

## SERIES II.

### LECTURE I.

#### ON ZOOLOGICAL SYSTEMS, AND THE DISTINCTIVE CHARACTERS OF ANIMALS.

WHILE every department of nature displays an unbounded scope to the contemplative mind,—a something on which it may perpetually dwell with new and growing delight, and new and growing improvement; we behold in the great division of the animal kingdom a combination of allurements that draw us, and fix us, and fascinate us with a sort of paramount and magical captivity, unknown to either of the other branches of natural history; and which seem to render them chiefly or alone desirable and interesting, in proportion as they relate to animal life. There is, indeed, in the mineral domain, an awe, and a grandeur, and a majesty, irresistibly impressive and sublime; and that cannot fail to lift up the heart to an acknowledgment of the mighty Power which piled the massy cliffs upon each other, and rent the mountains asunder, and flung their scattered fragments over the valleys. There is in the realm of vegetables an immeasurable profusion of bounty and of beauty, of every thing that can delight the external eye, and gratify the desire; simple, splendid, variegated, exquisite. But the moment we open the gates of the animal kingdom a new world pours upon us, and a new train of affections take possession of the bosom; it is here, for the first time, that we behold the nice lineaments of feeling, motion, spontaneity; we associate and sympathize with every thing around us, we insensibly acknowledge an approximation (often indeed very remote, but an approximation nevertheless) to our own nature, and run over with avidity the vast volume that lies before us, of tastes, and customs, and manners, and propensities, and passions, and consummate instincts.

But where shall we commence the perusal of this volume? the different pages of which, though each intrinsically interesting, lie scattered, like the sibyl leaves of antiquity, over every part of the globe, and require to be collected and arranged in order, to give us a just idea of their relative excellence, and to enable us to contemplate them as a whole.

The difficulty has been felt in all ages; and hence multiplied classifications, or schemes for assorting, and grouping into similar divisions, such individuals as indicate a similar structure, or similar habits, or similar powers, have been devised in different periods of the world, and especially in modern times, in which the study of zoology has been pursued with a searching spirit, unknown to the sages of antiquity.—And well has it deserved to be so pursued. “This subject,” observes M. Biberg, “is of so much importance, and of such an extent, that if the ablest men were to attempt to treat it thoroughly, an age would pass away before they could explain completely the admirable economy, habits, and structure even of the most imperceptible insect. There is not a single species that does not, of itself, deserve an historian.”\*

Before we gird ourselves then to a critical indagation into any particular part of the immense theatre which this study presents to us, it may be convenient to contemplate it upon that general survey which it is the object of such schemes or classifications to lay down; to travel over it and mark its more prominent characters by a map, anterior to our entering upon the country itself. And such are the humble pretensions of the present lecture; which will merely attempt to place before you a brief sketch of zoology, in

\* *Amnitates Academicæ Suecicæ*, vol. ii. art. 19, *Œconomia Naturæ*.

regard to its bare outlines; for such a sketch is the whole that our time will allow; yet if it be found faithful, it will assuredly be found beneficial; for if the outlines be correctly laid down, the picture may be filled up at our leisure.

That most sublime and magnificent of all poems, ancient or modern, the Book of Job, establishes, in the most satisfactory manner, that the study of natural history, and especially the history of the animal kingdom, was cultivated at a very early period of the world,—in all probability as early, at least, as the Mosaic epoch,—with a considerable degree of minute attention in regard to various kinds and species; and the detailed references to the habits and manners of other animals that lie scattered through almost every part of the Hebrew Scriptures, and especially through the book of Psalms, and those of the Prophecies, and the distinct historical notice which is given of the scientific acquaintance of Solomon with this attractive study,\* establish, not only that it was attended to at a very early period, but that it was a very favourite and fashionable pursuit for many ages throughout Egypt, Syria, and Arabia. But the first physiologist who, we can say, with any degree of certainty, pointed out the expediency of a methodical arrangement of animals was Aristotle. His works upon this subject have reached us; yet while they prove that he took the same extensive and scientific view of it which he did of all other subjects, to which he directed the wonderful powers of his comprehensive mind, they prove also, that the study of natural history in Greece had by no means, in his day, kept pace with a variety of other studies; and that he did not conceive, aided as he was by all the mighty patronage of Alexander the Great, and the concurrent exertions of every other physiologist, that he was in possession of a sufficiency of facts to attempt the same kind of systematic arrangement here, which he is so celebrated for having effected almost every where else. He modestly contented himself, therefore, with pointing out the important use of such an arrangement as soon as it could be accomplished, and with suggesting a few hints as to the principles upon which it should be constructed. He observes, that the distinctive characters of animals might be taken from the nature of their food, from their actions, their manners, or their different structures. That their inhabiting land or water, offers a distinction of another sort: and that of land animals, there are some kinds that respire by lungs, as quadrupeds, and others that have no such kind of respiration; that some are winged, and others wingless; that some possess proper blood, while others are exsanguineous; that some produce their young by eggs, and these he named oviparous, while others bring them forth naked, and these he called viviparous; that quadrupeds, again, may, perhaps, be distinguished by the make of the foot, as being of three kinds, undivided, cloven, and digitated, or severed into toes or claws.†

These, indeed, were mere hints, and only intended as such; but they were truly valuable and important; for they roused zoologists to that general comparison of animal with animal, which could not fail of very essentially advancing the cause of natural history; and have, in different degrees, laid the foundation of almost every methodical arrangement which has since been offered to the world.

To run over a list of these arrangements would be equally useless and jejune. The writers who have chiefly signalized themselves in this department, are Gesner, Aldrovandi, Johnston, Ray, Linnæus, Klein, Lacépède, Blumenbach, and Cuvier; and in particular sections of it, Lamarck, Bloch, Fabricius, Latreille, and Brogniart; all of whom have flourished since the middle of the sixteenth century; most of whom have contributed something of importance to a scientific method of studying and distributing animals; and the most celebrated of whom are Ray, Linnæus, and Cuvier.

The system of Ray is derived, in its first outlines, from that recommendation of Aristotle, which suggests an attention to the different structures of different descriptions of animal life; and his observation, that one of these

\* 1 Kings, iv. 33.

† *Arist. Hist. Anim. lib. 1. cap. 1, cap. 3; cap. 6.*



differences consists in their possessing lungs and a sanguineous system, or their being destitute of lungs and exsanguineous.

The Linnæan method is, for the most part, built upon this general arrangement of Mr. Ray, especially in regard to quadrupeds; it is, however, an extension of it, and certainly an improvement. That of M. Cuvier, in its subordinate division, is founded upon both these; but in its primary and leading distinctions, upon the nervous or sensorial, instead of upon the respiratory and sanguineous systems; all animals, upon M. Cuvier's scheme, being primarily divided into vertebrated and invertebrated; those furnished with a back-bone, or vertebral chain, for the purpose of enclosing the spinal marrow, and those destitute of such a chain: the secondary sections, consisting of vertebrated animals with warm blood, and vertebrated animals with cold blood; invertebrated animals with blood-vessels, and invertebrated animals without blood-vessels.

All these, under his last modification, which is that subjoined to his Lectures on Comparative Anatomy,\* are regarded as embracing nine distinct classes; as, I. MAMMALS; and, II. BIRDS, which belong to the warm-blooded vertebral division. III. AMPHIBIALS; and, IV. FISHES, which belong to the cold-blooded vertebral division; and the five following, which fill up the division of invertebrated animals: V. MOLLUSCOUS, soft-bodied marine animals, or mostly marine animals, as oysters, limpets, whelks, cuttle-fish, pipe-worms or ship-worms, defended by a testaceous covering. VI. CRUSTACEOUS; as crabs, various lobsters, shrimps, sea-spiders, and the monocusculus tribes. VII. INSECTS; being all those ordinarily so denominated. VIII. WORMS; embracing, along with those commonly so called, leeches, and various sea-worms with bristles on the sides of the body, as aphrodites, terebels or naked ship-worms, serpules, amphitrites, nereids, tooth-shells. IX. ZOOPHYTES; the term being used very extensively, so as to include, not only all the zoophytes or plant-like animals of Linnæus and other naturalists, but all their infusory, wheel, or microscopic animals; their medusas or sea-nettles, actinias or anemonies, and other efflorescent worms, urchins, and star-fishes; and thus largely infringing on the molluscous order of prior arrangements.

Many of these classes have inferior sections and subsections, under which the genera that appertain to them are respectively marshalled. But in a general outline it is not necessary to follow up the arrangement more minutely.

The common classification of zoological writers of the present day is still that of Linnæus; and as such, it is that which I shall regularly follow up in the remainder of the present study, as being best adapted to popular purposes. It is probable, however, that the classification of Cuvier will ultimately take the lead of it; it is somewhat more abstruse, but considerably more definite; and offers a noble specimen of scientific ingenuity, applied to one of the noblest branches of scientific study; and I shall hence advert to this classification as we proceed, for a comparison with that of the justly celebrated Swedish naturalist.

The Linnæan system of zoology divides all animals into six classes, and each class into a definite number of orders; every order consisting of an indefinite number of kinds or genera; and every kind or genus of an indefinite number of species: the individuals in each species being perhaps innumerable.

The six classes are as follows: I. mammals, or suckling animals; II. birds; III. amphibials; IV. fishes; V. insects; VI. worms.

These may be contemplated either in an ascending or a descending scale. As we have begun with brute matter, and have progressively pursued it from a shapeless mass to mineral crystallization, from mineral crystallization to vegetable organization, and from vegetable organization to animal spontaneity, it will be most congruous still to continue in the same direction, and to commence with the lowest class constituting the worm tribes.

I. WORMS, in the Linnæan vocabulary, is a term of far more extensive

\* *Leçons d'Anatomie Comparée de G. Cuvier, Svo. 4 tom. Paris, 1805.*

import than in its popular signification; and the reason of this we shall perceive as we proceed. They include all animals below the rank of insects, and are classically characterized, as being mostly without distinct head and without feet; the most prominent organ being their tentacles or feelers. The class is divided into FIVE ORDERS; intestinal, molluscous, testaceous, zoophytic, and infusory.

The FIRST ORDER OF INTESTINAL, with a few exceptions which are found in the waters, consists of animals that are uniformly traced in the bowels of the earth, or of other animals; whence, indeed, their ordinal name. They are ordinarily characterized as being simple, naked animals, without limbs. I shall instance as examples of it, the ascaris, which is found so frequently in the intestinal tube of mankind, in the species of maw or thread-worm, and round-worm: the tænia, which comprises among many others the two species of tape-worm and hydatid; and the filaria or Guinea-worm, which inhabits both the Indies, and is frequent in the morning dew; at which time it winds unperceived into the naked feet of slaves, or other menials, and creates the most troublesome itchings, frequently accompanied with inflammation and fever. The only method of extracting it is to draw it out cautiously by means of a piece of silk tied round its head as it peeps from the inflamed surface; for if, in consequence of too much straining, the animal should break, the part remaining under the skin will still survive, grow with redoubled vigour, and occasionally augment the local inflammation to such an extent, as to prove fatal. It is often twelve feet long, though not larger in diameter than a horse-hair.

The next intestinal worm at which it is worth while to throw a glance as we pass on, is the fasciola or fluke, principally known from one of its species being found in large abundance in the liver of sheep during the disease called the rot, but whether the cause or the result of this disease has never yet been sufficiently ascertained. There are other species of this animal found in the stomach, intestines, or liver of various other animals, and occasionally of man himself. The fasciola is hermaphrodite and oviparous.

The gordius or hair-worm is chiefly worthy of notice as being supposed, in one of its species, if incautiously handled, to inflict a bite at the end of the fingers, and produce the complaint called a whitlow. It inhabits soft stagnant waters, is from four to six inches long, and is almost perpetually twisting itself into various contortions and knots.

The last two kinds I shall enumerate under this order of worms are, the lumbricus or earth-worm, including the dew-worm and the slug; and the hirudo or leech, both of them too well known under several species to require any farther remark in the present rapid outline. This order includes nearly the whole of M. Cuvier's class of worms, with the exception of his sea-worms, already adverted to.

The SECOND ORDER OF THE WORM CLASS is denominated MOLLUSCA, MOLLUSCOUS, OR SOFT-BODIED SHELL-WORMS; and consists, for the most part, of similar animals to those found in snail, oyster, nautilus, and other shells, but without a shelly defence: and hence, in their ordinal character, they are described as simple animals, naked, but furnished with limbs, of some kind or other. By this last mark they are distinguished from the preceding, or intestinal order, which, as already observed, consists of simple animals, naked and destitute of limbs. To place the order more immediately before you, I shall select a few examples from those animals that are most familiar to us, or are most remarkable for the singularity of their structure or other properties.

The limax or slug is one of the most simple animals that belong to this order: its only limbs are four feelers, tentacles, or horns, as they are commonly called, situate above the mouth, with a black dot at the tip of each of the larger ones, which is supposed to be an eye, though this point has not been fully established. Another genus of molluscous worms is the terrabella; one species of which is the ship-worm, with an oblong, creeping, naked body, and numerous capillary feelers about the mouth, from four to six inches in length. It is sometimes enclosed in a testaceous or shelly tube, and is then



called termes, pipe-worm, or shelly ship-worm, and belongs to the next order. In both forms it is peculiarly destructive to shipping; boring its way into the stoutest oak planks, with great rapidity and facility; and chiefly forming a necessity for their being copper-bottomed. The animal is, in its habits, gregarious; and hence, in attacking a vessel, it advances in a multitudinous body, every individual punctiliously adhering to its own cell, which is separated from the adjoining by a partition not thicker than a piece of writing-paper. In a preceding lecture, however, I had occasion to observe, when glancing at the shelly ship-worm, or teredo *navalis*, that, by its attacking the stagnant trunks of trees and other vegetable materials, that in many parts of the world are washed or thrown down by torrents and tornadoes from the mountains, and block up the mouths of creeks and rivers, and thus powerfully contributing to the dissolution of dead vegetable matter, it produces far more benefit than evil; the benefit being universal, but the evil partial and limited. In 1731 and 1732 they appeared in great numbers on the banks of Zealand, and considerably alarmed the Dutch, lest the piles by which these banks are supported should have been suddenly destroyed. They never, however, staid long enough to commit mischief, the climate, perhaps, being too cold for them.

Another genus worthy of notice under this order is the actinia, which includes those species of naked sea-worms which are vulgarly called sea-daisy, actinia *Bellis*; sea-carnation, a *Dianthus*; sea-anemony, a *Anemonoides*; and sea-marigold, a *Calendula*; from their resemblance to the stems and flowers of these plants. The first three are found on the warmer rocky coasts of our own country, as those of Sussex; and the last on the shores of Barbadoes. The sea-carnation is sometimes thrown upon our flat coasts, and left evacuated of its water by the return of the tide; in which case it has the appearance of a slender, long-stalked, yellow fig.

Most of us are acquainted with some species of the sepia or cuttle-fish, which is another genus of the order before us. The common cuttle-fish, *sepia officinalis*, is an inhabitant of the ocean, and is preyed upon by the whale and plaise tribes; its arms are also frequently eaten off by the conger-eel, but are reproducible. The bony scale on the back is that alone which is usually sold in the shops, under the name of cuttle-fish, and is employed in making pounce. These animals have the singular power, when pursued by an enemy, of squirting out a black fluid or natural ink, which darkens the waters all around, and thus enables it to escape. This natural ink forms an ingredient in the composition of our Indian inks. The worm or fish was formerly eaten by the ancients, and is still occasionally used as food by the Italians. In hot climates, some of the species grow to a prodigious size, and are armed with a dreadful apparatus of holders, furnished with suckers, by which, like the elephant with its proboscis, they can rigidly fasten upon and convey their prey to the mouth. In the eight-armed cuttle-fish, *sepia octopodia*, which inhabits the Indian seas, the arms or holders are said to be not less than nine fathoms in length. In consequence of which the Indians never venture to sea without hatchets in their boats to cut off these monstrous arms, should the animal attempt to fasten upon them, and drag them under water. This genus, with that of the argonauta and nautilus, constitute the order CEPHALOPODA of Cuvier, which belongs to his class named MOLLUSCÆ.

The medusa is another genus entitled to attention, as affording various species that shine with great splendour in the water. The worms of this kind are vulgarly denominated sea-nettles, and consist of a tender gelatinous mass, of various figures, furnished with arms or tentacular processes, issuing from the under surface. The larger species, when touched, produce in the hand a slight tingling and redness, and hence, indeed, the name of sea-nettles, by which they are commonly distinguished. A few of the species are found on our own coasts; but by far the greater number are exotics.

The asterias, sea-star, or star-fish, is another genus of molluscous worms, and, in some of its species, is known to all of us. The most curious species of this genus is the asterias *Caput Medusæ*, or basket-fish; which inhabits most seas, and consists of five central rays, each of which divides into two

smaller ones, and each of which smaller ones again divides into two others; the same kind of division and subdivision being continued to a vast extent, and every ray regularly decreasing in size, till at length the ramifications amount to many thousands, forming a beautiful net-work spread over the water. The colour of the worm varies: being sometimes pale, sometimes reddish-white, sometimes brown.

The only other genus I shall mention under this order is the echinus, sea-urchin, or hedgehog: its species are very numerous, and of a great multiplicity of forms, globular, oval, shield-like, and heart-shaped. Many of them appear to have long since become extinct, and are only to be found in a state of petrification. The surrounding spines form an admirable coat of mail when perfect; but they are generally broken off from the shell when it is picked up empty on our own coasts.

The THIRD ORDER of the Linnaean class of worms are called TESTACEA or TESTACEOUS; and comprise those that are surrounded with a shelly or testaceous covering. They are of three kinds; those possessing a single shell, of whatever form or kind, and hence denominated univalves; those possessing two shells, which are called bivalves or conchs; and those possessing more than two shells, which are in consequence named multivalves.

The UNIVALVES, or SINGLE-VALVED, are the most numerous, and exhibit the greatest variety of forms. For the most part they are regularly or irregularly spiral: among the most common of them may be mentioned the helix or snail-genus; the patella or limpet; and the turbo or wreath-genus, of which the periwinkle is a species; the animal in all which is a limax or slug. Among the more curious are, the murex or purple-shell so highly valued by the ancients for the exquisite dye it is capable of producing; the volute or mitre, including those fine polished spiral shells, without lips or perforation, which so often ornament our chimney-pieces, sometimes embellished with dots, and at other times with bands of colours of various hues; the strombus, comprising the larger shells appropriated to the same purpose, spiral like the volute, but with a large expanding lip spreading into a groove on the left side, and often still farther projecting into lobes or claws, the back frequently covered with large warts or tubercles, in some species called coromant's foot; in all which, the animal or inhabitant is still a limax or slug; and the nautilus and argonauta, the pearl-nautilus and paper-nautilus; the first of which is lined with a layer of a most beautiful pearly gloss, and in the East is manufactured into drinking-cups; and the second of which is remarkable for its exquisite lightness, and the rumour common to most countries of its having given to mankind the first idea of sailing. In reality, it sails itself, and with exquisite dexterity; and to this end the animal that is usually found inhabiting the shell, and which, till of late, was supposed to be a four-armed cuttle-fish, though now regarded as an ocythoe, by Dr. Leach named o. Cranchii, in memory of the indefatigable, but unfortunate, Cranch of the British Museum,\* as soon as it has risen to the surface, erects two of its arms to a considerable height and throws out a thin membrane between them, thus producing a natural sail; while the oars or rudder are formed by the other two arms being thrown over the shell into the water, by which ingenious contrivance, or rather instinctive device, the paper-nautilus sails along with considerable rapidity. M. Cuvier has separated the nautilus from the rest though distinctly a univalve; and, as we have already noticed, has united it with the cuttle-fish, under an order of MOLLUSCÆ, which he calls CEPHALOPODA. The ordinal name for the others is with him GASTEROPODA, as most of them crawl on their bellies, and carry the shell over them as a shield. They have a distinct and moveable head, by which they essentially differ from our next order, which are without a distinct head of any kind. The two sexes are united in the same individual, but require a reciprocal union for breeding.

The BIVALVED or TWO-SHELLED TESTACEOUS WORMS, the acephala or headless of Cuvier, are best explained by referring you to the oyster and the muscle



(*ostrea* and *mytilus*), both which contain species that produce pearls, and mother-of-pearl; though the real pearl-muscle is *amya* or *gaper*, found chiefly on the coasts of Malabar and Ceylon, where the principal pearl-fisheries are established. The species of oyster that produces small pearls is sometimes traced on our own shores, and is said to have been at one time frequent in the river Conway, in Wales. Most of the oysters cast their spawn towards the close of the spring, or in the beginning of the summer, as the month of May. This spawn is by the fishermen called *spat*, and in size and figure each resembles the drop of a candle. As soon as cast or thrown off, these embryon disks adhere to stones, old oyster-shells, pieces of wood, or whatever other substance comes in their way; a calcareous secretion issues from the surface of their bodies, and in the course of twenty-four hours begins to be converted into a shelly substance. It is two or three years, however, before they acquire their full size.

The scallops, which are a tribe belonging to the oyster kind, are capable of leaping out of the water at pleasure, to the distance of half a yard: when elevated they open their shells, and eject the water within them, and then falling back into the water close them with a loud snap.

Among the more elegant of this division is the *nacre*, *pinna*, or sea-pen, so called from its form; the animal of which (a *limax* or slug) secretes, as we have already observed, a large quantity of fine strong silky hair, or beard, which by the Italians is woven into a kind of silky plait. And among the most extraordinary is the gigantic *chama* or clamp-shell, in form resembling the oyster: one species of which we noticed not long since, as found in the Indian Ocean, of the weight of between five and six hundred pounds; the fish or inhabitant large enough to furnish a hundred and twenty men with a full meal, and strong enough to lop off a man's hand, and cut asunder the cable of a large ship.

Of the MULTIVALVED TESTACEOUS WORMS, or those containing more than two shells, there are but three known species, the *chiton*, the *lepas* or acorn-shell, and the *pholas*, or, as it is often improperly called, *pholas*, so denominated from its secreting a phosphorescent liquor of great brilliancy, which illuminates whatever it touches or happens to fall upon, and to which Linnæus chiefly ascribed the luminous appearance which the sea often assumes at a distance: a subject, however, which we shall have occasion to examine hereafter.

The FOURTH ORDER of the Linnæan class of worms is called ZOOPHYTES, or PLANT-ANIMALS, so denominated from their efflorescing like plants. Most of them are of a soft texture, as the *hydra* or *polype*, so well known from its being capable of existing when turned inside out, and of reproducing any part of its tentacles or body when destroyed by accident. Some are corky or leathery, as different species of the *alcyonium*; some bibulous, as the *spongia* or sponge, which is now decidedly ascertained to be an animal substance; and some calcareous, as the numerous families of coral, which, under the form of tubular, starchy, or stony stems, are denominated *tubipores*, *madrepores*, and *isises*.

The FIFTH or INFUSORY ORDER of worms, comprehends those minute and simple animalcules which are seldom capable of being traced, except by a microscope; and, for the most part, reside in putrid infusions of vegetables, or in stagnant waters filled with vegetable matter. Of these, the smallest known species is denominated *monas*. To a glass of the highest magnifying power it appears nothing more than a minute simple point or speck of jelly, obviously, however, evincing motion, but often from its delicacy seeming to blend itself with the water in which it swims.

Such is a bird's eye view of the Linnæan class of worms, and its five orders of intestinal, molluscous, testaceous, zoophytic, and infusory animals.

The INSECTS form the NEXT CLASS in an ascending scale; classically characterized as small animals, breathing through lateral spiracles, armed on all sides with a bony skin, or covered with hair; furnished with numerous feet and moveable antennæ or horns, which project from the body, and are

the probable instruments of sensation. They are so voluminous in their orders, as well as in the genera belonging to the class (this single class containing, perhaps, as many species as are known to the whole twenty-four classes of the vegetable kingdom), that our time will allow us to do little more than instance the names of a few of the most common and familiar kinds, under the ordinal arrangement. The orders are seven; all insects being included under the technical names of coleopterous, hemipterous, lepidopterous, neuropterous, hymenopterous, dipterous, and apterous; or, to exchange the Greek for English terms, under those of crustaceous-winged, half-crustaceous-winged, scaly-winged, reticulate or net-work-winged, membranaceous-winged, two-winged, and wingless. From all which it is obvious that the ordinal character of insects is derived from the general idea of wings; to which I may add, that under this general idea, while the individuals of the last order are destitute of wings, and those of the last but one are only possessed of two wings, the individuals of the preceding five orders have four wings each, though not particularly specified in their ordinal names.

The COLEOPTEROUS or CRUSTACEOUS-WINGED INSECTS, constituting the FIRST ORDER, are by far the most numerous; and, as the ordinal term imports, embrace all those whose wings are of a shelly or crustaceous hardness; and are subdistinguished by the nature of their antennæ as being clubbed at the end, thread-like or bristly. Among the more familiar of this order, I may mention the *scarabæus* or beetle-kinds, a very numerous race, equally distinguished by the metallic lustre of their wing-shells, and their attachment to dunghills, and other animal filth. The *dermestes* or leather-eater, the larvae or grubs of one species of which are found so perpetually to prey on the bindings of books, and sometimes even on the shelves of libraries. The *coccinella* or lady-bird; the *curculio* or weevil, the larve of which is found so frequently in our filbert and hazel-nuts, and which secretes such a quantity of bile as to give the nut a bitter taste to a considerable extent beyond the place in which it is immediately seated.

The *ptinus*, producing in one of its species the death-watch, is another insect belonging to this order, whose solemn and measured strokes, repeated in the dead of the night, are so alarming to the fearful and superstitious; but which, as we formerly noticed, merely proceed from the animal's striking its little horny frontlet against the bedpost it inhabits, as a call of love to the other sex. The *lampyris* or glow-worm, the *cantharis* or Spanish-fly, and the *forficula* or earwig: the last of which is characterized by the singularity of its brooding over its own young like a hen, and only leaving them at night, when it roams abroad in quest of food for their support. A few of these, as the lady-bird and earwig, are by M. Cuvier taken away from the present order, and, with several of the ensuing, as the cockroach, locust, and grasshopper, carried to a new order, which he has named ORNITHOPTERA.

The SECOND ORDER of INSECTS, entitled HEMIPTERA or half-crustaceous, and by some writers RHYNGOTA, has the two upper of the four wings somewhat hard or shelly, though less so than the preceding, while the two lower wings are for the most part soft and membranaceous. To this order belong the *coccus* or cochineal insect; the *blatta* or cockroach, of which the chaffer is a species; the *gryllus* or locust, of which one species is the little cheerful chirping cricket; the *cicada* or grasshopper, still more celebrated for its musical powers than the cricket; and the *cimex* or bug, celebrated also, but for powers which you will, perhaps, spare me from detailing.

The THIRD ORDER of INSECTS, COLEOPTERA, or SCALY-WINGED, contains but three genera or kinds; and these are, the *papilio* or butterfly, the *phalæna* or common moth, and the *sphinx* or hawk-moth; which last has a near resemblance to both the others, and flies with a humming noise, chiefly in the morning and evening, as the moth flies chiefly in the evening and at night, and the butterfly only in the daytime. They have all a general resemblance to each other, and feed equally on the nectary of flowers: the antennæ of the butterflies are mostly knobbed or clubbed at the tip; those of the moths are moniliform, those of the sphinxes tapering.



The NEUROPTEROUS INSECTS, or those with four reticulate or net-work wings, form the FOURTH ORDER of the Linnæan class; and they may be exemplified by the ephemera and hemerobius, the day-fly and May-fly of the angler, those little busy insects that surround us in countless multitudes when we walk on the banks of a river in a fine summer's evening, and the whole duration of whose life, in a perfect state, seldom exceeds two days, and often not more than as many hours; while it has comparatively a long life in its imperfect state, or previous to its metamorphosis. It is the agnatha of several entomologists. This order is not numerous, and I will therefore only add another example, the libellula or large dragon-fly, so denominated from its ferocity towards smaller insects; usually seen over stagnant waters; the more common species, libellula *Virgo*, possessing a beautiful, glittering, and green-blue body, with wings bluish towards the middle. The larve in its internal parts, is larger than the insect, and catches its prey at a distance, by suddenly darting forward the lower lip. The tracheæ, or respiratory organs, are singularly placed at the verge of the tail. It is the odonata of Cuvier.

The FIFTH ORDER OF INSECTS comprises the HYMENOPTERA, the piezata of some entomologists, or those possessed of four membranaceous wings, most of which are armed with a sting at the tail. They of course include the apis and vespa, or wasp and bee. To which I may add the formica or ant, the ichneumon, and the cynips or gall-fly, to which we are indebted for our gall-nuts, whose peculiarities and habits I shall hereafter have an opportunity of reverting to.

The SIXTH ORDER OF INSECTS is denominated DIPTERA, and deviates from all the preceding in possessing only two wings instead of four. It includes among others the musca or common fly, the hippobosca or horse-fly, the oestris or gad-fly, the tipula or father-long-legs, and the culex or gnat. It is subdivided into such animals as possess a sucker with a proboscis, and such as possess a sucker without a proboscis. This order is the antliata of some entomologists.

The LAST ORDER OF INSECTS differs still more largely from all that have been hitherto noticed; for it consists of those kinds that have no wings whatever, and hence the class is called APTERA or wingless. To this order belong most of those insects that are fond of burrowing in animal filth upon the animal surface; as the pulex, pediculus, and acarus, the flea, louse, and itch-insect. To the same order belongs also the aranea or spider; the oniscus, wood-louse or millepede; the scorpio or scorpion, and even the cancer or crab, and lobster; the Linnæan system making no distinction between land and water animals from the difficulty of drawing a line; of which, indeed, the cancer genus is a very striking example, since one of the species, cancer *curicola* or land-crab, is, as we have already seen, an inhabitant of woods and mountains, and merely migrates to the nearest coast once a year for the purpose of depositing its spawn in the waters. These, however, are separated from the class of insects in M. Cuvier's classification, and form a distinct class by themselves under the name of CRUSTACEA; while the greater part of the rest, as spiders, water-spiders, spring-tails, millepedes, centipedes, and scorpions, are also carried to a distinct order of the insect class, which he has called GNATHAPTERA, leaving to his own order of APTERA nothing more than the first three of the preceding list, the flea, louse, and tick or itch-insect.

But of all the animals belonging to this division under the Linnæan classification, I should mention, perhaps, on account of its singular instinctive faculties, the termes or white ant. The kind which inhabits India, Africa, and South America is gregarious, and forms a community, far exceeding in wisdom and policy the bee, the ant, or the beaver. The houses they build have the appearance of pyramids, of ten or twelve feet in height; and are divided into appropriate apartments, magazines for provisions, arched chambers, and galleries of communication. The walls of all these are so firmly cemented that they will bear the weight of four men without giving way; and on the plains of Senegal, the collective pyramids appear like villages of the natives. Their powers of destruction are equal to those of architecture; for

so rapidly and dexterously will they destroy, in less bodies, food, furniture, books, clothes, and timber of whatever magnitude, leaving in every instance the merest thin surface, that a large beam will in a few hours be eaten to a shell not thicker than a page of writing paper.

It was my intention to have finished our survey of the Linnæan system in the course of the present lecture; but the prospect swells so widely before us that it is impossible; and the remaining four classes of fishes, amphibians, birds, and mammals must be reserved for another study.

In the mean time, allow me to remark, that low and little as the tribes we have thus far contemplated may appear, they all variously contribute to the common good of animal being, and aid, in different ways, the harmonious circle of decomposition, renovation, and maturity of life, health, and enjoyment. The insect tribes, beautiful as they are in their respective liveries, may be regarded as the grand scavengers of nature. Wherever putridity is to be found, they are present to devour the substance from which it issues; and such is the extent and rapidity of their action, that it has been calculated by some naturalists that the progeny of not more than a dozen flies will consume a dead carcass in a shorter space than a hungry lion. Thus, while they people the atmosphere they purify it; and in many instances, perhaps, and by tribes invisible to the naked eye, purge it of those noxious particles with which it is often impregnated, and which, at certain seasons, are apt to render it pestilential.

The indefatigable labour of the worm-tribes in promoting the general good is still more striking and manifest. The gordius or hair-worm perforates clay to give a passage to springs and running water; the lumbricus or earth-worm pierces the soil that it may enjoy the benefit of air, light, and moisture; the terebella and terredo, the naked ship-worm and the shelly ship-worm, penetrate dead wood, and the phloas and mytilus, rocks, to effect their dissolution; while the termes or white ant, as we have just observed, attacks almost every thing within its reach, animal, vegetable, or mineral, with equal rapacity, and reduces to its elementary principles whatever has resisted the assault of every other species. The same system of warfare is, indeed, pursued among themselves; yet it is pursued, not from hate, as among mankind, but from instinct, and as the means of prolonging and extending as well as of diminishing and cutting short the term of life and enjoyment.

It has often been urged against the goodness, and sometimes against the existence, of the Deity, that the different tribes of animals are, in this manner, allowed to prey upon one another as their natural food, and that a large part of the globe is covered with putrid swamps, or wide inhospitable forests, or merely inhabited by ravenous beasts and deadly serpents.

Presumptuous murmurers! and what would *your* wisdom advise, were Providence to consult you upon so glaring an error? Would you then leave every rank of animals to perish by the mere effects of old age? With the example so often before you of the misery endured by a favourite horse or a favourite dog when suffered to drain out the last dregs of existence in the midst of ease he cannot enjoy, and of food he cannot partake of,—a misery which often compels us, as an act of mercy, to anticipate his fate, even at last, by the aid of violence,—would you abandon every animal to the same wretchedness, only a hundred-fold multiplied by the horrors of want and hunger, which he must, by growing every day more infirm, be every day growing more incapable of appeasing?—Or would you cut short the evil at once, by destroying death itself, and thus rendering every animal immortal? They would not thank you for such an interference, nor applaud the vain benevolence that might dictate it; an interference which, by preventing the necessity for offspring, would extirpate from the animal frame its best feelings; which would extinguish the wise and harmonious distribution into sexes; and make an equal inroad on the pleasures of sense and the endearments of instinct.

It is granted, that a great part of the globe is an inhospitable wilderness; that it consists, to a considerable extent, of waste inaccessible jungle overrun



by rapacious beasts and reptiles, of putrid swamps crowded by myriads of venomous insects, and of immense warrens burrowed by countless hordes of the hamster, the mole-rat, and the white ant. Even here, however, wherever life exists, it exists to those that possess it as an enjoyment; while these very scenes and these very animals only fill up what man has no occasion for, and equally and instantly disappear as soon as he presents himself, and exercises that industry and ingenuity which alone constitute his authority; and upon which alone his health and his happiness are made to depend.

But this is not all.—While in their different gradations these outcasts from man are thus enjoying life themselves, they are preparing, in the best manner possible, the various tracts they occupy for his future use and habitation. The soil that supports us, and gives us our daily bread, is nothing but a mixture of animal and vegetable materials; other substances, indeed, enter into it, but the great, the important, the active, and leavening constituent is of an organized origin. These materials, then, are perpetually forming and accumulating, and rising into an unbounded and inexhaustible storehouse of subsequent riches and plenty by the alternate generation and decomposition of the different kinds and orders of plants and animals which thus fill up, and, as we are apt to believe, encumber the regions we are contemplating; regions which, though in our own day unexplored or abandoned both by savage and civilized man, may, in that revolution of countries and of governments which is perpetually passing before our eyes, become, in some future period, the seat of universal dominion, the emporium of taste and elegance, of virtue and the sciences. So the fairest fields of Rome were formed out of the putrid Pontine marshes, and England has become what she is, from being a land of bogs and of blights, of wolves, wild boars and gloomy forests.

## LECTURE II.

ON ZOOLOGICAL SYSTEMS, AND THE DISTINCTIVE CHARACTERS OF ANIMALS.

(The subject continued.)

In our last lecture we took a momentary glance at the history of zoology as a science, noticed the primary features of the best methodical arrangements to which it has given rise, and made some progress towards a brief delineation of that of Linnæus, which still takes the lead amid the writers of the present day, and is hence chiefly entitled to attention in a course of popular study, generally collating it, however, with that of M. Cuvier, as we proceeded.

We observed that the Linnæan system comprehends all animals of every description whatever, under the six classes of mammals, birds, amphibials, fishes, insects, and worms. We pursued this arrangement in an ascending scale, as most consistent with the plan adopted at the opening of the present course of instruction; and commencing with the class of worms, finished with that of insects. It remains for us to prosecute the same rapid outline of inquiry through the four unexamined classes of fishes, amphibials, birds, and mammals.

Fishes are classically characterized in the Linnæan system as being always inhabitants of the water; swift in their motion, and voracious in their appetite; breathing by means of gills, which are generally united by a bony arch; swimming by means of radiate fins, and for the most part covered over with cartilaginous scales.

The class is divided into six orders; the ordinal characters being taken from the position of the ventral or belly fins, or from the substance of the gills. The orders are, apodal, fishes containing no ventral or belly fins; jugular, having the ventral fins before the pectoral; thoracic, having the ventral fins under the pectoral; abdominal, having the ventral fins behind the pectoral. In all these four, the rays or divisions of the gills are bony. In the fifth order, which is called branchiostegous, the gills are destitute of bony rays; and in the sixth, or chondropterygious order, the gills are cartilaginous; all which will be easiest explained by a few familiar examples. Into the general divisions of this class M. Cuvier has introduced no change of any importance whatever, his own sections and names running parallel with those of Linnæus.

The kind best calculated to elucidate the FIRST OR APODAL ORDER, is the well known *muræna* or eel; since every one must have noticed, that this fish has no ventral or, indeed, under-fins of any kind. In many of its species, it has a very near approach to the serpent tribes; insomuch that several of them are called sea-serpents, and by some naturalists are described as branches of the serpent genus. Even our own common eel, *muræna Anguilla*, is often observed to quit its proper element during the night, and, like the snake, to wander over the meadows in search of snails and worms.

The next genus I shall mention is the *gymnotus*, of which one species, *gymnotus electricus*, is the electric eel, an inhabitant of the rivers of South America, from three to four feet long, and peculiarly distinguished by its power of inflicting an electrical shock, so severe as to benumb the limbs of those that are exposed to it. The shock is equally inflicted whether the fish be touched by the naked hand, or by a long stick. It is by this extraordinary power, which it employs alike defensively and offensively, that the electric eel escapes from the jaws of larger fishes, and is enabled to seize various smaller fishes as food for its own use. There are, however, a few other fishes, as we shall have occasion to notice in proceeding, that possess a similar power, as the torpedo of European seas, and especially of the Mediterranean, and the electric *silurus* of those of Africa.