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CUVIER
AND
ZOOLOGY.

A POPULAR BIOGRAPHY, WITH AN
HISTORICAL INTRODUCTION
AND SEQUEL.

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P R E F A C E.

A TASTE for Zoology has never been more widely diffused than at the present day; for there never was a period in which so large a number of works written expressly to illustrate the history and economy of animals met with the eager reception now given to them. The scientific treatises of our best naturalists, adapted to aid the researches of the retired student, the richly-illustrated folios fitted to grace the apartments of the nobility, and a multitude of lesser works, designed to make zoology popular among all classes, sufficiently attest, by their general distribution, the increased interest with which this particular department of natural history is viewed.

The immediate cause of this increased interest, as it respects the middle classes of society, may probably be found in the labours of the Zoological Society, by means of which public curiosity has been gratified with exhibitions of animals on an extensive scale, placed in attractive gardens, and surrounded by the accessories of art. Such gardens afford to the inhabitants of our principal cities a valuable and inexpensive source of amusement, while they admit of many attractive lessons to the young, and excite a desire for information, and an interest in zoology, which could scarcely be aroused by other means.

But for the more remote cause of the present favourable state of things as it regards the popular taste for zoology, we must look to the gradual developement of the science itself, effected by the labours of those eminent men, whose lives, as sketched in the following pages, are identified with the progress of zoological knowledge. From the days of Aristotle to those of the immortal Cuvier, gradually increasing light has gladdened this portion of the field of nature; nor has it suffered diminution since Cuvier's time, through lack

of endeavour on the part of succeeding naturalists to follow in the glorious path opened by him, and to profit by the discoveries due to his genius.

We have reason to be proud of many names belonging to our own country and times, and we may justly boast that England is keeping pace with other countries in the career of zoological discovery; but every unprejudiced person, on carefully reviewing the history of science, will at once admit, that to *one* richly-gifted and most powerful mind the science of zoology is mainly indebted for its present flourishing condition. CUVIER, who, by the investigation of fossil remains, unfolded the obscure and half-obliterated records of a former world, and brought the knowledge thus gained to bear upon the state of the existing animal kingdom, performed inestimable services to the cause he loved, and demands the gratitude of every intelligent inquirer into the mysteries of nature. Of the character of this distinguished man too little is known to the reading public. While his name is familiar, and his labours are not altogether overlooked, the beauties of his character remain unappreciated. The life of Cuvier can scarcely be read without emotion, abounding as it does with proofs of the most benignant spirit, the tenderest affection, the most unaffected piety, and the highest intellectual attainments. Yet notwithstanding that an excellent memoir of him exists in our own language, and that various means of studying his character are also open to those who can appreciate the literature of France; the subject appears almost wholly neglected, to the detriment of numbers who might gain a valuable lesson from the life of this excellent man. From Mrs. Lee's interesting memoir, drawn up from personal acquaintance with the great naturalist; from the sketch of M. Laurillard (Cuvier's secretary), contained in the *Biographie Universelle*; and from the funeral *Eloges* of MM. Duvernoy, Pariset, &c., we have obtained the data for our present memoir. In the sketch of zoology generally, the works of Whewell, Swainson, Kidd, Griffith, Pidgeon, and other eminent writers, have been consulted.

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‘NATURAL History has not only, like most other sciences, made great progress of late years, but it has assumed an importance to which formerly it in vain attempted to lay claim. It is not, indeed, surprising that so long as it was restricted to collecting plants and animals as mere objects of curiosity, or judged to be of no further consequence than as it admitted of application to economic purposes, it should be either held up to contempt by the majority of thinking men, or tolerated only so far as it was studied with immediate reference to the ends just alluded to. But there are other grounds upon which, in these days, it is deemed worthy of our regard. The mere collector, indeed, is held in no higher esteem than formerly. The advantages we derive from an acquaintance with those organized beings which are capable of supplying the wants, or augmenting the conveniences of life, are not overlooked, but are considered rather as indirect benefits resulting from the cultivation of this science, than as the immediate objects to which all our researches incline. Natural history is of importance from the effects which it produces, or which it at least is capable of producing, upon the human mind. As a study, it tends equally with all other studies to strengthen the faculties, to fix the attention, and, to a certain extent, to exercise our powers of correct judgment and reasoning. As the particular study of those innumerable beings which people the earth, it has an especial tendency to infuse habits of accurate observation; and as one of its objects consists in tracing the complicated relations which these beings bear to one another, it naturally leads the observer to certain first principles of systematic arrangement, which being afterwards transferred to other subjects, are made susceptible of more general application. There are yet further advantages which accrue from the pursuit of this science, sufficient to recommend it, even when followed for its own sake, and apart from all other inducements. The relaxation which it affords the mind, when fatigued with severer studies, or oppressed with anxiety;—the never-

failing entertainment which it yields, even in the most retired and solitary spots;—the charms with which it can invest a country life, diffusing happiness over our leisure hours, and converting every walk into an intellectual treat;—these are fruits which will not be esteemed lightly, or considered by a reflecting mind as beneath its notice. Above all, we may allude to those devout meditations which this science is calculated to suggest to all such as are alive to the impressions of religion. It tends to uphold that secret communion with the Creator, which Revelation so much encourages. And if this remark has been often made, it only shews how general has been the feeling to which it relates. Strange indeed must be the perversion of that mind, which is made neither wiser nor better, by studying the works of Him whose own wisdom is infinite, and all whose operations tend to good and happiness. We are not disposed to wonder because we find some to whom the study itself fails in affording the same degree of interest which we ourselves derive from it. But to have the thoughts leaning of their own accord to such pursuits;—to be able to expatiate with delight on that immense field of wonders which nature opens to us;—to trace the workings of the most consummate skill, power, and benevolence:—and yet in our researches to find no room for moral improvement,—no incitement to remember the great Author of all;—we fear this indicates a mind estranged from its own best interests, and but ill qualified for the more exalted employments of a future existence¹.

Every part of the globe we inhabit is occupied by vast multitudes of living beings, whose habits, forms, instincts, and passions, afford a field of never-failing and deeply interesting study, which has been explored in successive ages by man, the most gifted and elevated of all.

¹ The Rev. Leonard Jenyns, in the *Magazine of Zoology and Botany*.

The department of knowledge thus opened to us is called Zoology, which treats of the various tribes of animals, marks their separate forms and habits, compares their various organs, unfolds those laws which regulate their geographical distribution, and attempts to arrange them into families according to principles deduced from their structure.

What may have been the degree of knowledge possessed by the early inhabitants of the world, must ever remain in a great degree hidden from us. But the Sacred Records make known to us that some acquaintance with the properties of animals, and with their uses to mankind, was communicated to our first parents. The works of God in creation were also studied by Solomon, whose wisdom probably much extended the knowledge of his predecessors. Yet whatever might have been the attainments of the ancients, whether among the chosen people of God, or in the heathen world, we have no reason to suppose that zoology had assumed a definite form until the time of Alexander the Great.

The best authorities date the rise of zoology as a science from this period, when the renowned Aristotle directed his powerful mind to the study of the animal creation. While collecting and recording the observations of his predecessors, this great man undoubtedly did far more by extensive and important researches of his own; and it is remarkable that he stands as a solitary example of eminence in this respect; for if others followed in his steps, the records of their progress and success have not reached modern times. The labours of Aristotle are thus forcibly described by Swainson:—
‘ Had this extraordinary man left us no other memorial of his talents than his researches in zoology, he would still be looked upon as one of the greatest philosophers of ancient Greece, even in its highest and brightest age. But when it is considered that his eloquence, and his depth of thought, gave laws to orators and poets; that he was almost equally great in moral as in physical science, and that no department of human learning escaped his research, or was left unilluminated by his

genius,—we might be almost tempted to think that the powers of the human mind in these latter days had retrograded; and that originality of thought and of philosophic combination existed in a far higher degree among the heathen philosophers than in those who followed them. A moment's reflection, however, will show that such ideas are grounded upon partial considerations, and they are at once to be refuted by such names as those of Newton and Bacon. Furthermore, it should be remembered that the most ordinary observer can readily distinguish a quadruped from a bird, and a vertebrated from a boneless animal. All these distinctions are obvious, and therefore known even to the vulgar. Nor does it require any great skill to express these differences in words. The same may be said of those secondary divisions by which a beetle may be known from a butterfly, and these, again, from a bee. It is not so much, therefore, from having embodied facts like these in classic language, that the philosopher of Stagyræ derives his high fame; it rather reposes upon the peculiar tact with which he brought the rules of philosophic reasoning to bear upon a subject hitherto neglected,—upon the extent and depth of his personal researches,—upon the clearness with which he arranged his results,—and, above all, upon those obscure perceptions which he acquired, while so employed, of hidden truths, which were only to be developed in subsequent ages. Nor should that innate grandeur of his mind be forgotten, which led him, in an age of universal superstition, to discard from his work all those popular tales, and fancies, and beliefs, which were received by the mass of his countrymen as religious truths, sanctioned by antiquity, interwoven in their history, and consecrated in their poetry.'

Since then the first steps in the systematic study of animals were taken by Aristotle, it will be desirable to trace the principal events in a life which bears so important a relation to the science of zoology.

Aristotle was born in the city of Stagyræ, in the Thracian Chersonesus, in the first year of the ninety-

ninth Olympiad, or 384 years before the Christian era. His father was physician to Amyntas, king of Macedonia, the grandfather of Alexander the Great. His family claimed descent from Machaon, the son of Esculapius. Aristotle had the misfortune to lose his parents in early life, and was therefore consigned to the care of a guardian named Proxenus. Some authorities assert that this guardianship was not very faithfully performed, and that the youth fell into a dissipated course of life, wasting his time and patrimony in licentious indulgences. Others consider that these aspersions of his character were the slanderous reports of envious men.

When at length it became necessary to choose a profession, Aristotle went to Delphi to consult the oracle, and was directed to apply himself to the study of philosophy, and to repair to Athens for that purpose. Accordingly, at the age of seventeen, he devoted himself with all the ardour of a naturally energetic disposition to this new pursuit, and commenced his career as the pupil of Plato. With such unwearied diligence did he pursue his studies that he soon surpassed all his companions, so that Plato called him the *mind* of his school, and compared him to a spirited colt that required to be reined in, that his ardour might be subdued. There was, indeed, much reason for this comparison, since the eagerness of the scholar outwent every prudent consideration with respect to his health. In order to reduce the amount of his sleep within the smallest possible limits, Aristotle placed a metal basin beside his couch, and on lying down, held out one hand which clasped an iron ball. On falling asleep he would of course drop the ball, which, striking on the sonorous metal, would immediately awake him. It is difficult to see how this practice could help his studies; for experience proves that languor and indisposition by day are the constant result of disturbed and insufficient rest at night.

It is doubtful whether Aristotle commenced his career as a public teacher until after the death of Plato, which happened in the year 348 B.C. A personal enemy has accused him of ingratitude towards his aged

master, and of setting up a school in opposition to him ; but it would be unfair to receive testimony on this point from such dubious authority. On the death of Plato, Aristotle retired from Athens and went to reside in Mysia, with his friend Hermeias. There he remained three years ; when his friend was executed as a rebel against Persia by command of Artaxerxes, and Aristotle took refuge in Mytelene, taking with him Pythias, the adopted daughter of his deceased friend, whom he afterwards married. The union took place when Aristotle was in his thirty-seventh year ; but death soon deprived him of his consort. An infant daughter was left to him, and was named, after her mother, Pythias.

Not long afterwards Aristotle was appointed to the important office of tutor to the young prince. Philip king of Macedonia had already distinguished the philosopher, and honoured him with marks of friendship ; for the latter had risen to great fame owing to his skill in various sciences, and in the doctrine of politics. It appears probable that Aristotle had previously been consulted respecting the education of the young prince ; but when in his forty-second year he took the full management of his studies, the young Alexander being at that time fifteen years of age.

Alexander was ambitious of excelling in every pursuit, and therefore he doubtless profited greatly by the lessons of the most eminent philosopher of the age. Aristotle instructed him in rhetoric, physics, ethics, and politics, and the young prince rightly held his instructor in the highest estimation, regarding him as a second father. While residing at the court, Aristotle was not so wholly occupied by his duties as tutor, as to neglect public business and philosophic research. For the latter purpose, he is said to have received liberal pecuniary aid from the king, who further manifested his regard for him, and the estimation in which he held his various merits, by rebuilding his native city, Stagyra, which had been destroyed in the wars, and restoring it to its former inhabitants, who had been scattered or enslaved.

The assassination of Philip, king of Macedonia, by Pausanius, one of the officers of the guard, called Alexander to the throne when he had scarcely completed his twentieth year. But the youthful monarch was not disposed to part with his wise instructor; and Aristotle therefore remained at court for two years longer, until, at the commencement of Alexander's celebrated expedition into Asia, some misunderstanding arose, and Aristotle retired to Athens. He was well received in that city, many benefits having been conferred on the inhabitants by the late king for his sake. There, at the Lyceum, he founded his celebrated school, and his disciples received the name of Peripatetics, or walking philosophers, because it was his custom to communicate much of his instruction while walking with his pupils. The Lyceum soon acquired such great celebrity, that scholars flocked to it from all parts of Greece. The school of Plato was at that time conducted by Xenocrates, and it has been affirmed that a spirit of contemptuous opposition actuated the proceedings of Aristotle in establishing another seminary. 'But,' says Magillivray, 'although the rival sages of those days cannot be supposed to have been influenced by a gentler spirit than animates those of our own times, there is no reason for attributing to the Stagyrte in this matter any other motive than a laudable desire of seeking his own interest by communicating knowledge to those who were very desirous of receiving it.'

Aristotle continued to lecture at Athens for the space of thirteen years, and it is pleasing to find that, during the greater part of this period, he maintained a correspondence with Alexander, and received from that prince most valuable aid in carrying on his philosophical researches. Alexander placed several thousand persons at his disposal, who were employed in hunting, fishing, and making observations necessary to the completion of Aristotle's great work, the History of Animals. He also sent to the philosopher, from time to time, a large variety of zoological specimens, collected in the newly-subdued countries, and he is also said to

have granted to him the sum of eight hundred talents for philosophical purposes.

The misunderstanding already alluded to between Aristotle and his royal pupil, appears to have originated in an unworthy jealousy on the part of Alexander, at the publication to the world of some of that valuable knowledge which had been communicated to him by his tutor. As in the present day, we find some persons averse to the general spread of knowledge, from a mistaken idea that it will tend to level necessary distinctions in society, so Alexander evinced a similar dread of being rivalled in knowledge by the rest of mankind. Having published his works on physics and metaphysics, Aristotle received from Alexander the following letter:—‘Alexander to Aristotle, wishing all happiness. You have done amiss in publishing your books on the speculative sciences. In what shall I excel others, if what you taught me privately be communicated to all? You know well that I would rather surpass mankind in the more sublime branches of knowledge than in power. Farewell.’

Thus it appears that the renowned Alexander was not possessed of that true greatness of mind, which seeks to impart to all the world the blessings individually received. Nay, if we may believe the assertions of some writers, this prince, in the midst of seeming friendship for Aristotle, so far resented the publication of these works, as to seek to mortify their author by exalting his rival, Xenocrates, and even at one time to meditate his death.

The philosopher was also deeply wounded by the conduct of Alexander towards his kinsman and disciple Callisthenes, who had been appointed to attend the king on his Asiatic expedition. Callisthenes had little of the courtier about him, and the freedom, combined with rudeness, with which he expressed his opinions, was not likely to make him a favourite. But having once become an object of suspicion and dislike to the king, his ruin was inevitable; and, on the first plausible pretext, Alexander caused him to be put to death. Aris-

totle naturally took the part of his relative, and so deeply resented his death, that he could no longer look on his destroyer but with feelings of disgust. It is even said that he plotted against the life of the king; but of this there is not full evidence. If it should seem that a spirit of enmity and revenge was inconsistent with the high character and principles of the philosopher, we must remember that Christianity alone has power to quell the violence of human passions, and to calm those resentments which may exist in all their intensity beneath the refinement of intellect attainable by heathen nations.

Though secretly disliked, Aristotle continued ostensibly to enjoy the patronage of Alexander, so that none of his enemies could seriously molest him. But on the death of the king, all those who had entertained jealousy at the talents, celebrity, and advantages of the philosopher, conspired together to effect his ruin. The charge preferred against him was that of impiety in having commemorated the virtues of his wife and of his friend Hermeias with such honours as belonged only to the gods. Remembering the fate of Socrates, Aristotle prudently made his escape to Eubœa, whither he was accompanied by a few friends, and where he shortly after died in the year 322 B.C. and in the sixty-third year of his age. Various accounts are given of his demise. Apollodorus says that he died of a disease in the stomach, Eumolus and Phavorinus state that he swallowed poison; while Procopius and others assert that he drowned himself in the Eubœan Euripus, because he could not discover the cause of its ebbing and flowing seven times a-day. This last assertion is classed among vulgar errors, for it appears that the stream in question only ebbs four times a-day, as is the case with other parts of the sea, though it is subject to irregularities dependent upon the winds and other causes.

The personal appearance of Aristotle was by no means commanding. He was short of stature, with slender legs, and remarkably small eyes. He had a shrill voice and hesitating speech. He dressed mag-

nificantly, wore rings of great value, and shaved his head and face, thus differing from other philosophers of the school of Plato. His enemies failed not to revile him on this account, and also for his social indulgences, calling him a glutton, a parasite, a drunkard, a despiser of the gods, a vain man, whose chief care was in ornamenting his person, and endeavouring to counteract the unfavourable impressions produced by his disproportioned figure. It is also said that the principles which he instilled into the mind of Alexander were not adapted for a prince of his ambitious nature, and that his desire of being eminent as the founder of a philosophical sect induced him to prefer abstract disquisitions to solid knowledge, and to delight in contradiction and innovation. On the other hand, his friends extol him as a prodigy of knowledge and learning; he has been regarded by all who have examined his works as a most extraordinary individual; and many religious writers believe him to have been raised up specially to prepare the way for a divine revelation.

Aristotle was twice married. His daughter Pythias by his first wife was married to Nicanor, the son of Proxenus. By Herpytis, his second wife, a native of Stagyra, he had a son named Nicomachus. To his surviving wife he left the choice of two houses, one in Chalcis, the other at Stagyra. He commends her domestic virtues, and requests his friends to shew her the kindest attentions. To his son and daughter he bequeathed the remainder of his fortune, except his library and writings, which he left to Theophrastus of Lesbos, one of his favourite pupils whom he had appointed his successor at the Lyceum. The bones of Pythias were ordered to be disinterred and buried with his own body, as she herself had desired. None of his slaves were to be sold: all of them were either set free by his will, or ordered to be emancipated by his heirs as soon as they should become worthy of liberty.

Aristotle is said to have composed more than four

hundred different treatises, forty-eight of which are all that have been transmitted to the present age. 'He was scarcely less ambitious,' says Magillivray, 'than his pupil Alexander, and his works embrace nearly the whole range of human knowledge as it existed in his day. He was the inventor of the syllogistic mode of reasoning, the principles of which he lays down in his work on logic. In his books on rhetoric, he has investigated the principles of eloquence with great accuracy and precision, insomuch that they form the basis of all that has since been written on the subject. His work on poetics, or rather the fragment which has come down to us under that name, although almost entirely confined to the drama, contains principles applicable to poetical composition in general, and is equally distinguished for precision and depth of thought. Those on ethics and politics are also remarkable productions; and although the former has been effectually superseded by a more perfect system, the latter contains much that is interesting even in the present day. In his metaphysics, he expounds the doctrine of being, abstracted from matter, and speaks of a First Mover—the life and intellect of the universe, eternal and immutable, but neither omnipresent nor omnipotent. When treating of physics, he does not in general lay down rules *à priori*, but deduces them from the observation and comparison of facts. This being the case, we might expect that such of his writings as relate to natural history should contain much truth.'

This latter department of science is in fact that which was most ably treated by the philosopher. Cuvier declares that he not only made himself acquainted with a great number of species, but studied and described them on a luminous and comprehensive plan; classing the facts, not according to the species, but according to the organs and functions—the sole method of establishing comparative results. The principal divisions which naturalists still follow in the animal kingdom are due to Aristotle. He ever observed facts with attention, com-

pared them with sagacity, and endeavoured to rise to the qualities which they have in common.

Aristotle's great work on the history of animals requires to be specially noticed in this place. 'This great man was the first to observe and attempt to explain the organization of animals. His book on the history of animals will always be justly regarded as one of the masterpieces of antiquity. It contains, in the clearest style, a prodigious number of facts and observations. The organization of animals in its divers parts is compared with that of man. Their generation, their habits, their organs, the mechanism of their functions, their relations, their resemblances and differences, are discussed with astonishing clearness and sagacity. He may be considered to have established a solid basis for natural history; and his principal divisions of the animal kingdom are so well founded, that almost all of them are still substantially admitted. Nothing can more clearly prove than this circumstance how deeply he had meditated on the subject. In arranging facts, he goes back to causes; from general principles he deduces a multitude of comparisons pregnant with result, and calculated to exhibit his subject under every point of view. The work, replete with luminous speculations and important truths, bespeaks at once the vigour and extent of a mighty genius, and the acuteness of a correct observer, whose opportunities of research, through the liberality of Alexander, have perhaps been seldom equalled. Not to speak of other branches, Aristotle may be considered as, properly speaking, the first ichthyologist. He has not only collected all preceding observations on fishes, and added a multitude of his own, but he has arranged those animals, and considered them, in a general view, with a discrimination and exactness not less to be admired than the order of his ideas and the simplicity of his diction. It is true he has confined himself to the grander and more marked external distinctions in his classification of fishes. But this, as well as other defects and errors which have crept into his treatise, may justly be considered as belonging to the

age in which he wrote; while its merits, which are infinitely more numerous and prominent, may be attributed to himself alone¹.'

Aristotle notices the difficulty in ascertaining the common boundary between inanimate matter and living beings: he observes that in the scale of material existence plants immediately succèd to lifeless forms of matter; and that plants represent as it were a middle term between animals and all other bodies; appearing as indued with life in comparison with all other forms of matter, but devoid of life in comparison with animals. The change from the vegetable to the animal is as gradual as from inanimate to vegetable matter; for there are some marine productions of which it is difficult to affirm whether they are animal or vegetable; since they permanently adhere to the spot where they are found, and cannot be separated from it without perishing; and they manifest little or no sensation. The whole class of testaceous animals can scarcely be considered as superior to plants when compared with those animals which are indued with the power of moving from place to place. The substance of these animals also resembles vegetable matter. And as different bodies seem to be endowed with different degrees of vital power, so do they differ with respect to activity in the functions of life. Plants, for instance, seem to be incapable of doing much more than provide their own nutrition, and for the continuation of their species; and the same remark applies to the lowest species of animals. But as sensibility is increased so also are the pleasure and activity of life. Some animals merely extend their species after the manner of plants, and take no further care of the individuals produced by them. Some nourish their young until they are capable of providing for them-

¹ The *Animal Kingdom* of Cuvier, edited by Griffith. The following analysis of Aristotle's *History of Animals* is abridged from Professor Kidd's notice of the opinions of the ancients on the organization and classification of animals, contained in his *Bridgewater Treatise*.

selves ; some indeed apparently indued with a higher degree of intelligence enter into social communion, and form a kind of polity with their offspring. Aristotle distinguishes between such animals as are merely gregarious and those which unite for the completion of some one work ; as man, the bee, the ant, &c.

The above opinions are consonant with the present knowledge, except in the single statement that inanimate matter graduates into life. Every naturalist now considers 'that the difference between organized and unorganized matter, in other words, between living and lifeless matter, is extreme ; so that they cannot possibly be ranged in the same line,' and that 'however remarkable may be the apparent affinity between plants and animals, they may always be distinguished.'

Aristotle employs the terms of classification, species, and genus ; of the first of which his definition is remarkably precise : 'An animal *species* is an assemblage of individual animals, in which not only the whole form of any one resembles the whole form of any other, but each part in any one resembles the corresponding part in any other. Thus, every horse not only resembles every other horse generally, but the eye or the hoof of every horse resembles the eye or the hoof of every other horse. And the same statement is applicable to man and other animals. They are therefore the same in the character of their individual parts.' His definition of a genus is as follows :—'A *genus* is an assemblage of individuals, in which any one bears, upon the whole, an obviously perceptible resemblance to any other. Thus, birds and fish constitute two distinct genera ; each comprehending several species. But the corresponding parts in the different *species* of the same genus usually differ in colour, form, number, size or proportion. In different *genera*, indeed, the difference of corresponding parts occasionally proceeds still farther ; the only resemblance being that of analogy, as between a scale and a feather ; a scale being to a fish what a feather is to a bird.'

Although Aristotle applies the term genus to an assemblage of different species having a general resem-

blance to each other; he extends it so as to serve the purposes which we express by the more comprehensive terms of *tribe, family, order, class*.

Aristotle establishes a fundamental natural division answering to the red-blooded and white-blooded animals of modern zoology. He was also aware of a connexion between the existence of red blood and a spine or backbone made up of vertebræ; and accordingly vertebrated animals are made to occupy the first division in his scale. He also separates into distinct classes animals which have blood, and those which have not blood. Among the former are *man, viviparous and oviparous quadrupeds, birds, fish, cetaceous animals, and serpents*; among the latter are animals naturally divisible into segments, as *insects*; animals of a soft substance throughout, as *cuttle-fish, &c.*; animals having comparatively a soft shell, as *lobsters, &c.*; and those which have a hard shell, as *oysters, &c.* He then proceeds to say, that after having considered the common attributes and actual differences of animals, we must endeavour to find out the causes of these; for only by a demonstration and comparison of the peculiarities of individuals can we hope to arrive at a natural method of classification. And first, we must compare together the several component members of animals; for the chief differences among animals will be found in the presence or absence of particular members, and in their order or position, or in their form, proportion, the analogy of their uses, or the peculiarities of their colour, &c.

Professor Kidd remarks on the above, that in the same philosophical spirit, and in terms not essentially different, Cuvier affirms that, in the attempt to establish a natural classification, he examined one by one all the species that he could procure; and then classed together, as a subordinate generic group, all those which, resembling each other in the more important parts of their structure, differed only in size or in colour, or in other points of little importance.

In examining the component members of animals in general, Aristotle selects man as a standard of com-

parison; and then places viviparous animals, birds, reptiles, and fish, next in succession. In one instance he inverts the order of arrangement, and begins with those animals that least resemble man, and proceeds in the following order:—animals having a hard shell; animals having a soft shell; mollusca, or animals of a soft substance throughout; insects, fish, birds, oviparous and viviparous quadrupeds, and man.

Aristotle considered that the most comprehensive groups into which the greater number of animals may be divided are these:—one, of birds; one, of fish; one, of whales and other cetaceous animals; all of which have blood. He then enumerates those which are without blood. Of those animals which do not come within the foregoing arrangement, he says there are no comprehensive groups; for no individual type comprehends many species; and there is one type which is unique, affording only a single species, namely, man. And though there are many species of viviparous quadrupeds, yet they have no collective denomination, but each is distinguished, as in the case of the human species, by its proper name, as the lion, deer, horse, &c.; on which account we cannot describe them collectively, but must consider the individual nature and character of each.

Aristotle refers to a few marine animals (principally the zoophytes), without comprehending them under a distinct name. He does not notice that extensive class of animals, the polypes, which fabricate and inhabit coral; nor that still more extensive class, the animalia infusoria, which are, for the most part, microscopic.

‘The death of this great father of our science was,’ as Swainson truly remarks, ‘the death of natural history in the Grecian era. The splendour of his discoveries passed like a comet. He left no luminary behind to follow in his wake, still less to throw additional light upon realms which he had but glanced upon.’

A long interval of darkness now ensued, and it was not until four hundred years had nearly rolled away that another philosopher arose to follow up the pursuits of

the Grecian sage. This new light of science appeared among the Romans, and though shining with far inferior lustre, was yet a valuable aid to that semi-barbarous nation.

Pliny, the Roman naturalist, so far followed in the steps of Aristotle, that, like him, he extended his studies to the whole range of science and of learning; but with less genius, and a more credulous mind, he mingled together fact and fiction, and presented rather a compilation of the thoughts and discoveries of other men than the result of his own researches. 'We find,' says the writer last quoted, 'the wheat intermixed with abundance of chaff: the nutritive grain and the useless straw are equally hoarded, and brought into the garner. Amidst all the polished graces of diction, great and diversified erudition, and no inaptitude for occasionally describing with clearness and precision, we look in vain for the powerful genius and the originality of thought of his great master.'

The notices of Pliny's history are brief, and even the place of his birth is not certainly known, the honour having been assigned to Verona, Comum, and Rome. The year is however stated as the twenty-third of the Christian era. Suetonius gives the following account of him:—'Caius Plinius Secundus was a native of New Comum. When young he served with distinction in the cavalry. He was intrusted with the most important procuratorships, and on all occasions discharged his office with the greatest integrity. At the same time he engaged with so much assiduity in the study of literature, that hardly any one, though entirely free from public occupations, wrote so many works. Among these was an account of all the wars which had been carried on between his countrymen and the Germans, which he comprehended in twenty volumes. He also compiled thirty-six volumes of natural history.'

The industry and application by which Pliny was enabled to perform his extensive literary labours, are thus noticed by his nephew:—In summer he usually began his studies about sunset, and in winter generally

at one in the morning, never later than two, bestowing very little time on sleep. Before it was day, he went to the Emperor Vespasian, who, like himself, was in the practice of using the hours of darkness for philosophy, or business. He then proceeded to perform the duties of his office, and on returning home spent the remainder of the morning in reading or contemplation. In summer, when he happened to have any leisure, he often lay in the sunshine having a book read to him, from which he carefully took notes. It was a saying of his, that no treatise was so meagre but that some part of it might afford instruction. Afterwards he usually took a cold bath, ate a little, and slept a very short time. He then resumed his labours till the hour of dinner. These were his ordinary habits while occupied with his public duties and amid the tumult of the city. In retirement his studies were still more constant. When travelling he seemed to set all other cares aside, and employ himself in literary occupations. He had a secretary by his side with a book and tablets, his hands in winter protected by gloves, so that even the inclemency of the weather should not occasion any loss of time. For the same reason, when at Rome, he was carried in a sedan chair. By this continued application he accumulated an almost incredible mass of materials, insomuch that his works, had they been preserved, would have formed a library of themselves.

Gaining thus the greater part of his knowledge from books, it cannot be expected that much original description should be found in the works of Pliny. But as a compilation of all that preceding observers had discovered, they are extremely valuable. Pliny studied at an early age under Appion, at Rome, and, it is probable, that he was admitted to the court of Caligula. When twenty-two years of age he resided for some time on the coast of Africa, and afterwards served in the cavalry under Lucius Pomponius, when he traversed Germany. Even at this period he found time to write a treatise on the art of casting the javelin on horseback, and also to compose a more elaborate work, being the history of all

the wars carried on by the Romans beyond the Rhine. At the age of thirty he returned to Rome, and became a member of the college of augurs. He superintended the education of his nephew, and for his benefit, probably, wrote his three books entitled *Studiosus*, or the progress of an orator towards perfection. Towards the close of Nero's reign he was appointed procurator in Spain, where he seems to have remained during the civil wars of Galba, Otho, and Vitellius. On his return to Rome he was favourably received by Vespasian, whom he attended every morning before sunrise, for the purpose of study. About this time he is supposed to have written the history of his own times, consisting of thirty-one books. His natural history, dedicated to Titus, was finished about the seventy-eighth year of our era.

From the elegant pen of his nephew we have also an account of the melancholy end of this celebrated man. He was at Misenum, in the Gulf of Naples, his sister and her son, the younger Pliny, being with him. On the 24th of August, A.D. 79, about one o'clock in the afternoon, his sister desired him to observe a cloud of a very unusual size and shape. He was in his study; but immediately arose, and went out upon an eminence to observe it more distinctly. It was not at that distance discernible from what mountain this cloud issued, but it was found afterwards to ascend from Mount Vesuvius. Its figure resembled that of a pine-tree, for it shot up to a great height in the form of a trunk, which extended itself at the top in the manner of branches; it appeared sometimes bright and sometimes dark and spotted, as it was either more or less impregnated with earth and cinders. This was a noble phenomenon for the philosophic Pliny, who immediately ordered a light vessel to be made ready; but as he was coming out of his house with his tablets for his observations, the mariners belonging to the galleys stationed at Retina earnestly entreated him to come to their assistance, since that port being situated at the foot of Mount Vesuvius, there was no way for them to escape but by sea. He therefore ordered the galleys to be put to

sea, and went himself on board, with the intention of assisting not only Retina but several other towns situated upon that beautiful coast. He steered directly to the point of danger, from which others were flying with the utmost terror, and with so much calmness and presence of mind as to be able to make and dictate his observations upon the motion and figure of that dreadful scene. He went so near to the mountain that the cinders which grew hotter and thicker the nearer he approached, fell into the ships together with pumice-stones, and black pieces of burning rock: they were likewise in danger not only of being aground by the sudden retreat of the sea, but also from the vast fragments which rolled down from the mountain, and obstructed all the shore. Here he stopped to consider whether he should return, to which the pilot advising him, 'Fortune,' he said, 'befriends the brave; carry me to Pomponianus.' Pomponianus was then at Stabiæ, a town separated by a gulf which the sea, after several windings, forms upon that shore. He found him in the greatest consternation, but exhorted him to keep up his spirits; and the more to dissipate his fears, he ordered, with an air of unconcern, the baths to be got ready. After having bathed he sat down to supper with apparent cheerfulness. In the meantime the eruption from Vesuvius flamed out in several places with much violence, which the darkness of the night contributed to render still more visible and dreadful. Pliny, to soothe the apprehensions of his friend, assured him it was only the burning of the villages which the country people had abandoned to the flames; after this he retired and had some sleep. The court which led to his apartment being in the meantime almost filled with stones and ashes, if he had continued there any longer it would have been impossible for him to have made his way out; it was therefore thought proper to awaken him. He got up and went to Pomponianus and the rest of the company, who were not sufficiently unconcerned to think of going to bed. They consulted together whether it would be most prudent to trust to the

houses, which now shook from side to side with frequent and violent rockings, or to fly to the open fields where the calcined stones and cinders, though light indeed, yet fell in large showers and threatened destruction. In this distress they resolved for the fields, as the less dangerous situation of the two; and went out having pillows tied upon their heads with napkins, which was all their defence against the storms of stones which fell around them. It was now day everywhere else; but there a deeper darkness prevailed than in the most obscure night, which however was in some degree dissipated by torches and other lights of various kinds. They thought proper to go down further upon the shore, to observe if they might safely put out to sea; but they found the waves still running extremely high and boisterous. Then Pliny taking a draught or two of water, threw himself down upon a cloth that was spread for him; when immediately the flames, and a strong smell of sulphur which was the forerunner of them, dispersed the rest of the company, and obliged him to arise. He raised himself with the assistance of two of his servants (for he was corpulent) and instantly fell down dead, suffocated, as it is supposed, by some noxious vapour; for he had always weak lungs, and was subject to a difficulty of breathing. As soon as it was light again, which was not till the third day after, his body was found entire and without any marks of violence upon it, exactly in the same posture that he fell, and looking more like a man asleep than dead.

Such was the end of this great man, of whose vast performances, the *Natural History* still extant affords a good specimen. This work consists of thirty-seven books, the first of which is a table of contents of the other thirty-six. The second book treats of the world, the elements, the stars, the winds, &c.; the third, fourth, fifth, and sixth books contain a geographical account of the whole of the then known world; the seventh book treats of the generation and organization of man, the most remarkable characters that have ever lived, and the most useful inventions; the eighth, ninth, tenth, and

eleventh books contain a system of zoology, and treat of beasts, fishes, birds, and insects, and of human and comparative anatomy; sixteen books, from the twelfth to the twenty-seventh, are devoted to botany, and give an account of trees, herbs, fruits, corn, &c., and the medicines which they furnish; the five succeeding books treat of medicines derived from different animals; the thirty-third and thirty-fourth of different kinds of metals, &c.; the thirty-fifth of colours and painting; the thirty-sixth of stones and sculpture; and the thirty-seventh of different kinds of gems, &c.

Of the merits of this extraordinary work very different opinions have been given. Buffon says, 'He wished to embrace everything, and seems to have measured nature, and found her too small for his genius. His natural history comprehends (besides the history of animals, plants, and minerals) that of the heavens and the earth, medicine, commerce, navigation, the history of the liberal and mechanical arts, the origin of customs, and, in short, all the natural sciences, and all human arts; and, what is most astonishing, is, that in each department he is equally great. The loftiness of his ideas and the nobleness of his style enhance still more his profound learning. He not only knew all that in his age could be known, but he had that facility of thinking on a grand scale which multiplies science; he had that nicety of reflection on which depends elegance and taste, and he communicates to his readers a certain freedom of spirit, and boldness of thought, which is the germ of philosophy. His work, no less varied than nature herself, always paints her in the brightest colours. It may be called a mere compilation of all that had been written before him, a copy of all that was excellent and useful to be known; but still this copy has such grand features, this compilation contains things put together in so novel a manner, that it is preferable to the greater part of original works which treat on the same subjects.'

This high character of Pliny as an author goes perhaps beyond the truth. The opinion of Cuvier is more

likely to give a just idea of the mind and talents of the philosopher. Speaking of the Natural History, he says that 'it is at the same time one of the most precious monuments left us by antiquity, and a proof of the astonishing learning of a warrior and a statesman. In order justly to appreciate this vast and celebrated composition, it is necessary to consider the facts, and the style. * * * It was impossible but that the author, in treating of such a prodigious number of objects, should record a multitude of remarkable facts, which are to us the more valuable, because he is the only extant author who mentions them. Unhappily, the way in which he has collected and arranged them causes them to lose much of their value by the mixture of truth and falsehood which is met with in almost equal proportions, and especially by the difficulty, and in most cases the impossibility, of recognising the precise creatures that he means to describe. Pliny was not an observer, like Aristotle; still less was he a man of genius, capable, like that great philosopher, of seizing the laws and relations which have guided nature in her productions. For the most part he is only a compiler who has not himself any idea of the subjects on which he collects the testimonies of others, and therefore cannot appreciate the truth of these testimonies, nor even always understand what they mean. In short, he is an author devoid of criticism, who, after having spent a great deal of time in making extracts, has ranged them under certain chapters, to which he has added reflections that have no reference to science, properly so called, but display alternately either the most superstitious credulity, or the declamations of a discontented philosophy which finds fault continually with mankind, with nature, and with the gods themselves. * * * With respect to his style, wherever he introduces general ideas or philosophical views, his language assumes an energy and vivacity, and his thoughts acquire an unexpected boldness, which makes some amends for his dry enumerations, and excuses him, in the opinion of many of his readers, for the deficiencies of his scientific information. He is

perhaps too fond of point and contrast, and emphasis ; and there is in some places an obscurity, which results less from the nature of his subject, than from the desire of expressing himself with a pregnant brevity and conciseness ; but he is always grave and noble, and everywhere shows a love of justice and respect for virtue, a horror of the cruelty and meanness of which he had before his eyes such terrible examples, and a contempt for the unbridled luxury which had in his time so deeply corrupted the Roman people. In these respects he cannot be too much commended, and in spite of the defects which we recognise in him as a naturalist, yet of all the authors who wrote after the Augustan age, he deserves to be regarded as one of the most valuable, and most worthy to be ranked among the classics.'

Pliny's writings very plainly testify that down to his time no system of zoology had been arrived at, nor did he attempt to establish any. Though the foundation was laid by Aristotle, yet no progress was made by his successors towards classifying the animals described, and Pliny also, in this respect, left zoology as he found it.

From the death of this remarkable man until the commencement of the sixteenth century there were few naturalists deserving of notice. Indeed, the writings of Ælian and others who arose previous to the period just named, were so full of fables and absurdities, that they bore sufficient evidence of the declension of science among the Romans. Mr. Griffiths thus notices the character of Ælian :—'Ælian is a writer whom it would be difficult to notice except in terms of censure. He far surpassed Pliny in credulity, or, perhaps it was his intention to impose upon his readers. He was a Greek sophist, one of a class of men whose profession it was to defend absurdity and falsehood. * * * He may justly be considered as the father of all the falsehood and error which disgraced for so long a period the natural history of animals in general, and more particularly that of fishes. His book, like that of Pliny, is a compilation ; but utterly unredeemed by any elegance of style or brilliancy of thought. The accounts taken

from various sources are put together without the least attention to order or plan. There are however some curious details in it respecting the habits of fishes, and a few facts which may be relied on.'

It was not until the sixteenth century that several naturalists appeared, whose labours were of importance to the science; and although their acquirements were not extraordinary, they may yet be considered the fathers of modern zoology. Of these, the first who treated the subject with any regard to system was Pierre Belon, born at Mans in 1517, and indebted to the bishops of Mans and Clermont, and afterwards to the cardinals of Tournon and Lorraine, for his education. To these kind patrons he also owed the means of travelling, in 1550, through Greece, Egypt, Palestine, and Asia Minor, and of publishing the observations made during his travels. In 1557 he undertook another journey into Italy, Savoy, Dauphiné, and Auvergne, and on his return commenced a translation of Dioscorides and Theophrastus, and was preparing a work on agriculture when he was cut off in the midst of his useful career by the arm of an assassin. This murder was committed in the Bois de Boulogne in the year 1564, when he was about forty-five years of age. The general arrangement of Belon had an evident approach to a natural system, and is therefore to be commended, notwithstanding many inaccuracies in the details with respect to birds. 'Commencing with the land-birds of prey, as the vultures, falcons, shrikes, and owls, he passes to the water-birds of prey, as the cormorant, albatross, &c.; the wading order naturally follows; and from this he proceeds to the gallinaceous tribe, including the ostrich family. The last two chapters are devoted to the pigeons, crows, and thrushes, and all the smaller perching birds.' Regarding this arrangement with respect to the primary groups, we have precisely the same disposition as is now known to be a natural series. This naturalist was also an original writer, and described his subjects with much exactness.

At the same period with Belon flourished Salviani and Rondelet, both famous for their knowledge of fishes.

The former was a physician at Rome, and published a work on ichthyology, with very beautiful engravings, in the year 1554. The latter was a professor of medicine at Montpellier, and he also wrote on the nature of fishes in general, and described with considerable exactness, a large number of those which inhabit the Mediterranean Sea. His work is written without any attempt at systematic arrangement, and he describes fabulous marine monsters, &c.; but with these defects, it is still valuable on account of the excellent and accurate woodcuts which are abundantly introduced. Rondelet was in early life so weak in health, as to be judged incapable of active employment, and therefore he received but a slender patrimony, though sufficient to procure his entrance into a convent. But his strength increasing with his years, he declined the monastic life, and commenced his studies at the age of eighteen, being supported by his elder brother. About the year 1529, he commenced his career as a medical practitioner, but with so little success, that he was obliged to seek a subsistence by setting up a grammar-school. On the failure of this also, he became tutor to a young nobleman, and subsequently returning to the medical profession, he met with better success, and in 1537 received a medical degree at Montpellier. The following year he married an estimable young lady destitute of fortune, and by this alliance increased his pecuniary difficulties. But at length he was appointed professor of medicine in the university, and physician to the cardinal of Tournon, whom he accompanied on his travels, taking every opportunity at the same time to increase his knowledge of natural history. On his return he established an anatomical theatre, at which he lectured daily to a numerous audience. In 1560 his wife died, but he soon married again, choosing, as before, a lady who was poor and amiable. In 1566, while on a journey to Toulouse, he was attacked by a dysentery, occasioned by eating too many figs, and died at Realmont, on the 30th of July of that year, aged fifty-eight. Rondelet was a man of very small stature, but robust and active.

He early renounced the use of wine and spirits, but indulged too far his appetite for fruit and pastry. His profession was tolerably lucrative; but he spent his money freely in building, and in acts of generosity, so that he left very little behind him. His passion for anatomical studies was so great that on the death of one of his own children he dissected the body, and thus brought on himself the reproach of being a man destitute of all feeling. But this does not appear by any means to have been the case.

While Salviani and Rondelet were directing their researches in natural history, chiefly to the elucidation of fishes, two other naturalists were labouring at a general history, somewhat after the manner of Pliny. One of these was Conrad Gesner, a man of remarkable industry and talent, whose compilations exhibit a wonderful amount of labour performed during a short life, and amidst the duties of the medical profession. Gesner was born in poverty at Zurich in the year 1516, when his parents were struggling to support a numerous family. His father was a skinner or worker in hides, and wholly unable to give him an education. To the kindness of a maternal uncle he appears to have been indebted for his early instruction, though some of his biographers relate that Ammian, professor of rhetoric at Zurich, took him into his house, and defrayed the expenses of his education, and that he remained with the professor three years, studying diligently. At length, when about fifteen, he set out for Strasburgh to seek his fortune. The well-known Lutheran Wolfgang Fabricius Capito gave him some employment, and here he resumed the study of the Hebrew language, which he had begun at Zurich. Returning again to Switzerland, the academy of Zurich allowed him a small pension, and he then set out on his travels in France. At Bourges he remained a year and studied principally Greek and Latin, teaching in a school at the same time, that he might be the better enabled to meet his expenses.

He then repaired to Paris, and afterwards to Strasburgh, hoping in the latter city to find employment.

The university of Zurich, however, demanded his services as a teacher, though with a very small salary, and he gladly repaired to his native city, where, at the early age of twenty, he married, much against the wishes of his friends.

The church had until now been considered his destination; but, having a strong predilection for the study of medicine, he applied himself diligently to such pursuits as were necessary to his advancement. In 1541 he obtained his degree at Basil, where he arranged some extracts on botany and physic, taken from Greek and Arabian authors. These were published the following year at Zurich and Lyons. Soon afterwards appeared his catalogue of plants in four languages. His circumstances having much improved, he was able to cultivate his taste for natural history. His famous *Bibliotheca Universalis*, containing a catalogue of all the works then known, whether extant or not, was followed by several other proofs of industry; and in 1555 he was appointed professor of natural history at Zurich. There he founded and supported a botanic garden, collected an extensive library, and made numerous drawings, in addition to the labours of his profession, and the toils of authorship. Gesner's greatest work was his *Historiæ Animalium*, being a series of folio volumes, published at different periods, and having for its object the general history of animated nature. This work is a miracle of industry, but was left unfinished, in consequence of the sudden death of its author. In 1565 the plague broke out in Zurich, and Gesner's profession necessarily exposed him to danger. He treated the disease successfully in some of the cases which came under his notice, but was at length himself attacked. A plague-boil made its appearance in the arm-pit, and was accompanied by symptoms which Gesner well knew to be fatal. He desired to be conveyed to his museum, where, surrounded by the familiar objects of his studies, and supported by his faithful and affectionate wife, whom no dread of contagion could keep from him, he breathed his last with all the calmness of a Christian philosopher.

Gesner was honoured and respected for his talents,—beloved and lamented for his many amiable qualities. He appears to have been a truly benevolent man, and a universal peace-maker, soothing the angry and excited feelings of others by his calm and equable temper. According to Haller, Conrad Gesner was the first short-sighted person who aided the defect of his sight by concave glasses. Gesner, with all his industry and talent, was quite destitute of system in what he wrote, the subjects in his principal work being arranged alphabetically.

The other naturalist already alluded to as labouring at the same time in extensive compilations, was Ulysses Aldrovandus, a naturalist of noble family, and whose fortune enabled him to travel extensively, to collect materials for his works, and to employ artists in their illustration. He is said to have carried his liberality in these respects to such an extent as to exhaust his patrimony, and to leave himself destitute in his old age.

His works extend to fourteen folio volumes, most of which were published after his death. In these volumes he collected together, from all quarters, facts and fables, valuable information and useless lumber—all, in short, that had been written upon animals, true or false. Cuvier pronounces his works to be ‘an enormous compilation, without taste or genius,’ from which, if the useless parts were removed, it would be reduced to a tenth of its bulk; yet it undoubtedly contributed, together with the works of Gesner, to make the study of natural history more popular than before. While this large work of Aldrovandus was in progress, a Roman physician, Fabius Colonna, published two treatises on natural history, which rank higher than those of his contemporaries, and have procured for their author considerable reputation.

The taste for natural history does not appear to have extended to Great Britain until the commencement of the sixteenth century; but in 1634, Mouffet, physician to the Earl of Pembroke, published his *Theatrum Insectorum*, which was the first zoological work ever printed

in Britain. This author made insects his sole study, and wrote his work in Latin, as was usual at that period. But in 1658, Topsel, an ecclesiastic of St. Botolph's, London, published an English translation, in folio, of Mouffet's work, and also of Gesner's history of quadrupeds, 'thus placing in the hands of our countrymen, in their own language, the two best works upon beasts and insects that had appeared since the revival of learning.' Natural history also found a protector at this period in the great and chivalrous Count Maurice of Nassau, whose judicious efforts for the promotion of science are thus noticed by Swainson: 'Count Maurice, upon his assuming the command of the Dutch armament, which subsequently dispossessed the crown of Portugal of nearly all its Brazilian possessions, took with him, as if anticipating victory and subsequent ease, a young and enthusiastic naturalist, whom we now look on as the venerable Marcgrave, the father of Brazilian zoology. Not content with his aid, the count employed artists and botanists to draw, collect, and preserve everything that might interest the naturalists of Europe. To this munificent patron was the learning of the seventeenth century indebted for the first account ever published of the natural history of tropical America. Considering the then state of science, Marcgrave's work, written probably when he was not more than twenty-five, abounds with a vast mass of new and original information, very different from what was to be found in the crude and verbose compilations of this period. Unfortunately, however, Marcgrave lived not to arrange and digest these materials, as he no doubt would have done had he returned to Europe. Anxious to extend his discoveries, he accompanied one of the bold expeditions of his patron to attack the Portuguese possessions on the coast of Guinea, where he fell a victim to the climate, at the early age of thirty-four. His original manuscripts, and a collection of drawings, chiefly of the rare fishes of Brazil, made by his accomplished patron, are said to be preserved in the Royal Library of Berlin.'

The entomology of the seventeenth century received in 1662 a great impulse from the publication of a work on the metamorphosis of insects, by John Goedart, of Middleburg, in Holland. He was a close observer of nature, and of the properties of insects, examining them with great patience and sagacity. Goedart was a painter by profession, and he adorned his work with accurately coloured engravings, which may be consulted with advantage even at the present day. It is probable that his experiments led the way to those of Francis Redi, physician of Florence, who studied the generation of insects, and published three small volumes at different periods, the first appearing in 1670.

But the most eminent man of this period was the celebrated Swammerdam, a naturalist of high talent, who died at the age of forty-three, worn out with intense study. He was born at Amsterdam in 1637. His father was an apothecary, and the young Swammerdam was designed for the church, and instructed in the Greek and Latin languages for that purpose. But he shrank from the important office, under the idea that he should never be qualified to perform its duties; and taking a great liking for natural history, he began to form collections, and was allowed to devote himself to such pursuits as were consistent with the profession of medicine, for which he was now designed. 'Day and night he pursued his favourite employment, searching the woods and fields, the sandhills and muddy shores, the lakes, rivers, and canals, for insects, worms, and mollusca, until he acquired, even while a youth, a more extensive knowledge of the lower animals than all the naturalists who had preceded him.' In 1651 he went to Leyden, and studied surgery and medicine under Van Home and Francis Sylvius. He became much attached to the study of anatomy, and exercised great ingenuity in devising means for preserving his preparations. After two years' residence at Leyden, Swammerdam went to Saumur, in France, and subsequently to Paris, where he gained the friendship of Thévénot the celebrated traveller, who was afterwards his chief patron. The modest

and retiring disposition of the young naturalist is apparent from the account of his behaviour among the distinguished persons to whom he was introduced at the house of Thévénot. Although he had now made some remarkable discoveries in the dissection of insects, and might have been entitled to enter freely into discussion with other eminent men, yet in their society he preferred to remain a listener, and could scarcely be prevailed upon to communicate his ideas ; and it was only when he had been led by urgent solicitations to exhibit one of his minute dissections, that they discovered, with astonishment, his profound knowledge and wonderful skill. Through the recommendation of Thévénot permission was granted to Swammerdam to examine the bodies of patients dying in the hospital of Amsterdam, and on his return to this his native city he failed not to avail himself of the means of improvement thus afforded to him.

In 1666 he went again to Leyden, where, in the following year, he obtained his medical diploma. There he made numerous anatomical researches, and first employed the method of preparing the blood-vessels by means of waxen injections. The eagerness with which he pursued his investigations was such as to injure his health, and he fell into a state of extreme debility. On this account he relinquished for two years the studies connected with the medical profession, but followed up his discoveries in the structure of insects, and became so fascinated with this pursuit, that he never after long ceased from it. The Grand Duke of Tuscany visited Amsterdam at that time, and examined Swammerdam's collections. He was so struck with the wonderful dissections of insects that he offered twelve thousand florins for the museum, on condition that its proprietor should accompany it to Florence, and take up his residence in the palace ; but Swammerdam, accustomed to liberty, could not be persuaded to accept an offer, however advantageous, which would confine him to one spot.

In 1669 Swammerdam published his *General History of Insects*, and soon afterwards he was obliged to

retire into the country to recruit his enfeebled health ; but he found it impossible to relinquish study. He published, in 1672, some of his anatomical discoveries, and two years afterwards his treatise on the natural history of bees, a most astonishing performance, of which Boerhaave thus speaks: 'He had laboured so assiduously at this work as to destroy his constitution ; nor did he ever recover a shadow even of his former strength. The labour, in fact, was beyond the power of ordinary men : all day he was employed in examining subjects, and at night described and delineated what he had seen by day. At six in the morning, in summer, he began to receive sufficient light from the sun to enable him to trace the objects of his examination. He continued dissecting till twelve, with his hat removed, lest it should impede the light, and in the full blaze of the sun, the heat of which caused his head to be constantly covered with a profuse perspiration. His eyes being continually employed in this strong light, the effect of which was increased by the use of the microscope, they were so affected by it, that after mid-day he could no longer trace the minute bodies which he examined, although he had then as bright a light as in the forenoon.' It is painful to read that these investigations were often carried on amidst sigh and tears. In his extremely weakened state, poor Swammerdam began to doubt whether all this zeal for new discoveries was not the result of an ambitious desire to stand high in the estimation of his fellow-men ; and being desirous of checking all sinful propensities, and setting his affections on God alone, he vainly struggled with his love of science, under the false impression that his duty required him to give it up. Yet there were moments when the truth flashed upon his mind, that the investigation of the works of Omnipotence was a study worthy of the highest powers of man's understanding, and he would then renew his studies with fresh zeal, until doubts again occurred and drove him to distress. It is easy to trace the cause of all this in an overstrained and unsettled mind, occasioned by too much study, and acting on the amiable and

pious feelings of the naturalist. Unfortunately, he met with the enthusiast Antoinette Bourignon, the leader of a sect, who encouraged him in his idea of renouncing all his former studies. He therefore sought to dispose of his collections, and consulted a friend on the propriety of offering them to the Grand Duke of Tuscany, who had formerly wished to become a purchaser. This friend, who had himself abjured the Protestant faith, said that he would venture to ensure the sale of the museum if Swammerdam would embrace the Roman Catholic faith, and proceed at once to Florence. Swammerdam indignantly replied, that he would not sell his soul for money.

Previous to giving up his accustomed pursuits, he published his last work *The Anatomy of the Day-Fly*, a most remarkable production, on which he had been engaged ten years. In 1676 Swammerdam's father died; but the property left to him, and which would have been sufficient for his support, was made the subject of a lawsuit in the family, which much agitated the already excited feelings of the naturalist. A severe ague seized him, and he was confined to his bed three months. Though he partially recovered from this attack, he soon sank under another, and on the 25th of January, 1670, perceiving his end approaching, he bequeathed to Thévénot all his original manuscripts on the history of bees, butterflies, and anatomy, with fifty-two plates. He then spent the whole of his remaining time in devotion, and was perfectly free from wanderings of mind or insanity, which some have attributed to him in the closing scenes of his life. A modern writer justly remarks: 'Although he lived in misery, the close of his life was perhaps more enviable than that of many who have gone smiling to their final account; and it is well for those who, before the period arrives when as the tree falls so it must lie, can like him, become sensible of the vanity of all earthly pursuits, even although after death they should be pointed out as the victims of a distempered imagination.'

CHAPTER II.

HISTORICAL SKETCH OF ZOOLOGY FROM THE TIME OF SWAMMERDAM TO THE DEATH OF BUFFON.

Progress of Natural History in England—Ray, Willughby, and Lister—Friendship between Ray and Willughby—Their Travels—Zoological Labours of Willughby—His early Death—His *Ornithologia* and other Works edited by Ray—His Character as drawn by Ray—His merits as a Zoologist—Ray's Work on Insects—His other Works—Lister's Work on Conchology—Sir Hans Sloane—Notice of his Life—His *Natural History of Jamaica*—His Museum becomes the foundation of the British Museum—Reaumur—His *History of Insects*—His Method of Study—his Character—Linnæus—Notice of his Life—His Character—Value of his Zoological Works—His *Systema Naturæ*—Ellis—Labours of the Disciples of Linnæus—Pennant—Block—Latham—Buffon—His early History—His Habits of Study—His Character—Value of his Zoological Labours—The Narrative Style relinquished by Zoologists.

WE have now arrived at a period when natural history began to be pursued in England with greater earnestness than in any other part of Europe. The writings of English naturalists were distinguished by simplicity and perspicuity, and there was a constant aim at order and systematic arrangement. The three remarkable names of this period are those of Ray, Willughby, and Lister, who directed their labours, contemporaneously though in different departments, to one and the same object. The name of Ray is chiefly connected with botanical science, and therefore requires in this place only a brief notice. Born in obscure circumstances, this eminent individual raised himself by his industry and talent to an honourable rank in life, and received many collegiate and other distinctions as the reward of his high attainments. His constant and attached friend was Francis Willughby, only son of Sir Francis Willughby, Knight,

born in Lincolnshire, in the year 1635. Great attention was paid to the education of Willughby, and the youth responded to the pains bestowed upon him with an assiduity that threatened to injure his health. He was admitted at Trinity College, Cambridge, where he studied under the tuition of Ray, and where the intimate friendship just spoken of was formed between two men who were destined to shine together as promoters of natural science. Ray had at this time made great progress in botany, and had begun to classify and arrange. Willughby was similarly disposed towards zoology, and both naturalists were actuated by the same zeal. Dr. Derham says, 'these two gentlemen finding the history of nature very imperfect, had agreed between themselves, before their travels beyond sea, to reduce the several tribes of things to a method; and to give accurate descriptions of the several species, from a strict view of them.' Willughby earnestly desired to examine for himself how much of the descriptions of previous naturalists was to be taken as true, and for this purpose he first went to Oxford that he might consult the works on natural history in the libraries there, and afterwards, in company with his friend Ray, he made a tour on the continent, visiting France, Spain, Italy, Germany, and the Low Countries. Ray examined plants, while Willughby attended to animals; ornithology and ichthyology being however his favourite departments in zoology. Having collected a vast number of specimens and observations, they returned to England, and Willughby immediately commenced working with a view to the publication of a large work on the animal kingdom. In order to increase the interest of this work he contemplated a voyage to America. But health now failed, and in the midst of his labours, and in the prime of life, he died on the 3rd of July, 1672. Five years previously he had married the daughter of Sir H. Bernard, and settled at Middleton Hall, in Warwickshire. The education of his two infant sons was confided to Mr. Ray, who was one of his executors. Willughby modestly thought his works too imperfect for publication, but Ray felt otherwise, and

urged it upon him for three reasons ; first, the glory of God ; secondly, the assistance of others in the same studies ; thirdly, the honour of his native land. Upon these grounds he gave his consent, and Ray became their editor. The *Ornithologia* was published in Latin in 1676, and in English in 1678, the translation being made by the editor. It contains a large amount of original observation, and a full and exact account of the habits of such birds as are described, of the maladies to which they are subject, and of the best methods of domesticating them. Many excellent anatomical descriptions of birds are also given. Cuvier says that Willughby's observations are wonderfully correct, and that all subsequent writers have followed him. In the year 1686 Ray edited a second work, which included the fishes. Cuvier states that it contains numerous observations on the fishes of the Mediterranean, which at the time could not be found elsewhere. Willughby was careful in all his descriptions to distinguish specific characters, and by such means he corrected many of the errors of previous writers.

Willughby and Ray were fellows of the Royal Society of London. Willughby contributed some papers to the *Philosophical Transactions* ; and after his death Ray contributed several papers on insects, the materials for which were furnished by Willughby's manuscripts.

In the *Ornithologia* Ray devotes the greater portion of the preface to a beautiful and touching tribute to the memory of his departed friend. He says, ' he was from his childhood addicted to study, and ever since he came to the use of reason, so great a husbander of his time, as not willingly to lose or let slip unoccupied the least fragment of it, detesting no vice more than idleness, which he looked upon as the parent and nurse of almost all others. Nay, so excessive was he in the prosecution of his studies and other employments without any intermission or diversion, that most of his friends were of opinion he did much weaken his body and impair his health by his incessant labours, and perpetual intention of mind upon business. However that be, hence it

came to pass that he attained very good skill in all parts of learning, and particularly got a deep insight into those sciences which are most abstruse and impervious to vulgar capacities, I mean the most subtil parts of the mathematics. Of his skill in natural philosophy, chiefly the history of animals, I shall say no more at present, but that it hath not yet been my hap to meet with any man, either in England or beyond seas, of so general and comprehensive knowledge therein.

‘ But, secondly, what rendered him most commendable was his eminent virtue and goodness. I cannot say that ever I observed such a confluence of excellent qualities in one person. For, 1. Notwithstanding the forementioned advantages, which are wont to puff up men’s minds with pride, he was so truly humble, that I have not known any man of the meanest fortune or birth exceed him in that virtue. He despised no man for his poverty or mean parentage; honoured all men, was affable to the meanest, not preferring himself before others, but condescending to them of low degree. 2. He was so resolutely sober and temperate, that neither the importunity of company or pleasure of sense could ever tempt him to excess. 3. Of that exemplary chastity and purity, that his life condemns the dissoluteness and corrupt practices of the present age, and demonstrates the possibility of restraining and regulating those motions and desires which of all others are wont to be most violent and inordinate. 4. So scrupulously just and righteous, that he had rather a great deal suffer wrong than do any. 5. So true to his word and promise, that a man might safely venture his estate and life too upon it; his word being, as an honest man’s is said to be, as good as his bond. 6. So faithful and constant to his friend in all conditions, as well adverse as prosperous, that one might be secure of him and confident of his help and assistance, whatever distress or calamity might befall one; he never deserting any man only because fortune frowned upon him, as the common sort of friends are wont to do. 7. He was of so diffuse and comprehensive charity, that he could

heartily affect and embrace good men of all persuasions; good men, I say, to exclude such opinions as are destructive of, or inconsistent with, true goodness.

‘To these I might add his patience and submission to the Divine will, which did eminently appear in the time of his sickness, when he professed himself contented to leave the world if it pleased God to have it so, though then in the height of his strength and parts, and in the hot pursuit of youthful studies and designs, and in such circumstances as to his private affairs and concerns in the world, as rendered some continuance of life very desirable to him, and would have tempted a man of ordinary virtue to express some anger and discontent at the sentence and expectation of death. And, lastly, his due fear and reverence of the Deity, deep sense of his goodness, and thankfulness for the same; sincere piety in all his carriage towards Him, and great abhorrency of whatever tended to his dishonour.’

The merits of Willughby as a natural historian continue still to be recognized. Swainson says that he ‘was the most accomplished zoologist of this or any other country; for all the honour that has been given to Ray, as far as zoology is concerned, belongs exclusively to him. He alone is the author of that system which both Ray and Linnæus took for their guide, which was not improved by the former, or confessed by the latter. It has been customary for writers to represent Willughby more as a wealthy and intelligent amateur, than as an original thinker; as the disciple and pupil of Ray in zoological pursuits, rather than as his master and instructor.’ But Ray did not take this honour to himself; for he says that he found among his friend’s manuscripts, the histories of beasts and insects, no less than of birds and fishes, ‘digested into a method of his own.’

The life of Ray was protracted to the space of seventy-seven years, and during the greatest part of that period he studied botany chiefly, if not exclusively. At the advanced age of seventy-five he began a work

on insects, of which the following notice is given by Haworth, in his *Review of Entomology*:—‘The descriptions given in the *Historia Insectorum*, especially considering the dark ages of this science in which they were written, are master-pieces of clearness and precision, and such as in general render it tolerably easy to ascertain the articles they belong to; but with respect to the arrangement and distribution of its materials, the work is in both these essential points unquestionably very far inferior to that of Linnæus; and, indeed, in some particulars, is not much superior to its predecessors.’ The name of Ray will ever be respected by the religious portion of the community for the use to which he turned his acquirements. His *Wisdom of God manifested in the Works of Creation*, and also his *Persuasive to a Holy Life*, exhibit the pious spirit of their author, and give an instructive example of true Christian philosophy.

While Willughby and Ray were devoting their time and talents to the illustration of different departments of natural history, Dr. Martin Lister, chief physician to Queen Anne, and secretary to the then recently instituted Royal Society, was earning the title since given him of ‘Father of Conchology.’ His first work was devoted to the spiders, the shells, and the fossil echini, &c. of Great Britain, and consists of accurate descriptions and tabular systematic arrangements. His principal work did not appear till 1685. It contains his general system of conchology, with no less than one thousand and fifty-nine plates or figures of shells, some of which also represent the internal structure of the animals themselves. Lister’s work still forms a standard book of reference to the conchologist, most of the figures being remarkably accurate and characteristic.

The cause of natural history was at this period advocated by several persons of less note than the preceding, but whose labours were instrumental in various ways in the advancement of science. Among these the name of Sir Hans Sloane is conspicuous, and will be held in lasting remembrance, since his love for natural

history prompted him to spend a princely fortune in forming a museum and library, which were afterwards purchased by government, and became the foundation of our national collection. Sir Hans Sloane was born at Killileagh, in Ireland, in 1660. His father was a Scotchman, and the head of a colony established in the north of Ireland in the reign of James the First. Young Sloane evinced an early partiality for natural history, and having chosen the profession of medicine, he studied four years in London, where he became acquainted with Boyle and Ray, and then went to Paris, and afterwards to Montpellier, where he took his degree. When twenty-four years of age he settled in London, and became a member of the Royal Society. In 1687 he went to Jamaica, as physician to the Duke of Albemarle, who was appointed governor of that island, but the duke dying soon after his arrival there, Dr. Sloane again returned to England, after only fifteen months' absence. Honours and appointments soon afterwards fell thickly upon him. He was made secretary to the Royal Society, and physician to Christ's Hospital; he obtained a medical diploma from Oxford, and was after a few years elected associate of the Academy of Sciences at Paris. George the First created him a baronet in 1716, and he was afterwards appointed physician-general to the army. By George the Second he was made physician in ordinary to his Majesty, and on the death of Sir Isaac Newton he succeeded that illustrious man in the chair of the Royal Society. Sir Hans Sloane died at Chelsea, in the year 1752. The most important of his works was his *Natural History of Jamaica*; but, says Swainson, 'although it has never been superseded by a better, it cannot be looked upon as having advanced either the precision or the arrangement of zoology.'

To the attachment which Sir Hans Sloane bore to natural history we are indebted for the first establishment of the British Museum. Having with great labour and expense, during the course of his long life, collected a rich cabinet of medals, objects of natural history, productions of art, antiquities, and an extensive library of

manuscripts and printed books, he bequeathed the whole to the public, on condition that twenty thousand pounds should be paid to his executors. Included in this collection were gold and silver coins, which, considered only as bullion, were worth upwards of seven thousand pounds. The gems and precious stones in great variety; the numerous vessels of jasper, agate, onyx, cornelian, sardonyx, &c.; the curious cameos, the vast stores of the various productions of nature; and the most complete library then extant in medical science and natural history, consisting of fifty thousand volumes, of which three hundred and forty-seven are drawings, or books illuminated; three thousand five hundred and sixteen manuscripts; altogether forming a collection which Sir Hans solemnly declares in his will to be worth more than four times the sum that he required to be paid for them.

Government fulfilled the terms of the legacy, and in 1753 an act of parliament was passed for the purchase of Sir Hans Sloane's Museum, together with the Harleian Collection of Manuscripts, and for procuring one general repository for the better reception and more convenient use of the collections, and of the Cottonian Library, and additions thereto. The museum of Sir Hans Sloane was accordingly removed from Chelsea to Bloomsbury, and thus commenced the formation of the British Museum.

The close of the seventeenth century was also distinguished by the birth of one of the most ingenious naturalists France had yet produced. This was René Antoine Ferchault de Reaumur, born at Rochelle, in 1683. Possessed of a fortune sufficient for his support, this talented individual was unoppressed by many of those cares under which other naturalists have pursued their labours. He could therefore calmly devote his days to the occupations most congenial to his taste; and the more remarkable of these proved to be a minute and patient investigation of the habits of insects, carried on during many years chiefly in his own garden, where he kept and encouraged insects of all kinds for the pur-

pose of examining their respective habits and changes. Reaumur made himself remarkable, and performed important services in several departments of the arts and sciences; but our notice must be confined to his zoological labours, which might alone have been deemed sufficient to occupy the whole lifetime of one man. His *History of Insects* extends to six quarto volumes, but was rather intended to furnish materials for the use of future naturalists than to present a systematic description of insects. To explain the reason of the deficiency, as to method and arrangement, he says, 'The number of observations necessary for a tolerably complete history of so many minute animals is prodigious. When one reflects on all that an accomplished botanist ought to know, it is enough to frighten him. His memory is loaded with the names of twelve or thirteen thousand plants, and he is expected to recall on occasion the image of any one of them. There is perhaps not one of these plants but has insects peculiar to itself; and some trees, such as the oak, give sustenance to several hundreds of different species. And, after all, how many are there that do not live on plants! How many species that devour others! How many that live at the expense of larger animals, on which they feed continually! How many species are there some of which pass the greater part of their time in water, while others pass it entirely there. The immensity of nature's works is nowhere more apparent than in the prodigious multitude of the species of these little animals.' This being the case, he deems it impossible for one man to acquire a knowledge of all the insects of even a limited district, therefore instead of burdening the memory with the characteristic distinctions of these creatures, to the neglect of matters of greater importance, he recommends attention to principal *genera*, and especially those that are of most frequent occurrence, that a knowledge of their peculiarities, food, and propagation, and the different forms they assume, may be accurately obtained.

In his first two volumes, Reaumur treats of cater-

pillars and their changes; in the third, of the clothes-moth, and the aphides, or plant-lice; in the fourth, of gall-insects, and the various two-winged flies; in the fifth, of bees; in the sixth, of wasps, hornets, &c. The cricket, grasshoppers, and beetles, were to have been included in a seventh volume; but, by the death of the author, this last portion of the work was left in such an imperfect state, that it was not capable of publication. The published volumes are however extremely valuable, and Cuvier remarks, that they cannot fail to be studied with the liveliest interest by those who wish to attain just ideas of nature, and of the marvellous variety of means employed to preserve the most fragile of her productions. 'The author,' he adds, 'here carries to the highest point his acuteness of observation in the discovery of those instincts, so constant and so complicated, in each species, which maintain these feeble creatures. He continually excites our curiosity by new and remarkable details. His style, though diffuse, is clear; and the facts which he relates may always be depended on.' Reaumur was the first naturalist who formed an extensive collection of animals in France. Brisson, who was the keeper of his museum, took the opportunity of studying and describing the objects committed to his care, and hence originated his celebrated works on quadrupeds and birds.

Reaumur passed his life in retirement, sometimes residing on his estate at Saintonge, sometimes at his country-house at Bercy, near Paris. He is described as a man of amiable disposition and correct habits, free from many of the cares of life, and little operated on by the bickerings and jealousies that too frequently disturb the repose of literary men. He died on the 18th October, 1757, at the age of seventy-four, his death being accelerated by a fall which he received while riding in the country.

We now arrive at the Linnæan era; and in noticing the life and labours of the great Swedish naturalist, it will be necessary to dwell on those points only which affect the progress of zoology, since the general history

of so eminent an individual would require a much greater space than could here be devoted to it, and would also embrace a wide range of details connected with the science of botany, to which Linnæus especially devoted his time and talents. Charles Linnæus was born on the 23d of May, 1707, at Rashault, in the province of Smaland, in Sweden. His father was pastor of the village, and possessed a taste for natural history, which was inherited by the son. The study of medicine was preferred by the latter to that of divinity; and amidst many difficulties, occasioned by the poverty of his relatives, Linnæus pursued his education at the university of Lund, and afterwards at that of Upsal. Though botany was evidently his favourite science, yet, from the commencement of his career, he manifested a strong interest in the department of zoology, and laboured assiduously in that science. In 1732 Linnæus was sent by the Royal Society of Upsal to explore the desert region of Lapland; and, in the course of this perilous undertaking, he made many interesting and valuable observations on plants and animals. On his return to Upsal he had still to struggle against adverse circumstances; and in 1734 he accompanied the sons of Baron Reuterholm on their travels as far as the mines of Roraas, in Norway. On his return Linnæus contracted a matrimonial engagement with the daughter of a physician at Fahlun, named Moræus, with the understanding, that if he succeeded in obtaining his diploma, the lady was to become his bride at the expiration of three years. This period was spent by Linnæus in various travels and studies, chiefly connected with botanical inquiry.

It was not until the summer of 1739 that the circumstances of Linnæus became sufficiently prosperous to permit of his marriage. Being at that time in Stockholm, he was successful in the treatment of disease among persons of influence at court, and was even consulted by the queen, Ulrica Eleonora, which was quite sufficient to establish his fame, and to render him the fashionable physician. He was now therefore able to

claim his bride, with a prospect of supporting her in comfort and respectability. The lady moreover brought him a considerable portion; and, by her thrifty disposition, was likely to increase wealth rather than happiness. In the autumn of the same year Linnæus resigned the presidency of the academy, on which occasion he delivered a discourse on insects.

In 1741, the chair of *materia medica*, botany, dietetics, and natural history, at Upsal, was given to Linnæus, and thenceforth he began to shine in his proper sphere. The botanical garden was renovated by him, and greatly enriched by contributions from his foreign correspondents: in 1745, a museum of natural history was added. These two departments were described in his *Flora Suecica*, and his *Fauna Suecica*; the former containing descriptions of eleven hundred and forty species of Swedish plants, the latter exhibiting the character of thirteen hundred and fifty animals occurring in the same country. In a later edition this number was increased to two thousand two hundred and sixty-six. In 1750 we find Linnæus exciting and directing the prevalent taste for natural history, and superintending the private collections of the king and queen. Of the honours and emoluments conferred on him from time to time, it is unnecessary here to speak; but we may state that during the latter period of his life, his income, now become a large one, was doubled by order of the king, and also that letters of nobility were presented to him. In 1774 he suffered from a slight attack of apoplexy; and from that time until his death, which took place on the 10th of January, 1778, he was a great sufferer, and for the most part lost his memory and intellectual powers, so that he could not recognize his own works, or even remember his own name. There were intervals in which some degree of intellectual vigour was manifested, but these only served to render more affecting the lamentable state into which the great naturalist had fallen. He died in the seventy-first year of his age, and 'was carried to the grave, with the grief of his

fellow-citizens, the admiration of the learned of all countries.'

To Linnæus belongs the renown of having been the only individual who arranged and described all the animals, plants, and minerals, known in his time; and the fact of his having accomplished this herculean task is sufficient to prove his extraordinary genius and energy, his excellent judgment, and unwearied zeal. 'In his zoological works,' says Swainson, 'there is every indication of a powerful, comprehensive mind, while in his botanical writings we trace the spirit of a philosopher. The services he rendered natural history, at the time he wrote, were immense; nor will they ever be forgotten. His unrivalled invention of nomenclature, which came from his hands, as it were, *perfect*, will remain of undiminished value, so long as science exists; while the simplicity of those rules by which he arranged all the productions of nature then known cannot be too closely imitated, however different may be the series in which these productions are disposed. He may be said to have created a language peculiar to natural history, for the sole expression of the ideas pertaining to it;—a language which all, even his greatest opponents, are constrained to adopt, if they desire to be understood.' Of his system of zoology, the same writer observes, that after having served its purpose, above all others, in the cultivation of the science, it has almost passed away in form, although not in spirit. 'His unrivalled invention of nomenclature, and the clear and lucid manner in which he arranged his materials, gave a facility to the study of natural history perfectly delightful, and introduced a precision it had never before possessed. * * * * He knew the difference between a natural and an artificial system; he appreciated the value of the former, but he prosecuted his invention of the latter because he saw it was more suited to the then state of science. That he possessed no inconsiderable knowledge of comparative anatomy is abundantly evident; but he knew that the external characters of most animals were quite sufficient

for the purpose of identifying them; and he wisely refrained from overburdening his definitions with unessential details and characters. Simplicity, in short, was his ruling passion, and it would be well for modern science if this principle had been imbibed by his successors.'

The *Systema Naturæ* published by Linnæus astonished by its amount of information, while it delighted by the simplicity of its arrangement. 'In those days no other knowledge was sought for than the correct name of an animal or plant—whether it was known or unknown, and what were its distinguishing characters. No wonder, therefore, that he who so admirably succeeded in communicating this information insured immediate applause, and was immediately raised to the rank of an oracle. His merits could be at once appreciated; no course of previous study was necessary to comprehend them—no train of laborious investigation was essential to reveal their beauties. This was the true cause of the brilliant success experienced by Linnæus, and the rapid adoption of his system.'

While the naturalists of all countries were thus captivated by the writings of the illustrious Swede, there were not wanting ingenious and original thinkers, who instead of being dazzled by the splendour of his fame, were only the more stimulated in the path of inquiry, and who were able greatly to extend the bounds of knowledge. Ellis, famed for his discovery of the animal nature of corals and corallines, was one of these, and was also a favourite friend and correspondent of Linnæus. He was a native of Ireland; but had settled in London, and during the early part of his life had engaged in mercantile pursuits. He was subsequently employed as agent for West Florida and Dominica, and from his foreign connexions he received rich supplies of curious specimens; hence he was enabled to make many discoveries in botany and zoology. Linnæus was so much pleased with the particular discovery already noticed that he wrote to Ellis thus, 'You have taken so lofty a rank in science by your discovery concerning

corallines, that no vicissitude in human affairs can obscure your reputation.'

The immediate disciples of Linnæus were also making rich acquisitions in foreign countries, and gathering from widely distant parts of the earth innumerable novelties for the inspection and arrangement of their revered master. Zoology thus made rapid strides on the continent, while few works of moment were produced in England until the time of Pennant, who first treated the natural history of Britain in a popular and amusing style. Numerous works on entomology appeared about this period both in England and on the continent, with large collections of descriptive plates. Ichthyology was also greatly advanced by the famous work of Block, a Jewish physician, of Berlin, who published, in 1785, his *Ichthyology*, in twelve folio parts, with four hundred and fifty-two coloured plates. Five years later, the study of ornithology was advanced by Dr. Latham's laborious work, called *A General Synopsis of Birds*, which was brought to a close in 1790.

While zoological science was successfully explored by the naturalists of the Linnæan school, there was another class of writers, followers of the celebrated Buffon, who seemed to despise all system, and to study only the more attractive parts of the subject, writing a sort of biographical notice of each animal, and avoiding dry and technical details. But the writings of Buffon had too important a bearing on natural history to allow us to pass over the life of this author without a particular notice.

George Louis le Clerc, Comte de Buffon, was born at Montbard, in Burgundy, Sept. 7th, 1707, (the same year in which Linnæus was born). His father was a counsellor of parliament, and the young Buffon was early placed at a Jesuit's college, at Dijon, as a student of law. But his destined profession was distasteful to him, and he attached himself entirely to the study of astronomy and mathematics. It is said that while his companions were at their sports he was poring over his pocket Euclid with the greatest assiduity. At Dijon

Buffon became acquainted with Lord Kingston and his tutor, with whom he travelled through Italy; and while the tutor's scientific knowledge was useful to him, he seems also fully to have entered into the young lord's pleasures. During this expedition he lost his mother, and by her death became entitled to a large income, (nearly twelve thousand pounds); but having become entangled in some affair he found it necessary to leave Montbard. He accordingly visited Paris and England, and did not settle down upon his estate till the age of twenty-five. When he was thirty-two years of age he was called to succeed M. Dufay as intendant of the Royal Garden and Museum; and from that moment he devoted himself with ardour to the pursuit of natural history. His wide and comprehensive views led him to take the theory of the earth as a basis, and to follow out its history in a great work, in which, while he availed himself of the studies of Daubenton, Lacepede, and other naturalists, he also established his own name as a great zoologist. The division of his time and the scene of his studies, during his labours in natural history, are thus described by one of his biographers. 'After he was dressed, he dictated letters, and regulated his domestic affairs; and at six o'clock he retired to his studies at the pavilion called the tower of St. Louis. This pavilion was situated at the extremity of the garden, about a furlong from the house, and the only furniture which it contained was a wooden secretary and an arm-chair. No pictures or books relieved the naked appearance of the apartment, or distracted the thoughts of the learned professor. The entrance was by green folding doors, the walls were painted green, and the interior had the appearance of a chapel, on account of the elevation of the roof. Within this was another cabinet, where Buffon resided the greater part of the year, on account of the coldness of the other apartment, and where he composed the greater number of his works. It was a small square building situated on the side of a terrace and was ornamented with drawings of birds and beasts. Prince Henry of Prussia called it the cradle of natural

history; and Rousseau, before he entered it, used to fall on his knees and kiss the threshold. At nine o'clock Buffon usually took an hour's rest; and his breakfast, which consisted of a piece of bread and two glasses of wine, was brought to the pavilion. When he had written two hours after breakfast he returned to the house. At dinner he spent a considerable portion of time, and indulged in all the gaieties and trifles which occurred at table. After dinner he slept an hour in his room, took a solitary walk, and during the rest of the evening he either conversed with his family or guests, or sat at his desk examining the papers which were submitted to his judgment. At nine o'clock he went to bed, to prepare himself for the same routine.'

In 1762, at the age of fifty-five, Buffon married Mademoiselle de Saint Belin, a lady who added greatly to his happiness, and who took a deep interest in his studies. She is represented as anxiously watching all the steps he took on the road to fame, and participating in his joy and triumph, when his talents were rewarded by various marks of esteem and honour from royal personages and learned bodies throughout Europe. In 1776 Louis XIV. raised his estate into a *compté*, and invited him to Fontainebleau to offer to him the post of Administrator of the Forests of France, but this office was declined by Buffon.

This naturalist possessed an insatiable desire after knowledge, and great perseverance and fondness for study, added to which his biographers confess that his vanity was excessive. He was accustomed to read aloud to his visitors those passages of his works which were the most likely to draw forth their admiration. So much was an auditor once affected by his poetical passages on the swan, that (being no less a person than Prince Henry of Prussia) he sent the zoologist a service of porcelain, on which swans were represented in a great number of attitudes. Buffon was extremely fond of dress and magnificence. He had a fine countenance and commanding figure, and it was his delight to display them to the best advantage. He dressed in the extreme of fashion, and amidst all his studies found

time to submit his head to the hair-dresser two or even three times in the day. On Sundays the peasantry of Montbard assembled to gaze at the Count after the service of the church, when he passed through their ranks magnificently dressed, at the head of his son and retainers.

Thus admired and courted, Buffon passed a life of prosperity and tranquillity, until at the age of seventy-three he was attacked by a distressing malady (the stone), under which he laboured for eight years, suffering intensely, but refusing to submit to an operation, which his physicians felt certain would give him relief. He died on the 16th of April, 1788, aged eighty-one, leaving an only son whose abilities were considerable, and who rose to the rank of a major in the regiment of Angoumois, but perished on the scaffold during the Revolution.

Great respect was paid to the memory of Buffon. His funeral was attended by crowds of academicians and persons of rank who were anxious to pay this last tribute to the great naturalist, and twenty thousand persons were congregated to see the funeral pass. The character of Buffon as a naturalist stands deservedly high, but his works are tainted by a spirit that savours strongly of infidelity. Some of his opinions drew upon him the censure of the Sorbonne, and in his *Histoire Naturelle* the letters of the faculty of theology and his answers are both given. His moral character was also unworthy of his great name, being undoubtedly licentious both as to habits and conversation.

His great work was that already named, the *Histoire Naturelle*, the first edition of which, consisting of thirty-six volumes, was printed at the royal press in 1749, and was in a course of publication down to 1788. This work has been translated into Italian, Spanish, Dutch, German, and English. By means of this great work Buffon extended the range of natural history by making it acceptable to all classes of readers. In the preliminary sketch to Griffiths's Cuvier, we find the following high eulogium of this attractive author. 'His great genius clothed natural history in a new dress, and decorated it with the attractions of an eloquence unrivalled

in his own, or perhaps in any other language. He was the first who extended the sphere of its popularity, by the charms of his style, beyond mere scholars and men of science; his naturally expansive mind and love of sublimity led him rather to the contemplation of generalities than details. He was also occasionally carried by the force of his imagination into hypotheses that rested on no solid foundation. He had, nevertheless, a truly philosophical spirit, could observe facts, and compare results, and possessed the most extensive degree of information. His genius was of a very different character from that of Linnæus. To the latter belonged clearness, method, admirable precision, and wonderful acuteness of observation and research; but the genius of Buffon was adapted to generalize and enlarge our view of things. While the one is perpetually aiming at order, exactness, and the developement of details, the other is contemplating nature in all her wild magnificence, and neglects particularity, that he may embrace a more extensive scope. Might we dare to find fault with either of these great men, we would say, that Linnæus was sometimes almost too methodical and dry; while Buffon, on the other hand, sometimes departs too much from order, and is too prone to fanciful speculations; but the fact is, that such faults are almost necessarily connected with the peculiar perfection of their respective genius. It is too much to demand of human nature a combination of the greatest, and at the same time most opposite qualifications, in the same individual. There are four great naturalists who have each of them exhibited nature under a different aspect. Aristotle has shown us the profound combinations of its laws; Pliny, its inexhaustible riches; Linnæus, its wonderful details; and Buffon, its majesty and power. Let us then be contented to take advantage of these different views, instead of invidiously dwelling on the defects of four writers, who may justly be considered the fundamental pillars of natural history. * * *

On the whole, one may pronounce the work of Buffon with all its faults to be one of the most valuable accessions that natural history ever received. It contains

such a picture of nature as was never given before or since by the pen of any individual; independently, too, of the actual merit of his book, Buffon had the happiness of bringing the cultivation of the science more generally into fashion than it ever was before. Under his auspices it took a higher flight than ever, and the minds of his countrymen received a universal bent towards this study. There can be no doubt that the perfection to which natural history generally, and zoology in particular, have arrived in France, is to be mainly attributed to the labours of this illustrious writer.'

'The narrative style of treating natural history,' says Swainson, 'adopted by Buffon and his immediate followers, however, interesting and popular, was soon found to be quite inconsistent with the study of nature as a science; and even the most eminent of his own countrymen, when the fever of admiration had somewhat subsided, began to see the impossibility of going on without a more orderly method of arranging their discoveries, and of communicating their knowledge.' This being the case, a new school of zoologists arose in France, who, finding the necessity of systematic arrangement, and perceiving that the great advances in science since the time of Linnæus had rendered necessary extensive alterations and additions to his system, applied themselves earnestly to investigate the structure of animals, and especially to the study of internal comparative anatomy, with a view to zoological classification. Pre-eminent among those who held these enlightened views was that truly remarkable man **GEORGE CUVIER**, whose career, brilliant with important scientific discoveries, forms an era in the history of zoology as well as of several allied departments of knowledge. The history of this eminent man has been traced in a most interesting manner in various memoirs, essays, eloges, and other laudatory notices on the part of his numerous friends and admirers; while the journals of science and of literature throughout all Europe have vied with each other to do justice to his greatness. From many of these sources the following memoir has been prepared.

CHAPTER III.

THE LIFE AND LABOURS OF CUVIER.

Importance of the Subject—Birth of Cuvier—His Family—His Mother—Her Character—Cuvier's Affection for Her—She superintends his early Education—His Love for Natural History—His Perusal of Buffon's Work—Anecdotes—His Success at School—Attracts the Notice of Duke Charles of Würtemberg—Is sent to the Academie Caroline—Notice of this Academy—His Success therein—Becomes a private Tutor—His Character at this Time—His original Researches in Natural History—Becomes acquainted with the Abbé Tessier—Goes to Paris—His Reception—Obtains an Appointment—Review of his Career—Commences his Collection of Comparative Anatomy—Becomes a Member of the National Institute—His Discoveries, Labours, and Publications—His further Appointments—His Marriage—His Report on the Progress of Science—His Journeys for organizing Educational Establishments—Publication of his Work on Fossil Remains—The title of Chevalier conferred on him—Loses two of his Children—Napoleon's Estimate of Cuvier—Is made Chancellor of the University at the Restoration—Effect of his being a Protestant—He publishes the *Regne Animal*—Plan of the Work—His first Visit to London—Anecdotes—His further Appointments and Titles—Is created a Baron—His continued Labours in the Cause of Science—His Eloges—Loses his only Daughter—Affecting Anecdote—Review of his Public Duties—His Merits as a Public Lecturer—His second Visit to London—Revolution of 1830—Cuvier's Employment of his Time in London—Anecdotes—His Knowledge of Languages—His Disposition.

OF the distinguished individual whose history forms the subject of the present chapter it has been truly said: 'His various acquirements equally vast and minute; his multiplied labours; his elevated views; his private virtues, have furnished to each admirer so many topics of just eulogy. The naturalist, the moralist, the orator, the

statesman, have each acknowledged the sympathy which binds them all to a man in whom every variety of merit seemed to be united, and whose eloquence equally adorned and enforced the philosophy of science and of life. His attached friends and the pupils who revered and loved him have felt that the contemplation of such a character charmed and elevated their own, and have lingered over reminiscences, before which all that was mean, or indolent, or unintellectual, fled away.'

George Léopold Chrétien Frédéric Dagobert Cuvier was born at Montbéliard (département du Doubs), on the 23rd August, 1769. This town, which now belongs to France, was then included in the kingdom of Würtemberg. His family originally dwelt at a village of the Jura, which still bears the name of Cuvier, but, becoming the victims of religious persecution, they were much impoverished, and were driven to settle at Montbéliard at the period of the Reformation. The grandfather of Cuvier had two sons, one celebrated for his learning, the other belonging to a Swiss regiment, and made Chevalier de l'Ordre du Merite Militaire, which, among the protestants, was equal to the catholic Croix de St. Louis. After forty years' service he retired with a small pension to Montbéliard, where he was appointed commandant of the artillery of that town. At fifty years of age he married a young and estimable lady, by whom he had three sons. The eldest died a short time before the birth of the second son, who also proved so extremely delicate, that there appeared little hope of his arriving at manhood. This was the infant George¹, the subject of our present notice, the object of many cares on the part of his excellent mother during his early years, which his feeble constitution rendered neces-

¹ The name of George did not belong to Cuvier, but he was called so by his mother in remembrance of her first-born, whose early death has been just noticed. Cuvier retained the name from custom and out of respect to his mother; and after his marriage, when some difficulties were likely to occur from his use of it, he took the necessary measures for obtaining a legal right to this favourite name.

sary, and which were deeply impressed on his mind through life. 'He cherished every circumstance connected with her memory; he loved to recall her kindnesses, and to dwell upon objects, however trifling, which reminded him of her. Among other things he delighted in being surrounded by the flowers she preferred, and whoever placed a bouquet of red stocks in his study or his room was sure to be rewarded by his most affectionate thanks for bringing him what he called the favourite flower.' Not only did the mother of Cuvier watch over the health of her child with unwearied assiduity; she also exercised her influence in a way that was highly beneficial in the formation of his character. She guided his religious duties, nurtured every good and moral feeling, helped him in his lessons, and constantly supplied him with select works by which his ardent desire for knowledge was gratified and encouraged. Under her instructions he could read fluently at the age of four years; and when placed at an elementary school, he was, by her continual assistance, better prepared with his Latin and other tasks than any other boy in the school. She taught him drawing, in which art his progress was afterwards superintended by one of his relations, an architect in the town of Montbéliard. Thus does the early life of Cuvier add another to the numerous instances of distinguished men who owed much of their greatness to the attainments and character of a mother of superior understanding. At ten years of age he was placed at a school of a higher description, called the *Gymnase*, where he remained till he was fourteen. He now made rapid progress; he was constantly at the head of the classes of geography, history, and mathematics, and acquired Latin and Greek with readiness. His taste for natural history began to appear by the frequent visits which he paid at the house of a relation who possessed a complete copy of Buffon, and by the zeal and fidelity with which he copied the plates of that work, and coloured them according to the printed descriptions. Sometimes he employed water-colours for this purpose, and at other times he would amuse

himself with cutting out correct profiles of the birds in pasteboard, and sewing on bits of silk of the colour and shape of the wings. On obtaining the loan of the work, he always carried a volume of it in his pocket, and this was read again and again. The dawning talents of the legislator also manifested themselves at this period, for 'Cuvier chose a certain number of his schoolfellows, and formed them into an academy, of which he was appointed president. He drew up the regulations, and fixed the meetings for every Thursday at a stated hour, and, seated on his bed, and placing his companions round a table, he ordered that some work should be read which treated either of natural history, philosophy, history, or travels. The merits of the book were then discussed, after which the youthful president summed up the whole, and pronounced a sort of judgment on the matter contained in it, which judgment was always strictly adopted by his disciples. He was even then remarkable for his declamatory powers; and on the anniversary fête of the sovereign of Montbéliard (Duke Charles of Würtemberg), he composed an oration in verse on the prosperous state of the principality, and delivered it fresh from his pen, in a firm manly tone, which astonished the whole audience.' On account of an unkind prejudice on the part of the head of the school, arising from annoyance at some youthful sarcasms in which Cuvier had indulged, this display of talent did not meet with its proper reward; and instead of being placed in the first rank of the themes presented, it was degraded to the third. This was the more vexatious, as the station of the boy at college depended on it; and though Cuvier afterwards felt that the change in his destiny which resulted from this circumstance was one for which he had much reason to be thankful, yet at the time its evident injustice was severely felt.

The fame of the young student, however, and his disappointment, reached the ears of Duke Charles by means of the princess, his sister-in-law; and when on a visit to Montbéliard, he sent for Cuvier, asked him

several questions, and examined his drawings. He then declared his intention of taking him under his special favour, and sending him to the university of Stuttgart, free of expense, there to enter into his own academy, called the Académie Caroline. At this academy the pupils were instructed in every branch of knowledge that was especially useful to men destined to govern and direct the affairs of communities, and many there educated became the ministers of the various courts of Germany, and even of that of Russia. The school had a military character, the scholars wearing uniforms, and being under the orders of a colonel and major; but the education was by no means restricted to youths intended for the military profession. This academy has had the honour of contributing not only to the education of Cuvier, but also to that of Schiller, Kielmeyer, and many other eminent men.

At the early age of fourteen, Cuvier quitted his parents, and was sent among strangers, without having any idea of the establishment he was about to enter. His three days' journey thither was not recalled, even in his latest years, without a sensation of fear. 'He was seated between the chamberlain and secretary of the Duke, both entirely unknown to him, and who spoke nothing but German the whole way, of which the poor child could not understand one word.' It was on the 4th of May 1784, that he entered the Académie Caroline; unusual attainments enabled him to take his seat amongst the most celebrated students of the academy. In this place he continued to study during four years all that was taught in the higher classes—mathematics, law, administration, tactics, commerce, &c. He profited by every opportunity of pursuing his darling study of natural history. He frequently read over Linnæus, Reinhart, Mur, and Fabricius, he collected a very considerable herbarium, and drew and coloured an immense number of insects, birds, and plants, with wonderful correctness. He obtained various prizes, and was one of the five or six out of four hundred to whom the

honour of the order of *Chevalerie*¹ was granted. Nine months after his arrival at Stuttgart he carried off the prize for the German language.

At the termination of his academical career Cuvier was promised a place in the administration of his country ere long; but circumstances obliged him to seek employment in a manner wholly different to his own wishes, or the hopes of his patron. The unsettled state of finance in France caused his father's pension to be withheld, and being thus unwilling to burden his father, and unable to wait perhaps two or three years, till an opportunity of advancing his fortunes should be presented to the duke, Cuvier was obliged to accept the offer of one of his countrymen, (M. Parrot, who was going to Russia), to take his place in the situation of private tutor in a protestant family. Those who knew his extraordinary talents considered the office as a lamentable waste of his powers; but here, again, that which was esteemed a severe misfortune proved a stepping-stone to future fame and success. In July 1788 Cuvier arrived at Caen, in Normandy, and stationed himself in the family of Count d'Hericy, for the education of the only son.

On arriving at Caen he brought with him that love of labour, that depth of reflection, that perseverance, that uprightness of character, from which he never swerved. To these admirable foundations for glory he afterwards added that remarkable clearness of system, that perfection of method, that tact of giving only what is necessary;—in short, that elegant summing up the whole, which particularly distinguishes the French writers: the whole superstructure was completed by the most perfect modesty, and that respect for his own esteem, without which, talents become the medium of traffic for the acquirement of sordid possessions. Whilst with the count's family, Cuvier saw all the nobility

¹ The chevaliers dined at a separate table, and enjoyed many privileges. They were also considered as being under the immediate patronage of the duke.

of the surrounding country, and acquired the forms and manners of the best society. And not only this: as a poor tutor, in a retired district, at the age of twenty-one, he laid the foundation of that fame which was to fill the world, and to reach to distant ages. A long sojourn on the borders of the sea induced him to study marine animals; and some fossil remains having been dug up near Fécamp, the thought struck him of comparing fossil with recent species, and the casual dissection of a *calmar* (a species of cuttlefish) led him to study the anatomy of molluscous animals, which afterwards conducted him to the development of his great views on the whole of the animal kingdom. 'The class called *Vermes* by Linnæus included all the inferior animals, and was left by him in a state of the greatest confusion. Cuvier examined their organisation, classed them into different groups, and arranged them according to their natural affinities. He committed his observations and thoughts to paper, and said to a friend, "These manuscripts are solely for my own use, and, doubtless, contain nothing but what has been done elsewhere, and better established by the naturalists of the capital; for they have been made without the aid of books or collections." Nevertheless, almost every page of these precious manuscripts was full of new facts and enlightened views, which were superior to almost all that had yet appeared.'

While he was thus employed, a society was formed at Valmont, in his neighbourhood, for the encouragement of agriculture. L'Abbé Tessier had sought at this place a refuge from the persecutions of the revolutionists; and, at one of the meetings of the new society, Cuvier discovered this learned old man, under his disguise of a surgeon, and addressed him by name. He had been able to recognize him from his style of speaking, which strongly resembled that of his writings; but the recognition was at first the cause of alarm to the poor abbé, who was then under proscription. He found in Cuvier, however, a generous friend and admirer, and was so delighted with his talents, that he afterwards

wrote of him to Jussieu in the following terms: 'At the sight of this young man I experienced the delight of the philosopher who was thrown on an unknown shore, and saw traced there the figures of geometry. M. Cuvier is a violet, which was concealed among common herbs. He knows much; he draws figures for your work. I have begged him to give botanical lectures this summer; he has agreed to do so; and I congratulate the students of your hospital that he consents; for he demonstrates with much method and clearness. I doubt your finding a more able person for comparative anatomy. It is a pearl worthy of being gathered by you. I contributed to draw M. Delambre from his retreat; help me to draw M. Cuvier from his: he is made for science and the world.' The perusal of some of Cuvier's writings soon made the literary men of the capital as anxious as M. Tessier to draw the young naturalist from his obscurity, and accordingly, at the age of twenty-six, he was called to Paris, and immediately appointed a member of the Commission of Arts; and, shortly after, professor at the central school of the Panthéon. For this school he composed his *Tableau élémentaire de l'Histoire des Animaux*.

A writer in the *Foreign Quarterly Review*, remarking on the industry of Cuvier, has the following sensible observations:—'On looking back at the career of men who have risen by successive performances to the highest distinction, the obstacles against which those performances were achieved are so faintly seen amidst the splendour they produced, that part of the lesson is lost to subsequent aspirers, who, feeling the pressure of difficulties of all kinds, and seeing the temple of fame shining afar off, on a steep all but inaccessible, forget, or do not know, that those whose names adorn that temple once felt all that harasses their minds, or clouds the prospect before them. Many professed lovers of natural history resign themselves to inactivity because they live in the country, and have no coadjutors, or no collections, or few, to resort to. Such persons should remember how much Cuvier accomplished in Normandy;

that he became acquainted with all the fishes of that coast, and all the shells, in years of early obscurity, and without pecuniary resources; that a collection having been fortunately made by a resident at Fécamp, every specimen it contained was carefully drawn by him; and that these were in reality the foundations of all that has since given imperishable lustre to his name. Great as was the reputation which Cuvier lived to enjoy, no characteristic of him is more striking than his early and high distinction; for it is evident that before he left the retirement of Normandy he had already taken a very extensive view of the animal creation, and had read, with the eye of one destined to be the master of that science, the works of all the greatest naturalists. His letters, written from that retreat, exhibit the first outlines of great designs; and before he became personally known to the philosophers of Paris he had arrived at those profound views which first guided his classification of the lowest classes of animals, to the exclusion of the most prevalent systems of the day. Thus, when he appeared in Paris, it was but to be everywhere heard with delight and conviction, and honoured with applause and appointments.

In the month of July 1795 Cuvier was associated at the Jardin des Plantes with M. Mertrud, who had been appointed to the newly-created chair of comparative anatomy. Cuvier then sent for his father, at that time nearly eighty years of age, and for his brother, M. F. Cuvier, who was married, to reside with him. He immediately commenced the magnificent collection of comparative anatomy, now so celebrated, and allowed nothing to interfere with his purpose. He began by collecting, in large granaries near the house, some skeletons left by Mertrud, and all that could be recovered of those collected by Daubenton, or that Buffon had drawn from the Academy of Sciences, and which had been heaped together in the depths of the Museum of Natural History. It frequently happened, during these early labours, that Cuvier and his brother were obliged themselves to saw and fix up the rude planks on which

they arranged their specimens. The National Institute was created in 1796, and Cuvier was made one of its first members. In the same year he announced his discovery of red blood in leeches, and in the following year he read his celebrated memoir on the nutrition of insects. In 1798 he was invited to accompany the expedition to Egypt, but refused to do so, from a conviction that he could better serve the interests of science by remaining among the daily improving collections of the Jardin, where his labours could be systematic. He steadily occupied himself in amassing those materials which enabled him to establish the science of comparative anatomy, to discover the zoology of former worlds, and to bring about a reform in the whole of the animal kingdom. His enlightened views were made apparent in his *Tableau élémentaire de l'Histoire Naturelle des Animaux*, published in 1798, and being a sketch of his subsequent and more perfect work, the *Regne Animal*. In 1800 appeared the first two volumes of his *Leçons d'Anatomie comparée*, which met with the greatest success, notwithstanding a few errors afterwards corrected and acknowledged by their author. The last three volumes, which were far more complete and correct, were published in 1805. These lessons were much needed by his numerous pupils. Only the introduction, the first lesson, and the headings of chapters, were actually written by the hand of Cuvier; two of his pupils, MM. Dumeril and Duvernoy wrote the remainder from notes which they had taken of Cuvier's lectures, and from the result of dissections which they had assisted him in. Cuvier corrected the proofs, and is the undoubted author of the work, though some writers, as if anxious to derogate from his great fame, have endeavoured to give the credit to the assistants, rather than to the master from whom they derived their knowledge. At the time of the publication of the first of these volumes, Cuvier was appointed Professor of natural history at the College de France; two years afterwards he was made one of the six inspectors general of education, in which capacity he founded the public schools, now

called royal colleges, at Marseilles, Nice, and Bordeaux. While thus employed at Marseilles he continued his study of marine animals. During his absence the secretaryships of the National Institute were made perpetual, and Cuvier was elected to that of natural sciences, which he held with honour to the day of his death. The salary of the perpetual secretaries of the Institute was fixed by Napoleon at six thousand francs; and on its being observed to him that it was too much, he replied, 'The perpetual secretary must be enabled to receive at dinner all the learned foreigners who visit the capital.' On this appointment Cuvier quitted his labours as inspector-general. While the talents of Cuvier were advancing him to the fame of a great naturalist, he never showed the least disposition in his conversation or writings to disparage the labours of those who had preceded him. 'In proceeding to treat of any of the great subjects which occupied him, his first care seems ever to have been to set before the reader the merits of his predecessors: he shows what they performed, and how far all who succeeded were indebted to them. Throughout each of his works his frequent acknowledgements of the aid derived from the observations of others shows the candour of a great mind, zealous for truth, and truth alone.'

Cuvier's father died shortly after his arrival in Paris, and the wife of his brother was also suddenly removed by death, so that the brothers, with the infant son of M. F. Cuvier, were left in comparative solitude. The subject of our memoir now thought of seeking a companion for life, and happily made choice of a lady who is described as exhibiting a rare combination of mind, manner, and disposition. It was no interested match, for Madame Duvaucel was the widow of a fermier general who perished on the scaffold in 1794, and she brought a family of her own to the care of M. Cuvier. But she is said to have shed a bright halo of happiness around him, to have been a support to him in suffering, and a powerful auxiliary when his heavy duties permitted him to seek unrestrained conversation with

her¹. In 1808, Cuvier, in his character of secretary, wrote a Report on the Progress of the Natural Sciences from the year 1789. A mere report was demanded, but the author produced one of the most luminous treatises that had ever appeared. This Report was presented to the emperor, and in the same year, when Napoleon created the Imperial University, Cuvier was made one of the counsellors for life, and was thus brought constantly into the immediate presence of the emperor. In 1810 he commenced a series of journeys for the purpose of organizing the foreign establishments for public instruction. He began with the academies of the Italian states, then examined those of Holland, and finally those of Lower Germany. These journeys were doubly useful to him, by establishing his health, which had suffered in consequence of his incessant labours, and by giving him an opportunity of visiting the museums of those countries, where he took drawings of new objects, particularly of the fossil remains of Tuscany, of which he had procured a great number. In the year 1811 his most important scientific work appeared—that on fossil remains; and he also wrote admirable reports from Holland and the Hanseatic towns. While at Hamburgh the title of Chevalier was conferred on him by the emperor, and assured to his heirs. But wordly honours were not to be transmitted to his posterity, for after losing a daughter four years old, in 1812, he was bereaved of his son in 1813, who was seven years of age. The impression produced by this last stroke was never entirely effaced, and even after the lapse of many years he never saw a boy of that age without emotion. Often when walking with his daughter he would stop before a group of boys,

¹ Of the four children of Madame Duvaucel, one was assassinated in Portugal, in 1809; another fell a victim to his scientific zeal in a pernicious climate, dying at Madras, after making collections for the museum at Paris, during four years, in different parts of India. The third son held a high place in the customs of Bordeaux, and the daughter, who was loved by Cuvier as his own, devoted herself entirely to him in his last moments.

who as they played reminded him of his child. This loss happened to him while at Rome, then annexed to the French empire, where he was sent to organize the universities. Being a protestant, the mission was one requiring peculiar forbearance and firmness; yet the enlightened tolerance of Cuvier, and his mild and benignant manners, gained for him the esteem and respect of all parties.

The confidence reposed in Cuvier by the emperor was such, that, in addition to all his other offices of trust, he intended making him tutor to his son, and ordered him to draw up a list of books as a preliminary step. In 1814 he made him a counsellor of state, and Louis XVIII. reappointed him to the office. 'After the hurricane of the hundred days,' says Mrs Lee, 'it became necessary to remodel both the Royal and Imperial Universities, and a provisional superintendence was deemed necessary. A committee of public instruction was created to exercise the powers formerly belonging to the grand master, the council, the chancellor, and the treasurer of the university. M. Cuvier made a part of this committee, and was at once appointed to the chancellorship, which office he retained till his death, under the most difficult circumstances, in the midst of the most opposite prejudices, and notwithstanding the most inveterate resistance offered to him as a protestant. Could he have been prevailed on to change his religion, he might have been grand master of the university. The jesuitical tendency of those in power augmented the difficulties that a wise and disinterested man must at all times meet with in trying to do good and to prevent evil; but when that man was of a different religion, it may easily be imagined in how delicate a situation he must have been often placed, and how greatly his religious faith must have increased the obstacles he had to encounter. To those unacquainted with the early part of M. Cuvier's career, it would seem extraordinary that all these high functions should be conferred on a naturalist by profession, but it should be considered, that he only thus pursued his original

destination, out of which he had been thrown by political events. He took a very active part, not precisely in political measures properly so called, from which he by choice withdrew himself as much as possible; but in projects for laws, and every sort of administration, which especially belonged to the committee of the Interior attached to the Council of State. He was also, generally speaking, the Commissaire du Roi, appointed for defending the new, or ameliorated laws, before the two chambers.'

In the year 1811 appeared his justly celebrated production, the *Regne Animal*, which classed every branch of zoology according to its organization. 'Setting out from the principles,' says M. Laurillard, 'that the natural history of a being is a knowledge of all its relations, of all the properties of that being, and that the whole of its organization should serve to assign it a place in a methodical arrangement, he concluded that anatomy and physiology should form the basis of zoology, and that the most general and constant fact in the organization should determine its grand divisions, and the least general and most variable facts the secondary divisions. He thus established a subordination of character, which ought to be, and alone can be, the principle of a natural method; that is to say, of such a method of arrangement of beings that the place occupied by each of them gives a general idea of its organization, and of the relations which connect it with all the others; a method which he regarded as science itself reduced to its most simple expression.

'Thus examining the modifications of the organs of circulation, respiration, and the sensations throughout the animal kingdom, instead of the six classes of Linnæus, *namely*, quadrupeds, birds, reptiles, fishes, insects, and worms, M. Cuvier established four great types—vertebrated animals, molluscous animals, articulated animals, and radiated animals, which he calls *embranchemens*, and divides into classes of nearly equal value with those long established among the vertebrated animals. This was very much to raise the importance

of the inferior classes; but already, since the time of Linnæus, it had become understood that neither size nor utility should enter into the computation in scientific distributions; and the justness of the reasons by which M. Cuvier supported his views caused them to be generally adopted.'

In the year 1818 he visited London, and remained there with his family and his secretary about six weeks, visiting every thing worthy of notice. His remark to his majesty George IV. concerning our natural history, was, that if the private collections could be amassed into one, they would form a great national museum which would surpass every other. The election for Westminster was going on at the period of his visit, and he frequently dwelt on the amusement he had derived from being on the hustings every day. 'These orgies of liberty were then unknown in France, and it was a curious spectacle for a man who reflected so deeply on all around him, to see and hear our orators crying out at the tops of their voices to the mob, who pelted them with mud, cabbages, eggs, &c., and Sir Murray Maxwell, in his splendid uniform, flattering the crowd, who reviled him, and sent at his head all the varieties of the vegetable kingdom.' Cuvier frequently described this scene with great animation.

Cuvier passed several days at Oxford, and was greatly delighted with the city and its objects of interest, and also with the distinction which attended his reception there. His wife and daughters met him at Windsor, and after passing a day in the castle, park, &c., they proceeded late in the evening to the house of Sir W. Herschel, who received them with the utmost kindness, and exhibited to them his great telescope. Another visit was also productive of the greatest pleasure: it was to Sir Joseph Banks, at Spring Grove, where the entertainment given to the whole party resembled a *fête champêtre*. 'The only thing to which Cuvier could not reconcile himself in England was the formality and length of our dinners, the long sittings after which were always mentioned by him with an

expression of ennui, even in his countenance. At one of these sittings at Sir Everard Home's the conversation turned upon some political question. In the course of the discussion M. Cuvier said, "But it would be very easy to clear up this point if Sir Everard would send to his library for the first volume of *Blackstone's Commentaries*." Upon this, Sir Everard, with great emphasis, exclaimed, "Know, Monsieur, that I have not such a book in my library, which, thank God, only contains works of science." To this M. Cuvier quietly replied, "The one does not prevent the other;" but never could recollect this, to him extraordinary boast, without a mixture of amusement and astonishment.'

The great naturalist often spoke with gratitude of his reception in England, and of the facilities afforded him by our statesmen and literary men for ascertaining the influence of our constitutional government, and the state of science in this country.

In the year 1818, also, Cuvier was elected a member of the Académie Française, on which occasion he delivered a discourse of extreme beauty and elegance. In the following year he was made president of the Comité de l'Interieur, and created a baron. In 1822 his appointment to the office of Grand Master of all the Faculties of Protestant Theology was made. In 1824, as president of one of the councils of state, he took part in the coronation of Charles X., on which occasion he was made Grand Master of the Legion of Honour, and Commander of the Order of the Crown by the King of Würtemberg. In 1827 he was appointed Censor of the Press, but the office was so odious to his feelings that he instantly and firmly refused it, although at the risk of losing all his other offices by so doing. Charles X. exhibited some displeasure on the occasion; but afterwards gave further proof of confidence in him by charging him with the administration of all the non-Catholic religions in France.

Sacrificing everything to the interests of science, Cuvier formed a vast library, and permitted naturalists who sought the privilege, to go and work in it as in a

public library. No mean spirit of rivalry—no petty jealousies of the discoveries of others—ever displayed any power over the spirit of this extraordinary man ; on the contrary, he rejoiced at the advancement of knowledge by whomsoever effected, and even when it led to alterations in what he had himself propounded. At his request travellers were sent by government into all parts of the world to collect observations and specimens for the enrichment of the museum. Each of these travellers received directions and instructions from his own mouth ; so that it might be said of him, as of Linnæus, that Nature was everywhere interrogated in his name.

As secretary to the Institute Cuvier had become the biographer of the Academy of Sciences, and it was in the fulfilment of this duty that he wrote and delivered those celebrated *éloges* which are perfect models of composition, and in themselves sufficient to establish the fame of their author. The public services of the individual forming the subject of the *éloge* were prominently set forth ; private occurrences bearing on those services were noticed with great delicacy and propriety ; due allowances were made for the influence of the circumstances in which the individual had been placed, while pleasing traits of character and instances of noble feeling were brought out to exhibit the worth of the departed. In addition to this task, the performance of which brought such high renown to the secretary, he was also expected to produce reports on each memoir or work submitted to the Academy, and had likewise the task of preparing an annual analysis of the transactions of that body, a duty which he performed to the last year of his life. ‘There is no part of his works,’ says an accomplished writer, ‘which so completely shows the universality of his comprehension and acquirements as these reports. Not only was he obliged to understand each subject, but to embrace its connexion with the past, and its bearings on the future ; the whole range of natural sciences came before him, and seems to have been enough to fill up his life, without leaving room for

his own great endeavours. His language was so clear and precise in those analyses, that many scientific men were afterwards glad to adopt his descriptions rather than their own for revealing their discoveries to the world.

In the year 1827 Cuvier lost his only daughter, the pious, talented, and beautiful Clementine, at the age of twenty-two, and then on the eve of her marriage. 'Lovely in every action—lovely in person and attainments—no question ever arose as to who did or did not admire Clementine Cuvier; she unconsciously commanded universal homage, and secured its continuance by her lowliness of heart and her unfailing charity. The daughter was worthy of the father: it may be imagined then how that father loved her, and how heavy was the visitation. But M. Cuvier, with that high sense of duty which had always distinguished him, felt that he lived for others, and that he had no right to sink under the heavy load of grief imposed on him. With the energy that might be expected from such a character, he sought relief in his duties; and although many a new furrow appeared on his cheek,—although his beautiful hair rapidly changed to silvery whiteness,—though the attentive observer might catch the suppressed sigh, and the melancholy expression of the uplifted eye, no one of his important offices remained neglected; his numerous protégés received the same fostering care; and when time had softened the deep distress of Madame Cuvier he welcomed strangers to his house with his wonted urbanity. It has been related by an eyewitness, that at the first sitting of the Comité de l'Interieur at which M. Cuvier presided after this event, and from which he had absented himself two months, he resumed the chair with a firm and placid expression of countenance; he listened attentively to all the discussions of those present; but when it became his turn to speak and sum up all that had passed, his firmness abandoned him, and his first words were interrupted by tears; the great legislator gave way to the bereaved father; he bowed his head, covered his face with his

hands, and was heard to sob bitterly. A respectful and profound silence reigned through the whole assembly; all present had known Clementine, and therefore all could understand and excuse his deep emotion. At length M. Cuvier raised his head, and uttered these few simple words: "Pardon me, gentlemen; I was a father, and I have lost all!" then with a violent effort he resumed the business of the day with his usual perspicuity, and pronounced judgment with his ordinary calmness and justice.'

After this period Cuvier seems to have worked harder than ever; and a new proof of his perseverance came out in 1829, being a second edition of the *Regne Animal*, with additions and modifications. To this succeeded the third and fourth volumes of his *Ichthyology*, the former volumes having appeared the year before.

The great number of public offices held by M. Cuvier led to the unjust opinion that he was ambitious of power, especially among those who looked at his appointments and did not consider the wonderful fidelity with which he fulfilled the duties belonging to each of them. So far from having sought or solicited places, he nobly rejected several that were offered to him. Twice, at different periods, did he refuse the directorship for life of the Museum of Natural History; and, at another, to enter the ministry,—an advantage which, at that time, no one thought of rejecting.

With respect to the public duties of this great man, the writer in the *Foreign Quarterly Review* already quoted, has the following remarks: 'That in addition to his philosophical researches Cuvier should have found time to be a most laborious public functionary, and in more than one department, would scarcely be deemed credible, if he had not left indisputable proofs of it, and of various kinds. Yet nothing indicates that by undertaking so much anything was neglected. Follow him where we may, we trace him by works worthy of his genius and accomplishments.' And, again, the same writer justly says, 'Talents so eminent as those of

Cuvier, united with so much dignity of character and so much experience, were indispensable to France under all the successive changes of government which happened during his lifetime. The Consulate, the Imperial Government, the Restoration, the Monarchy of July, did but anew direct public attention to the civil services of a man whose attainments and whose sagacity were for all time. Subservient only to good and great designs worthy of his exalted intellect, he was a favourite of the consul, of the emperor, of the restored sovereigns, and of him whom the people elected; and yet independent,—for what could governments or kings do for Cuvier? Undistracted by all the changes that befel his country he was ever occupied with her best interests,—ever laboriously endeavouring to diffuse that mental and moral preparation without which he well knew the political rights she so urgently sought would prove the reverse of blessings.'

As a public lecturer Cuvier was peculiarly gifted, and attracted crowded audiences. Mrs. Lee says, 'The charms of his flexible and sonorous voice, which could be heard everywhere in its sweetest tones, the benignity and animation of his countenance, attracted each sex, and various ages. In the coldest weather the audience assembled an hour before the time, and some were contented to remain on the staircase, provided they could catch some of his melodious words; and the enthusiasm with which he was received, while it endangered his personal convenience, called forth that benevolent smile, which was calculated rather to encourage than to repress these marks of admiration.' When lecturing, he would turn to the black board behind him, with the chalk in his hand, and, speaking all the time, he would rapidly sketch the subject of his discourse, sometimes beginning even at the tail, proportioning every part with admirable precision, and preserving the character to such a degree that the species even was discernible, and could be immediately pronounced. This taste for drawing led him to delight in visiting ex-

hibitions and collections. During his last visit to England he went to Hampton Court, and it was with difficulty he could tear himself away from the cartoons of Raffaele, in order to keep a dinner appointment.

Cuvier's second visit to London was made in 1830, and Mrs. Lee thus notices the circumstances attending his journey: 'On the publication of the famous ordinances of Charles X. and his ministers an universal silence in public was observed, as if the first person who ventured to talk about them was to set fire to a train of gunpowder. Even M. Cuvier, though so clear-sighted on other occasions, was completely taken by surprise in this instance, and partook of the general opinion, that "this stroke of policy on the part of the state would lead to a lengthened resistance of taxes, and to partial disturbances, but not to any violent crisis;" and deceived, as so many others were, by the profound tranquillity which reigned in every part of the capital, he started for England on the appointed day. Five hours after his carriage had passed the barrier, the firing commenced in Paris, and he and his daughter-in-law pursued their route by easy stages. They were overtaken on the road near Boulogne by the flying English, who gave them vague reports, and they pressed on to meet their letters at Calais. There, after two days of the deepest anxiety, during which they formed twenty projects for immediate return, and were as often detained by the certainty of not being able to re-enter Paris, or even proceed on the road back with passports dated in the month of May, and leave of absence signed by the hand of Charles X., they at once received the details of the revolution, and of the restoration of peace. The power of asking leave of absence was so rare, and M. Cuvier's time so precious, while the assurances of perfect tranquillity in Paris, combined with the safety of those whom they loved, were so decided, that he and Mademoiselle Duvaucel determined on proceeding to England. Instead

however of making a stay of six weeks, as they had at first intended, they returned in a fortnight; and, to the happiness of those around him, M. Cuvier found himself in possession of all his honours, his dignities, and his important functions.

‘The object of one of Cuvier’s first walks after his arrival in London was to see all the new caricatures contained in our shop-windows; for he was a warm admirer of our performances in this art, and already possessed a voluminous collection of the best which had appeared. They afforded him more than mere amusement, for he considered them as curious documents of the moral and political history of certain periods; and often, in the midst of a serious conversation concerning the events of our own times, he would mention circumstances which had been stamped upon his recollection by the sight of an English caricature. While in London Cuvier rose at six, and visited many places on foot; then, returning to breakfast, he entered his carriage with his daughter-in-law, and went to the parks, the exhibitions, collections, &c. He had often heard Richmond highly spoken of, and therefore went to survey its scenery: the day was rather stormy, with intervals of brightness; and he observed that, when he saw such a sky over such a country, he could not wonder at the perfection to which the English had carried their landscapes in water-colours.

Cuvier was gratified with the respectful reception he everywhere met with in England. One amusing mark of reverence afforded him great entertainment: ‘During the absence of his valet, Cuvier sent for a barber to shave him; but when he offered to pay the requisite sum, the enlightened operator, who happened to be a Gascon, bowed, and positively refused the money, saying, with his comic accent, “he was too much honoured by having shaved the greatest man of the age to accept any recompense.” Hardly suppressing a smile, Cuvier felt bound to give him the honour to its full extent, and engaged him to perform

his function every day while he remained in London. It is scarcely necessary to add, that the barber, in a short time, felt it a still higher duty to consult prudence rather than empty honour, and pocketed the amount due for the exercise of his calling.

Cuvier spoke German and Italian fluently. He read several other languages, and, among them, the English, which he often lamented his inability to speak. His knowledge of the dead languages was not only a source of exquisite enjoyment to him, but was absolutely necessary to his profound researches. He seldom alluded to Greek or Latin authors in conversation, but there was a classical precision and elegance of expression, even in his ordinary discourse, which can scarcely be acquired by other means than the study of such writers.

The disposition of Cuvier was naturally irritable, and frequently betrayed him into expressions of impatience, for which no one could be more sorry than himself, and the caresses and kindness which were afterwards bestowed seldom seemed to him to speak sufficiently the strength of his feelings at his own imperfection. 'Anything wrong at table, to be kept waiting, a trifling act of disobedience, &c., would rouse demonstrations of anger which were more violent than necessary. His impatience also was not confined to little annoyances; but if he expected anything or anybody he scarcely rested till the arrival took place. If he had workmen employed for him, the alteration was made in his imagination as soon as commenced, and he would walk along the scene of operation, exclaiming every instant, "Dépêchez vous donc," and absolutely hindering them by the rapidity of his orders. Accustomed to the most tedious and minute labour himself, it may seem inconsistent that he should be thus impatient when the activity of others was in question. But it must be remembered that he found very few who would work as he did; and that while so employed his mind was absorbed by every step he was taking to ensure the wished-for result, and had no

time to bound over the space between thought and execution.

‘No labour however minute irritated him when he believed it to be requisite for the attainment of his object, and this patience was the more remarkable in a man whose blood would boil at a false reasoning or a sophism—who could not listen to a few pages of a book that taught nothing, or a work that bore the marks of prejudice or passion, without feeling the greatest irritation.’

CHAPTER IV.

THE LIFE AND LABOURS OF CUVIER. (CONTINUED).

The domestic Habits of Cuvier—His active Benevolence—His Soirées—Person of Cuvier—His love of Order—His Manners—Anecdotes—Cuvier in his Study—Cuvier at the Institute—Further Examples of his Liberality—His intense Study—His last Lecture—Impression produced by it—His Illness—Progress thereof—His Death—Burial—Eloges—His Property—Notice of his great Work on Fossil Remains—Progress thereof—Anecdotes—Cuvier's religious Character—Charges against it refuted—Eloge of Cuvier pronounced by H. R. H. the President of the Royal Society of London.

THE domestic life of Cuvier presents a remarkable scene of diligent cultivation of time. His hours of audience were usually before and after breakfast, and no one was refused admission. The breakfast hour was ten o'clock; but Cuvier had generally risen at seven, or earlier, and had prepared his papers for the day, arranged the occupations of his assistants, and received most of his visitors. While taking his breakfast Cuvier generally read the newspapers, or looked over the books for the use of the primary schools, which had been sent for his inspection. After breakfast, he dressed, and entered on his numerous occupations. His carriage was punctual to a moment, and no one was allowed to keep him waiting. When the ladies were to accompany him, they made a point of being as exact to time as possible, knowing how much he was vexed by delay; and yet, says Mrs. Lee, 'I used to think I saw a faint smile on his countenance, when we flew down stairs, our gloves in our hands, and our shawls streaming after us. The instant he had given his orders,' she adds, 'he would thrust himself into a corner of the carriage, and resume

his reading and writing, suffering us to talk as much as we pleased. Many of his most brilliant memoirs were finished as he thus rode through the streets of Paris; and he had a lamp fixed to the back of his carriage that he might read on his return home at night from his visits; but he found it so distressing to his eyes, that he could not long make use of it. All others, however, were delighted at the disappointment, because he was by it cheated into a few more moments of repose.'

The family dinner-hour was half-past six, and if Cuvier had a few minutes to spare before that time, he would occasionally join his friends in Madame Cuvier's room; but more frequently he seems to have given even this short period to study. One or two intimate friends often increased the family circle at dinner, which is represented as being a privileged time for conversation of the most delightful kind. On proceeding to the drawing-room, Cuvier sometimes gratified his friends by an hour's stay among them before he retired to his occupations or his visits; but so untiring was his industry that he often set the whole party to work aiding him in his researches. 'If he had any of M. Champollion's letters from Egypt, he would station us at different tables with volumes of the great work on Egypt, and verify the descriptions of the antiquary step by step. He never was weary of research; though it must be owned, we occasionally wished for the sound of the carriage-wheels to interrupt our employment. He never suffered people to be idle in his house; and no sooner did friends station themselves among the family for a time, but he would come into their rooms with folios and paper in his hand, and set them to trace plates for him; and seldom forgot, on his return from duties abroad, to enquire how much had been done. To be sure, it was a pleasure to work for him, he was so grateful for the service, and so happy when the task was properly completed.'

Cuvier's hours of relaxation were few. Change of employment afforded him great relief, and conversation still greater. At the close of his day's labour, when

he found it impossible to work any longer, he was accustomed to throw himself on a sofa, hide his eyes from the light, and listen to the readings of his wife and daughter, and sometimes of his secretary, M. Laurillard. These nightly readings lasted about two hours, and by their means he became acquainted with the literature of the whole civilized world. An immense number of volumes were in this way gone through; while the effect on the mind of Cuvier was also beneficial, by quieting feelings which might have been previously excited, and ensuring him undisturbed repose.

The benevolence of this great man appears to have been of the most extensive kind. He sought out students and others in their retreats, and freely bestowed advice, protection, and pecuniary assistance. When his friends reminded him that in his generosity he was exceeding the bounds of prudence, he would say: 'Do not scold me—I will not buy so many books this year.' Nothing saddened his spirit so much as ingratitude; and this, in common with other generous persons, he sometimes met with; yet his benevolence was not contracted thereby, but he persevered in doing good both to students and to all who were suffering misfortune; and in these kind acts he was fully seconded by the females of his family.

Cuvier was a decided enemy to satire and ridicule of the conduct of others. He never indulged in it himself, and he carefully discouraged it in those about him, even when embellished with sallies of wit and drollery, and his rebukes to those who indulged in sarcasm were accompanied by a sharpness of expression generally unusual to him. Another beautiful trait in his character was the absence of all resentment. The annoyances and disappointments of his public career left no trace of bitterness in his soul, and he was always willing to lay the fault on the ignorance, rather than on the bad feeling, of the offenders. 'They are more to be pitied than blamed,' he would say, 'for they know not what they do.'

The soirées of Baron Cuvier are so delightfully de-

scribed by Mrs. Lee, that we must present her account with very little abridgement. These took place every Saturday evening, and were sometimes preceded by a party. They were the most brilliant and interesting meetings in Paris. There passed in review the learned, and the talented, of every nation, of every age, and of each sex; all systems, all opinions were received; the more numerous the circle, the more delighted was the master of the house to mingle in it, encouraging, amusing, welcoming everybody, paying the utmost respect to those really worthy of distinction, drawing forth the young and bashful, and striving to make all appreciated according to their deserts. Nothing was banished from this circle but envy, jealousy, and scandal; and this saloon might be compared to all Europe. It was at once to see intellect in all its splendour; and the stranger was astonished to find himself conversing without restraint, without ceremony, with or in the presence of the leading stars of Europe: princes, peers, diplomatists, savans, and the worthy host himself, now receiving these, and now the young students, from the fifth pair of stairs in a neighbouring hotel, with equal urbanity. No matter for him in which way they had directed their talents; what was their fortune—what was their family; and wholly free from national jealousy, he alike respected all that were worthy of admiration. He asked questions from a desire to gain information, as if he too were a student; he was delighted when he found a Scotchman who spoke Celtic: he questioned all concerning their national institutions and customs; he conversed with an English lawyer, as if he had learned the profession in England; he knew the progress of public education in every quarter of the globe; he asked the traveller an infinity of things, well knowing to what part of the world he had directed his steps, and seeming to think that every one was born to afford instruction in some way or other, he elicited information from the humblest individual, who was frequently astonished at his interest in what appeared so familiar to himself. One thing used particularly to annoy him—which was,

to find an Englishman who could not speak French. It gave him a restraint, of which many have complained; but which, on these occasions, solely arose from a feeling of awkwardness on his part, as not being able to converse with his foreign guest.

No one ever rendered greater justice to his predecessors or contemporaries than Cuvier. 'Half a century,' he said, 'had sufficed for a complete metamorphosis in science; and it is very probable that, in a similar space of time, we also shall have become ancient to a future generation. These motives ought never to suffer us to forget the respectful gratitude we owe to those who have preceded us, or to repulse, without examination, the ideas of youth; which, if just, will prevail, whatever obstacles the present age may throw in their way.' This was a delightful manner of making every one feel satisfied with himself; the naturalist from a remote province, or perhaps from a colony at the other end of the world, was no longer ashamed to think that he had not kept pace with the march of science in the capital; and the young student was not afraid to utter the objections, or to point out the fallacies or inaccuracies he fancied he had detected in the writings of recent authors.

The repast which closed these evening entertainments was served in the dining-room, and certainly at the most delightful tea-table in the world. A select few only would stay, though Cuvier sometimes pressed into the service more than could well be accommodated; and while the tea, the fruit, and refreshments of various kinds were passing round, the conversation passed brilliantly with them. Descriptions of rarities were given, travellers' wonders related, works of art criticised, and anecdotes told; when, reserving himself till the last, Cuvier would relate something that crowned the whole; and all around were struck by the complete change given to the train of thought, or were forced to join in a general shout of laughter.

The period of these brilliant soirées was that of the career of the lovely Clementine Cuvier. Of her, Mrs.

Lee thus speaks : ' This pure creature was so good herself that she never suspected evil in others, and was the light of everybody's existence in this hallowed circle. Her likeness to her father was very striking ; and though her eyes and hair were of a darker and different shade, his every feature could be traced in her countenance, softened into feminine beauty. Her talents, her acquirements, her modest opinion of herself, her sound judgment, her active charity, her extreme piety, seemed to mark her as a being who could not long remain in this world of sin : she died of rapid consumption, which disease, though probably long engendered in her constitution, only manifested itself in its decided form six weeks before her death, amid the joyful preparations for her marriage.'

A mournful change then took place in every arrangement ; the sorrow of the father has been already alluded to, and that of the heart-broken mother was even more difficult to soothe. Long was the saloon closed against visitors ; and when at length a few old friends assembled there once more, the soirées were found to be stripped of their principal charm, and the dejection and abstraction of Madame Cuvier were not to be wholly overcome. After the death of his own daughter, Cuvier became more than ever attached to his daughter-in-law, Mademoiselle Duvaucel. His care and anxiety on her account manifested itself on all occasions. If she were ill, he would mount the stairs ten times in the course of the day to enquire at her bedside how she felt ; and if she coughed, it seemed to give a pang to his very heart.

In person Cuvier was moderately tall, and in youth slight ; but the sedentary nature of his life had induced corpulence in his later years, and his extreme near-sightedness brought on a slight stoop in his shoulders. His hair had been light in colour, and to the last flowed in the most picturesque curls, over one of the finest heads that ever was seen. The immense portion of brain in that head was remarked by Messrs.

Gall and Spurzheim as beyond all that they had ever beheld; an opinion which was confirmed after death. His features were regular and handsome, the nose aquiline, the mouth full of benevolence, the forehead ample, the eyes full of intellect, vivacity, and sweetness. The love of order which so prevailed in great things was by Cuvier carried into all the minutiae of life. His toilette was adjusted with care, and he himself designed the patterns for the embroidery of his Court and Institute coats, invented all the costumes of the university, and drew the model of the uniform of the council. 'I was very anxious,' says Mrs. Lee, 'to see him in his university robes, and having mentioned my wish, he came into the room where I was sitting, when dressed for a grand meeting. The long, flowing gown of rich violet-coloured velvet, bordered with ermine, added to his height and concealed the corpulence of his figure; the cap of the same material could not confine his curls; and, brilliant with his ribands and his orders, the outward appearance fully accorded with the internal man. The manners of M. Cuvier by their dignity resembled those of the ancient nobility, but without the same excess of ceremony; for accustomed to mingle with the highest of all classes and countries, and naturally desirous of paying a just tribute of respect and good-will to everybody, he was likely to be generally polished and courteous, though in company, at the houses of others, sometimes stately. That stateliness was often deemed stiffness; and it must not be denied that real stiffness was assumed on some rare but necessary occasions.' Frequently this arose from timidity; for it wore off the instant he saw any one inclined to lay aside the restraint which his presence often, but needlessly imposed. When he saw people afraid of him he fancied he must have caused it by something on his side; and thus a counter-reserve was produced that seldom ceased with either party. To the young he was always encouraging, and they could not more entirely win his heart than by talking in his presence in their

naturally open manner. Towards females he was particularly kind and attentive—delighting in their sensible remarks, and listening to their anecdotes with the greatest interest. ‘Now and then, when the summer lessened his heavy public duties he would take a walk with us; and no schoolboy with permission to go out of bounds could set off with more delight than we all did. Once in the Jardin he was attracted by the brilliant appearance of *Coreopsis tinctoria*, then new in France. He in vain inquired the name of us, and we continued our walk. He quitted us, and in about half an hour returned, and stopping for an instant as he descended to his carriage said, ‘Ladies, I have been to M. Deleuze (a learned botanist of the Jardin), and ascertained the name of the flower;’ he then gave it us, genus, species, country, and the reason for its appellation, and making his bow, retired perfectly happy at the knowledge acquired and imparted. As in this trifling circumstance, so was it in all things, he never hesitated saying when he did not know, he never rested till he did know, if the means of acquiring the information were within his reach; and once known he was most willing to impart it to those who wished to learn.’

The terms in which Mrs. Lee speaks of Cuvier might possibly be considered as highly coloured, and as arising from the long friendship and the many benefits she acknowledges, did we not meet with the same testimony from various other writers to the intellectual and moral eminence of the great naturalist. ‘To have seen and known Cuvier,’ says another writer ‘is what no one who ever had that privilege can wish to forget. We saw him not long after that cruel domestic affliction which deprived him of a daughter worthy of her name, and beneath which his mighty heart had well nigh broken. His house was for a long time closed to the learned and the scientific who used thither to resort, and there to show of what the highest minds are capable in social communion. At the time of which we speak, the stranger who was to be presented to him in his spacious dwelling in the Jardin des Plantes, was led

to the highest story, which appeared to be entirely devoted to books and study, and through several rooms, all fitted up as so many libraries, in some of which secretaries or amanuenses were writing, with books and engravings before them, and probably employed on some portions of the great work on fishes, which was then in progress. At length the study of Cuvier was reached, and the illustrious occupier was found deeply engaged among his papers, dressed in a grey dressing-gown and cap, and having an air of plain good sense and gravity, strongly enough contrasted with the vivacity of address of some of his brother savans of the time. He seemed to have the art or the habit of directing the conversation to circumstances most interesting to the individual who visited him, and to his English visitors he generally made it apparent that he was well acquainted with the constitution of our places of education, and with most of our countrymen distinguished for scientific acquirements. His manner was composed, without any approach to moroseness. His expression was mild and penetrating; the tone of his voice was very pleasing; at once firm and gentle; and there was an air of sincerity in everything he said which was particularly gratifying. In the afternoon of the same day it might happen that those who had been honoured with such an interview, saw him again at the Institute in his capacity of secretary. Cuvier would then be dressed as became his station in society, and his cap being thrown aside left his very striking features and his noble head unconcealed¹.

‘Cuvier’s demeanour at the Institute was, perhaps, somewhat stately, not always without a slight admixture of impatience; sometimes, indeed, accounted for by the

¹ The expression of Cuvier’s features may be in some degree judged of by the exclamation of Madame Cuvier on receiving the generous present from Mr. Pickersgill of her husband’s picture, painted by the artist’s own master-hand: ‘It is he: it is his noble, pure, and elevated mind, often melancholy, but always benevolent and calm, like real goodness. It is the great man passing over this earth, and knowing that there is something beyond.’

frivolities occasionally mixed up with the proceedings even of the most scientific assemblies, when they consist of numerous members; but sometimes a little too repressive, or to a foreigner appearing so, of the lively and intelligent sallies of young members who were not yet quite undistinguished. His tones, on such occasions, commanded immediate attention; and a few simple words from him seemed at once to settle points about to be vivaciously disputed; whilst his manner was very dignified, and that of one who strove, not without success, to repress a constitutional irritability; an irritability compatible, it must be remembered, with such patient attention to minute details as few were capable of.'

Cuvier was not so absorbed in scientific pursuits as to neglect the means of doing good to his fellow-creatures. Appointed to inform the public how certain prizes had been awarded by the Académie Française, he produced a most interesting volume called *Discours sur la Distribution des Prix de Vertu*. The prizes in question had been founded by a philanthropic individual, M. de Montyon, for the reward of virtuous actions. One of the great prizes awarded on the occasion of which Cuvier wrote, was five thousand francs to Louise Scheppler, so well known as the faithful servant and tried friend of the Pastor Oberlin and his family.

The private bounties of Cuvier were large and well-bestowed. 'His purse was ever open to the needy and unfortunate of all countries and stations, and the stricken inhabitants of the most miserable dwellings, the well-born associate struggling in straitened circumstances, and the modest student scarcely able to pay his fees, were alike objects of his bounty. Many hotels in the neighbourhood of the colleges and institutions, and in rooms five stories high, contained one, two, or even three young men, who attended the classes, and who by joint subscription contrived to get one volume at a time of the requisite books from the shop of a bouquinist; and many were there of these who would be surprised by a gentle tap at the door, and on permission to enter,

by the appearance of their revered master. He would come as if entering the chamber of a peer, and with a respectful salutation offer the assistance which he saw was so much needed; if sickness assailed them, no rest was known till he had procured relief and medical advice. Himself keenly alive to the slightest rudeness or neglect, and grateful for the smallest proof of affection, he knew how to give, not only with a liberal hand, but with a delicacy which never wounded the most sensitive temper.'

Cuvier's health was generally good, and the use he made of his carriage was more to save time than to protect his person. Although subject to occasional slight ailments, his life of temperance and rectitude had preserved his constitution unimpaired, and at the age of sixty-two both his bodily and mental vigour appeared perfect. The sudden summons he then received to quit his earthly labours was therefore as unexpected as it was deeply afflictive to his friends, his country, and the world at large. 'Never were his intellectual faculties more brilliant,—never was his great mind more fully possessed of that clearness, that comprehensiveness which so peculiarly marked it, than at the time of his seizure.' His secretary states that it was his intention to review all his works, and put them on a footing with the last discoveries, and then to deduce from them all the consequences, all the general principles, which might emanate from such an assemblage of facts. His meditations and studies had convinced him that organised beings exist for an end, for a special object; but he did not admit any scientific theory, and energetically maintained that it was not yet possible for any to be formed. But the intended publication was denied to the world by the occurrence of the event we have now to relate.

The year 1832 witnessed the disturbed state of Paris, and the prevalence of a fearful pestilence among the population. The cholera raged around the dwelling of Cuvier, and he saw many cut down by it in the midst of youth and strength. At this time he gave up his

evening visits, and the few relaxations which he had permitted himself to enjoy. Secluding himself from society, except that of his own family, he had no sooner performed his daily routine of public duties, than he returned to his studies with a zeal and closeness of application that was doubtless injurious to him, though he himself said that he had never worked with so much real enjoyment. His literary undertakings thus advanced rapidly and delightfully to their author. On Tuesday, May 8th, he opened the third and concluding part of his course of lectures at the College de France on the History of Science, &c. This was his last discourse, and appears to have been unusually impressive, as we may gather from the following account: 'He forcibly inveighed against that heresy in natural history which derives everything in this vast universe from one isolated and systematic thought, and shackles the future of science with the fallacious progress of the moment; he pointed out what remained for him to say respecting the earth and its changes, and announced his intention of unfolding his own manner of viewing the present state of creation; a sublime task which was to lead us, independent of narrow systems, back to that Supreme Intelligence, which rules, enlightens, and vivifies,—which gives to every creature the especial conditions of its existence,—to that Intelligence, in short, which reveals all, and which all reveals,—which contains everything, and which everything contains. In the last part of this discourse there was a calmness, a clearness of perception, an unaffected and unrestrained manifestation of the contemplative and religious observer which greatly added to its force, and which involuntarily recalled that book which speaks of the creation of the earth and of the human race. The similarity was avoided rather than sought: it was not to be found in the words, but in the ideas; and at once flashed across the minds of his auditors when the great professor declared that each being contains in itself an infinite variety, an admirable arrangement for the purposes for which it was intended; that each being is good, perfect,

and capable of life, each according to its order and species, and in its individuality. In the whole of this lecture there was an omnipresence of the Omnipotent and Supreme Cause; the examination of the visible world seemed to touch upon the invisible; the search into creation necessarily invoked the presence of the Creator; it seemed as if the veil were to be torn from before us, and science was about to reveal eternal wisdom. Great then was the effect produced by the concluding sentences, which seemed to bear a prophetic sense, and which were the last he ever addressed to his audience. "These," said he, "will be the objects of our future investigations, if time, health, and strength are given to me to continue, and to finish them with you." Those who were versed in human destiny seemed to feel that his sphere of action was even then placed out of this world, and that he had pronounced his farewell. So near the great and awful tribunal what other words—what other thoughts—than those contained in this lecture could have so plainly shown the preparation already made for his journey thither?

'I am told that the profound emotion occasioned by this last discourse was universal, and that few left the hall without an undefined feeling of sadness, and sentiments of reverence, far beyond their power of expression.'

On the evening of the same day on which this sublime lecture was delivered, Cuvier felt some pain and numbness in his right arm, which was supposed to proceed from rheumatism. The next morning, being Wednesday the 9th of May, he presided over the Committee of the Interior with his usual activity; but at dinner that day he felt some difficulty in swallowing, and the numbness of his arm increased. 'Never can the look and the enquiry he directed to his nephew, when he found that bread would not pass down his throat, be forgotten, nor the self-possession with which he said, as he sent his plate to Madame Cuvier, "Then I must eat more soup," in order to quiet the alarm visible on the countenances of those present. M.

Frederic Cuvier the younger sought medical advice ; and an application of leeches was made during the night, without producing any amelioration. The next day, Thursday, both arms were seized, and the paralysis of the pharynx was complete. He was then bled, but without any benefit, and from that moment he seemed perfectly aware of what was to follow. He, with the most perfect calmness, ordered his will to be made ; and in it evinced the tenderest solicitude for those whose cares and affections had embellished his life, and for those who had most aided him in his scientific labours. He could not sign it himself, but four witnesses attested the deed. Perfectly convinced that all human resource was vain, he yet, for the sake of the beloved objects who encircled him, submitted without impatience to every remedy that was suggested. The malady augmented during the night, and the most celebrated medical practitioners were called in : emetics were administered by means of a tube, but, like all other endeavours, they did not cause the least alteration. Friday was passed in various but hopeless attempts to mitigate the evil ; and perhaps they only increased the sufferings of the patient. In the evening the paralysis attacked the legs ; the night was restless and painful ; the speech became affected, though it was perfectly to be understood. He pointed out the seat of his disorder, saying, "Ce sont les nerfs de la volonté qui sont malades." He was moved from his own bed-room to the saloon, where he had once been the life and soul of the learned world ; and though his speech was less fluent, he conversed with his physicians, his family, and the friends who aided them in their agonising cares. Among other anxious enquirers came M. Pasquier, whom he had seen on the memorable Tuesday ; and he said to him, "Behold a very different person to the man of Tuesday ; nevertheless, I had great things still to do. All was ready in my head ; after thirty years of labour and research ; there remained but to write ; and now the hands fail, and carry with them the head." M. Pasquier, almost too much distressed to speak, attempted to express the

interest universally felt for him ; to which Cuvier replied, " I like to think so ; I have long laboured to render myself worthy of it." In the evening fever showed itself, and continued all the night, which produced great restlessness and desire for change of posture ; the bronchiæ then became affected, and it was feared that the lungs would soon follow. On Sunday morning the fever disappeared for a short time ; consequently he slept ; but said on waking that his dreams had been incoherent and agitated, and that he felt his head would soon be disordered. At two o'clock in the day the accelerated respiration proved that only a part of the lungs was in action, and the physicians, willing to try everything, proposed to cauterize the vertebræ of the neck ; the question, had he a right to die ? rendered him obedient to their wishes ; but he was spared this bodily torture, and leeches and cupping were all to which they had recourse. During the application of the former, Cuvier observed with the greatest simplicity that it was he who had first discovered that leeches possess red blood. He had foretold that the last cupping would hasten his departure ; and when raised from the posture necessary for this operation he asked for a glass of lemonade, with which to moisten his mouth. After this attempt at refreshment he gave the rest to his daughter-in-law to drink, saying it was very delightful to see those he loved still able to swallow. His breathing now became more and more rapid ; he raised his head, and then letting it fall, as if in meditation, he resigned his great soul to its Creator without a struggle. Those who entered afterwards would have thought that the beautiful old man seated in the arm-chair by the fireplace was asleep ; and would have walked softly across the room for fear of disturbing him ; so little did that calm and noble countenance, that peaceful and benevolent mouth, indicate that death had laid his icy hand upon them.'

Thus died one of the greatest men the world has ever produced, whose genius, though principally irradiating the sphere of natural history, was of the most comprehensive character, and shone conspicuous in the many

high offices to which he was chosen, so that the various duties devolving on him were all performed with an enlightened zeal, and a profound knowledge, which left nothing to be wished for. It was Cuvier's wish to be privately interred in the cemetery of Père la Chaise, under the tomb-stone which covered his daughter; but it was not possible to avoid the public manifestation of respect which was desired to be shown to so remarkable a person. The funeral procession was followed by deputations from the council of state, from the Academies of Sciences, of Inscriptions, of Medicine, of France; by members of the two Chambers, the Ecole Polytechnique, &c. The coffin was alternately borne by pupils of the Jardin des Plantes, the Schools d'Urfort, of Law, and of Medicine, and first taken to the protestant church in the Rue des Billettes. The pall was supported by M. Pasquier, president of the Chamber of Peers, M. Devaux, councillor of state; M. Arago, secretary of the Academy of Sciences; and M. Villemain, vice-president of the Royal Council of Public Instruction. Different members of the learned and legislative bodies each pronounced a funeral discourse over the grave.

Eloges were also pronounced on Cuvier before the legislative and learned bodies; that in the Chamber of Peers by M. Pasquier; at the Academy of Sciences by M. Flourens; at the Academy of Medicine by M. Pariset; at the Entomological Society by M. Audouin; at the Académie Besançon by M. Laurillard; and at the Royal Society of London by the Duke of Sussex.

Cuvier was too generous, and too anxious for the acquisition of mental treasures to die rich. His various offices gave him the means, had he been so disposed, of amassing vast possessions, but his unbounded liberality, especially in the cause of science, and the great expenses which he incurred by the purchase and freight of objects for the national collection, which were freely presented by him for the advancement of science, prevented his fortune from accumulating, so that at his death his possessions were found to consist of only

about four thousand pounds sterling, a library worth about the same sum, and a dwelling for his family.

Among all the labours of Cuvier, there was none to which he himself attached so much importance as his researches into fossil remains. In the preliminary discourse of this work, he states that the great principle in the study of comparative anatomy is this—that in every animal the several parts have such a mutual relation, both in form and function, that if any part were to undergo an alteration, in even a slight degree, it would be rendered incompatible with the rest; so that if any part were to be changed, all the other parts must undergo a corresponding change: and thus, any part, taken separately, is an index of the character of all the rest. This law of the co-relation of parts is indeed so defined, that even a portion of a bone may often serve to verify the species of the animal to which it belonged.

Cuvier commenced his researches in this department of science by his discrimination of fossil and living elephants in 1796, and from that time the subject was never long absent from his mind. The quarries of Montmartre afforded him a never-failing supply of specimens, and every load of fragments which he could obtain from thence was studied with the greatest delight; and the wonderful genius he displayed as a geologist and comparative anatomist enabled him to prosecute his discoveries until he attained the most important and unexpected results, and at the same time perpetuated his own name to the latest posterity. Cuvier described one hundred and sixty-eight fossil vertebrated animals, forming fifty *genera*, of which fifteen were new, comprehending animals belonging to every order except the *Quadrumana*. But while he was astonishing the world by his remarkable discoveries, ‘neither the grandeur of his subject, nor the dazzling novelty of many of the phenomena elicited in its pursuit, led the severely philosophic mind of Cuvier into unguarded hypotheses. Everywhere we remark the

simplicity of a great historian of nature; the tone, not of a prophet, or of one inspired to treat of a mighty theme, but of one who knows how elevated is that theme, and yet hears, and dispassionately balances, and unaffectedly relates, all that his study and long meditation have taught him. His mind is raised and excited by the great views that break upon him as he advances, but never discomposed; he knows the value and the greatness of the truths he discovers, but beyond them he sees other truths, to him and to his age denied, yet to be won by the research of those who shall begin where he, obedient to the laws which limit the range of the most powerful among mortal minds, knows that he must leave off. So strongly is this philosophical character imprinted on all that Cuvier has written, that the mere perusal of his writings seems to withdraw the mind from less worthy pursuits, to a holy retirement, wherein some sage interprets the laws of the great Creator by pointing to his works, unregarded before, or not understood.'

Cuvier employed an intelligent workman, at his own expense, in the quarries of Montmartre, to collect the bones which were continually found there. All who would bring contributions to his collection were likewise rewarded with the greatest liberality. Before he had an opportunity of publishing his discoveries, and when the expense of employing professed artists was beyond his means, he not only drew but engraved the plates himself. Some of these valuable proofs of his industry and talents are scattered through his great work on fossil remains. M. Laurillard, his secretary, was afterwards associated with him in these researches. Of the origin of Cuvier's regard for this gentleman we have a characteristic anecdote. Laurillard was also a native of Montbéliard, and left his native place for the cultivation of his talents as an artist. At Paris he was introduced to M. Frederic Cuvier, for whom he executed some drawings. He also made one or two for Cuvier, but without particularly attracting his notice. One day, however, Cuvier went to his bro-

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ther's apartment to ask for assistance in disengaging a fossil from its surrounding mass. Laurillard was the only person to be found upon the spot, and Cuvier applied to him. Little aware of the value of the specimen confided to his care, the artist cheerfully set to work, and succeeded in getting the bone entire from its position. In a short time Cuvier returned for his treasure, and when he saw how perfect it was, his ecstasies became uncontrollable; he danced, shook his hands, and uttered expressions of delight, till Laurillard, ignorant both of the importance of the discovery, and of the ardent character of Cuvier, thought he was mad. Taking, however, the fossil foot in one hand, and dragging Laurillard's arm with the other, Cuvier led him up stairs to present him to his sister-in-law, saying, 'I have got my foot, and M. Laurillard found it for me.' It seems that he had long been meditating on the existence and form of a foot which he had vainly sought; so that when he appeared particularly absent, his family were wont to accuse him of seeking his fore-foot. The next morning Laurillard was engaged as Cuvier's secretary, and proved an able coadjutor and faithful friend.

The scientific men of France have been too often subjected to a general and sweeping charge of infidelity, and even the excellent Cuvier has not escaped this most unjust and uncharitable censure. If there have been some among the philosophers of that country whose names cannot be recalled without a feeling of pain and regret, there are certainly others of whom any country might be proud, and whose Christian principles are as undoubted as their genius. Such a philosopher was Cuvier, whose character as a religious man has been thus sketched by an able pen:—'He promoted the cause of true religion by every means in his power, both public and private; he was a warm supporter of the Bible Society, and caused the Old and New Testament to be widely disseminated in every part of protestant France. In his letters to the heads of colleges and masters of schools he strongly recommended them to teach for the love of God, himself pointing out their

duties according to that great rule. He constantly adhered to the protestant faith, when it is well known that a change to the Roman Catholic form of worship would have been the surest step to the attainment of the highest honours in the state; he caused a number of chapels to be established, in order to give facility for attending Divine worship; he in all his works refers the wonders of creation to the one true source. He never would receive any salary for administering to the interests of the protestant religion, but faithfully discharged all the duties of his office with a zeal which showed that he had a much higher motive than that of gain or reputation. Humility and forgiveness marked his character; he was thankful for the correction of errors; gloried as much in the discovery of another as his own; and in the triumph of joint labours unhesitatingly gave the preference to his colleague: he suffered even his servants to expostulate with him; and the very nature of his amusements was social and cheerful. He felt keenly ingratitude, unkindness, and injustice; but they made him sad, not angry. His antagonists openly indulged in the most irritating and violent taunts, or secretly intrigued against him; the former never excited him beyond a clear, firm, and dignified reply, wrung from him only when reply was absolutely necessary; and the latter nothing but candid remonstrances. To those high attributes we may add charity. The failings of others were never trumpeted forth by Cuvier; he did not even tolerate playful satire, however disguised by wit; his earnest desire to make all happy around him, even by a sacrifice of his own convenience, and his resignation under calamities which bereaved him of the dearest objects of his affection; all these things appear to us to establish his character as a Christian.'

It is to be regretted that the enemies of Cuvier are able to say, with truth, that he did not habitually frequent the Lutheran chapels; but only appeared there on solemn occasions. The fact that the state of feel-

ing on the subject of the public ordinances of religion, during a great portion of Cuvier's career, was extremely lax, and that these ordinances were imperfectly and inefficiently conducted, is not a sufficient excuse for his neglect; but may serve to show, that we have no right to judge him in this respect, without a full understanding of all the circumstances of the case. The pastors of those churches, however, looked upon him as their best friend and patron, and they had good reasons for so regarding him. During his direction of the protestant faculties he became one of the vice-presidents of the Bible Society, and caused the creation of fifty new cures, which were much needed. For the regulation and discipline of the protestant churches he collected the opinions of the different pastors, and had drawn out a new law, which, however, he did not live to lay before the session. The estimation in which he was held by the protestants may be gathered from the funeral discourse preached in memory of him by M. Boissard, minister of a protestant church in the Rue des Billettes:—‘ Let us not forget these long-abandoned chapels re-opened to our youth in the royal colleges; let us not forget the abundant distribution of religious and moral books under his superintendence. Now that his voice is extinct, let us fervently ask of our God, let us ask in the name of our dearest mortal interests, in the name of our eternal welfare, to raise up other voices which may speak with the same eloquence, the same wisdom, and the same authority. We have lost him who, with inviolable attachment, honoured the creed of our forefathers; whose great name, whose immortal labours shed so much lustre over our churches; who burdened himself with our ecclesiastical rights in perfect disinterestedness of spirit, and with the purest and most extensive benevolence. What do we not owe to that penetrating glance which revealed to him all that was wanting in our institutions, and under which privations we had long groaned! How many ameliorations took place in a few years! With what wisdom and charity he

examined our requests! and what a new order of things would have arisen at his bidding, had the Almighty suffered him to continue among us!’

On perusing such testimonies as these to the character of Cuvier, the virulent assertions that have been made against him sink into their deserved insignificance. A well-meant, but injudicious notice of the lovely Clementine Cuvier, states that she was uneasy as to her father’s religious state, and prayed for his conversion. Yet it is certain that love and veneration for her father often drew from her the declaration, that the name of Cuvier was her greatest glory, but that she felt herself utterly unworthy to bear it. The prayers she offered up for him when she was on her death-bed were the prayers of a daughter for a parent, that he might receive that support which alone could enable him to bear with resignation the heaviest of sorrows.

Thus by a review of the different sketches that have been given of the life of this great man, we find his career to be full of interest and instruction. In private life, he exhibits fewer failings, and a greater amount of wisdom, benevolence and virtue, than is often met with. As a savant, a legislator, a friend and promoter of education, and of the protestant religion, he attained an eminence, which will ever cause his name to be beloved and revered in France, and in all other countries where his labours can be justly appreciated.

This notice cannot perhaps be more appropriately concluded than by giving the opinion of the scientific men of England, as represented by the Royal Society, on the character of Cuvier. This opinion was pronounced by His Royal Highness the Duke of Sussex, at the anniversary of that learned body, in his office as president, on the 30th day of November, 1832.

‘It is not necessary for me to detail any of the circumstances of the life of one whose name has been long known and revered in every region of the globe which has enjoyed the blessings of European civilization; suffice it to say, that he was honoured, and even courted by every government in France, from

the period of the convention to the present day ; that he held the most lucrative and distinguished appointments which the wise policy of that great nation has provided for the honourable support of its men of science and literature ; that after the death of Laplace he was universally regarded by his countrymen as the most illustrious of their men of science, and as one of the most distinguished of their men of literature ; that funeral orations were pronounced over his grave by men of all political parties, however much opposed to him during his life ; and mathematicians and naturalists, geologists, historians, and poets, all felt themselves impelled to pay this last tribute of homage to the genius of one who, in so many capacities, had done so much honour to his country.

‘M. Cuvier was in every respect a most extraordinary man: his very presence was calculated to command respect, his countenance bearing that impress of powerful intellect which all men recognize, when seen, however difficult it may be to define its character: his manners were dignified and polished, and his conversation possessed that happy ease and subdued gaiety which characterized the best age of French society. He was well acquainted with ancient literature, and familiar with the principal languages of modern Europe. His memory was singularly accurate and retentive ; and his knowledge of facts, not merely in those sciences which he especially cultivated, but likewise in all other departments of knowledge, and particularly history, was a subject of surprise and admiration to all who knew him. He was also eminently distinguished as a writer of his own language, and his numerous *éloges* delivered in his capacity of *secrétaire perpétuel* to the Institut, of which three volumes have been published, if considered as specimens of composition merely, have equalled, if not surpassed, the best examples of a species of eloquence of which the French nation has just reason to be proud ; but if they be considered as specimens of correct and precise discrimination of the merits of the persons commemorated, as determined

by their writings and discoveries, and by the influence which they have exercised upon the progress of knowledge, they may justly be pronounced to be unrivalled. It was to this publication that he was indebted for his place amongst the *forty* of the *Académie Française*, an honour which he alone, in his age, enjoyed in conjunction with his place in the *Académie des Sciences*.

‘It is however chiefly as a naturalist that Cuvier must be viewed, when we seek to determine his permanent rank amongst the few great men who have effected great revolutions in the sciences which they have cultivated, or have left ineffaceable traces of the influence of their discoveries behind them. The whole animal kingdom, from the most obscure indications of the separation between inanimate and animate existence to the mighty monsters of a former world, has assumed under his hands a systematic arrangement, not founded upon superficial and unimportant external characters merely, but upon a most careful and laborious observation of the analogies of internal structure. By tracing every organ successively through the whole series of animals; by carefully determining the functions of such organs and their relations to each other; and by considering them in every animal in the first place as an individual, and in the second place with reference to others, he has been enabled to distribute them into species and genera, and families and classes, whose every successive step in their arrangement is the result of a legitimate and inductive generalization. It is by such means that he has been enabled to convert the science of natural history, at least in the animal kingdom, from being little more than a systematic classification, formed for the purpose of identifying genera and species, and with no higher view, into a science of strict and severe induction, founded upon a careful observation and comparison of every fact which anatomical and physiological science can detect, and thus to confer upon it a dignity which is only inferior to that of the physical sciences.

‘It has resulted also, from his researches, that every animal considered as one of the same genus or species,

is not only an individual considered as a whole, but also when considered in all its parts; in other words, that every bone, every muscle, every organ, and every part of its structure, is *essentially* distinguished from the corresponding parts of an individual of any other genus or species. To a perfect naturalist, therefore, the inspection of a bone, or any other part of an animal, would bring to his mind the entire animal itself, and would identify it as perfectly as if it was exhibited entire to his eye: this would be a triumph of science to which our limited knowledge and faculties can never completely attain; but it was to this point that Cuvier approximated, when he reconstructed, as it were, the fossil animals of an antediluvian world, from the imperfect fragments which remained of them; when he shewed in what such animals must have differed, and in what they must have agreed, whether in magnitude or in kind, from the animals which exist at present; when he ventured, in fact, to define their habits, and to write as it were the natural history of a former world, by throwing upon its obscure and half-obliterated records the powerful light of science and philosophy. The *Histoire des Ossemens fossiles* must ever remain a classical work to geologists; and the discoveries which it contains, and those to which it has led in the hands of others, are some of the most interesting and extraordinary with respect to the past ages of the world, which observations upon the surface of the globe have ever enabled us to ascertain.

‘The last great work upon which he was engaged was the *Histoire Naturelle des Poissons*, a prodigious undertaking, of which eight volumes have been published, and which he expected to extend to twenty-five; it was undertaken in conjunction with Messrs. Valenciennes and Laurillard, to whom also he has bequeathed the task of completing it. It will contain the description of six thousand species of fish, four thousand of which had not been noticed in any other work.’

CHAPTER V.

THE FELLOW-LABOURERS OF CUVIER.

Cuvier's Acknowledgement of Aid from other Naturalists—Lamarck—Sketch of his Life—His early Adventures—Circumstances which led to his Study of Natural History—His *Flore Française*—Merits of the Work—His Travels as a Botanist—His Appointment in the Museum of Natural History—His Study of the Invertebrated Animals—Importance of his Labours—His Researches in other Departments of Science—Failure of his Sight—His total Blindness—Sketch of his Character by Cuvier—Notice of his Works—Latreille—His Education as an Ecclesiastic—Begins the Study of Entomology—Effects of the Revolution on his Career—Cuvier's Anecdote—Becomes permanently attached to the Museum of Natural History—His high Character as an Entomologist—Tardy Honours paid to him—Character of Latreille—His Works—Progress of Zoology in Germany, the Netherlands, France, and England—Notice of the Linear and Circular Systems—Present State of Zoology.

THROUGHOUT the whole of Cuvier's career it is pleasing to observe that the fullest acknowledgement was made by that eminent man of the assistance he had derived from others. There is no attempt to represent himself as the unerring interpreter of Nature, to whose decision others must necessarily bow: on the contrary, he seems to have delighted in exhibiting the merits of contemporary naturalists, and in claiming them as fellow-labourers in the great work to which his life was devoted. The preface to his *Regne Animal* abounds with such acknowledgements: for instance, he says, 'On the recent and profound labours of my friend and colleague M. Geoffroy St. Hilaire, I have founded my observations on the quadrumana and chiroptera;' and, again, 'The researches of my brother, M. Frederic Cuvier, on the teeth of the carnivora, and others, have been of the

greatest use to me in arranging the sub-genera. Though the genera of the late M. Illiger are but the results of the same researches, and of those of some foreign naturalists, I have generally adopted his names whenever my sub-genera could be comprehended under his genera; I also eagerly adopted the excellent divisions of M. de Lacépède in this kind; but the characters which I have marked as indicative of all the various degrees have been all taken from nature, either in the cabinets of anatomy, or the galleries of the Museum.' Respecting birds he says, 'I trust that naturalists will approve of the numerous sub-genera which I have thought proper to institute in the birds of prey, passerines, and water-fowl. They appear requisite for the purpose of introducing clearness into the arrangement of these birds, hitherto so complicated; I have also marked, as far as possible, the correspondence of these sub-divisions with the genera of MM. de Lacépède, Meyer, Wolf, Temminck, and Savigny, and referred to each of them the species of which I possessed authentic information. I have derived considerable pleasure in precisely defining those several species from many elegant works on ornithology, lately published, especially those of M. Le Vaillant, and M. de Vieillot.' Of the ulterior divisions of shells he says, 'I have chiefly confined myself to a brief sketch of such as are admitted by MM. Lamarck and Montfort. Those few genera and sub-genera which belong to myself are the result of observation. In this department, however, I do not profess to have observed a similar degree of critical accuracy as on the vertebrated animals and the naked mollusca.' While Cuvier speaks thus modestly of portions of his work in which he was indebted to the researches of others for much of his information, he openly gives the merit of certain divisions of the *Regne Animal* to the individuals whose history will form the chief subject of the present chapter. 'The crustacea, arachnoides, and insects,' he remarks, 'belong (with the exception of some anatomical details) to M. Latreille, who will himself explain every thing peculiar to his own

researches. On the zoophytes, I have availed myself of the labours of M. de Lamarck, respecting the echinodermata.' Taking the latter individual, according to priority of birth, we subjoin a sketch of his life and labours, which had an important influence on the natural history of his era.

Jean Baptiste Antoine de Monet Lamarck, a naturalist of whom France is justly proud, was born on the 1st of April, 1744, at Bazantin, a village in the department of the Somme. He was of noble family, and being the eleventh child of his father, he had therefore only in prospect the slender patrimony which might fall to his lot in the division of a moderate fortune among such a numerous family. Therefore, according to the custom of the times, he was destined to the priestly office, and sent to a Jesuits' college at Amiens. But it was not at such a time when France was engaged in a desperate contest with Prussia and England, and when his brothers had already distinguished themselves in the army, that the young man could easily give up the career of arms, to which his ancestors had long been devoted. It required, therefore, a fixed determination on the part of his father to keep him to the prescribed course, and on the death of the elder Lamarck, which took place in 1760, remonstrances were unavailing to keep him at college. Scarcely seventeen years of age, he set out on a miserable horse, and attended by a poor village-boy to join the German forces, confident in his own courageous feelings and in a letter of recommendation which he had obtained from a friend of his family, and which he bore to the colonel of the regiment of Beaujolais. This officer, though little prepossessed by the appearance of the youth, admitted him as a volunteer. Lamarck had entered the army at a critical moment; Marshal Broglie, commander-in-chief of the French army, had just joined his forces with part of those of the Prince de Soubise, for the purpose of attacking the allies, under Prince Ferdinand of Brunswick. The battle was lost by the French, but the bravery of Lamarck had not passed unnoticed, and the

marshal rewarded him with a commission. Soon afterwards the young man obtained the rank of lieutenant, and honourably distinguished himself on several occasions during the campaign. The hopes raised by this favourable commencement of his career were, however, suddenly disappointed. During the peace, and when his regiment had been sent to Monaco, one of his comrades, in a frolic, lifted him up by the head, and thus brought on so serious a malady that Lamarck was obliged to go to Paris for the best advice. There he was under the care of Tenon during a whole year, and was only restored by an operation, the traces of which he bore in deep scars to his grave. While detained by this misfortune in solitude and confinement he had much leisure for meditation. His lodging, which was much higher than he wished, gave him very little prospect except the clouds, and these he began to consider with interest, noticing their different shapes and appearances, and gaining some vague ideas of meteorology. He had already been attracted, during his stay at Monaco, by the curious vegetation of that rocky country, and had taken some predilection for botany from reading a treatise on common plants, which happened to fall in his way. He therefore began to see that the profession of arms was not the only one worth living for, or in which distinction might be earned; and he took the bold resolution of applying himself to the study of medicine. This, considering the smallness of his resources, was hardly less hazardous than his former determination to join the army. Unable to defray the expense attending the studies to which he now applied himself, he was forced to seek employment as a banker's clerk, and thus to work for the means of pursuing his purpose. He studied medicine four years, and at the end of that time not finding it accord with his taste, he relinquished it in order the more closely to attach himself to botany. In this science he laboured most perseveringly, and after a preparation of ten years he suddenly revealed himself and his views to the learned world in a work as remarkable for the novelty of the

plan, as for the mode of execution. 'For a long time, says Cuvier, 'while collecting plants, and visiting the Jardin du Roi, he gave way to discussions with other botanists on the imperfections of all the systems of classification then known, and on the ease with which a new system might be created capable of determining plants with greater quickness and certainty. Wishing to prove what he had so often affirmed he set to work, and after six months of incessant labour he produced his *Flore Française*.'

This work was merely an epitome of plants indigenous to France, to which Lamarck had not ventured to add one new species; but it was a convenient and sure guide to the *name* of every plant, and was peculiarly acceptable at a time when the writings of Rousseau had rendered botany popular. By Lamarck's arrangement the most easily reconciled portions of the systems then in vogue, namely, those of Tournefort, Linnæus, and Jussieu, were selected to form a new method of classification. This method was admired by the Academy of Sciences, and was also recommended by Buffon, who had sufficient interest to get it published at the expense of the government for the benefit of the author, who much needed such aid. The style of Lamarck was inelegant, and even incorrect, and his work was polished in this respect by Haüy. In 1779 Lamarck was promoted to a vacant place in the Académie des Sciences, and during 1781 and 2 he went as botanist to the king through Holland, Germany, and Hungary, visiting public establishments and learned men, and taking with him the son of the celebrated Buffon as his pupil. On his return to France, he applied himself zealously to his former studies and produced the botanical portion of the *Encyclopédie Méthodique*. At this work Lamarck laboured diligently, and even with too much precipitation, to the injury of his performance. He also executed a series of plates to illustrate the different genera of plants. These appeared arranged according to the Linnæan system, though contrary to the wish of the author. Lamarck

went on with the work until the breaking out of the Revolution arrested the publication of the *Encyclopédie*. In 1788 Lamarck was associated with Daubenton as botanist of the Cabinet du Jardin du Roi, and charged with the preservation and arrangement of the herbariums. Here amidst his peaceful occupations and studies he remained unmolested amidst all the troubles of the Revolution, and even busied himself in framing a plan for the organization of the Museum. Though little attention was paid to it at the time, he had the pleasure of witnessing the institution of the Museum in 1793, when the Jardin du Roi was reconstituted by the national convention under the title of Museum of Natural History. The twelve professors were left to distribute among themselves the new chairs which were at the same time instituted. Lamarck being the last comer, had no choice in the matter; but could only occupy that which had been refused by the other eleven. It was the professorship which related to the class of animals called by Linnæus worms and insects, and which had hitherto been almost overlooked, on account of the supposed unimportance of the subject.

Until that time Lamarck had never studied animals, and of course knew nothing of the branch of zoology which was now entrusted to him. He had taken an interest in shells, and had made a small collection, but this was all. But although he was now fifty years of age, he did not shrink from the task before him. He set to work with inexhaustible courage, availing himself of the advice of his friends, and applying to the new study all that sagacity and perseverance which had already been so invaluable to him in his botanical works.

By his indefatigable zeal in this new sphere of inquiry Lamarck was soon enabled to discover and to demonstrate that the animals whose history had been left to him through contempt, were quite as interesting as others, if not more so, on account of their vast numbers, the important part they perform in nature, the infinite variety of their forms, and the wonders of their

organization. His extraordinary labours in this department have contributed even more to his fame than his botanical writings, and are certainly more valuable. He seems to have exercised his abilities to the utmost in these researches; and if since that time it has been necessary in some instances to alter, to amend, or to extend the limits of his work, yet it remains a lasting memento of his talents, and it will be long ere any one shall be found sufficiently profound in knowledge to undertake a general revision and alteration of his works.

During the thirty years which had passed away since the peace of 1763, Lamarck had not confined his attention entirely to botany, to which section in the Institute he had been appointed from the time of its creation in 1796. He had studied the general laws of physics and of chemistry, the revolutions of the globe, atmospheric phenomena, the laws which regulate organization and life. He also took care publicly to proclaim his ideas; though, unfortunately, they were not always at this period worthy of attention. His greatest error, and one which we can scarcely understand in a man who had devoted his life to observation, was to strive, after the manner of certain schools of philosophy, to create a general system from the scattered fragments of former ones, and thus as it were to re-construct nature. Without any other weapons than those of mere argument, he was not afraid to attack the theory which Lavoisier had just established and confirmed by experiment, and in this way he provoked all modern chemists to the combat. The latter rightly considered as unworthy of their regard hypotheses that were not only empirical, but had not always the merit even of being intelligible. In geology likewise Lamarck invented a system, possessing some meritorious points, but which has the undoubted error of not harmonizing with well-established facts. That part of Lamarck's labours which has been the most disapproved, and which has met with the most ridicule, is his meteorology; but of this we cannot here speak, except to notice that it

appears to have prejudiced the mind of Napoleon against him, who now looked upon him as a publisher of almanacs and predictions. Lamarck found that he had committed an error, and afterwards confined himself to his works on invertebrated animals, and on general physiology. From the time of his taking the chair of zoology his sight began to fail, so that he was obliged to have recourse to Latreille in the department of the insects. He soon became unable to distinguish small objects, and at last was afflicted with total blindness. His retired life, and his continued war against prevailing systems, operated to his disadvantage. Cuvier says, 'When numerous infirmities, the accompaniments of old age, had multiplied his wants, his means of subsistence were nearly reduced to the small income derived from his chair of zoology. The friends of science, attracted by the high reputation of his botanical and zoological works, were astonished to observe this neglect; it seemed to them that a government so favourable to the sciences ought to have been more careful of the interests of such a celebrated man. But their sympathy with Lamarck was redoubled when they observed the fortitude with which the illustrious old man supported the vicissitudes of fortune, and the failing of his natural powers. They also admired the devotion with which he had been able to inspire those of his children who remained under his roof. His eldest daughter consecrated her time to the duties of filial love for whole years, never quitting her father for an instant, lending herself to every study which could in any way supply the defect of his vision, writing under his dictation part of his last works, accompanying him, and supporting him when he was able to take any exercise, and enduring sacrifices greater than could be expressed for his sake. When the father could no longer leave his chamber, the daughter no longer quitted the house. So long was she deprived of fresh air, that when she again faced the open breeze it was more than she could bear. If such conduct as this is rare, so is the power of inspiring such devoted affection, therefore we add

to the renown of Lamarck, when we proclaim what his children endured for his sake.' Lamarck died on the 18th December, 1829, aged 85. His principal zoological works were, *Système des Animaux sans vertèbres*, presenting the essential characters of invertebrated animals, and their distribution according to their natural relations, and their organization. This was the first sketch of a more important work. Lamarck has the credit of introducing into science the term 'invertebrated animals,' to express creatures hitherto called worms and insects. What is especially valuable in this term, is the fact that it expresses the only circumstance of organization which is common to all these animals without exception. The next work to be noticed here is the *Philosophie Zoologique*, or exposition of considerations relative to the natural history of animals, the diversity of their organization and faculties, the physical causes which maintain life in them, and give rise to the movements which they execute, and the causes likewise that produce feeling and intelligence. In this work the author propounds a physiology quite his own. One of his propositions has raised a host of objections, being this, 'that the feeling of need may in itself be sufficient to create an organ.' To what absurdities this doctrine would lead, it is not necessary to state: we therefore proceed to notice his great and famous performance, the *Natural History of Invertebrated Animals*. This work presents the general and particular characters of the animals in question, their distribution, their classes, their families, genera, and principal species; with an introduction offering the determination of the essential characters of an animal, and its distinction from vegetable and other bodies, also an explanation of the fundamental principles of zoology. This is one of the few works of this author which will pass to posterity, and materially contribute to the advancement of science. It will ever remain as one of the proudest monuments of skill and industry. Lamarck also published a memoir on the fossils of the environs of Paris. This treats only of fossil-shells, to

the study of which the author did more perhaps to incite the public than any other person. The talents and unwearied industry of Lamarck are deserving of all praise; but it is much to be regretted that with his extensive knowledge of the subjects on which he wrote, he should have introduced the absurd theories which disfigure his lectures and his writings in general. Among other wild fancies, he supposed that all organized beings, throughout their endless varieties, were progressively developed from similar living microscopic particles; thus propounding a doctrine of metamorphosis. Such notions were then, however, more likely to find favour than at any other period of modern science, Buffon and Maillet having led the way in the march of conjecture.

The period marked by the discoveries of Lamarck and contemporaneous naturalists was one of unexampled ardour on the subject of zoology in France. Yet this science was still destitute of any fundamental law, applicable alike to all its various departments. The question, what was the rule of natural progression, had still to be settled. Lamarck, it appears, was the first to intimate the existence of a double series, which, setting out in opposite directions from a given point, met together at another. This first obscure intimation was afterwards followed by clearer and more extended views on the part of other naturalists. Not to anticipate, however, we return to the consideration of the fellow-labourers of Cuvier, among whom none is, perhaps, more highly distinguished than Latreille.

Pierre André Latreille, justly surnamed the Prince of Entomologists, was born at Brives, in the department de la Correze, November 29, 1762. He was the illegitimate son of illustrious parents. The family of M. Laroche, Officier de Santé, took care of his childhood, during which his education was chiefly directed towards theology, because he was designed for an ecclesiastic. A merchant of his native town, M. Malpeyre, early inspired him with a taste for natural history by lending him various books which treated of that science. He was sixteen years old when Baron

d'Espagnac, Gouverneur des Invalides, sent for him to Paris, and placed him in the college of Cardinal Le-moine, where he had the good fortune to attract the notice of the celebrated Haüy. Death soon after deprived him of the patronage of M. d'Espagnac, but he found other friends in the sister of the deceased, the Baroness de Puymaretz, and in her nephews, as well as in the family that had adopted him from the cradle. In 1786, Latreille retired into his own province, and there devoted all his leisure to researches in insects. Two years afterwards, when he made a journey to Paris, he became acquainted with Olivier, Bosc, and the celebrated Fabricius. Some curious plants, with which he paid homage to Lamarck, likewise procured him an introduction to that great man, who afterwards received him as a friend, assistant, colleague, and successor. In 1791, a memoir on Hymenopterous Insects, procured to Latreille the title of Correspondent of the Society of Natural History of Paris, and shortly afterwards that of Correspondent of the Linnæan Society of London. Up to this period natural history had been with him but a secondary object. Attached to his ecclesiastical functions, he could not give unlimited scope to his taste for these studies without compromising his duties. The Revolution, by breaking up existing institutions, and depriving him of the means of support, obliged him to seek a new career. Condemned to exile as an ecclesiastic, he was protected by the favour of some influential friends. The circumstance which operated in his favour, when detained a prisoner, is worth mentioning. While under confinement he caused a rare insect (*necrobia ruficollis*) to be presented to one of the proconsuls sent to Bordeaux, and this person being a great lover of entomology, interested himself for the prisoner, who soon regained his liberty. Proscribed anew in the year 1797, he had the happiness of being saved from death by the love of his fellow-citizens, and the solicitations of several persons at that time possessing influence, among others General Marbot. Returning to Paris the following year, La-

treille found succour in the friendship of M. Antoine Coquebert and his family. Soon afterwards he was named Correspondent of the Institute, and obtained permission to employ himself at the Museum of Natural History, where he was entrusted with the methodical arrangement of insects. He occupied this inferior post for nearly thirty years, and during that period he published a long series of works varying in importance, but of which some are placed among the greatest productions of modern naturalists. Fabricius placed him in the number of the law-givers of entomology, and immediately afterwards Linnæus accorded him the same honour, though without risking public opinion, the illustrious Swede might have taken that honour to himself. Though made a member of the Institute in 1814, Latreille did not obtain the decoration of the Legion of Honour till 1829. At the death of Lamarck, one of the two chairs created by the division of that lately occupied by the student of invertebrated animals, was given to Latreille. All the efforts and influence of Cuvier were necessary to gain this tardy honour for one who so well deserved it. Latreille was unable to reap in that post the credit which he would have done twenty years earlier; but this was to be expected as the result of such long neglect of a man who had brought honour to science and to his country. Poor Latreille, speaking of this late reward, and the duties it imposed, said: 'They have given me bread when I have no longer teeth to eat it with.' Indeed he did not long enjoy this recompense of a laborious and honourable life. Latreille expired on the 6th of February, 1833. His character was made up of gentleness and benevolence: he had not even moral energy sufficient to make the necessary efforts for the amelioration of his condition; and had it not been for Cuvier, that friend of the unfortunate, and who, in Latreille's case, had the additional motive of personal regard and esteem, he might have plodded on to the end of his life in the subaltern ranks of an establishment, of which he was one of the greatest ornaments. Latreille was a corresponding member of

nearly all the academies of Europe, and an honorary president of the Entomological Society of France. This society caused a monument to be erected to his memory in the Cemetery of Pere la Chaise, with the inscription: '*Necrobia ruficollis* saved Latreille;' and an effigy of the insect so named, which had been the means of delivering him from prison, as already related. The works of Latreille are too numerous to be recapitulated; but we may name a few of them: *The Natural History of Ants, with Observations on Bees, Spiders, and other Insects*—*The Natural History of the Crustacea, and of Insects*—*Memoirs on many Subjects of Natural History*—*On the Formation of the Wings of Insects*—*Course of Entomology*—contributions to the *Encyclo pédie Méthodique*, &c. &c.

While these eminent men were labouring in the cause of natural history in France, some of the more imaginative minds in other countries had begun to perceive analogies in organs and parts of the animal frame which had previously only been regarded under their distinct or individual relations. The German poet, Göthe, who had founded the doctrine of organic analogies in plants, also made the first step in the promulgation of similar views respecting animals. In the course of his researches, and those of his followers, Oken, Geoffrey, and others, some important facts were elicited, which have more than compensated for what was shadowy and unsubstantial in their views. Meanwhile Germany and the Netherlands are justly proud of the names of Illiger, Wagler, and Temminck; the last being noted for his able investigation of the birds of Europe, and for works which are still successively enlightening our own times. Professor Lichtenstein and Dr. Rüppell are also pursuing with much success the study of zoology.

The insect world has been also explored by many other naturalists besides Latreille; indeed, it would be impossible here to enumerate even the titles of the works produced on this subject. The structure and

economy of bees had been particularly studied by our scientific countrymen, Mr. Kirby and Mr. Spence; whose investigations doubtless led the way to those of Latreille; but the labours of Huber in this department must ever claim the highest attention. The magnificent work of Block led the way for other publications illustrative of fishes. Splendid illustrations of zoology by Temminck, Desmarest, Vieillot, Audebert, and others, together with voluminous dictionaries of natural history, also made their appearance.

In our own days much laborious study, and not a little difference of opinion has resulted from a desire, on the part of naturalists, to investigate the order in which beings are arranged in the kingdoms of nature. A simple view of the subject is thus given in Dr. Roget's *Bridgewater Treatise*: 'The notion has long prevailed among naturalists that the beings composing the vegetable and animal kingdoms might, if we were thoroughly acquainted with their structure and economy, be arranged in a linear series, commencing with the simplest, and regularly ascending to the most refined and complicated organizations, till it reached its highest point in man, who is unquestionably placed at the summit of the scale. Bonnet, in particular, cherished with enthusiastic ardour the hypothesis, that all organic beings formed a continuous gradation, each member of which, like the successive links of a chain, was connected with that which preceded and with that which followed it; and he pursued this idea by applying it even to the productions of the mineral world. But divesting ourselves of these hypothetical views and figurative images, we find, on sober observation, that instead of one continuous series we are presented with only detached fragments and interrupted portions of this imaginary system; so that, if for the sake of illustration we must employ a metaphor, the natural distribution of animals would appear to be represented not by a chain, but by complicated net-work, where several parallel series are joined by transverse and oblique lines of connexion. A

multitude of facts tend to show that the real types or models of structure are more correctly represented by circular, or recurring arrangements.'

As has been stated, the idea seems first to have occurred to Lamarck, that instead of a mere linear progression in nature by which each genus is placed in contact only with that which goes before it and that which follows, a double series might be traced, setting out in opposite directions from a given point and meeting at another. The Russian zoologist, Fischer, without being aware of the opinion of Lamarck, arrived at a similar conclusion, and observed a tendency in these two series to form a circle of their own, which circumstance he announced in 1808. But it was in 1819 that this new doctrine was first scientifically treated in the work of Mr. Macleay, entitled *Horæ Entomologicæ*, which exhibits much originality and deep research. The system propounded by Mr. Macleay is called the *Quinary System*, because of the supposed universal prevalence of the number *five* in the division of natural groups; nor does he contend that the doctrine entirely originates with himself; thus he remarks, 'Certain it is that the doctrines of quinary distribution of the circular progression of a series of affinity, and of analogies as distinct from affinities, have all been in some measure advanced by authors prior to the publication of the *Horæ Entomologicæ*. Indeed, it would add little to our conviction of these being great natural truths to find that only one writer had observed them, and that others had taken them for granted on his assertion. Accordingly we learn that the number five has had an importance in the construction of the universe given to it from the days of Plato and Cicero; that Linnæus, Pallas, and Desfontaines, have mentioned certain analogies in nature as distinct from affinities; and that one of the most distinguished zoologists of the present age, Professor Gotthelf Fischer, of Moscow, has stated the progression of certain series of affinities being in circles.'

The quinary system has been applied in this country, by Mr. Vigors to the birds, and by Mr. Bennett to the

mammalia and fishes. With certain modifications it has been also applied by Mr. Swainson to the animal kingdom generally. On the continent this system is not in much esteem, and in this country its followers are comparatively few. To endeavour in this place to enter into an explanation of the system would be to suppose the reader already acquainted with the details of anatomy and comparative physiology. Our notice of this system must therefore close with the observations of the eminent writer of the *History of the Inductive Sciences*.

‘It will appear, and indeed it hardly requires to be proved, that those steps in systematic zoology which are due to the light thrown upon the subject by physiology are the result of a long series of labours by various naturalists, and have been, like other advances in science, led to and produced by the general progress of knowledge. We can hardly expect that the classificatory sciences can undergo any material improvement which is not of this kind. Very recently, however, some authors have attempted to introduce into these sciences certain principles which do not at first sight appear as a continuation and extension of the previous researches of comparative anatomists. I speak in particular of the doctrines of a *circular progression* in the series of affinity; of a *quinary division* of such circular groups; and of a relation of *analogy* between the members of such groups, entirely distinct from the relation of *affinity*.

‘The doctrine of circular progression has been propounded principally by Mr. Macleay; although, as he has shown, there are suggestions of the same kind to be found in other writers. So far as this negatives the doctrine of a mere lineal progression in nature, which would place every genus in contact only with the preceding and succeeding ones, and so far as it requires us to attend to more varied and ramified resemblances, there can be no doubt that it is supported by the result of all the attempts to form natural systems. But whether that assemblage of circles of arrangement which is now offered to naturalists, be the true and only way of

exhibiting the natural relations of organized bodies, is a much more difficult question, and one which I shall not here attempt to examine. The prevalence of an invariable numerical law in the division of natural groups (as the number five is asserted to prevail by Mr. Macleay, the number ten by Fries, and other numbers by other writers) would be a curious fact, if established; but it is easy to see that nothing short of the most consummate knowledge of natural history, joined with extreme clearness of view and calmness of judgment, could enable any one to pronounce on the attempts which have been made to establish such a principle. But the doctrine of a relation of analogy distinct from affinity, in the manner which has recently been taught, seems to be obviously at variance with that gradual approximation of the classificatory to the physiological sciences, which has appeared to us to be the general tendency of real knowledge. It seems difficult to understand how a reference to such relations as those which are offered as examples of analogy can be otherwise than a retrograde step in science.'

The progress of zoology at the present time is highly satisfactory. That a taste for the science prevails among all ranks in this country is testified by the encouragement given to the large number of books on this subject, constantly issuing from the press; from the magnificent and richly illustrated folio, down to the cheap and popular hand-book. The ornithology of America has been unfolded by Wilson's charming descriptions, and by the equally interesting and splendidly illustrated writings of Audubon. Poli has made known the organization of the mollusca in the Sicilian seas; Della Chiage, Phillippi, and Madame Power, have followed him. The Prince of Canino and Musignano has produced an excellent *Fauna Italica*; while in France the works of Rang, Desmarest, De Blainville, Dumeril, Bibron, and Milne Edwards, are supplying valuable assistance to all Europe. To sum up the state of zoological science at the present time, we use the language of Mr. Broderip: 'England has produced the promi-

ment names of Willughby, Pennant, Latham, White, Leach, Bewick, Montagu, Selby, Gray, Swainson, Stevens, and Curtis; but a powerful stimulus to the science was given by the Zoological Society of London, in the establishment of which Sir Stamford Raffles had the principal share. To the taste for zoology thus diffused may in a great measure be attributed the ready acceptance which the elegant hand-books of Yarrell, Bell, Forbes, and Owen, have already found, or are finding, and the well-merited patronage which has enabled Mr. Gould to publish his magnificent works. *The Birds of the Himalaya Mountains*, *The Birds of Europe*, the monographs on the *Rhamphastidæ*, the *Trogonidæ*, and the *Kangaroos*, and though last, not least, *The Birds of Australia*, prove the interest taken in the subject by the affluent; while the success of all the cheaper publications shows that it is shared by all classes in this country. The nobly illustrated French voyages, which have done so much for natural history, have at last caused the government of this country to lend their seasonable aid to the heavy expenses attending the publication of illustrated works of natural history; and the *Fauna Boreali-Americana*, the *Zoology of the Beagle*, and Smith's *Illustrations of the Zoology of South Africa*, have already borne testimony to the worthy manner in which that assistance has been applied.

‘But we have been far from idle in England while following the steps of Cuvier in the department of palæontology. Conybeare, De la Beche, and Buckland, bravely broke ground in the search for fossil animal forms; and, although we cannot claim Agassiz as a countryman, we have had the satisfaction of aiding in the publication of his great work on fossil fishes. Professor Owen has enriched the fossil catalogue beyond hope in almost every class of *Vertebrata*; and among these, the grand mammiferous additions, *Myiodon*, *Glyptodon*, *Toxodon*, a host of enormous reptiles, and lastly, the gigantic *Dinornis* of New Zealand, eminently stand out.’

APPENDIX.

OUTLINE OF CUVIER'S CLASSIFICATION OF ANIMALS.

THE great merit of Cuvier's system of Zoology consists in its being a natural system founded on the organization and the essential resemblances of living beings. "It presents us with a chart of animal life, and shows us that all the varied forms and modes under which sentient creatures exist are referable to four distinct forms or models, and these forms are the foundation of the four grand divisions of the animal kingdom. Each of these forms or models, without changing its essential characters, admits of different modifications, corresponding with the internal organization, and thus a natural sub-division into classes is established; and on the same principle is made a farther sub-division of each class into orders, genera, and species." The grand divisions are founded upon physiology.

I. In the *first* of these forms, which is that of man and the animals that most resemble him, the brain and the principal trunk of the nervous system are enclosed in a bony envelope, which forms the skull and the vertebræ; to the sides of this vertebral column are attached the ribs and the bones of the members that form the framework of the body. The muscles generally cover the bones which they move, and the viscera¹ are enclosed in the head and the trunk of the body.

Animals of this form are called VERTEBRATED ANIMALS. They all have red blood, a muscular heart, and a mouth with two horizontal jaws; distinct organs of sight, of hearing, of taste and smell, are placed in the cavities of the face. Vertebrated animals have never more than four limbs, the sexes are always separated, they have all nearly the same distribution of the medullary masses, and of the principal branches of the nervous system.

II. In the *second* form there is no skeleton; the muscles are only attached to the skin, which forms a soft envelope that is contractile in every direction. In many species the skin produces stony coverings called shells, the position and extent of which are analogous to those of the mucous body. The viscera and the nervous system are included in the general envelope. The nervous system is composed of many distinct masses united by nervous threads; the principal of these are placed near the œsophagus, and have received the name of the brain. In animals of this division the organs of two senses only, viz. those of taste and sight, can be

¹ The common meaning of *viscera* is 'the intestines;' but in scientific language *viscus*, with its plural *viscera*, may denote any internal organ or organs.

distinguished. One single family only exhibits organs of hearing. The system of circulation is however complete, and there are particular organs for respiration. The organs of digestion and secretion are nearly as complicated as those of vertebrated animals.

The animals of this second form are called **MOLLUSCOUS ANIMALS**. Although the plan of their organization, with respect to the external configuration of the parts, may not be so uniform as that of vertebrated animals, there is always a resemblance between these parts, at least of the same degree, in the structure and in the functions. The cuttle-fish, and animals with univalve or bivalve shells, belong to this division.

III. The *third* form is that which is observed in insects worms, &c. In animals of this division the nervous system consists of two long chords, ranging along the belly, and swelling out at intervals into *ganglions* or knots. The first of these knots, placed near the œsophagus, is called 'the brain;' it is but little larger than the rest. The envelope of the trunk is divided by transverse folds into a certain number of rings, the coverings of which are sometimes hard and sometimes soft, but the muscles are always attached to them beneath. The trunk has often articulate members, or legs on each side, but is frequently without them. The animals of this form are called **ARTICULATED ANIMALS**.

In the animals of this division we first observe the passage from circulation in a vascular system to nutrition by imbibition, and a corresponding passage from respiration in circumscribed organs to that in air-vessels called 'tracheæ,' which are spread over the whole body. The organs of taste and sight are the most distinct in the animals belonging to this division; one single family only exhibits organs of hearing. The jaws are always lateral.

IV. The *fourth* form, which comprises all the animals known under the name of zoophytes, may be called **RADIATED ANIMALS**.

In all the preceding divisions the organs of sense and motion are placed symmetrically, on the two sides of an axis: in the animals of this fourth division they are placed circularly round a centre. Many radiated animals approach in substance to the homogeneity of plants; they exhibit no distinct nervous system, nor organs of the particular senses; in some of them scarcely any traces of circulation are perceived; their organs of respiration are almost always on the surface of the body; in the greater number the whole intestine consists of a bag without a vent; and in the lowest families the bodies are of a kind of homogeneous pulp, possessing a certain degree of mobility and sensation.

The following tabular view of Cuvier's Classification of Animals, with examples of animals belonging to each division, may be studied in connexion with such works on the subject as supply the necessary details.

I. VERTEBRATA.

1. MAMMALIA.

Bimana (with two hands)	}	<i>Man.</i>
Quadrumana (with four hands)	}	<i>Monkey, Ape, Lemur.</i>
Cheiroptera (with winged hands)	}	<i>Bat, Colugo.</i>
Insectivora (feeding on insects)	}	<i>Hedgehog, Shrew, Mole.</i>
Plantigrada (placing the whole foot on the ground in walk- ing)	}	<i>Bear, Badger, Glutton.</i>
Digitigrada (walking on the toes only)	}	<i>Dog, Lion, Cat, Martin, Weasel, Otter.</i>
Amphibia (having a double life <i>i.e.</i> on land or in water)	}	<i>Seal, Walrus.</i>
Marsupialia (with a bag or pouch)	}	<i>Opossum, Kangaroo, Wombat.</i>
Rodentia (Rodents or Gnawers)	}	<i>Beaver, Rat, Squirrel, Porcu- pine, Hare.</i>
Edentata (toothless)	}	<i>Sloth, Armadillo, Ant-eater, Pan- golin, Ornithorhynchus.</i>
Pachydermata (thick-skinned)	}	<i>Elephant, Hog, Rhinoceros, Tapir, Horse.</i>
Ruminantia (chewing the cud)	}	<i>Camel, Musk, Deer, Giraffe, Antelope, Goat, Sheep, Ox.</i>
Cetacea (belonging to whales)	}	<i>Dolphin, Whale.</i>

2. AVES.

Accipitres (takers by force)	}	<i>Vulture, Eagle, Owl.</i>
Passeres (Sparrow kind)	}	<i>Thrush, Swallow, Lark, Crow, Sparrow, Wren.</i>
Scansores (Climbers)	}	<i>Woodpecker, Cuckoo, Toucan, Parrot.</i>
Gallinæ (<i>Gallina</i> a hen)	}	<i>Peacock, Pheasant, Grouse, Pi- geon.</i>
Grallæ (Waders)	}	<i>Plover, Stork, Snipe, Ibis, Fla- mingo.</i>
Palmipedes (web-footed)	}	<i>Ank, Grebe, Gull, Pelican, Swan, Duck.</i>

3. REPTILIA.

Chelonia (<i>χελωνη</i> a tortoise)	}	<i>Tortoise, Turtle, Emys.</i>
Sauria (<i>σαυρα</i> a lizard)	}	<i>Crocodile, Lizard, Grecko, Cha- melon.</i>
Ophidia (<i>οφεις</i> a serpent)	}	<i>Serpents, Boa, Vipers.</i>
Batrachia (<i>βατραχος</i> a frog)	}	<i>Frog, Salamander, Newt, Pro- teus, Siren.</i>

4. PISCES.

Acanthopterygii (spinous-finned)	}	<i>Perch, Mackerel, Sword-fish, Mullet.</i>
Malacopterygii (soft-finned)	}	<i>Salmon, Herring, Pike, Carp, Si- lurus, Cod, Sole, Remora, Eel.</i>
Lophobranchi (tufted gills)	}	<i>Pike-fish, Pegasus.</i>
Plectognathi (upper jaw and palate immovable)	}	<i>Sun-fish, Trunk-fish.</i>
Chondropterygii (Cartilaginous)	}	<i>Lamprey, Shark, Ray, Sturgeon.</i>

II. MOLLUSCA.

1. Cephalopoda (heads furnished with feet)	}	<i>Cuttle-fish, Calamary, Nautilus.</i>
2. Pteropoda (wing-like feet)	}	<i>Clio, Thyalæ.</i>

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|---|---|------------------------------------|
| 3. Gasteropoda
(creeping on the stomach) | } | <i>Slug, Snail, Limpet, Whelk.</i> |
| 4. Acephalá
(headless) | } | <i>Oyster, Muscle, Ascidia.</i> |
| 5. Brachiopoda
(arm-like feet) | } | <i>Lingula, Terebratula.</i> |
| 6. Cirrhopoda
(thread-like feet) | } | <i>Barnacle.</i> |

III. ARTICULATA.

1. ANNELIDA.

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|--|---|--|
| Tubicola
(inhabiting tubes) | } | <i>Serpula, Sabella, Amphitrite.</i> |
| Dorsibranchia
(breathing apparatus on the back) | } | <i>Nereis, Aphrodite, Lob-worm.</i> |
| Abranchia
(with no apparent gills) | } | <i>Earth-worm, Leech, Nais, Hair-worm.</i> |

2. CRUSTACEA.

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|---|---|-------------------------------|
| 1. Malacostraca
(soft-shelled) | | |
| Decapoda
(ten-legged) | } | <i>Crab, Lobster, Prawn.</i> |
| Stomapoda
(anterior feet near the mouth) | } | <i>Squill, Phyllosoma.</i> |
| Amphipoda
(feet all round) | } | <i>Gammarus, Sand-hopper.</i> |
| Læmodipoda
(feet on the neck) | } | <i>Cyamus.</i> |
| Isopoda
(equal feet) | } | <i>Wood-louse.</i> |
| 2. Entomostraca
(Insects with shells) | } | <i>Monoculus.</i> |

3. ARACHNIDA.

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|---|---|-------------------------------------|
| Pulmonalia
(having pulmonary cavities for the purposes of respiration) | } | <i>Spider, Tarantula, Scorpion.</i> |
|---|---|-------------------------------------|

Trachealia (having <i>tracheæ</i> or air- pipes)	}	<i>Phalangium, Mite.</i>
4. INSECTA.		
Aptera (without wings)	}	<i>Centipede, Podura.</i>
Coleoptera (wing-cases)	}	<i>Beetle, Glow-worm.</i>
Orthoptera (four straight wings)	}	<i>Grasshopper, Locust.</i>
Hemiptera (upper wings of un- equal consistence)	}	<i>Fire-fly, Aphis.</i>
Neuroptera (four equal wings)	}	<i>Dragon-fly, Ephemera.</i>
Hymenoptera (four unequal wings)	}	<i>Bee, Wasp, Ant.</i>
Lepidoptera (powdery wings)	}	<i>Butterfly, Moth.</i>
Rhipiptera (fan-like wings)	}	<i>Xenos, Stylops.</i>
Diptera (two wings)	}	<i>Gnat, House-fly.</i>

IV. ZOOPHYTA.

1. Echinodermata (<i>εχινος</i> a hedgehog; <i>δερμα</i> the skin)	}	<i>Star-fish, Urchin.</i>
2. Entozoa (<i>εντος</i> within; <i>ζωον</i> an animal)	}	<i>Fluke, Hydatid, Tape-worm.</i>
3. Acalephæ (<i>ακαληφη</i> a nettle)	}	<i>Actinia, Medusa.</i>
4. Polypi (<i>πολυς</i> many; <i>πους</i> a foot)	}	<i>Hydra, Coral, Madrepore, Pen- natula.</i>
5. Infusoria (animals found in in- fusions.)	}	<i>Brachionus, Vibrio, Proteus, Monas.</i>

