In Nature's Workshop.

By Grant Allen.

VIII.—ARMOUR-PLATED ANIMALS.

MEN and monkeys, we all know, are imitative creatures; but there are few departments of human life where man has been so entirely anticipated and at the same time surpassed by the lower animals as in the invention of armour. His cunningest devices of the mailed fist order were none of them original. If you examine a fine and fully-developed suit of plate-armour, in the form which it assumed at its highest zenith in the fifteenth century, you will find that the trunk and limbs were completely inclosed in a splendidly-fitting jointed case of iron plates, all exquisitely polished. The joints of these plates were arranged in the most ingenious manner so as to move freely over and under one another, without exposing any part of the body for a moment to the deadly chance of a sword-lunge or a lance-thrust. For example, the scale-like pieces which covered the shoulders were cleverly protected at the edges by fan-shaped projections, making it impossible for an enemy, however quick and deft, to get at the line of junction. The knee-caps, the shoes, the elbows, the gauntlets, all the minor parts of the caparison, were admirably designed with great skill and care, so as to afford the utmost possible security to the wearer, and yet interfere as little as practicable with his freedom of movement. The suit, as a whole, was a triumphant product of the armourer's art. Yet if you look at the lobster's tail represented in No. 10, you will see at a glance that all these clever devices of man's imagining had been invented and patented long before by nature, and that the elaborate workmanship of the Plantagenet craftsmen, who cased knight and horse for the battle-field or the tournament in movable plaques of glistening metal, was but a poor imitation of the ineffable skill with which the unheeded crustaceans of the time protected every vulnerable portion of their bodies from the assaults and attacks of their submarine enemies. Gorget and visor and greaves and hauberk yield in perfection of fit and in absolute ease and freedom of action to the beautiful blue-black male of these rock-haunting paladins, or to the absolutely unassailable yet flexible corselets of the little burrowing South American armadillos.

It is interesting to notice, too, that just as in the case of the prickly plants and animals, so in the case of the armour-plated types, members of the most dissimilar and unrelated families, when circumstances happen to call for the development among them of mail-clad forms, produce on the whole extraordinarily analogous suits of panoply. They crop up everywhere. With the exception of the birds, which are never armour-plated (for one can hardly conceive of a flying ironclad), there is scarcely a single great group in the animal kingdom which does not number among its members one or more such cuirass-bearing species: and all the armoured types, from China to Peru, resemble one another in the most astonishing manner. It seems as if even nature could only find one central plan for coats of mail. Often, indeed, the resemblance is so close between unallied kinds that only a naturalist can perceive the deep underlying diversity in the midst of so much apparent similarity of external configuration. Just as a knight in armour and a horse in armour seem almost to belong to the same general group of articulated animals, so the armadillo absurdly resembles the tortoise, though one is a mammal and the other a reptile: while the similarity in type of the molluscan chiton (No. 12) to the common wood-louse (No. 5) is so close that it might deceive almost anyone but the scientific observer.

As a good introduction to the tactics of the plate-armoured class in general, I will begin with some brief account of the curious South African and Indian pangolins, or scaly ant-eaters. No. 1 exhibits a typical specimen of this quaint and belated race, the short-tailed pangolin, various modifications of which are found in most of the southern parts of the Dark Continent, from the West Coast and Mozambique to Zanzibar and Somaliland. The pangolins are also a good

set of armour-bearers to begin upon, because, curiously enough, they stand about half-way in military tactics between our old friends the prickly hedgehog group, whose armour is offensive, and the turtle group, whose armour is defensive only. As we shall see a little later, the pangolins (like the White Knight in "Alice," with his spiky armour) to some extent unite both these methods of passive warfare: they are turtles when unrolled, but turn into incomplete hedgehogs or porcupines if hard pressed by assailants.

1.—TILE-SHAPED PLATE-ARMOUR: THE PANGOLIN.

A glance at the portrait of the short-tailed pangolin in No. 1 will show you at once that this uncouth beast is clad from head to tail in serried plates of defensive armour. He is about two feet long, and his head, I will admit, is remarkably small for his size: to say the truth, he does not possess much brains to speak of, being a fairly dull and unintelligent animal. Central and South Africa have never been famous for evoking the higher intellectual qualities: most native races there, whether of Hottentots or beasts, are tolerably stupid. And the pangolin is, so to speak, the Bushman among South African mammals. The great peculiarity of the race, the point that has told for them in the struggle for existence, in spite of their stupidity, is the thickness of their skin, or rather of their solid plate-like covering. This covering consists of large and sharp-edged scales, which overlap one another like the tiles on a house—another example of nature anticipating humanity, though to be sure in this case fishes had already anticipated pangolins. The origin and character of the scales is in itself one of the queerest points about this very queer and uncanny animal. They are composed of hairs, which have grown side by side and got gummed to one another, as it were, by an organic secretion: they are clotted curls, so to speak: in the very young cub, they are quite soft and light-coloured (like the prickles of new-born hedgehogs); but as the cub grows older, they become gradually harder and darker. In the full-grown pangolin they form a complete suit of jointed and plated armour, each plate being fastened at one end and free at the other, tile-wise, an arrangement which allows of great ease of movement. Part of the head, however, and the under portion of the body are comparatively unarmed: and this gives rise to the habit of rolling up, which we have already observed in the case of the hedgehog and other prickly animals.

While the pangolin is walking, or rather shuffling along, for he is an ungraceful promenader, he is sufficiently protected from most enemies he is liable to meet on his nightly excursions — he is a nocturnal creature—by his scaly suit of impenetrable armour. But when any particularly persistent foe tries to investigate him too closely, or to attack his one exposed and vulnerable point, the head, then the pangolin grows angry and forthwith adopts the hedgehog tactics. He rolls himself round into a ball (for which his arched back is admirably adapted), tucks his snout between his legs in front, and covers it from behind with the scaly tail, which is similarly tucked under him: and in this safe position, a living sphere, he sticks out his sharp scales at right angles, thus offering their unpleasantly pointed edge to the tender nose of his astonished adversary. Further inquiry is thus instantly obviated.

The resemblance to the hedgehog in all this is so striking that one might at first sight imagine the two creatures were closely related to one another. But this is not the case. The likeness is a likeness of habit only. The hedgehog is an insectivore, while the pangolin belongs to a very ancient and almost extinct group of animals, the toothless mammals or edentates, once widely spread over the surface of the earth, but now surviving only in a few outlying and unprogressive countries. It is well known to zoologists that South Africa, South America, Southern India, and Australia are (so far as their types of life are concerned) very belated and antiquated regions: they are not up to date: the animals which inhabit them are of those slow-going kinds which once

roamed over Europe, Asia, North Africa, and North America, but which have been long since replaced in the go-ahead continents by much more advanced and business-like creatures. Sloths, wombats, armadillos, ant-eaters, are types of the older and slower sort; lions, tigers, deer, antelopes, monkeys, are types of the newer and more progressive fauna. Now, it is odd that out of the eight or ten species of pangolin known to men of science, half live in Central and Southern Africa, and the other half in India, Java, and Southern China. That is to say, they are scattered survivors of a kind once more widely spread, like the Finns and Lapps in Europe, the Eskimo in America, and the Samoyedes in Siberia, among human races.

At the risk of saying too much about one group alone among my armour-plated series, too, I must just find room to add here that the pangolin's second name of scaly ant-eater sufficiently describes his mode of life and staple diet. The little beasts are burrowing animals, and they have a very peculiar, long, worm-like tongue, which they can dart out and retract with lightning rapidity. The tongue is also covered with a sticky glutinous secretion: and this secretion serves the pangolin in good stead in earning its daily bread, or rather its daily ants and termites. It is a curious sight to see them feeding. The animal makes an opening in the nests of the insects on which it preys, and darts out its extensible tongue into the galleries of the interior. The ants or termites rush out, as is their wont when disturbed, to repel the invader. They are then caught and entangled in the sticky secretion, like flies on treacle-paper; as soon as the pangolin has secured as many as will make a mouthful, he withdraws his tongue or trap, and swallows his haul with great gusto. For this reason he has no need of teeth: but he grinds up his food internally afterwards, in a sort of gizzard-like stomach, assisted (as in the case of many birds) by occasional pebbles which act as mill-stones.

You may also perhaps observe that the pangolin's fore-feet have very long curved nails or claws, looking as if his mother had carelessly neglected to cut them in early infancy. These claws are excellently adapted for burrowing, and also for breaking into the nests of white ants and other tropical insects; but, on the other hand, they are so much bent under (like a hoe or pick) that, when the animal walks, he has to shamble along ungracefully on what ought to be their upper surface. This, however, does not greatly matter, as the pangolin is an infrequent and unobtrusive walker: he is generally engaged on private business underground; when he emerges into the open, it is mostly by night, in search of ants; for, being a slow and tardy creature, he naturally obeys the antique precept, "Go to the ant, thou sluggard." He shuffles along as best he may from nest to nest on the plain, in an awkward, slipshod fashion: and since he doubles himself up when attacked by more powerful animals, the clumsiness of his pace does not seriously harm him. Indeed, you will find that almost all armour-clad or prickly creatures are slow of progress: being amply protected by their coat of mail or their suit of spiny quills, they have little need of the fleet foot of the hare or the slender limbs of the timid antelope.

2.—THE TREE-HAUNTING PANGOLIN.

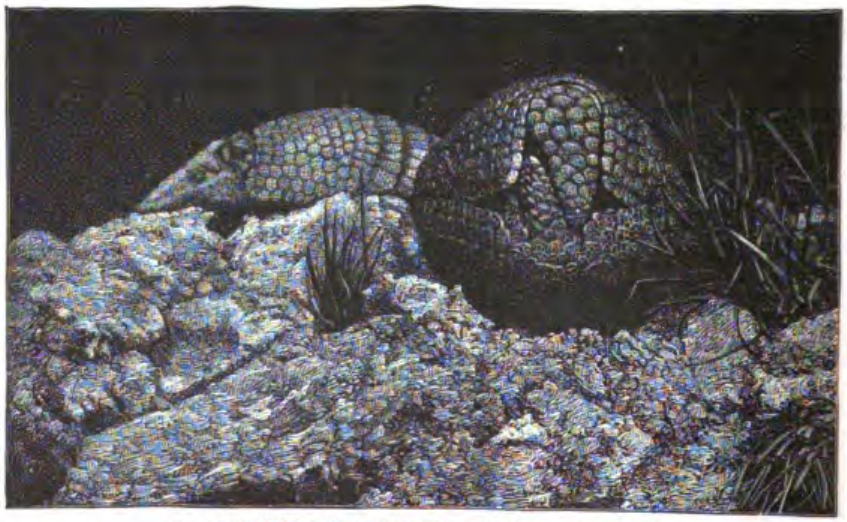
A somewhat different type of pangolin, also from the Dark Continent, is represented in No. 2, which shows the portrait of the pale brown scaly ant-eater, a West African species. This creature, though it nests underground, is not so much a burrower as a tree-climber: its scales each end in three sharp points, which give it a little more of the hedgehog character. Oddly enough, it has also one very hedgehog-like trick, for it will roll itself up into a ball as it sits on the branch of a tree, and then fearlessly trundle itself over, trusting to the elasticity and

3.—SOLID CUIRASSES: THE THREE-BANDED ARMADILLO.

solidity of its scales to break the fall for it. The pangolins, as a whole, indeed, have been well compared to "an animated spruce-fir cone, furnished with a head and legs." Nothing could better describe their quaint appearance.

Now, if we run right across the southern hemisphere from Africa to South America, we shall find once more another curious group of armour-plated animals, belonging to the same great order as the scaly ant-eaters—the ancient and almost moribund order of edentates—and living like them upon ants and termites: but otherwise very different in many important points of structure. These are the comic little armadillos, a great many species of which are now known—odd-looking wee beasts whose general type is well exhibited by the photographic portrait of the three-banded armadillo in No. 3. This portrait, together with several others in the present article, has been taken from the excellent specimen in the British Museum, and I desire here to express my thanks to the authorities at South Kensington for the kind way in which they have permitted Mr. Enock and myself to overhaul and pose their treasures. But the oddest point of difference between the armadillos and the pangolins is the nature of their covering: in the pangolins, the plates of the armour are horny in texture, and consist of united or agglutinated hairs; in the armadillo they are bony, being composed of bone-material deposited in the true skin in the shape of little shields, though each such shield is also itself once more inclosed or overlaid by a horny plate, developed in the epidermis or outer scurf-skin. In the particular instance I have chosen for our illustration—that of the quaint and dainty little three-banded armadillo—the coat of armour consists of several distinct portions. First, there is the cuirass or shoulder-shield, a sort of solid cape, within which the head and fore legs can be completely withdrawn. Then there is the jointed central part, consisting of the three movable bands from which the animal takes its Christian name, so to speak, being distinguished from the rest of the armadillo family in general as the three-banded armadillo: this central part is girt in rows of plates with movable skin between them, and is extraordinarily flexible and easy in its movements, the parts gliding beneath one another in the most admirable and workmanlike manner. Then comes the hind shield or body-armour, a sort of mantle for the flanks, with a notch in it to receive the tail; and this part serves to protect the hind legs as well as the whole of the back and digestive apparatus. Finally, a smaller set of plates protects the forehead and face, while another set covers the tail: so that only the under surface of the body is at any time exposed to the attacks of enemies.

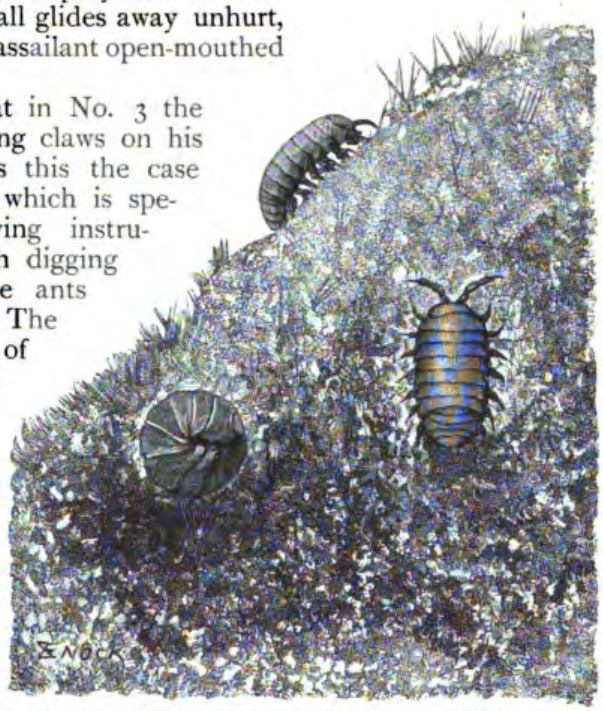
That is how the armadillo looks when it is abroad on its hunting expeditions and fears no foe: but let danger threaten, and, quick as thought, the little beast immediately clears the decks for action, as you see in No. 4, where it is shown preparing to receive cavalry.



4.—AN ENEMY THREATENS: THE ARMADILLO RETIRES.

A dog or other inquisitive assailant has manifested a desire to investigate the armadillo: the armadillo wisely declines to be examined, and prefers to retire into the privacy of its internal consciousness. By a strong muscular contraction, it folds itself up bodily: the head and fore legs retreat behind the cuirass or cape; the hind legs tuck themselves away neatly in the recess of the body-shield; and the armour-plated upper surface of the forehead and tail fill in the interspaces of the notched coat of mail, lying side by side in the crevice and completing the general globular form of the new position. When thus rolled up into a perfect globe, the armadillo is even better protected from attack than the hedgehog: for if a beast of prey tries to bite it, the smooth living ball glides away unhurt, and leaves the baffled assailant open-mouthed and wondering.

You will notice that in No. 3 the armadillo has very long claws on his fore-feet: especially is this the case with the middle toe, which is specialized as a burrowing instrument, and is useful in digging up the nests of white ants and other insects. The armadillos pass most of their life underground, and seldom venture out except in search of food or mates. But they are not for the most part nocturnal. All the existing kinds are comparatively small — none of then longer than 3ft.—but many of their cousins in late geological times were much more formidable in size, and must have looked like gigantic turtles. An extinct species, known to science as the glyptodon, measured no less than eleven feet in length; while a still more closely-related type, the chlamydothere (I am not responsible for these very learned words), was almost as formidable as its own name, for it rivalled in bulk our modern rhinoceroses. Such colossal creatures, clad in plate-armour to match, must have moved about like living terrestrial ironclads, and are sure to have been better respected than loved by most of their contemporaries.



5.—LIKE CAUSES, LIKE RESULTS: THE "ARMADILLO" WOOD-LOUSE.

It is to descend from the sublime to the ridiculous, I admit, to go straight from these huge South American fossil monsetrs to the common little wood-louse of our English copses (No. 5). Yet the resemblance of habit in that lurker under stones to the burrowing beasts of the Argentine Pampas is so great that many prim speakers, disliking the strong Saxon flavour of its good old English name, habitually speak of our British wood-louse as "the armadillo"; even science itself has sanctioned the usage in the slightly altered form of *armadillidium*. If you lift up a fallen log or mossy boulder in almost any English grove, it is ten to one that you will find crouched beneath it a curious little many-legged running beast, very smooth and shiny, who tries to avoid the light, and scampers away the moment the wood or stone which forms the roof is removed from his underground dwelling. Touch him with your finger, and he doubles himself up instantly into a shiny ball, as you see in No. 5, being then protected from harm by his tough shell or armour-plated carapace. So smooth and round is he, indeed, that he rolls away from your grasp, like a glazed pill, and can hardly be picked up save with a little care. He is not an insect. The wood-lice are land-haunting crustaceans, remote relations of the crab and lobster, marine creatures which have stepped boldly on shore and adapted themselves to the habit of breathing air, though they still live in moist holes or crannies, among dark damp spots, hiding through the day, and prowling forth in search of food at night-time. They are vegetarians by conviction and habit, and live mainly on dead leaves, though they have also a decided fondness for living lettuces. But the curious thing about these little beasts is that, though they are crustaceans by descent, utterly unrelated, of course, to the armadillo or any other mammal, they have

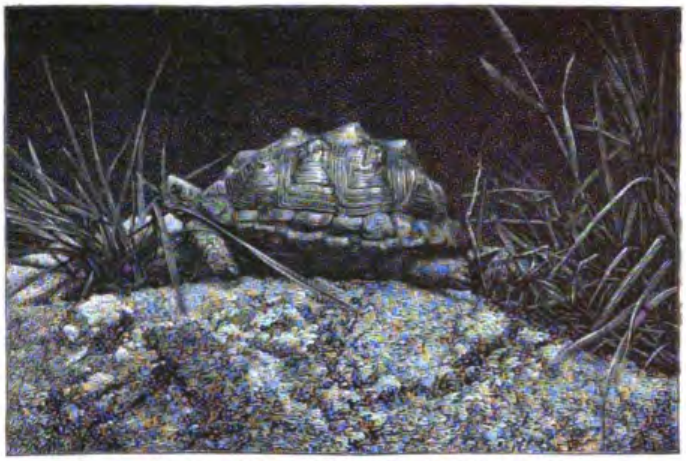
independently developed an almost identical mode of defence, and have learnt to tuck away their head and tail, and their many pairs of legs, within their smooth globular armour exactly in the same fashion as their South American prototype tucks his own belongings away within his bony cuirass. Even the muscular machinery for rolling and unrolling the body and shell is absurdly similar in the larger beasts and the small ones. Many other examples of such globular armour-plated animals occur in various groups of lower types; but I leave them to the ingenuity of the reader to discover.

Perhaps the most marvellous, however, of all the mail-coated animals are our good old friends, the common tortoises and turtles. We have been so long familiar with their shape, and with their extraordinary tunic of bone and horn, that we have long ago ceased even to wonder at them; but if we were shown a tortoise for the first time, and saw him withdraw his head and legs at a touch within the shelter of his shell, we should all exclaim, "What a surprising creature!" In order to understand the origin of the very complete defensive armour in the turtle group, we ought first to consider the bucklers and hauberks of the crocodiles and alligators, which, though much less perfect, lead up to and explain the turtle's panoply.

Crocodiles are, in essence, very big lizards, though they differ technically from the true lizards in some important points, but resemble them in outer shape and in most anatomical peculiarities. But their chief and best-marked external feature is their loose coat of movable scaly mail, which stands to the solid, welded shell of the turtles much as the old linked chain-armour of the Norman conquerors stood to the developed plate-armour of the later Plantagenet period. Crocodiles have their backs, tails, and the under side of their bodies amply defended by square horny shields, which move freely against one another at the edges. In the more vulnerable parts, such as the back, however, the wily crocodile does not trust to the strength of these horny plates alone: he has developed beneath them a similar series of stout bony plaques, each of which is neatly and deftly jointed at the edge with the ones beside it. So perfect a safeguard in its own fashion is this double set of armour, horny and bony, that sportsmen will tell you the only sure way to kill a crocodile is to hit him in the eye: that is his one vulnerable spot, his heel of Achilles: everywhere else, a bullet glides off him harmlessly. He lolls in the water unconcerned and winks at his assailant.

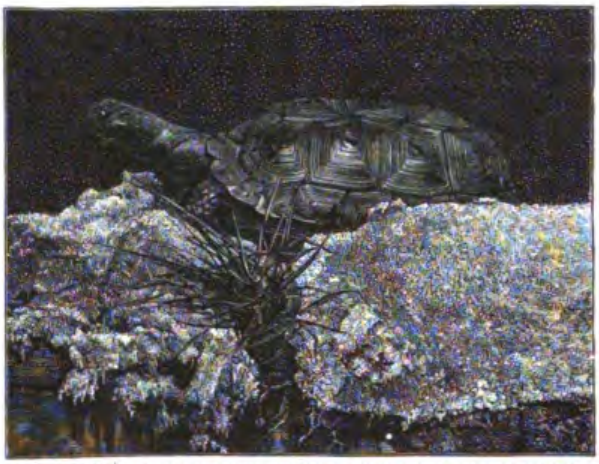
Now, the turtle group are descendants, apparently, of some ancient ancestor who possessed a coat of movable armour extremely like the plated suit of the existing crocodiles and alligators. I venture to believe, even, that crocodiles and turtles are remote offshoots of the same original lizard-like stock, which has variously specialized itself for various walks of life under different conditions. All turtles and tortoises possess what we call in common language a shell, though science—which always loves long words—prefers to describe it as a carapace. The shell is bony, and in almost all instances is actually welded together into one with the backbone and ribs, so as to form a single immovable dome-shaped suit of armour. If you look inside the dead shell, you will see the vertebræ like a chain running down the middle. There are usually two shells, one covering the upper part of the body and one the lower: and in many species of tortoise—for their name is Legion, the family being a very large one—the head and legs can be entirely withdrawn within the margin of the carapace. In such cases, just as in that of the armadillo, the gaps in the armour are neatly filled up, for the exposed parts are covered on purpose with horny masks or aprons, which thus complete and round off the entire defensive mechanism. The bony dome itself is also covered with a skin or breastwork of horny shields, which form the externally visible portion of the shell, and are most interesting objects for examination, because they exhibit the origin and development of the whole suit of armour. For the visible horny shell consists in most species of quite distinct and unwelded plates, much as in the crocodile, only that they are not separately movable: while the true bony shell beneath them consists, on the contrary, of a single welded or united piece, which, however, when one comes to look at it closely, turns out to be compound—shows by its lines and channels that it was originally composed of distinct plates, like those of alligators. Thus the turtles preserve for us in their own bodies an epitomized history of the course of their development.

I have selected for illustration here three species only among the many hundred kinds of the tortoise group now known to naturalists, in order to exhibit three successive stages in the gradual obliteration of the separate plates. No. 6 represents a land-tortoise from South Africa, in which the



6.—A SOUTH AFRICAN TORTOISE WITH DISTINCT SCALES.

plates are still almost as distinct as on a crocodile's back, though, of course, not movable. This is a very pretty dappled species, and the sculpture in relief on the separate shields or bosses which make up the shell is extremely elegant. No. 7, on the other hand, is a tortoise from the Argentine: it displays much more flattened and obliterated shields, which have coalesced more perfectly, and do not nearly so well recall the original crocodile or alligator type. No. 8, again, is a good example of the basking mud-tortoises, in which the separateness of the plates has almost disappeared, so that the entire shell, both bony and horny, has practically coalesced into a single smooth and rounded dome. The particular specimen here figured comes from Port Essington (in these days of Imperial extension, I will be cosmopolitan at all hazards): but other mud-turtles, similar in this respect, are found in shallow waters almost all the world over. We have in these cases a little bit of the history of evolution among animals served up for us in detail: indeed, if you will go to the Natural History Museum at South Kensington and look carefully at all the crocodiles, alligators, tortoises, and turtles there on view — an endless group—you will soon come to the conclusion that here at least there are no "missing links," but that every stage in the long, slow evolution of the tortoise's shell from the separate alligator-like scales of its lizard ancestor has been fully preserved for us. Incidentally such a visit will also serve to suggest the unspeakable variety and diversity of nature: before you examine the cases in the reptile room, you will probably imagine that a few dozen types of crocodile and turtle are all that exist: after you have compared them in full, you will come away astonished at the number, the strangeness, and the exquisite adaptation of the many kinds displayed for you—which after all form but a portion of those existing in nature.



7.—A SOUTH AMERICAN TORTOISE: THE SCALES COALESCING.

8.—A MUD-TORTOISE: THE SCALES ALMOST OBLITERATED.

Let me give one probably unexpected

instance of this curious adaptation to local conditions. The tortoises with humpy and bossy scales, more or less quaintly coloured (like the first here figured), are very conspicuous in museums: but in nature they are often quite hard to distinguish from their natural surroundings, even where they are plentiful and basking in the open: for they usually frequent rocky and pebbly spots, or else jungles of dry grass: and their humps and colours harmonize excellently with the shapes and hues of the objects about them. On the other hand, the smoothest forms are generally mud-tortoises, which sun themselves at their ease on logs in the water, or else lurk among soft mud, and under these circumstances their smoothness makes them less conspicuous to the few enemies whom even their solid coats do not enable them to set at defiance.

All the suits of armour with which I have hitherto been dealing are quite permanent: they cannot be taken off and put on again as readily as a mediæval knight-errant's casque and brigandine: indeed, since the turtle's coat and his backbone are, like the French Republic, "one and indivisible," he could no more divest himself of it with safety than you or I could change our skeletons, or get a new skull to suit the fashion. But the next suit of armour of which I am going to speak has that further peculiarity that it is shed by its owner at periodical intervals—I mean the lobster's. Everybody knows, of course, that lobsters moult as much as canaries. They begin life as tiny tadpoles or larvæ, about half an inch long, in which stage they have grotesquely big goggle eyes, like the dwarf in a pantomime, and swim about freely on the surface of the water. You would never take them for lobsters at all at this point in their history: they have much more resemblance to the uncouth larvæ of beetles and mosquitoes than to their own demure and sedate parents. After several moults, however, and several perplexing alterations of form, like so many crustacean "quick-change artists," they arrive at last at the adult lobster condition. Adult, I say, because they have now attained their final form: but not full grown: they go on growing: and as the shell they wear fits them tightly all over, and is composed of a single piece, though much jointed, they have no alternative but to cast it off bodily from time to time, and develop a new one. When the lobster is still very young, he does this at frequent intervals: in middle life, he does it once a year: but when he has grown old and thoroughly hardened, he changes his suit a good deal less frequently. At the moulting period he retires for a time into private life, and changes his suit, like a gentleman that he is, in a sequestered dressing-room, far from observers.

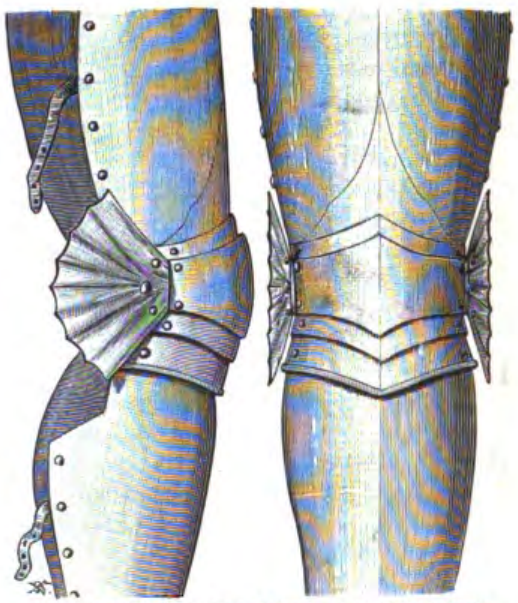
Oddly enough, however, he grows *before*, not *after*, he casts his shell. That is to say, he lays by material for new cells and tissues inside his old coat, but he does not plim them out, so to speak—does not inflate them, if I may use a metaphor which will be clear to all cyclists. The raw stuff is there, but not the mere filling. At last, when he has got everything ready for the eventful change, he proceeds to endue himself in his new suit of armour. An entire soft shell grows round his limbs within the old hard one; then the lobster withdraws himself, leg by leg, claw by claw, and swimmeret by swimmeret, from his disused coat, and steps out of his skin, a brand-new creature. Even the hard bits of the interior—the shelly walls at the base of the small legs—are shed w th the rest; for the whole suit hangs together in one piece, the inner parts being, in reality, mere folds of the skin, doubled inward. The cast skeleton, when he has wriggled out of it, forms a perfect model of a lobster, in fact, and looks like a whole beast, till you discover that it is empty. The real lobster himself, on the other hand, after thus shuffling off his mortal coil, emerges upon the world a new and defenceless fleshy creature. It must feel odd for him to find himself suddenly deprived of his wonted mail. For in order to withdraw his big claws from the shed skeleton, and otherwise disengage himself from the suit he has outgrown, he has to become as soft as a jelly: in which condition he pulls his limbs one by one through the narrow chink of the huge pincer-like claws in the most incredible fashion. As soon as the moult is complete, however, he begins to grow, or apparently grow, within the new and swelling skin, at a rate which might well astonish anybody but a mushroom. He absorbs water through the thin, jelly-like shell, and with it inflates the animal tissues; for before he takes off his old coat he has made himself a new one, perfect from head to tail, and waiting only to be hardened by a supply of lime, partly laid up in his body beforehand, and partly eaten for the purpose in the shape of other shells, which he greedily devours and digests in bulk at this stage of his existence. In a few days the new shell has acquired the consistency of a leathern jerkin, and by the

end of six weeks has once more become a perfect suit of solid plate-armour.

Our own common lobster is, perhaps, the finest example now living on earth of the mail-coated animals: for he is a soldier and a member of a dominant type, like the mediæval barons in their iron panoply; not a mere defensively-armed non-combatant, like the armadillo and the tortoise, which skulk and hide themselves. Shielded by his impenetrable corselet of stony armour, provided with huge pinching claws which can crush a sea-shell like so much paper, and capable of attacking almost any foe he meets in his own element, your lobster is a magnate of the most ancient order. My illustration, No. 9, however, represents not this hidalgo of the seas, but a cousin of the family of somewhat inferior rank—the spiny lobster or sea-crayfish—who unites in his own person to a certain extent the tactics of the tortoise with those of the hedgehog. He is half armadillo, half porcupine in his mode of defence. His body is covered by a stout corselet like that of the common lobster, but instead of being smooth it is prickly or thorny like the shell of the Japanese devil-crab, whom I had the honour of presenting to my readers in this Magazine on a previous occasion. And the reason why the spiny lobster needs this extra protection of spikes on his shell is pretty clear when you come to examine him closely. He has no great crushing nut-cracker claws like the powerful vices of the common lobster: his first pair of legs are scarcely bigger or more muscular than the others: as a man of war, he is not to be compared for a moment to his more familiar and highly developed relation. Therefore he makes up for it by spines on his back: he doubles the parts, as it were, of armadillo and hedgehog, so as to be safe either way. We have a spiny lobster of this type in our own British seas; but in

9.—THE SPINY LOBSTER, BOTH ARMOUR-PLATED AND PRICKLY.

10.—THE SPINY LOBSTER'S TAIL, TO SHOW ARRANGEMENT OF PLATES.



11.—A KNIGHT'S PLATE-ARMOUR, FOR COMPARISON WITH THE LOBSTER'S.

order to meet the views of Colonial readers—for THE STRAND MAGAZINE goes round the world—Mr. Enock has here selected for illustration its New Zealand representative.

No. 10 is an enlarged view of this sea-crayfish's tail, intended to show its very close analogy to the joints of plate-armour exhibited in No. 11. The resemblance is one of the best examples one could choose of the very close fashion in which art half unconsciously imitates nature, or nature half unconsciously foreshadows art. Compare it once more with the pangolin's tail and the armadillo's belts, and you will further observe how much nature also imitates and anticipates herself—how the same device to obtain the same result appears over and over again through all her handiwork.

The self-same lesson is very beautifully impressed upon us by the curious little marine creature delineated in No. 12. What is he? you wonder. Well, you know that most molluscs have either two valve-like shells, familiar to everybody in the oyster, the mussel, the cockle, and the scallop—I choose examples whose nearness to "the great heart of the people" makes them sure of recognition—or else a single more or less spiral shell, as in the equally well-known cases of the whelk, the periwinkle, the garden snail, and the limpet. But you would hardly suspect this odd-looking creature, like a lobster's tail with the body omitted, of being also a mollusc. Nevertheless, it is one. Its name is chiton: and chiton is good Greek for a cloak or robe. The quaint beast in question derives his title from the eight flexible shell-plates which cover his back with a complete suit of armour, exactly analogous to so many which we have already examined. A few species of chiton inhabit our British seas: but it will give once more a faint idea of the vast variety of all these strange types if I add that, taking the round world over, more than four hundred distinct kinds of these jointed molluscs have been described by naturalists.

12.—A JOINTED AND ARMOURED MOLLUSC, THE CHITON.

I have chosen only a few among the larger or more conspicuous members of the great group of armour-plated animals, but many of them occur in other classes—too many for me even to enumerate roughly. Sometimes a whole vast alliance is armour-plated almost without exception—for example, the molluscs. The enormous majority of these are inclosed in very hard shells, like the oyster and cockle, sometimes reaching the size of the huge conch or giant clam, with three great tooth-like furrows, which is occasionally used as a receptacle for fountains, or as a font or holy-water basin in Continental churches. The big univalves so often found as ornaments of cottage cabinets show one equal hardness: and in many cases the mouth of the shell, the only exposed part, is closed by a solid door, known as an operculum, which the animal pulls in behind it, and keeps in place by means of a powerful muscle. In not a few instances, the hedgehog principle reinforces the turtle one: the shells are covered with hard spines or prickles. Some few molluscs, however, like the slugs, have found it pay to get rid of their shells: and here it is curious to note a singular analogy with the gradual discarding of armour by human soldiers after the invention of fire-arms. For when the heavy plate-armour was superseded as a whole, the helmet and breast-plate, covering the most vulnerable and important parts, the head and heart, were still for a time retained, as by Cromwell's Ironsides. Now, just the same thing occurs in the transition from snails to slugs. True snails can retire altogether within their protective shells: intermediate types occur which have shells a little too small for them, so that they cannot hide in them: then come imperfect slugs, with small, shield-like shells carried on their backs—mere bucklers, just covering the heart and most vital organs: after that, we get slugs who have no visible external shell at all, but possess a hidden breast-plate under the "mantle" or flesh of the body, exactly as Cromwell himself is said to have worn concealed armour under his woollen jacket: and, last of all, as in the big black slug, we find forms with no shell of any sort, open or buried, but at best only an imperfect relic in the shape of a few formless fragments of lime

scattered about in the flesh of the mantle. Here, once more, as in the turtles, the various steps in the evolutionary history of a type have been fully preserved for us.

The greater number of crustaceans, again, such as crabs and prawns, are also armour-plated, the armour being, of course, proportioned in thickness, as a rule, to the size of the animal. The great edible crab of our own coasts, too well known on the supper-table to call for illustration, is a most formidable beast, protected alike by his solid carapace and by the muscular strength of his powerful crushing claws, weapons hardly second to those of our friend the lobster. Among insects, too, there are several great groups of armour-plated kinds; for example, the beetles. The common stag-beetle of our own country is a fine instance of a mailed type: some tropical kinds have shells as hard and as impenetrable as the crab's: many of them are also provided in addition with offensive weapons of no mean description. No. 13 exhibits a simple typical case of a mailed water-beetle. The scorpions form another stout armoured class, with pincer claws as strong as those of the crabs and lobsters. I need enumerate no more; I must resist the temptation to describe at length the bony-pike of America, a true fish inclosed from head to tail in a complete and close-fitting mail of lozenge-shaped scales, enamelled and slimy, like a glistening suit of silvery armour; or the ungainly sturgeons, with their rows of bony plates protecting the sides; or that quaint creature the coffer-fish, like a living carved-ivory box, incased in a hard setting of six-sided plates, which form a curious mosaic pattern over its entire body. But I must draw a line somewhere.

I will only suggest before I conclude that a good subject for a day's stroll through the Natural History Museum at South Kensington or any other great collection of zoological specimens would be the examination and comparison of all such armoured creatures. Such a study would show, not only the similarity of the means employed for defence in various cases, but also the beautiful variety of ways in which the general plan of armour-plating is adapted in each instance to the particular needs of the different kinds, crawling, swimming, or walking, marine or terrestrial, powerful or feeble, provided with offensive arms or dependent wholly on their defensive covering.

13.—A MAILED WATER-BEETLE.