it demands it receives. In the mere larve or caterpillar of a cossus, or insect approaching to the butterfly, Lyonet has detected not less than four thousand and sixty-one distinct muscles, which is about ten times the number that belong to the whole human body; and yet it is probable that these do not constitute any thing like the number that appertain to the same insect in its perfect state. The elator *noctilucus*, or phosphorescent springer, is a winged insect; but it has also a set of elastic muscles, which enable it, when laid on its back, to spring up nearly half a foot at a bound, in order to recover its position. This insect is also entitled to notice in consequence of its secreting a light, which is so much beyond that of our own glow-worm, that a person may see to read the smallest print by it at midnight. The cicada *spumaria*, or spumous grasshopper, is in like manner endowed with a double power of motion; and when attempted to be caught will either fly completely off, at its option, or bound away at the distance of two or three yards at every leap. This insect is indigenous to our own country, and is one of those which in their larve and pupe states discharge, from the numerous pores about the tail, that frothy material upon plants which is commonly known by the name of cuckow-spit.

Crabs and spiders have a strong muscular power of throwing off an entire limb whenever seized by it, in order to extricate themselves from confinement; and most of them throw off also, once a year, their skin or crustaceous covering, and secrete a new one. The muscular elasticity of the young spider gives it, moreover, the power of wings; whence it is often seen, in the autumn, ascending to a considerable elevation, wafted about by the breeze, and filling the atmosphere with its fine threads. The land-crab (cancer *ruricola*) inhabits the woods and mountains of a country; but its muscular structure enables it to travel once a year to the seacoast to wash off its spawn in the waters. The spawn or eggs thus deposited sink into the sands at the bottom of the sea, and are soon hatched; after which millions of little crabs are seen quitting their native element for a new and untried one, and roving instinctively towards the woodlands.

The hinge of the common oyster is a single muscle; and it is no more than a single muscle in the chama gigas, or great clamp-fish, an animal of the oyster form, but the largest testaceous worm we are acquainted with. It has been taken in the Indian Ocean of a weight not less than 532 pounds; the fish, or inhabitant, being large enough to furnish 120 men with a meal, and strong enough to lop off a hand with ease, and to cut asunder the cable of a large ship.

Nor is the muscular power allotted to the worm tribes less wonderful than that of insects, or its variety less striking and appropriate. The leech and other sucker-worms are as well acquainted with the nature of a vacuum as Torricelli; and move from place to place by alternately converting the muscular disks of their head and tail into air-pumps.

The sucker of the cyclopterus, a genus of fishes denominated suckers from their wonderfully adhesive property, is perhaps the most powerful, for the size of the fish, of any we are acquainted with; and is formed at will, by merely uniting the peculiar muscles of its ventral fins into an oval concavity. In this state, if pulled by the tail, it will raise a pailful of water rather than resign its hold.

The teredo *navalis*, or ship-worm, is seldom six inches in length, but the muscles and armour with which its head is provided enables it to penetrate readily into the stoutest oak planks of a vessel, committing dreadful havoc among her timbers, and chiefly producing the necessity for her being copper-bottomed. This animal is a native of India; it is gregarious, and always commences its attack in innumerable multitudes; every worm, in labouring, confining itself to its own cell, which is divided from that of the next by a partition not thicker than a piece of writing-paper. The seaman, as he beholds the ruin before him, vents his spleen against the little tribes that have produced it, and denounces them as the most mischievous vermin in the ocean. But a tornado arises—the strength of the whirlwind is abroad—the clouds

pour down a deluge over the mountains—and whole forests fall prostrate before its fury. Down rolls the gathering wreck towards the deep, and blocks up the mouth of that very creek the seaman has entered, and where he now finds himself in a state of captivity. How shall he extricate himself from his imprisonment?—an imprisonment as rigid as that of the Baltic in the winter season. But the hosts of the teredo are in motion:—thousands of little augurs are applied to the floating barrier, and attack it in every direction. It is perforated, it is lightened, it becomes weak; it is dispersed, or precipitated to the bottom; and what man could not effect, is the work of a worm. Thus it is that nothing is made in vain; and that in physics, as well as in morals, although evil is intermingled with good, the good ever maintains a predominancy.

LECTURE XI.

ON THE BONES, CARTILAGES, TEETH, ARTICULATION, INTEGUMENTATION, HAIR, WOOL, SILK, FEATHERS, AND OTHER HARD OR SOLID PARTS OF THE ANIMAL FRAME.

In a former lecture we took a general survey of the characteristic features that distinguish the unorganized from the organized world, and the vegetable kingdom from the animal: we examined into the nice structure of plants, and the resemblances which they bear to the animated form. In our last lecture we proceeded to an inquiry into the nature of the living principle, took a glance at a few of the theories that have been invented to explain its essence and mode of operation, and contemplated the origin and powers of the muscular fibre, which may be denominated its grand executive organ.

The muscles of an animal, however, are not the only instruments of animal motion; the bones, cartilages, and ligaments contribute very largely to the action, and the skin is not unfrequently a substitute for the muscle itself. These, therefore, as well as a variety of other bodies minutely connected with them, or evincing a similarity of construction,—as the teeth, hair, nails, horns, shells, and membranes,—are now to pass under our review, and are entitled to our closest attention; and I may add, that their diversity of uses and operations, and the curious phenomena to which they give rise, are calculated to afford not less amusement than instruction.

I had occasion to remark lately,* that lime is a substance absolutely necessary to the growth of man. It is, in truth, absolutely necessary to the growth of almost all animals; even soft-bodied or molluscous worms, except in a few instances, are not free from it; nay, even infusory animals, so minute as to be only discerned by the microscope, still afford a trace of it in the calcareous speck which constitutes their snout; but it is in the bones and shells of animals that lime is chiefly to be found; and hence those animals possess most of it in whom these organs are most abundant.

Bone, shell, cartilage, and membrane, however, in their nascent state, are all the same substance, and originate from a viscid fluid, usually supposed to be the coagulable lymph, or more liquid part of the blood; which, secreted in one manner, constitutes jelly, or gelatine, a material characterized by its solubility in warm water, heated to about half the boiling point; and secreted in another manner, forms albumen, or the material of the white of the egg, characterized by its coagulating instead of dissolving in about the same heat: the difference, however, between the two, consisting merely, perhaps, in the different proportion of oxygen they contain. Membrane, is gelatin, with a small proportion of albumen to give it a certain degree of solidity; cartilage

* Series i. Lect. vi. On Geology, p. 73, and passim; and Lect. viii. On Organized Bodies, and the Structure of Plants compared to that of Animals, p. 81.

is membrane, with a larger proportion of albumen to give it a still greater degree of solidity; and bone and shell are mere cartilage, hardened by the insertion of lime into their interior, the lime being secreted for this purpose by a particular set of vessels, and absorbed by the bony or shelly rudiments in their soft state. And hence any substances which, like the mineral acids, for example, have a power of dissolving the earthy matter of the two last, and of leaving the cartilage untouched, may be readily employed as reagents, to reduce them to their primary softness: and it was by this means that Cleopatra, as we are told by Pliny, dissolved one of the costly pair of pearls that formed her earrings, each of which was valued at upwards of eighty-thousand pounds (*centies sestertium*), at a feast given to Mark Antony, and then presented it to him in a goblet, with an equal mixture of wine.*

In the adult state, however, as well as in the embryo state, it is necessary that the bones, like every other substance of the animal frame, should be punctually supplied with the elementary matter, or the means of forming the elementary matter, of which it essentially consists, the old matter of every kind being worn out by use, and carried away by a distinct set of vessels, called lymphatics or absorbents. It is the office of the digestive organs to receive such supply from without, and to prepare it for the general use. And hence, if we could conceive it possible for these organs, or any organs dependent upon them, to be so peculiarly diseased as to be incapable of preparing or conveying to the bones a sufficient quantity of lime (of which some portion is contained in almost every kind of food) to supply the place of that which is perpetually passing off, the necessary consequence would be, that the bones would progressively lose their hardness, and become cartilaginous and pliable. Now we sometimes do meet with the digestive or the secretory organs affected by such a kind of disease, and that both in children and adults. In children it is more common, and is called RICKETS; in grown persons it is simply called a SOFTNESS OF THE BONES, OR MOLLITIES OSSIUM. In the former case, the softened spine becomes bent from the weight of the head, and other extremities, which it is now no longer able to sustain, while the chest and most of the limbs partake of the general distortion. In the latter case many of the bones are sometimes reduced to imperfect cartilages, and can be bent and unbent in any direction.

Lime, however, is never found in the animal system in its pure state, and is certainly never introduced into it in such a state. It is usually combined with some acid, either the phosphoric, in which case the compound is called phosphate of lime; or carbonic acid gas, when it is called carbonate of lime, or common chalk.

It is of no small importance to attend to the nature of these two acids; for it is the difference between them that chiefly constitutes the difference between bones and shells; bones uniformly consisting of a larger proportion of phosphate of lime, or lime and phosphoric acid, and a less proportion of carbonate; and shells of a larger proportion of carbonate of lime, and a less proportion of phosphate. There are a few other ingredients that enter into the composition of both these substances, and which are chiefly obtained from the materials of common salt, as sulphuric acid and soda; but the proportions are too small to render it necessary to dwell upon them in a course of popular study. Bones, shells, cartilages, and membranes may therefore be regarded as substances of the same kind, differing only in degree of solidity from the different proportions that they possess of albumen and salts of lime.

Teeth, horn, coral, tortoise-shell, fish-scales, and the crustaceous integuments of crabs, millepedes, and beetles, are all compounds of the same elements combined in different proportions, and rendered harder or softer as they possess a larger or smaller quantity of calcareous salts; ivory and the

* This was on a trial who could give the most sumptuous banquet. Munacius Plancus was the arbiter. The expense of Mark Antony's, already bestowed, had been valued at just the price of this single pearl. Cleopatra was proceeding to dissolve its fellow, when she was suddenly stopped by the umpire, who declared the victory to be hers. Plin. Hist. Nat. lib. ix. 35.

enamel of teeth possessing the largest quantity, and consisting almost exclusively of phosphate of lime, with a small proportion of animal matter.

The gelatin and albumen are unquestionably generated in the animal system itself from the different substances it receives under the form of food; and it is curious to observe the facility and rapidity with which some animals are capable of producing them. The gastrobranchus *cæcus*, or hag-fish, a small lamprey-like animal of not more than eight inches long, will convert a large vessel of water in a short period of time into size or mucilage, of such a thickness that it may be drawn out in threads. The form and habits of this little animal are singular: Linnæus regarded it as a worm; but Bloch has removed it, and with apparent propriety, into the class of fishes. It is a cunning attendant upon the hooks of the fisherman; and as soon as it perceives a larger fish to be taken, and by its captivity rendered incapable of resistance, it darts into its mouth, preys voraciously, like the fabled vultures of Prometheus, on its inside, and works its way out through the fish's skin.

But though gelatin and albumen are unquestionably animal productions, the one a secretion from the blood, and the other a constituent principle of it, there is a doubt whether lime ought ever to be regarded in the same character. A very large portion is perpetually introduced into the stomach from without. In our lecture on the analogy between the structure of plants and of animals,* I had occasion to observe, that it forms an ingredient in common salt; not, indeed, necessarily so, but from the difficulty of separating the other ingredients from their combination with it: yet it enters not more freely into common salt than into almost every other article, whether animal, vegetable, or mineral of which our diet is usually composed. And upon this common fact it is more generally conceived, at present, to be a substance communicated to the animal frame, than generated by it.

This opinion, however, is by no means established; and there are many circumstances that may lead us to a contrary conclusion. Though almost every kind of food contains some portion of lime, it by no means contains an equal portion; and yet we find that a healthy young animal, whatever be the sort of food on which it is fed, will still provide lime enough from some quarter or other to satisfy the demand of its growing bones, and to maintain them in a due degree of solidity and hardness.

Again, the soil of some countries, as the mountains of Spain, for example, consists almost entirely of gypsum or some other species of limestone; while in other countries these are substances very rarely to be met with. It is a curious fact, that in that vast part of the globe which has been latest discovered, and to which modern geographers have given the name of Australia, comprising New-Holland and the islands with which its shores are studded, not a single bed or stratum of limestone has hitherto been detected, and the builders are obliged to make use of burnt shells for their mortar, for which I have lately advised them to substitute burnt coral.† Now, it would be natural to suppose that the animals and vegetables of such a country would partake of the deficiency of its soil, and that the shells and bones which it produces would be less compact in their texture than those of other countries; yet this supposition is not verified by fact: nature is still adequate to her own work; the bones of animals are as indurated and perfect in these regions as in any parts of the old world; while the shells are not only as perfect, but far more numerous; and the frequent reefs of coral, altogether an animal production, that shoot forth from the shores in bold and massy projections, prove clearly that a coral rock, largely as it consists of lime, forms the basis of almost every island.

The prodigious quantity of lime, moreover, that is secreted by some animals at stated periods, beyond what they secrete at other times, seems to indicate a power of generating this earth in their own bodies. The stag, elk, and several other species of the deer-tribe, cast their antlers annually, and

* Series i. Lect. viii.

† It is understood that some beds of chalk have since been discovered on the farther side of the Blue Mountains, but none is still to be traced on the hither side in any of the settlements of the colony.

renew them in full perfection in about twelve weeks. These antlers are real bones; and those of the elk are sometimes as heavy as half a hundred pounds weight, and in a fossil state in Ireland have been dug up still heavier, and of the enormous measure of eight feet long, and fourteen feet from tip to tip; on beholding which, we may well, indeed, exclaim with Waller,—

> O fertile head! which every year
> Could such a crop of wonders bear.

In like manner, many species of the crab and lobster tribes annually throw off and renew the whole of their crustaceous covering, and apparently without any very great degree of trouble. The animal at this time retires to some lonely and sheltered place, where, in its naked and defenceless state, it may avoid the attack of others of the same tribe which are not in the same situation: a line instinctively drawn now separates the shell into two parts, which are easily shaken off, when the secernent vessels of the skin pour forth a copious efflux or sweat of calcareous matter all over the body, the more liquid parts of which are as rapidly drunk up by the absorbent vessels, so that a new calcareous membrane is very soon produced, which as speedily hardens into a new calcareous crust, and the entire process is completed in about a fortnight. This genus, also, in many of its species, is capable of reproducing an entire limb, with the whole of its calcareous casing, whenever deprived of it by accident or disease, or it voluntarily throws it off, as I have already observed it is capable of doing, to extricate itself from being seized hold of; though the new limb is seldom so large or powerful as the original. So, in other animals, we sometimes find a large and preternatural secretion of calcareous matter, in consequence of a diseased habit of particular organs, or of the system generally. The human kidneys are too often subject to a morbid affection of this kind, whence a frequent necessity for one of the most painful operations in surgery. The chalkstones, as they are erroneously called, that are often produced in protracted fits of gout and rheumatism, are rather lithate of soda than any compound of lime; but instances are not wanting in which one of the lungs has been found converted into an entire quarry of limestone.

In the Transactions of the Royal Society there are several cases related of young persons who, in consequence of a morbid habit, threw out a variety of calcareous excrescences, either over the hands and feet, or over the whole body;* and about four years since, a Leicestershire heifer was exhibited for a show in this metropolis, the head and neck of which were completely imbedded in horny excrescences of this kind, and the back and limbs profusely sprinkled over with them: some of the horns, and especially those about the dew-lap, were as long and as large as the natural horns of the forehead, but they were much more calcareous and brittle. A calcareous scurf, moreover, was secreted over every part of the skin, which, whenever the skin was scratched or bitten, united with the fluid that oozed forth, ramified, and divaricated into masses of small roses. At the request of the proprietor I took an account of this extraordinary animal, and have since communicated it to the Royal Society. In all other respects it was in good health; its size was proportionate to its age, and its appetite enabled it to digest foods of every kind equally; and though, in consequence of this, its diet had been frequently varied, the propensity to a secretion of calcareous matter continued the same under every change.

It appears, therefore, very doubtful whether the animal economy be not at times capable of generating lime, as well as gelatin or albumen, out of the different materials introduced into the stomach in the form of food. Vauquelin endeavoured to decide the question by a variety of experiments upon the nature of the egg-shells of a sitting hen, and an examination into the proportion of calcareous matter contained in a given weight of shells, compared with the calcareous matter furnished by her food, and that discharged as a

* See also Mr. Baker's account of the porcupine-man, Phil. Trans. for 1755.

recrement; and, so far as these experiments go, they support the opinion of a generation of lime, and that in very considerable abundance, the weight secreted appearing to have been five times as much as that introduced into the stomach. But to determine the question incontrovertibly requires so nice a precision in the mode of conducting such experiments, as from a variety of circumstances, it seems almost impossible to attain.

It is to the power which the living principle possesses, either of secreting or generating the substance of lime by its natural action, that we are indebted for all those elegant shells that enrich the cabinet of the conchologist, and seem to vie with each other in the beauty of their spots, the splendour and irridescence of their colours, and the graceful inflection of their wreaths. And it is to the power which the same principle possesses, of forming this substance by a morbid action, that we owe not only those unsightly excrescences I have just mentioned, but some of the most costly ornaments of superstition or luxury: those agate-formed bezoards which in Spain, Portugal, and even Holland were lately worn as amulets against contagion, and which have been let out for hire at a ducat a day, and been sold as high as three hundred guineas a piece; and those delicate pearls which constitute an object of desire among the fair sex of every country, and which give additional attraction to the most finished form.

The first are usually obtained from the stomach or intestines of the goat or antelope; in the latter case being called oriental bezoards, and possessing the highest value. The most esteemed are those obtained from the stomach of that species of the oriental antelope called the gazel, to which the Persian and Arabian poets are perpetually adverting whenever they stand in need of an image to express elegance of form, fleetness of speed, or captivating softness of the eyes. The second are obtained from the inside of the shells of the mytilus *margaritiferus* and mya *margaritifera*, pearl-muscle and pearl-oyster; the former, producing the largest and consequently the richest, is found most commonly on the coast of Ceylon; the latter not unfrequently on that of our own country, and was traced some centuries ago in great abundance in the river Conway in Wales. Linnæus is said to have been acquainted with a process by which he could excite at pleasure a secretion of new pearls in the pearl-oysters which he kept in his reservoirs. It is generally supposed to be a diseased secretion somewhat similar to that of the stone in the human bladder.

The murex *tritonis*, or musical murex, is here also worth noticing. Its calcareous shell is ventricose, oblong, smooth, with rounded whorls, toothed aperture, and short beak, about fifteen inches long, white, and appearing as if covered with brown, yellow, and black scales. It inhabits India and the South Seas, and is used by the New-Zealanders as a musical shell, and by the Africans and many nations of the East as a military horn.

Before we quit this subject, I will just observe, that it is to the same tribe we are indebted for our nacre or mother-of-pearl, which is nothing more than the innermost layers of the shell, in which the morbid works or concretions which we call pearls lie imbedded; and that to the same order of shells the Indians owe their wampum or pieces of common money, which are formed of the Venus *mercenaria*, or clam-shell, found in a fossil state; and that our own heralds owe the scallop, ostrea *maxima*, that so often figures in the field of our family arms, and was formerly worn by pilgrims on the hat or coat, in its natural state, as a mark that they had crossed the sea for the purpose of paying their devotions at the Holy Land.

From these facts and observations we cannot but behold the great importance of lime in the construction of the animal frame, the extensive use which is made of it, and the variety of purposes to which it is applied: combined in different proportions with gluten and albumen it affords equally the means of strength and protection, produces the bones within and the shells without, the external and internal skeleton, and is discoverable in every class, order, and even genus of animals, except a very few of the soft worms and insects in their first and unfinished state.

It is hence the cerambyx, and several other tribes of insects, are able to make that shrill sound which they give forth on being taken, and which appears like a cry from the mouth, but is in reality nothing more than the friction of the chest of the insect against the upper part of its abdomen and wing-shells. And it is hence, also, that the ptinus *fatidicus*, or death-watch, produces those measured strokes against the head or other part of a bed in the middle of the night, which are so alarming to the fearful and superstitious; but which, in truth, are nothing more than a call or signal by which the one sex is enticed to the other, and is merely produced by the insect's striking the bony or horny front of its head against the bed-post, or some other hard substance.

Having, then, taken a brief survey of the elementary nature and chemical composition of these harder parts of the animal frame, I shall proceed to make a few remarks upon the relative powers of each, and their diversified applications amid the different kinds of animals in which they are employed.

The BONES in their colour are usually white; but this does not hold universally, for those of the gar-pike (esox *belone*) are green; and in some varieties of the common fowl they approach to a black: Abelfazel remarks this of the fowls of Berar, and Niebuhr of those of Persepolis.

The bones of an animal, wherever they exist, are unquestionably the levers of its organs of motion: and so far the mechanical theorists are correct. In man and quadrupeds, whose habits require solidity of strength rather than flexibility of accommodation, they are hard, firm, and unpliant, and consist of gluten fully saturated with phosphate and carbonate of lime. In serpents and fishes, whose habits, on the contrary, demand flexibility of motion, they are supple and cartilaginous; the gluten is in excess, and the phosphate of lime but small in proportion to it, and in some fishes altogether deficient in the composition of their skeleton, though still traceable in their scales and several other parts. In birds, whose natural habits demand levity, the bones are skilfully hollowed out and communicate with the lungs, and instead of being filled with marrow are filled with air, so that the purpose for which the structure of birds was designed is as obvious, and as deeply marked, in the bones as in the wings, whose quills also are for the same reason left hollow, or rather are filled with air, and in many tribes communicate with the lungs as the bones do.

The skeleton of the cuttle-fish (sepia *officinalis*) is extremely singular: its back bone, for some purpose unknown to us, is much broader than that of any other aquatic animal of the same size, and of course would be much heavier but for a curious contrivance to prevent this effect, which consists in its being exquisitely porous and cellular, and capable, like the bones of birds, of becoming filled with air, or exhausted of it, at the option of the animal, in order to ascend or descend with the greater facility. It is an animal of this kind, or closely akin to it,* that inhabits the shell of the beautiful paper-nautilus, and still more beautiful pearl-nautilus (argonauta and nautilus tribes), and which hence obtain no inconsiderable portion of that lightness which enables them, with their extended sails, to scud so dexterously before the wind. In the calamary (sepia *loligo*) we meet with an approach towards the same contrivance, in a kind of leafy plate introduced into the body of the animal; and even in the cloak of the slug-tribe we trace something of the same sort, though proportionably smaller, and verging to the nature of horn.

Generally speaking, the bones grow cartilaginous towards their extremities, and the muscles tendinous; by which means the fleshy and osseous parts of the organs of motion become assimilated, and fitted for that insertion

* The animal has commonly been supposed to be a real sepia or cuttle-fish; but several naturalists have of late doubted this, inasmuch as there are a few marks of distinction that seem to take it out of this genus. Rafinesque has hence made another genus, for the purpose of receiving those which possess these distinctive signs; and Dr. Leach has lately distinguished it specifically, in consequence of specimens sent home from the unfortunate Congo expedition as collected by Cranch, by the name of Ocythoe *Cranchii*. Even this animal, however, is regarded as a parasite in the shell, and only possessing it when empty. The proper animal is not known to the present hour.—See Phil. Trans. 1817, p. 293.

of the one part into the other upon which their mutual action depends. The extent and nature of the motion is determined by the nature of the articulation, which is varied with the nicest skill to answer the purpose intended. In ostraceous worms the only articulation is that of the hinge: in the cancer tribes the tendon is articulated with the crust, whence the wonderful strength and activity of the claws; and it is articulated in a similar manner with the scaly plates of some species of the tortoise. In insects the part received and the part receiving form each a segment of a spheroid; whence the motion may be either rotatory or lateral, at pleasure. In mammalian animals the lower jaw only has a power of motion; but in birds, serpents, and fishes, the upper jaw in a greater or less degree possesses a similar power.

The motion of serpents is produced, according to Sir Everard Home, by their ribs, which for the most part accompany them, not only as organs of respiration, but from the hind extremity to the neck, and are possessed of a peculiar power of motion by means of peculiar muscles. "The vertebræ are articulated by ball and socket joints (the ball being formed upon the lower, and the socket on the upper one), and have therefore much more extensive motion than in other animals." In the draco *volans* the skeleton of the wings is formed out of ribs which "are superadded for this purpose, and make no part of the organs of respiration; the ribs in these animals appear to work in succession, like the feet of a caterpillar."

The TEETH vary in their form and position almost as much as the bones. Where jaw-bones exist they are usually fixed immoveably in their sockets; but in some animals a few of them are left moveable, and in others the whole. The mus *maritimus*, or African rat, the largest species of this genus which has hitherto been discovered, and seldom less than a full-sized rabbit, has the singular property of separating at pleasure to a considerable distance the two front teeth of the lower jaw, which are not less than an inch and a quarter long. That elegant and extraordinary creature the kangaroo, which, from the increase that has lately taken place in his Majesty's gardens at Kew, we may soon hope to see naturalized in our own country, is possessed of a similar faculty. And the hollow tusks or poisoning fangs of the rattlesnake, and other deadly serpents, are situated in a peculiar bone on each side of the upper jaw, so articulated with the rest, that the animal can either depress or elevate them at his option. In a quiescent state they are recumbent, with their points directed inwards; but whenever the animal is irritated he instantly raises them; and at the moment they inflict a wound, the poison, which lies in a reservoir immediately below, is injected through their tubes by the act of pressure itself.

In the shark and ray genera the whole of the teeth are moveable, and lie imbedded in jaw-cartilages instead of in jaw-bones, and like the fangs of the poisonous serpents are raised or depressed at pleasure. The teeth of the xiphias *gladius*, or sword-fish, are similarly inserted; while his long sword-like snout is armed externally, and on each side, with a taper row of sharp, strong, pointed spines or hooks, which are sometimes called his teeth, and which give rise to his popular name.

The ant-eater and manis swallow their aliment whole; and in many animals the jaws themselves perform the office of teeth, at least with the assistance of the tongue. In birds this is generally the case, sometimes in insects, whose jaws are for this purpose serrated or denticulated at the edge, and frequently in molluscous worms. The jaws of the triton genus act like the blades of a pair of scissors. The snail and slug have only a single jaw, semilunar in its form, and denticulated: but the mouth of the nereis has several bony pieces. The sea-mouse (aphrodita *aculeata*) has its teeth, which are four, fixed upon its proboscis, and is of course able to extend and retract them at pleasure; and the leech has three pointed cartilaginous teeth, which it is able to employ in the same way, and by means of which it draws blood freely. In like manner, though insects chiefly depend upon a serrated jaw, yet many of them are also possessed of very powerful fangs, of which we have a striking instance in the aranea *avicularia*, or bird-spider, an inhabitant