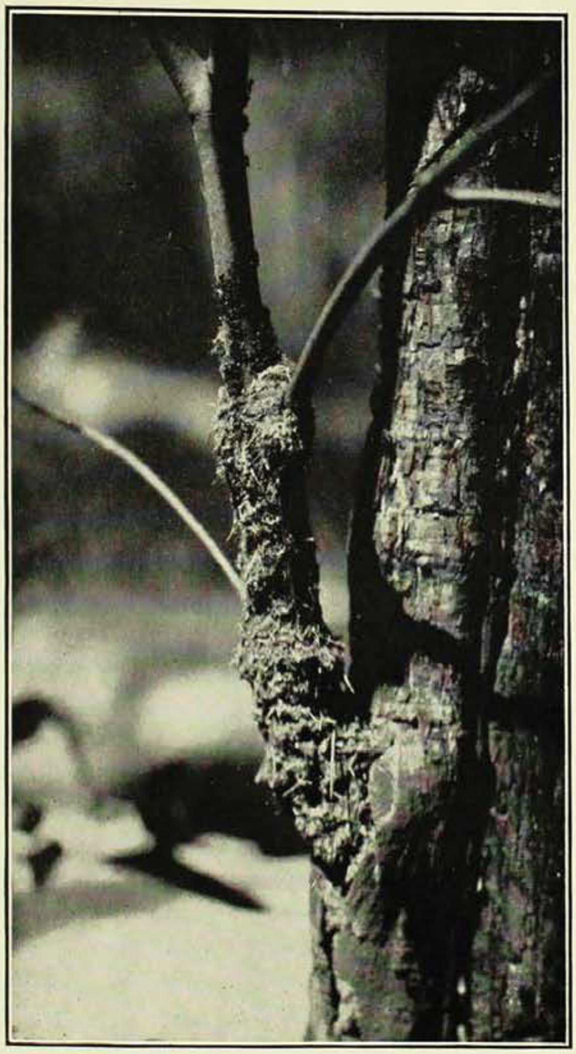
By KEITH C. MCKEOWN.

THERE is a tendency on the part of some writers of popular articles on ants and their ways to endow them with human attributes, human impulses and aims, and, although there are many close resemblances to our own activities in the communal life of the ants, yet this constant "humanizing" of them, if it may be so called, tends to produce a wrong idea of their social organization, and obscures the radical differences between the social insects and social man. In the one case the different castes are predetermined structurally, in the other by mental and other capabilities.

There are, however, certain activities of the ant community which remind us so irresistibly of our own pastoral and agricultural pursuits that they cannot be ignored; thus there are the agricultural ants, which harvest the grains and seeds which form their food and store them away, safe from moisture and the danger of germination, against times of scarcity. They have been credited with actually sowing the grasses or other plants from which they later harvest the seed, but this belief appears to have been founded upon the accidental germination of stored seed in a wet season, when all the ant's precautions have been rendered fruitless. While dismissing this aspect of ant horticulture, we must not forget those ants which cultivate fungus in their nests upon specially prepared fungus-beds of decaying leaf-mould, and by constant attention prevent its development into the normal toadstool-like form, but keep it in a stunted condition suitable for the food of their larvæ. This curious fungus-growing trait is also manifested in the termites, an entirely unrelated group. The true ants belong to the order Hymenoptera, the termites or "white ants" to the order Isoptera.

Other species of ants enslave workers of other species to carry on the work and defence of the nest, and some species have actually carried this slave-making habit so far that they have degenerated to such an extent that they are unable to feed themselves, and deprived of their servitors, die of starvation, although surrounded by plenty of their favourite food. It is not proposed in this article to deal with any of these aspects of ant life, but I will confine myself to their no less remarkable habit of "cattle raising" and "dairying."

Ants are omnivorous and there is little that comes amiss to them in the way of food; seeds, animal matter, and the hundred and one things which come to light in their constant search for provisions



An Ant's "Cow-Shed." The carton shelter covers a colony of Membracids from which the ants are obtaining honey-dew. A strong guard of ants is protecting the entrance from the intrusion of enemies.

[Photo.—*K. C. McKeown.*

for the nest are all utilized. Among these foods is honey, which may be filched from the nectaries of flowers without repayment of the plant by pollination in return for its sweets; it may be stolen from the nests of bees, or it may be obtained from the aphides and other allied insects, and it is these creatures which are designated as "ants' cows." It was the great naturalist Linnæus who first used this term for the aphides, and there is no doubt of its applicability.

The process of "milking" may be observed, either with the naked eye or with the aid of a lens, on almost any rose bush where aphides are found attended by the ants. An ant approaches a feeding aphid and strokes it rapidly and lightly with its antennæ, and the aphid, evidently pleased with this attention, almost immediately exudes a drop of honey-like liquid, which is eagerly consumed by the ant. There appears to be something especially stimulating in the ants' method of stroking the aphid, for Darwin and others have attempted to imitate it by lightly stroking the insect with a hair, but without result. Without this stimulus the aphid appears to be capable of retaining its secretion for hours. It has been wrongly assumed that the sugary secretion is given off by the two horn-like protuberances or cornicles upon the back of the aphid, and figures are frequently given in popular works on natural history showing the ants securing the honey-dew from these cornicles. The cornicles, however, secrete a waxy material, which is believed to be used defensively against marauding insects; this secretion is never used against the ants, which are evidently immediately recognized as friends. Aphides, Psyllids, Tree-hoppers or Membracids, and Coccids are sources of honey-dew, and many of these insects have developed special organs to facilitate the excretion of the fluid for the benefit of their friends the ants.

The ants are not content with simply "milking" such of these insects as they may meet in the field, but they go further in their dairying, and, in order to provide themselves with an assured supply of "cows," they indulge in cattle raising; they collect aphides eggs in autumn, storing them in their nests and caring for them as if they were their own. When the warmth of spring awakens them into life, the young aphides are distributed upon the roots and stems of their food-plants, where they are carefully tended, shepherded, and protected from their enemies. This rearing of aphides by the ants has an important economic bearing; so great a factor is the ant in the increase of aphides that in America one of the control measures against the Corn Aphis is the destruction of the species of ant which especially fosters them. Coccids are treated similarly and are frequently to be found in the nests of ants.

The ants' dairying activities do not, however, cease here; they are not content with the rearing and "milking" of their herds, for some species even build sheds over them as they feed upon the plants. These sheds are constructed of a kind of coarse *papier mâché* of soil and wood-fibres cemented together with a salivary fluid produced by the ants themselves. In these cow-sheds the aphides and tree-hoppers are protected from the direct rays of the sun and the optimum degree of humidity for their comfort and development is secured. The doors of the sheds are usually smaller than the insects enclosed and a strong guard of ants prevents them from straying and effectually protects them from their enemies, the ants fiercely attacking any creature which may attempt to molest them. For convenience in ingress and egress, the sheds are frequently connected with the ants' nests by long covered ways or galleries.

In most species of ants the honey secured from the "cows" is disgorged by the worker ants on their return to the nest and distributed among the members of the colony. In the Honey Ants, however, the honey is fed to certain members of the community, who, clinging to the roof of the nest, become enormously distended with the sweet fluid, frequently to the size of small grapes, and in fact become living reservoirs for the storage of the community's honey supply until it is required for distribution in time of dearth.

In referring to the dairying industry of ants, Julian Huxley writes: "As we have seen, the dairying life has grown up naturally enough. It is based on the fact that the sap-sucking insects utilize only a small portion of the sap they pump from the plant tissues, but void the major part of it. From licking up this sweet liquid, so agreeably made available to the ants—for their own jaws are useless for sap-extraction—to waiting for the actual voiding is only a simple step enough, and the stroking of the "cows" to speed up the appearance of the drop is another. The ants' invention of milking other insects is certainly no greater, as an evolutionary advance, than man's invention of milking other mammals.

"Just as man's agriculture, whenever it becomes at all systematic, is extremely deleterious to most other organisms, what with the felling of forests, the draining of marshes, the killing of beasts of prey, the banishment of so many birds which need cover and solitude; so the dairying propensities of the ants constitute one of the most harmful of all their activities. So numerous are the species engaged in the protection and often active dissemination of sap-sucking insects that a heavy toll is laid on plants, and man's efforts to keep his crops, flowers and fruit-trees clean of these vitality-sapping pests are, in large part, rendered vain."[1]

[1]Julian Huxley: "Ants," 1930.

Trilobites

By C. Anderson, M.A., D.Sc.

TRILOBITES were primitive arthropods (animals with jointed limbs) which existed in great numbers during Palæozoic times, many millions of years ago. They are of common occurrence as fossils in the oldest stratified rocks, and there are some localities in Australia, such as Bowning and Hatton's Corner, New South Wales, which are celebrated on account of the well-preserved trilobite remains which have been found there. In recent years even better specimens have been found on the Templeton River, about twenty miles from Mount Isa, Queensland, and the accompanying illustration is a photograph, approximately natural size, of a very fine trilobite from this locality. The specimen is the property of Mr. John B. Wadley, to whom we are indebted for permission to make the photograph.

Trilobites are well adapted for preservation as fossils, for they possessed a hard dorsal crust or shield, which, as a rule, is the only portion preserved. The ventral covering seems to have been more delicate in structure, but, fortunately, specimens have been found in which the ventral exoskeleton and the limbs which were attached to the ventral surface were beautifully preserved. Hence the structure of these ancient forms and their mode of life, deduced from their structure, are known in considerable detail.

The body was divided longitudinally by two dorsal furrows into three portions or lobes, from which the name trilobite is derived. The central or axial portion contained the principal organs, the lateral or pleural portions sheltered the limbs and gills. Like other arthropods the trilobites had segmented bodies. A number of segments at the anterior end were fused together to form the cephalic shield or *cephalon;* this was followed by a number of thoracic segments which were separate and movable on one another so that the animals could roll themselves up in a ball. The tail portion or *pygidium* is, like the head, covered by a series of fused dorsal segments. In most trilobites the cephalic shield carried a pair of compound eyes, which in some forms were large and prominent, in others comparatively small.

All the trilobites are found in rocks of marine origin, hence we know that they were aquatic animals which lived in the

A trilobite from the Cambrian rocks of the Templeton River, near Mt. Isa, Queensland, approximately natural size.

[Photo.—*G. C. Clutton.*

ocean. They played much the same part in the Palæozoic seas as the Crustacea (crabs, prawns, and others) do today, and, indeed, they have sometimes been regarded as primitive Crustacea and compared with the Isopoda, an order of the Crustacea to which the familiar wood-bug, *Porcellio scaber*, belongs. Like modern Crustacea they had become adapted to various conditions of life. Some were bottom-living forms which probably burrowed in the mud in search of worms and other small creatures. Others seem to have been pelagic in habit, swimming freely near the surface of the water, while still others inhabited the deeper waters.

Trilobites appeared in numbers in Lower Cambrian times, perhaps 600,000,000 years ago, but, from the high degree of organization which they had then attained, it is obvious that they had even then been in existence for a long time. They reached their greatest development in the Ordovician and Silurian periods, which succeeded the Cambrian, but in the later Devonian they dwindled both in numbers and in kinds and became extinct in the Carboniferous, the rocks of which have been estimated to be over 200,000,000 years old. The trilobites, then, had their beginnings far back in the very dawn of the earth as an abode of life, they multiplied, developed, and endured for about 400,000,000 years, then passed away, leaving, however, petrified remains and impressions such as our photograph shows. So numerous are trilobite fossils and so excellent is the state of preservation of some of the specimens that we are almost as well acquainted with their structure and habits as we should be if they were still extant.

Obituary

OCTAVIUS CHARLES BEALE.

BY the death of Mr. O. C. Beale, the result of a motoring accident on December 16, 1930, the Museum has sustained a grievous loss. He was elected to the Board of Trustees in 1924, and during his tenure of office he took great interest in the affairs and welfare of the Museum and gave of his best in its service. He was highly esteemed alike for his ability and his generous and genial nature, and his sudden death will be severely felt by his colleagues.

Mr. Beale was born at Mount Mellick, Queen's County, Ireland, in February, 1850, and came to Australia with his parents at an early age. He returned to his native land for his education and came to Australia again at the age of sixteen, when he embarked on a commercial career. Forty years ago he established a piano factory in Sydney, and this developed into a large and flourishing business. But, though he was recognized as one of Australia's leading business men, Mr. Beale was exceedingly versatile and had many interests. Botany, and particularly the collecting and cultivation of orchids, was his hobby, and his fine garden at his Burwood home contained many rare and beautiful plants. He was a great traveller, an accomplished linguist, was widely read, and himself had rare literary gifts. He was a Fellow of the Royal Historical Society (London) and of the Royal Society of Literature, and a member of the Authors' Club.

Although he had reached an advanced age, his energy and enthusiasm were remarkable, and his mental and physical vigour were the envy of men many years younger than himself; it may truly be said that he was cut off in the full tide of his powers. He was a kindly and courteous gentleman, full of charm and humour, and his memory will long be honoured by a very large circle of friends.

C. A.

Book Review

FORTY YEARS WITH THE ABORIGINES. By the Rev. E. R. Gribble. (Angus and Robertson.) 1930. Price : 6s.

This is an entertaining and informative book by one who has had many interesting and trying experiences in various parts of Australia, which he relates with gusto and humour. The author's parents were pioneer missionaries to the aborigines, and he himself has followed worthily in their footsteps, enduring many hardships and living laborious days in the exercise of his calling. His father, the Rev. J. B. Gribble, seems to have been a man of forceful character, and the son was brought up in a hard school, which included the "laying on of hands" as part of the training. In his youth the author had to turn his hand to many and varied tasks, and his experience as a bushworker, builder, brickmaker's assistant, mechanic, and stockman, formed a fine apprenticeship for his future work as a missionary, when, almost single-handed, he had to carve from the wilderness a home for himself and his dependants, white and black, and to provide for their needs.

The narrative is simple, straightforward, and spiced with a wealth of anecdote both tragic and humorous. One cannot but admire the dogged determination and the heroic and self-sacrificing endeavour associated with the foundation of pioneer missionary stations in wild places, where toil and danger were constant companions, and the tact and firmness with which difficult situations were met and overcome. Some idea of the trials which face the valiant sons of the Church in their labours on behalf of the aborigines may be gathered from the following episode which occurred in the early days of the Forrest River Mission in Western Australia: "A few days after their arrival one of the party was accidentally drowned in the lagoon while trying to secure some ducks which the Bishop had shot. The Bishop swam in and brought out the body, and in a small dinghy the Bishop and a boatman took the body fifty miles to Wyndham for burial." The church militant and natant! Incidentally, Wyndham is described as one of the hottest places on earth, where in a trying summer the inhabitants have to feed their fowls on chipped ice to keep them from laying fried eggs.

The book contains much interesting information regarding the characteristics and habits of the aborigines, whom the author regards as capable of reaching a fairly high stage of development if given suitable environment and conditions of life. Many of the customs of the blacks are strange and even repulsive to our way of thinking, but Mr. Gribble respected their old beliefs and interfered with them as little as possible. On one occasion, however, he did effectually take a hand. A native had been severely wounded by a jagged spear, the wooden head of which remained in the wound. The black "doctor" attended the patient for several days sucking various parts of his body, then spitting out little pieces of wood, which he claimed were part of the spear head. Realizing that unless the wood was extracted the man would die, Mr. Gribble, with some difficulty, fastened a piece of cord to the spear head. With the aid of two assistants, he then pulled out the spear head. "That man's roars could have been heard a mile or so around," but he recovered.

C.A.