

In Nature's Workshop.

By GRANT ALLEN.

VI.—ANIMAL AND VEGETABLE HEDGEHOGS.



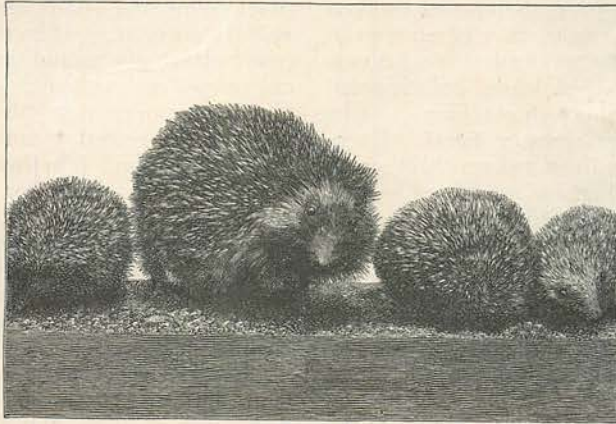
MAN was not the first inventor of coats of mail and ironclads. Two types of defensive armour are common in nature. The first type almost exactly resembles the jointed plate-armour of mediæval knights: one sees this kind well exemplified in the armadillo and the lobster; a little less well in the tortoise, the beetle, and many hard-shelled insects. The second type has no exact human analogue: it is offensive and defensive at one and the same time; one sees it exhibited in the porcupine, the hedgehog, the bramble, the thistle, and an immense variety of other plants and animals. With this second group the armour consists, not of plates, but of prickly spines or thorns, which repel assailants by wounding the tender flesh of the mouth or lips. Such prickliness of surface is perhaps the commonest among all the protective devices invented by living creatures:

it is remarkable for its universal diffusion both in various countries and in various classes. There are insect hedgehogs and vegetable porcupines. Indeed, scarcely a great order of plants or animals can be named which does not contain at least one or two such prickly or thorny species.

The common English hedgehog (shown in No. 1 in two characteristic attitudes) makes a good example of the prickly-armoured class with which to begin the examination of this interesting series. Everybody is tolerably familiar with the hedgehog's appearance—a squat, square, inquisitive little creature, one of nature's low comedians, with very short

legs and no tail to speak of, but covered on his back and upper surface with dirty white spines, which merge more or less into indefinite blackness. But if he is comic to us, he is serious to himself. Slow and sedate in all his movements, your hedgehog seldom does anything so undignified as to run: to say the truth, he is a poor racer; he is not built for haste, but strolls calmly along on his bandy legs, showing little sense of fear even when surprised on the open, for he is well aware that his coat of spines amply suffices to secure him from aggression. The hare trusts to his speed, the rabbit to his burrow; but the hedgehog relies upon his prickles for protection, and scorns to flee when he can

oppose to every foe an effective passive resistance. His bright, beady-black eyes form his one claim to beauty: they gleam with cunning: save for them, he is a dingy and unattractive animal. But though he belongs to a very ancient and honourable family—



1.—HEDGEHOGS, ROLLED AND UNROLLED.

that of the insect-eaters—long since superseded in most of the high places of the earth by younger and more advanced types, he still manages to hold his own in the struggle for life against all competitors, mainly by virtue of his excellent suit of spiny armour.

The hedgehog is, on the whole, a nocturnal animal, like most of this early group of insectivores to which he belongs. Now, as a class, the insectivores have been driven from the best positions in nature's hierarchy by the keen competition of the rodents, the ruminants, and the carnivores; they have been compelled to earn a precarious living in

out-of-the-way corners by night prowling. They are the gipsies and tinkers, the tramps and beggars of the animal economy. Our English hedgehog, one of the luckiest members of this persecuted class, lives usually in some comfortable hole in a hedge or copse, and sleeps away the daytime in owl-like seclusion. When night comes, however, he sallies forth on the hunt, in search of beetles and other hard-shelled insects, which form his staple diet, and for crushing which his solid set of grinders admirably adapts him. In winter, when insect food fails, he hibernates in his lair, rolling himself up in a thick blanket of dead leaves for warmth: his spines here stand him in good stead for a different function from that of mere defence, for he fastens the leaves on them as if they were pins, and so keeps himself warm and dry through the snows and frosts and rains of winter. He has a tramp's true instinct: he knows how to make the best of poor surroundings.

With the first genial showers of April, our prickly friend turns out once more, very thin and hungry, in quest of the insects which are then just emerging from their burst cocoons or their snug winter quarters. Often enough at this season he comes forth from his nest with a layer or two of leaves still impaled upon his prickles, in which condition he cuts a most quaint and amusing figure. Every evening he shuffles about awkwardly in search of his prey, which consists mainly of beetles, relieved by a pleasing variety of slugs, snails, worms, frogs, and young birds, as well as an occasional egg, and now and again a snake or a shrew-mouse. Though despised by man, in his own small hedgerow world he is an undisputed tyrant, and has few real enemies. Most higher animals are afraid to tackle him. A dog will just sniff at him with a dubious air of inquiry, but when the spines prick his tender nose, he draws back disgusted, and refuses to join battle with the uncanny, bow-legged creature. Indeed, the hedgehog's only serious foe is the owl, which has invented a special device for seizing him unawares. Almost all other mouse and rat-eating species fear to engage so well-armed an enemy.

The difficulty of the attack lies, of course, in his spines, a first line of defence which one may regard as typical of the tactics adopted among the whole group of prickly-bearing animals. These spines are hard in texture, and very sharp at the point: cylindrical in shape, and an inch long or thereabouts. They are lightly embedded in the

skin, and are so arranged that they can be erected at will into a most aggressive position. This trick of raising the spines is managed by an extremely interesting mechanism, something like the muscle by means of which certain gifted persons (chiefly schoolboys) can move and ruffle up the skin and hair of the head just above the temples, only on a much more extended scale of organization. The set of muscles thus specialized enables the animal to curl itself about in the lithest fashion. When an enemy approaches, the hedgehog does not flinch: he simply rolls himself up into a round ball. The South American armadillo does much the same thing: only, when the armadillo is rolled up, he becomes a mere hard sphere, something like a bomb-shell: whereas the hedgehog becomes an unapproachable globe of fixed bayonets. He tucks his head and legs well out of harm's way under his lower surface, and exposes only the spiny upper portion of his back and body. A great band of specialized muscle, assisted by several subsidiary belts, draws his supple skin tight over his whole body, and at the same time points the sharp ends of the spines radially outward. When a hedgehog is thus rolled up into his attitude of passive defence, no animal on earth can do anything with him in fair open fight, though some few of them have invented mean underhand tricks for getting round him by artifice. Most of these are too nasty for full description. Rolling him into water and drowning him is one of the least objectionable: but the method pursued by his chief human foe, the gipsy, though extremely cruel, is so quaintly clever that it seems to deserve a passing mention.

Gipsies never despise any form of wild food, and they have hit upon a perfidious dodge for utilizing the hedgehog. They catch him alive, which is always easy enough: for the little beast, trusting to his array of spines, seldom runs away when attacked, but contents himself with rolling himself up into his spherical and apparently lifeless condition. The season for hedgehogs is at the end of autumn, when the animal has fattened himself for his winter sleep. Kneading a ball of moist clay, the gipsies embed the poor creature in it entire, so that spines and all are completely covered. Then they lay the ball in their fire, and roast the unhappy animal alive. As soon as the clay cracks, the hedgehog is cooked: they break the ball, and the skin comes off whole, spines, clay, and all, leaving the steaming

hot body baked and savoury in the middle. I mention this curious but hateful trick because it is very characteristic of the sort of plan which many animals have adopted for getting rid of the spines or hairs in caterpillars and other protected but juicy creatures. What man does intelligently, that birds and quadrupeds also do and did before him by inherited and acquired instinct.

When the little hedgehogs are first born, the prickles are mere knobs, quite soft and flexible. As the puppies grow older the spines harden and become sharp at the point, and the little beasts acquire by degrees the power of rolling themselves into a ball like their parents. This power serves another purpose, however, besides that of mere defence: the spines and skin together form an elastic mass, so that when the animal wants to throw itself down a bank or precipice it rolls itself up into its sphere-like form and then trundles itself over the edge, blindfold and fearless, trusting to its elasticity to break the fall. When it reaches the bottom it uncoils itself quietly and waddles off about its business as if nothing had happened. The beady black eyes tell the truth as to their owner's intelligence: the hedgehog is an extremely clever and contriving creature.

It is interesting to note, too, that while in the mainland of the great continents—Europe, Asia, Africa—the hedgehogs and their like are all spiny, and possess the characteristic power of rolling themselves up into a perfect sphere, there are several half-developed hedgehog-like creatures, belated in various outlying islands,

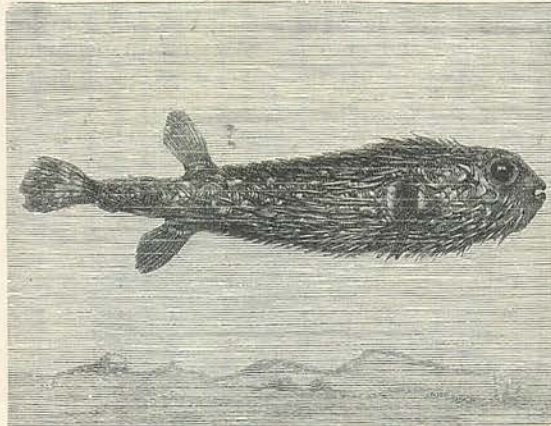
which are only rough sketches or imperfect foreshadowings of the fully-evolved type. Some of these, like the bulau of Sumatra, have just a few stiff bristles scattered about here and there among the hairs of the back; others, more advanced, like the Madagascar tanrec, have strong and stiff spines, but cannot roll themselves up into a perfect sphere like the true hedgehogs. Intermediate species also occur which more and more closely approach our European

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pattern. It is probable that these interesting undeveloped creatures represent arrested ancestral forms of our own English type: but that while in the great continents, the stress of competition has resulted at last in producing our highly-evolved form, a few outlying groups in isolated lands (such as Haiti and Mauritius) have retained to this day the earlier features of certain primitive stages in the history and evolution of the hedgehog family. We have here, so to speak, all the "missing links" in the development of the group, preserved for our edification, like living fossils, in remote and scattered oceanic islands. Even so, while Paris, London, New York, and Calcutta are civilized cities, the Andaman Islander and the Melanesians of the Pacific represent in our midst the primæval savage.

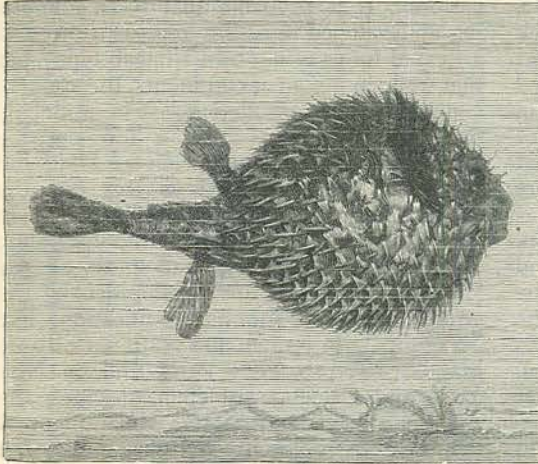
But the sea has its hedgehogs no less than the land: and the close similarity between the habits and manners of the two is a beautiful exemplification of the general principle that similar conditions produce similar effects even in quite unrelated plants and animals. The most interesting sea-hedgehog is a kind of globe-fish, and it is represented in its ordinary elongated swimming condition in No. 2. The porcupine-

fish, as this odd creature is often called, has a smooth, scaleless skin, thickly covered at intervals with sharp and stout spines. When the fish is swimming freely about in search of food, the spines are retracted, exactly as in the hedgehog, and point inoffensively backward. But let an enemy come in view, and, hi



2.—A SEA HEDGEHOG, THE GLOBE-FISH, SWIMMING FREELY.

presto! what a change! The porcupine-fish follows at once the tactics of his terrestrial analogue, and converts himself into a bristling ball of prickles, though by a somewhat different method. He rises to the surface and swallows in haste a quantity of air, which distends him instantly into a perfect balloon, as you see in No. 3. The skin is thus stretched tight like a drum, and the sharp spines stand out straight in every direction, forming a radial ball, exactly



3. THE GLOBE-FISH, INFLATED, WHEN DANGER THREATENS.

as in the case of the hedgehog. This erect and threatening condition of the spines is still better exhibited in No. 4, which shows the porcupine-fish as a very tough morsel for any aggressive shark or dogfish which may be minded to attack it. Oddly enough, the distention has one most unexpected result. When thus inflated, as if he were a Dunlop tyre, the fish becomes top-heavy, and turns upside down, floating passive on the surface with his back downwards. He does not attempt to swim, but lets wind and current carry him like a derelict vessel. Once the danger is passed, however, the fish expels the air from its mouth with a gurgling noise, and resumes its usual free swimming attitude.

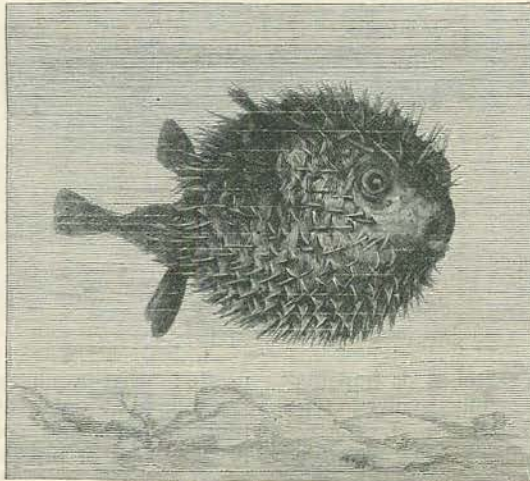
Few sea-wolves of any sort will venture to attack a globe-fish in its distended state: those that do so have often reason to regret it. Darwin mentions that globe-fish have frequently been found floating, alive and unhurt, within the stomach of a shark that has swallowed them, and even that one has been known to eat its way bodily through the devourer's side, so killing its would-be murderer. This feat is rendered possible by

the very hard and sharp jaws or beak of the globe-fishes, which resemble the hedgehog in this particular too—that they crunch extremely hard food, such as coral, shell-fish, and lobster-like creatures, for which purpose their solid tooth-like jaws are admirably fitted.

It is a pet theory of mine that whatever an animal does, some plant does also in all essentials. The hedgehog and porcupine with their vegetable imitators are good instances of the truth of this rough generalization. For there are plant hedgehogs and plant porcupines as well as animal ones. The most remarkable and strictly analogous examples of these spiny plants are of course the cactuses, which may be regarded as in one sense the porcupines, and in another sense the

camels, of the vegetable world. Cactuses grow wild only in very dry and poverty-stricken deserts, not absolutely waterless indeed, but given over for many months of the year to unbroken drought, and then drenched for a short time by the torrential rains of the tropical wet season. Under these circumstances, the cactuses have learnt to store water in their own tissues exactly as the camel does. They lay by, not for a rainy day, but for a dry one. Their stems have grown extremely thick and fleshy; the outer portion is covered with a hard

and glassy skin, which resists evaporation; and when the occasional rains occur, the provident plant sucks up all the water it can get as fast as it can suck it, and lays it by for future use in the cells of the bark and of the spongy pith which forms its interior. Protected by their layer of impermeable skin and their immense bulk from the parching sun and dry winds



4.—"WHO'S AFRAID? LET 'EM ALL COME!"

of the Mexican desert, the wily cactuses are thus enabled to hold out for months against continuous droughts, exactly as the camel holds out through a long march by means of the water he has similarly stored

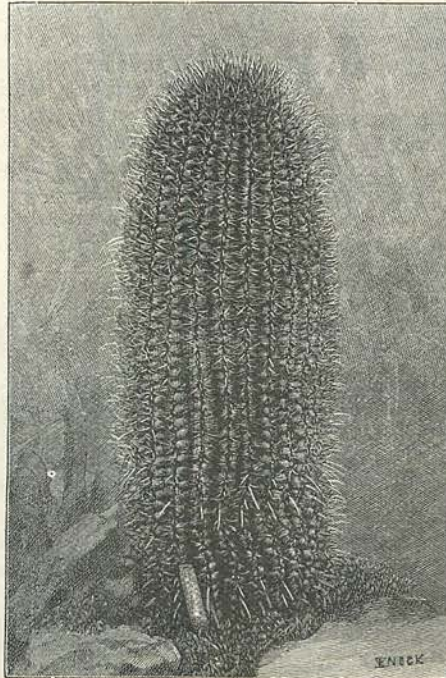
in his capacious and spongy stomach. They are, in fact, living reservoirs, which act as tanks for their own water-supply.

But the cactus has no green leaves ; or, rather, lest some clever critic should come down upon me, after the clever critic's wont, for this too sweeping generalization, I will say more guardedly, only a few half-developed and untypical cactuses have a few green leaves of the ordinary pattern : and these few species are not adapted for the most desert conditions. For clearly in very hot and dry countries thin green leaves would be worse than useless : they would be wilted up by the heat of the sun at once, and the plant would die for want of its accustomed mouths and stomachs. Hence almost all trees and shrubs which grow in very dry and hot regions have given up producing real leaves of any sort. In the Australian desert, it is true, the trees are covered with what look like leaves, but these are in reality thick flattened leaf-stalks : and even the leaf-stalks are all placed vertically, not horizontally, on the stems—stand with their flat edge or expanded surface sideways, up and down, instead of being extended parallel to the soil, to catch the sunlight : they are thus struck by the oblique rays in the early morning and late evening, when the sun has little power, but not by the direct and scorching rays of midday, which would burn them up and wither them. It is this peculiarity of vertical foliage (or what looks like foliage) which gives rise to the well-known shadelessness of the dreary Australian gum-tree forests. In the dry region of America, on the other hand, most of the plants have given up the vain attempt to produce leaves altogether, or even to imitate leaves by flattened branches : they let the green stem do all the work of eating and assimilating usually performed by the true foliage. That is why most cactuses have nothing that ordinary people would

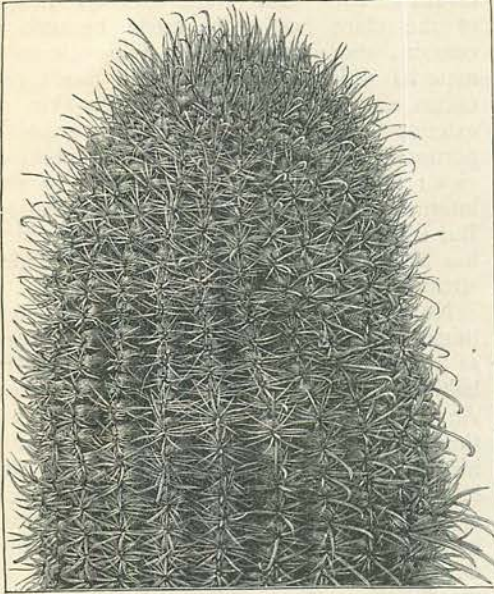
regard as bark : the whole exposed surface of the plant has to be green, because it contains the chlorophyll or living digestive material which assimilates fresh food : the cactus eats with every fold of its skin or exterior layer. In reality, this exposed portion is all bark, from a botanical point of view : and so is the greater part of the internal water-storing pith or spongy matter. But it is green bark, not brown : bark which has assumed the function of leaves under stress of circumstances.

Now, you will readily understand that, in a thirsty land, a plant so full of stored-up water as the various species of cactus must be very liable to attack from animals of all sizes. Any unarmed and unprotected kinds must thus from the very beginning of their family history have been greedily devoured by the herbivores of the desert. The consequence is that only the best protected and most hedgehog-like species have survived to our day, especially in the driest portions of the desert country. Nature is a great utilizer of odds and ends : she always finds some unexpected use for discarded organs. The cactuses, thus placed, and having nothing more for their leaves to do in the ordinary way of business, invented a new function for them by turning them into spines to protect

the precious store of internal water laid by in the spongy pith for the plant's own purposes. To deter thieves from breaking in and stealing this valuable deposit, they made their leaves ever shorter and stiffer, till at last they have assumed in many cases the form of regular rosettes of prickles, disposed in tufts over the whole surface of the plant that bears them. No. 5 shows us an excellent instance of these prickly and repellent desert types, a tall cactus which imitates in many ways a hedgehog, or still more closely a sea-urchin. No. 6 is an enlarged view of the top of the same plant, showing the thick



5.—A VEGETABLE HEDGEHOG, ONE OF THE SPINY CACTUSES.



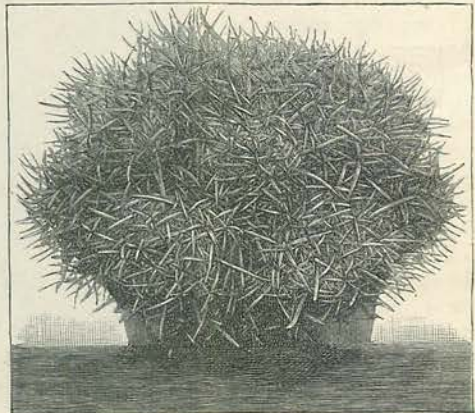
6.—TOP PART OF THE SAME, SHOWING THE ROWS OF FIXED BAYONETS.

coat of defensive spines, and the difficulty of attacking so bristling a treasure-house. Like a strong man armed, the cactus protects its vital water-supply with a serried row of weapons: it might almost be compared to a fort with an army mounting guard over its magazine, and fixed bayonets pointed in every direction. Observe how impossible it would prove to break the line anywhere: he would be a bold strategist who would venture to assault that perfectly defended position with its innumerable caltrops. The charge of the Lancers at Omdurman would be a mere trifle to it.

Nevertheless, astute enemies do sometimes manage to get the better even of these experienced vegetable tacticians. The horses that roam half-wild over the arid plains of upland Mexico will often combine to kick down the tall pillar-like cactuses which grow upright in those regions, knocking them fiercely with their hoofs, and then eating the soft and juicy pith, with its ample store of contained water. They will also trample open the globular forms which abound in the same district, and feed greedily upon the succulent interior. But only extreme thirst and hunger would drive them to tackle so dangerous a plant, and we must remember that horses are not native to Mexico or to any part of America: they were first introduced (in modern times at least) by the Spanish conquerors: therefore the cactuses

could not have been originally developed with an eye to defence against such solid-hoofed enemies. As a rule a cactus hedge is practically impervious to animals: hardly any living beast will venture to face it. Even the wild horses themselves often receive dangerous wounds while kicking cactuses, which thus avenge themselves on the invading army.

Various degrees of hedgehoginess exist, however, among the cactus group: there are more developed and less developed forms, according to the nature of the soil and the amount of rainfall or the character of the enemies to be expected locally. Some kinds, such as the leaf-like *Phyllanthus*, often grown in conservatories, are quite unarmed. Others, such as the well-known prickly pear—an American cactus now largely naturalized on the Riviera, in Italy, in Algeria, and in Syria—have comparatively few spines, though they are well beset with little groups of short sharp hairs, which break off at a touch and cause an immense amount of trouble in the hands when one rubs them. The fruit of the prickly pear is intended to be eaten: it relies upon animals for the dispersion of the seeds: it has therefore relatively few spines, but it must nevertheless be handled with caution. Other forms of cactus are progressively shorter, stouter, and more spiny, until at last, in the most exposed spots, we arrive at that most perfect of vegetable hedgehogs, the globular melon cactus, many species of which are commonly cultivated in pots in England, more for the oddity of their form than for the sake of the flowers. This quaint little creature is as round as the rolled-up hedgehog or the inflated globe-fish; and it is protected by a perfect array of thick and prickly spines. No. 7 shows one of these



7.—A STILL PRICKLIER CACTUS, ALL SPINES AND DEFENCES.

extremely dense forms, where the need for defence seems to have swallowed up the whole plant—like a military despotism, it has no time to think of anything but warlike preparations. Such types grow always in their native condition on very dry and open spots, where every living plant is eagerly devoured by the starving animals, unless it covers itself in this fashion with a regular arsenal of daggers and javelins.

It may have surprised you to be told that the spines of cactuses are in reality the last relics of the true leaves: I will return to that point a little later, and show by what gradual stages this curious transformation has been slowly effected. But for the present I want rather to insist upon the point that desert conditions almost necessarily run to the production of excessive prickliness in all sorts and conditions of plants and animals. Where water is so scarce, food is scarce too: and where food is scarce hunger drives the few animals which can exist in the dry region to attack every living thing they come across, be it animal or vegetable. Hence, the smaller animals of deserts have need of protection just as much as the plants. Western and Southern Australia, as everybody knows, have a very dry climate, and they are provided accordingly with a most prickly and spiny fauna and flora. Their bush is sparse and extremely thorny. No. 8 shows you a very characteristic specimen of the animal forms which arise under such conditions. It is a lizard which frequents the driest and sandiest soils of that desert tract, and it is specially adapted for holding its own against the local lizard-eaters of the neighbourhood it inhabits. Science knows it by the scriptural title

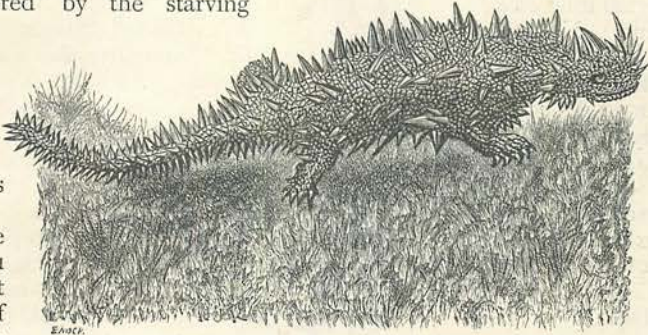
of Moloch—and, indeed, it is ugly enough and repulsive enough to be called any bad names; but the Western Australians, less polite in their speech than the Royal Society, describe it familiarly as the "thorny devil." It is one mass of spines, and its head and brain

in particular are specially protected by a couple of prickly horns, bent almost like fish-hooks. The Moloch, in spite of its name, is a harmless creature: it does not attack: it uses its armour only, like the commonthistle,

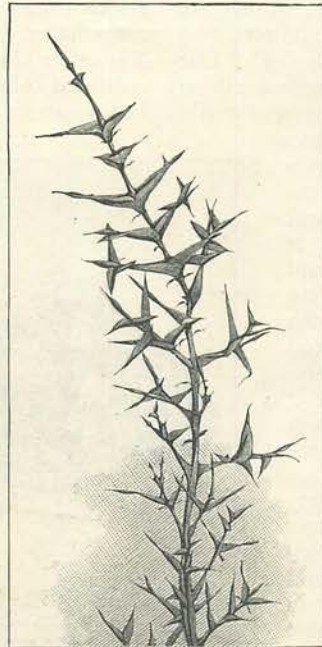
for defence, not defiance. But, like most prickly beasts, it knows it is practically safe from aggression, for it is as slow as the hedgehog in its movements, and basks openly on the sandhills, aware that few foes will venture to attack it.

A glance at No. 9, however, may bring into still stronger relief the point which I am labouring to show—the close analogy which

always exists between plant and animal life under similar conditions. Here we have a bush which exactly represents the thorny Moloch in the vegetable world. The desert regions of South America, indeed, are full of prickly or armour-plated animals: and in the same desert regions we get a whole group of intensely spinous and armour-plated plants and shrubs, of which No. 9 is a capital example. This curious bush, known as *Colletia*, is now fairly common in hot-houses in England, and is grown outdoors on the arid hills of the Riviera, where so many desert shrubs from Mexico, Arabia, Australia, and Peru find a congenial home. It is really the prickliest thing I know, for its branches are very stiff and its points very sharp, and I have never tried to handle one without



8.—A PRICKLY LIZARD, THE MOLOCH OR "THORNY DEVIL."



9.—A PLANT OF THE SAME TYPE—
THE COLLETIA.

wounding myself severely. The same conditions which make prickly animals make prickly plants: and *Colletia* is prickliness pushed to its utmost possible limit. It is true, the sharp ends are not so numerous as in many other instances, but they are as hard as steel, and as penetrating as a surgical instrument. Nobody tries twice to fight a *Colletia*.

Our common English gorse, represented in No. 10, will help to show how foliage-leaves can be developed into mere defensive spines, as we saw with the cactuses. I have already explained in this Magazine that the young gorse seedling has trefoil leaves like a clover, and have pointed out how, as it grows older, the successive blades become sharper and sharper, until at last they assume the shape of mere stiff prickles, scarcely to be distinguished from the pointed branches on whose sides they sprout. The illustration exhibits very well the intensely protective nature of the spines, which are so arranged as to defend the flowers and buds from the attacks of enemies. Our common heather also tells one something the same tale: its leaves are spiny, and would readily enough degenerate into prickles if need were: the cactuses have only carried the same tendency a degree farther, and reduced the flat part of their leaves till nothing is left of them except the prickly termination. Imagine a holly leaf or a thistle leaf with the fleshy portion suppressed, and you have an epitome of the probable history of the cactus-spine in the course of its development from expanded foliage to defensive prickle.

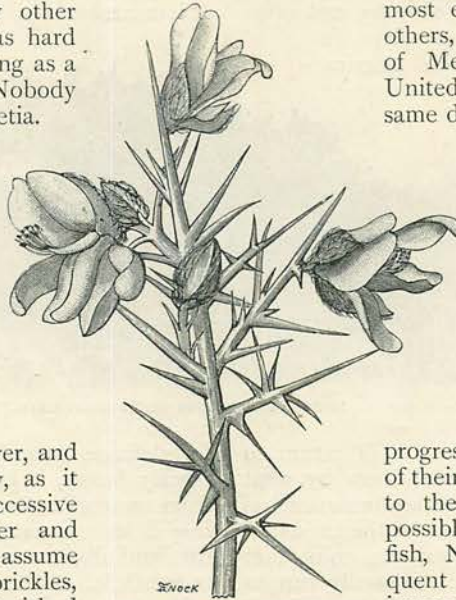
Indeed, in certain types, every stage occurs between the plants and animals which are quite undefended, through the plants and animals which are defended in part only or on the most vulnerable points, down to the plants and animals which seem reduced ex-

ternally, like the sea-urchin and the melon cactus, to a mere rugged mass of defensive javelins. Thus, among lizards, the iguanas have a sharp row of spines down the back only, the back being the part most exposed to attack: while others, like the horned lizards of Mexico and the southern United States, inhabiting the same dry region as the cactuses,

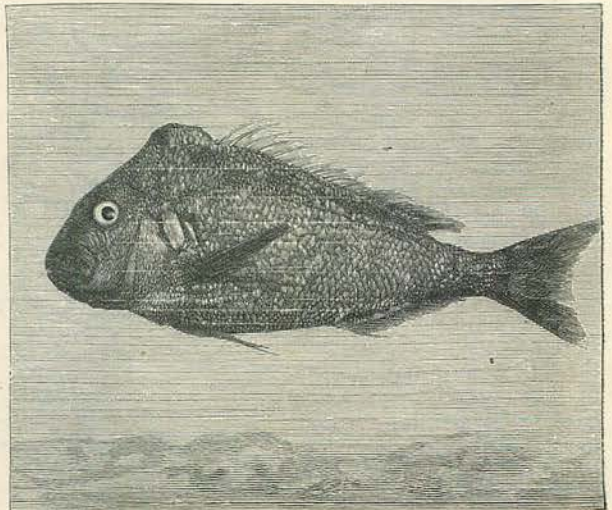
are almost as closely covered with protective spines as the Australian Moloch. In the Arabian desert, once more, we get the thorny-tailed lizards, whose hinder portion is ringed round with prickles; and in other dry districts we find other protected kinds,

progressively varying in the stage of their armour from the simplest to the most complex in every possible gradation. So among fish, No. 11 represents a frequent type, answering to the iguana type among lizards, where a few strong spines on the crest of the back seem sufficient to

deter most would-be assailants. Our own stickle-backs, as I have pointed out before, are smaller examples of the same principle. But other kinds of fish have more and more scattered spines over the whole body, till at last we arrive at highly protected species like



10.—BRANCH OF GORSE, WITH SPINES DEFENDING THE BUDS AND FLOWERS.



11.—A FISH, DEFENDED ON THE BACK ONLY.

the inflated globe-fish, which are veritable hedgehogs both in shape and in prickliness. You may observe that the best-armed kinds are almost always globular in form, at least in their defensive attitude, and are equally covered with prickles all over, because a sphere is, of course—as a soldier would say—the hardest “formation” to attack, while the equal distribution of the spines leaves no loop-hole for approach to the most cunning assailant.

An exactly similar gradation from the unarmed through the partially armed to the highly defended can easily be traced in many groups of plants. Take for instance the thistles. Here, there are one or two species which, though they look much like other thistles both in foliage and flower, have really no actual prickles at all; the ends and angles of the leaves, while shaped as in the armed sorts, are quite soft and yielding. Then there are more advanced types which have hard prickly points to every lobe of the leaf, but still can be grasped by the smooth and unarmed stem; these kinds live mostly in rather exposed spots, but not in those where competition is fiercest and grazing animals most numerous. Last of all, we get species like the one represented in No. 12, which have the leaves prolonged down the stem by means of prickly wings, so that every portion of the plant is absolutely protected. Such sorts are developed on open commons and in boggy clay soils where pasture is abundant. In the nettle tribe, the same tactics are carried still further, for there each hair or prickle has a poison-bag at its base—a sort of snake's fang in miniature—and positively stings the invader like a bee or a mosquito.

This is an extreme instance of that likeness of plan which everywhere pervades plant and animal life. If we knew stings only in hornets and wasps, we should laugh at the notion that a weed could resent and resist intrusion by injecting poison into its assail-

ant: yet nettles are such common and familiar objects in a country walk, and have so often forced themselves upon our unwilling attention, that we have almost forgotten how to be astonished at the marvel of their behaviour.

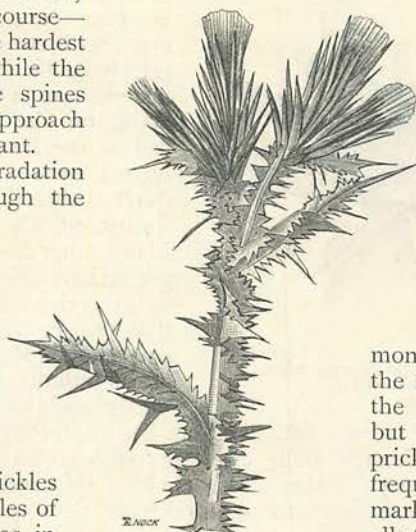
The sea is, if possible, even fuller of prickly creatures than the land. Against our hawthorn bushes, our brambles, our porcupines, and our “thorny devils,” it sets an immense array of spine-bearing animals of every conceivable type and pattern. They occur in every group. The com-

mon lobster belongs merely to the armour-plated section, like the tortoises and armadillos: but there is a well-known prickly lobster which also comes frequently into the London market, and which has its back all studded with defensive spines of the most deadly character. Similarly, most crabs have smooth shells; but there are

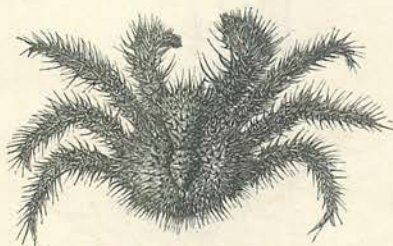
certain prickly devil-crabs (No. 13) which consist of one serried mass of dense spikes, and which probably never get attacked at all by any other animal. The edible prawn is not prickly all over like these crabs, but he has a saw-like beak, which must suffice to ward off most assaults of his adversaries. A great many mollusks have shells with spines and other sharp projections, and these obviously serve to defend them from their

enemies. But it is among the smaller and lower sea-beasties that one finds the greatest number of prickly forms. The starfish are frequently spiny on their exposed upper surface, and the very name “sea-urchin” is equivalent to sea-hedgehog, urchin being an old-English corruption of the French *hérisson*. Most

of the sea-urchins are intensely prickly: the curious one depicted in No. 14, where it is partly deprived of its spines, to show the shell, is not so much prickly as difficult to tackle for want of a point of approach: it resembles rather a blunt arrangement of

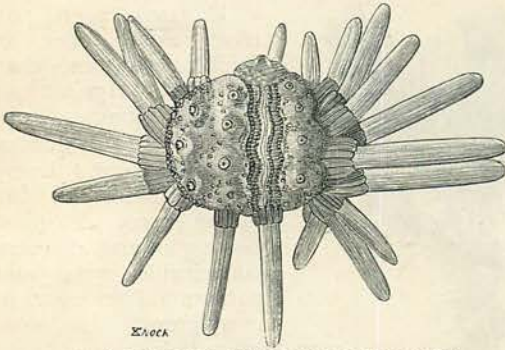


12.—A SPINY THISTLE, WITH PRICKLES RUNNING DOWN THE STEM.



13.—THE PRICKLY CRAB.

chevaux de frise than a circle of fixed bayonets. Roughly speaking, one may say that an immense majority of the lower creatures in the sea are more or less protected in one way or another. Either, like the urchins, they have



14.—A SEA-URCHIN, WITH SOME OF THE SPINES REMOVED TO SHOW THE SHELL.

spines and spikes : or, if they are soft, like the jelly-fish, then they frequently sting : or, if they do not possess either prickles or a stinging fluid, then they are nasty to the taste, and advertise themselves as such by means of brilliant colours, as is the case with a great many sea-slugs. A walk through the galleries of the Natural History Museum at South Kensington will show you at once how extremely frequent are these prickly animals, especially in the sea. And here I will just add parenthetically that it is very little use strolling listlessly through such collections, as most people do, with a casual glance right and left at the various cases : if you want a visit to a museum to do you any good, you must select some such line of study for an afternoon as this, and go through the corridors looking out carefully for the different plants and animals which exemplify (say) this defensive prickly habit in every direction.

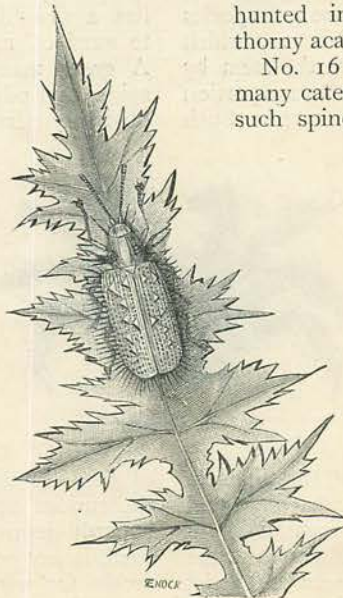
Even insects are often prickly, though we are a little apt to overlook the real prickliness of these smaller types, because it often does not look to our clumsy big eyes much more than mere hairiness, or even downiness. What is

to us men a soft fur on the stem of a plant will often prove to an ant an impassable jungle like a tropical thicket. and what looks to our sight a woolly caterpillar, may seem to a bird a harsh spine-covered creature. Sometimes, however, the spines on insects are spines even to our human eyes : as is the case with the well-defended prickly beetle illustrated in No. 15, where the creature is seen appropriately walking about on the leaf of a favourite thistle, just as the hedgehogs skulk among gorse or blackthorn, and as the prickly lizards dwell habitually in regions of prickly shrubs, prickly weeds, and prickly bushes. Many other beetles have spiny horns or projections which serve them in good stead as protective devices : a well-known case is that of our large and handsome English stag-beetle. Most of these armed creatures are as little likely to be molested by importunate enemies in their own small world

as the hedgehog, the porcupine, and the sword-fish are likely to be molested in larger circles. Of course it is impossible here to do more than quote a few examples out of the thousands that exist : but there are wide regions of the world where almost every plant and a vast number of the animals are thus covered with sharp thorns, or spines, or bristles. This is especially true of the Mediterranean region, as everyone knows who has wandered on the dry hills behind Nice and Cannes, or botanized the prickly bushes in the North African mountains, or hunted insects among the dry and thorny acacia scrub of Syria and Egypt.

No. 16 introduces us to one of the many caterpillars which are protected by such spines or bristles as seem to us

men scarcely more than hairs. It is the well-known larva of the tortoiseshell butterfly. At first sight, you would hardly suppose that these hairs could be classed among the spikes and prickles we have hitherto been considering. But just imagine yourself a bird, and try to think of yourself as swallowing one of these hairy insects. It must be pretty much the same thing as if you or I were to try swallowing a clothes-brush. As a matter of fact, indeed, protected caterpillars like these are



15.—A PRICKLY BEETLE.

seldom or never eaten by any of the small birds which frequent our hedge-rows; though they have other enemies which manage to tackle them somehow. The cuckoo, for example, is an insatiable caterpillar-eater, and, strange to say, he delights, most of all, in the hairy forms. He seems to have a throat specially constructed for bolting them, while the hair or bristles form at last a perfect coat of felt in the bird's stomach. That is characteristic of the check and counter-check of nature: every move on one side is met and defeated by an opposite move on the other. Nevertheless, it is quite clear that most hairy caterpillars are amply protected from the majority of their enemies, for they show themselves openly, like hedgehogs and porcupines, and do not attempt concealment like the edible sorts; though when attacked, they often roll themselves up into a ball, after the fashion of so many other animals in this protected group, and turn a uniform set of stiff bristles towards the attacking party.

It cannot be by accident, I think, that the globular form is assumed in such different cases both by thorny plants and by prickly animals. The various creatures must have learnt by ancestral experience that this spherical arrangement of the spines or hairs is the best mode for defence: and while some of them, like the melon cactus and the sea-urchin, assume it permanently, others, like the hedgehog, the globe-fish, and the woolly-bear caterpillar, assume it only when special danger threatens. It is curious to note that something similar happens with armadillos

and woodlice, as well as with many marine animals of the armour-plated kind. Analogies like this run all through nature: they recur again and again in the most unlike classes. What succeeds in one place will succeed in another, where conditions are similar: whatever device is hit upon by one plant or animal is almost certain to be independently hit upon in like circumstances

by some other elsewhere. We are all of us a great deal less original than we suppose: and as for us men, it almost invariably happens that our latest invention has been anticipated ages ago by a grub or a sea-anemone. When we prepare to receive cavalry on a thick wall of bayonets at different angles, what are we doing after all save imitating a device long since inaugurated by the hedgehog, the cactus, and the hairy caterpillars? Our hollow square is but an echo of the sea-urchin's

shell; our armoured ships, with their destructive rams, are strikingly like the lobster with his pointed forehead. If you look abroad in nature for such hints and anticipations of human progress, you will find them on all sides—especially as regards the arts and stratagems of war. It is only in the highest industries of peace and the fine arts of beauty that we have really got so very much ahead of our dumb relations. For desert warfare, in particular, was there ever a finer strategist than the humble melon cactus? Commissariat is always the great problem in the desert; wells are the crux: he has solved that problem and avoided that crux in a way that would seem to deserve a peerage.



16.—A PRICKLY CATERPILLAR.