Frederick H. Langton
with his Papa's & Mama's
best love & wishes.

Christmas 1869 —

LINKS IN THE CHAIN.

A Distinguished Visitor at Supper.

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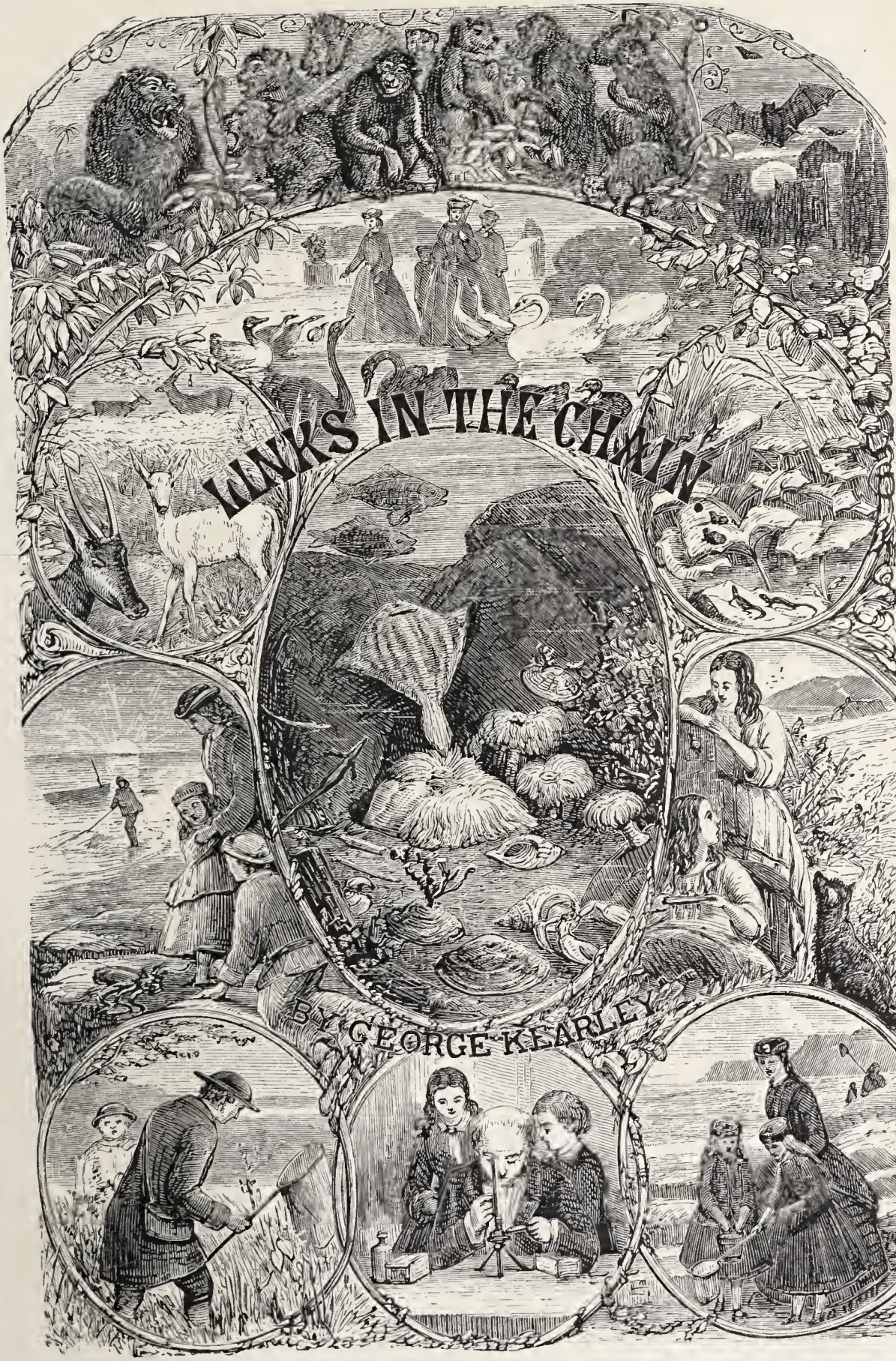
LINKS IN THE CHAIN.
BY GEORGE KEARLEY.

LINKS IN THE CHAIN;

OR,

POPULAR CHAPTERS ON THE CURIOSITIES OF ANIMAL LIFE.

BY GEORGE KEARLEY.

WITH ILLUSTRATIONS BY F. W. KEYL.

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SUBJECTS OF THE ILLUSTRATIONS.

LINKS IN THE CHAIN.

CHAPTER I.

AN UNSEEN WORLD.

"—— Where the pool
Stands mantled o'er with green, invisible,
Among the floating verdure millions stray."

If Dr. Livingstone, in the course of his African explorations, were to light upon some such nation of mannikins as that discovered at Lilliput by Mr. Lemuel Gulliver of famous memory, the announcement of the fact could hardly occasion greater surprise and astonishment than was felt by the philosophers of the last century at the remarkable disclosures of the microscope, with respect to the countless multitudes of minute forms of organic life which, unseen by our feeble powers of vision, people the waters of the earth, and swarm around us on every side.

The microscope has here revealed the existence of a new world of living beings, before unknown and unsuspected. It has shown that the water of our roadside ditches, and stagnant pools, of our lakes and streams, and of the sea itself, teems with various races of microscopic beings, many of which are so inconceivably minute, and abound in such amazing profusion, that thousands of them may often be detected in a drop of fluid taken up on the point of a pencil, while, within the narrow dimensions of a lady's thimble, we might easily collect together a number far exceeding that of the entire human population of the globe.

It rarely happens that important discoveries are made at once in all their completeness, and the discovery of this unseen world of organic life forms no exception to the rule. It will be obvious, indeed, that, as many of these minute beings are sufficiently large

to be discernible by the unassisted eye, there would be at least some knowledge of their existence even in the earliest times. But it was not until the invention of the microscope had given to man the means of penetrating the mysterious depths of this diminutive creation that any definite knowledge was obtained, either of its vast extent or of the exceeding wonderfulness of the beings which composed it; while almost every improvement which has subsequently been made in the construction of the microscope has largely added to the wonders which the instrument has here revealed.

The earliest microscopical observations of importance on these minute beings were made by Leeuwenhoek in the latter half of the seventeenth century; but it was not until a much later period that this branch of study excited any great amount of interest, or was prosecuted with anything like persevering zeal. It was towards the middle of the last century that the great stimulus was given to researches of the kind, by the publication of the celebrated memoir of M. Trembley, of Geneva, on the little Hydra, or fresh-water polyp of our ponds and ditches—an animal whose extraordinary history read, and, indeed, still reads, more like an extravagant romance than a sober recital of actual facts. The publication of this work marks one of the most important epochs in the history of microscopical inquiry, and speedily turned the attention of observers in all parts of Europe to the abounding marvels of the waters.

Nor is it at all remarkable that such should have been the result; for this same Hydra is one of a race of animals of which, up to that time, naturalists had been almost wholly ignorant, while the details that were given of its habits and economy were such as completely upset most of the prevailing notions as to the distinctive characteristics of animal life. For here was an animal whose young grew out from its sides like buds from the stem of a plant—that might not only be cut into pieces without being killed, but would reproduce a perfect animal similar to itself from every fragment of its original substance—that might be turned inside out, and yet suffer no detriment to its powers of digestion—that might, in fact, be mutilated and operated upon in almost any conceivable fashion, not only without apparent injury, but without, or at all seriously, interfering with the functions of active life. It is no wonder, therefore, that observers were everywhere

eager to test the accuracy of these astounding assertions, or that a great impetus should thus have been given to the general study of the minute forms of life with which the waters abound. But many years still passed before this branch of study was at all systematically pursued: and although towards the close of the last, and early in the present, century, it attracted to itself a considerable number of able and zealous investigators, it was not until almost our own day that it took its place as a recognized and important department of natural science.

It was for many years customary to speak of these living atoms indiscriminately as the *Infusoria*, or as Infusorial Animalcules, from the circumstance that they were originally detected in infusions of vegetable substances. More careful investigation, however, has shown that the organisms thus hastily associated together differ widely from each other; and that many of the tribes are, on the whole, more nearly related to the vegetable than to the animal world. Moreover, amongst those whose animal nature is perfectly obvious, the differences which have been observed as to organization are so great, that while most of the number take rank with the very humblest forms of sentient beings, others, again, present a much more complicated structure, and are now properly classed with the higher divisions of the invertebrate animals, minute though they be, and, in this respect, true animalcules. It would seem, indeed, that the earlier investigators of this invisible world of organic life were so elated with the remarkable discovery they had in charge, that they were disposed to regard everything belonging to it as perfectly unique, quite separate and distinct from all that had previously been known. No matter, therefore, what the objects were that came within the field of their microscopes—the eggs and larvæ of insects, the germs of embryo polyps, the spores of fungi, and many different forms of mature plants, together with other matters of a still more heterogeneous character—all were alike set down as being organisms of the same general character, and regarded as equally belonging to this newly discovered world of Infusorial Animalcules.

It affords a curious illustration of the union of great powers and special aptitude for delicate research with unaccountable proneness to deception, that Ehrenberg, the great microscopist of Berlin, and for many years the almost undisputed authority on

the Infusoria, was beguiled into more errors of the kind above alluded to than almost any other observer. In his great work, "Die Infusionsthierchen," published in 1838, and which, with all its imperfections, is undoubtedly a splendid monument of his industry and genius, there are perhaps a greater number of assumed discoveries which no subsequent observer has ever been able to confirm, and a greater number of inferences which are now discarded, although deduced from acknowledged phenomena, than are to be found in any similar work in the whole compass of modern science. And yet, when first published, this work seemed so complete and so exhaustive of the subject, that it was some years before any one doubted either the correctness of the observations or the soundness of the conclusions of its author. The name of Ehrenberg was a sufficient guarantee for any statement, however marvellous, and his reputed discoveries passed for a time unquestioned. Gradually, however, as the number of observers increased, and as various improvements were made in the construction of the microscope, the views of the great Berlin philosopher were discovered to be in many particulars erroneous, and that one of the two great characters on which he had relied for separating the Infusoria into their main divisions, was altogether imaginary.

According to the classification adopted by Ehrenberg, the Infusoria formed two principal and well-defined groups. To the first of these he gave the name *Polygastrica*, from the supposition that all the animalcules composing it possessed several distinct stomachs, united together by a sort of intestinal canal. The second group consisted of the *Wheel Animalcules*, so named on account of the wheel-like rotation produced by rows of delicate hair-like bodies, resembling eyelashes, and hence termed *cilia*, which fringe the upper extremity of the bodies of the animalcules; and to these Ehrenberg gave the name *Rotatoria*, or Rotifera. In these two groups, as the primary divisions, all the Infusoria were included; and though Ehrenberg was fully sensible of the great dissimilarity between the organization of the Rotifera and that of the various forms included in the other group, he seems to have had no doubt as to the perfect propriety of their being all retained under one and the same general designation. Never, however, have the views of a philosopher, or his supposed discoveries, been more completely set aside by subsequent observa-

tion than is the case with those of Ehrenberg in this his chosen field of research.

The Rotifera are now, by common consent, ranked with the lower divisions of the Articulate animals, with which, as Ehrenberg himself had pointed out, their complicated structure evidently brings them into close relation; so that thus, at a stroke, one of the two great primary groups of the Infusoria has been taken away. Then, with respect to the Polygastrica, although their rejection as a division of the Infusorial Animalcules has been neither so summary nor so complete as that of the Rotifera, their treatment by the most competent observers of the day is, in every respect, far more damaging to the authority and influence of the great microscopist of Berlin.

In the first place, it is now generally allowed that the term Polygastrica is altogether inapplicable, inasmuch as no such multiplicity of stomachs as was alleged is found to exist in any of the organisms to which it was applied. Ehrenberg was led to the opinion he entertained on this point by a somewhat curious expedient, first adopted, we believe, by Baron Gleichen, and which certainly exhibits his ingenuity and fertility of resource in a very favourable light. A very general characteristic of these so-called Polygastrica is, that they exhibit, in the interior of their substance, a number of clear spaces, resembling so many minute sacs—in some of the species these *vacuoles*, as they are termed, numbering upwards of a hundred. It occurred to Ehrenberg that possibly these *vacuoles* were stomachs; and, in order to test the accuracy of his conjecture, he tried the experiment of feeding the animalcules, employing for the purpose coloured substances, such as carmine and indigo, the particles of which, if imbibed, would, he knew, be readily discernible through the gelatinous substance of the animals' bodies. The experiment was perfectly successful. The delighted philosopher saw numbers of the minute beings coursing over the field of his microscope, with little specks of colouring matter distinctly visible within them. Ehrenberg had now no longer a doubt that the internal clear spaces were really stomachs; and, rendered enthusiastic by his singular discovery, he subsequently saw, or rather *fancied* he saw, distinct traces of a connecting intestinal canal.

No wonder, therefore, that from characters so marked and

peculiar, Ehrenberg derived a name for the entire class of organisms in which they obtained. But, unfortunately, the ablest observers since then, using the most powerful microscopes, have come to quite different conclusions with respect to the nature of the internal clear spaces, and have to this day failed to discover the assumed connecting canal. It is evident, indeed, that no such structure exists, and the term Polygastrica, therefore, is totally inadmissible. More than this, however, many tribes that were so designated are now known to be true plants, while others still form the subject of debate between the botanist and the zoologist; and another large section have been ascertained to be merely active germs, some of aquatic plants, others of worms or various insects. It is not too much to say, therefore, that by far the larger proportion of the organisms which Ehrenberg placed amongst the Infusoria as Polygastric Animalcules, are strictly referable to other and widely different groups; while in none of them is there to be seen that complicated and marvellous digestive apparatus from which the class, as a whole, received its designation.

The Infusoria, then, viewed as Ehrenberg regarded them—that is, as minute animals, and admitting of being arranged in two well-defined and homogeneous groups—are blown to the four winds. The classification is altogether at fault. But the various beings thus arbitrarily associated together exist none the less; and though they are in some respects, perhaps, a little less marvellous than the spurious discoveries of former times had led us to suppose, there is little need to surround them with imaginary wonders, in order to their commanding a deep and permanent interest. Nor is this at all the less true from our now having to regard many of these minute organisms as belonging rather to the vegetable than to the animal world. Plants or animals, it matters little—their extreme minuteness, the extraordinary abundance in which they swarm around us, the variety, and, in many cases, the great beauty of their structure, all conduce to render them objects of the greatest interest, and to make the study of them one of the most attractive departments of natural science.

Let us then—without caring much about classification—minding only to keep in view the great leading distinctions which recent research has established, look more in detail at the eco-

nomy of these microscopic beings, and at the various wonders which they display.

It may seem an odd way of beginning a volume on the curiosities of animal life to commence with an account of objects which belong to the *vegetable* kingdom; but all things considered, the proceeding is by no means so Hibernian as may at first sight appear.

The truth is that, in dealing with these minute forms of life, we are venturing on what has aptly been called the border land of the organic world—the frontier territory, so to speak, which lies between the two great kingdoms of animated nature; and, as in many another case of disputed boundary, the inhabitants of the debatable region have sometimes been claimed for the one side and sometimes for the other; and in this case it has so happened that many of them have occasionally been claimed with equal vehemence by both sides at once. The dispute as to what constitutes the essential difference between plants and animals can hardly yet be said to have terminated; and though there is now a very general concurrence of opinion that the distinction mainly consists, on the one hand, in the dependence of the being for nutriment on organic substances already formed, which in some way or other it takes into the interior of its body, and, on the other hand, in the possession of the power to obtain its nourishment by absorption from the inorganic elements on its exterior; yet this is a test which, in the nature of the case, is exceedingly difficult of application to these microscopic organisms. The power of spontaneous motion, which was at one time relied upon as a distinguishing mark of animal life, has long since lost its value in that respect, as it is now well ascertained that not only the early immature forms, but the fully developed individuals of many of the simplest aquatic plants are endowed with very active powers of locomotion, and, to all appearance, dance as merrily through the water as any of their compeers of the animal series. It has been argued, again, that the presence of what are known as contractile or pulsating spaces in the interior of the body is a proof of animality, but here also the progress of research has gone against the assumption, these contractile spaces being now known to be common to both the animal and the vegetable kingdoms. Owing to this apparent animality of many of these humble plants, it is extremely

difficult, and, in many cases, absolutely impossible, without carefully tracing out the entire life-history of an organism, to determine satisfactorily whether it belongs to the animal or the vegetable kingdom. The proper position of most of these mieroscopic beings, it is true, is now pretty well ascertained; but there are still doubtful raees which may yet change sides, and pass from amongst the plants, to be heneeforth regarded as animals; or, which is more probable, cease to be ranked with animals, to take their place henceforth with the plants. It will be a quite excusable licence, therefore, to include both sides in our present review, the more especially as, at one time, they were all alike regarded as true animals, and still equally belong to that unseen world of organic life with whieh we are now eoneerned.

One of the most recent results of the investigation whieh has been carried on into the history of these minute organisms has been to hand over from the animal to the vegetable kingdom the entire tribe of the so-called Monads, whieh, both in their simple and in their associated forms, have long attraeted the attention of microscopical observers. The simplest and most minute of these organisms is the Twilight Monad (*Monas crepusculum*), which, seen under glasses of the highest magnifying power, is still a merc speck of pellueid matter, which is known to be possessed of life only becausc of its vigorous and animated movements. It has a diameter of not more than the twenty-four thousandth part of an inch—a measure of magnitude, or rather of its opposite, whieh is easily expressed in words, but of which the mind is utterly unable to form any definite conception. But it is not in respect to size alone that these minute beings are so remarkable,—their amazing abundance is no less extraordinary. It is no uncommon thing to find them erowding the water in which they occur, to such an extent that they are separated from eaeh other by a space no greater than their own diameter; so that a single drop of thc fluid would contain, it is estimated, some hundreds of millions of living beings!

When the animal nature of the Monads was generally admitted, this remarkable abundance and minuteness combined invested them with a great degree of interest, and they were not inappropriately regarded as the starting-point, so to speak, of animal life—thc point at which its first feeble glimmer became distin-

guishable from the darkness of nonentity. The Monads are, for the most part, of a round or oval form, and in all the larger kinds a distinct tail-like appendage is discernible, which was supposed to be at once an organ of motion and a means of obtaining food. One tribe, however, which was included in the genus *Euglena*, bear a close resemblance to fishes in shape, and being provided with a large red eye-spot, they pass very well for "Fish Animalcules." It frequently happens that these tiny representatives of the finny tribes are congregated in such vast profusion as to impart to the water in which they occur a very perceptible tinge of colour; and Ehrenberg fancifully suggests that it was probably by the agency of one of them, which from its colour has earned the name of *Euglena sanguinea*, that the miracle recorded in Exodus, of turning the waters of the Nile into blood, was effected. The commonest of these Fish Animalcules in our own ponds and ditches is *E. viridis*, which, with its grass-green body and its carmine eye-spot, is a pretty object in the microscope, and one that may be observed with great interest, even though we may no longer believe with Ehrenberg that its "eye" is a real visual organ, or that the clear spaces within its body constitute a *bonâ fide* digestive apparatus.

In the heat of summer, the surface of stagnant pools often becomes covered with a thin film of scum, which looks to the naked eye like a coating of fine dust, but which, on being carefully removed and examined by the aid of a powerful microscope, is seen to consist in great part of various minute organisms, which, when disturbed, move briskly about in the water. A large proportion of the number are Fish Animalcules of the kind just alluded to; but, in addition to these, there are others of a larger size, closely allied to the Monads, but presenting some most extraordinary complications of structure. They are in fact compound structures, consisting of Monads grouped together in clusters, and imbedded in the interior of variously shaped gelatinous masses, which swim about by the united action of their tail-like appendages. One of the most curious of these is the *Gonium pectorale*, commonly called the High Priest's Breastplate, which consists of a combination of sixteen monadiform bodies, disposed regularly in a four-cornered tablet, like the jewels in the breastplate of the Jewish high priest. Another, and still more beautiful variety, is the *Pandorina morum*, in

which the investing gelatinous mass is of a globular form, and encloses about thirty Monads of a dark-green colour, which have a peculiarly elegant appearance in the centre of the transparent sphere.

It is a terrible coming down from the romantic views of Ehrenberg, no doubt, to assign these various bodies, simple and compound alike, to the vegetable kingdom, but such is unquestionably their true position; for they are now ascertained, beyond all reasonable doubt, to be nothing more than the successive stages of a humble plant—the *Protococcus pluvialis;* the so-called simple monads being merely the early "motile" or active germs of the plant, and the compound or associated forms the subsequent phases which the plant assumes by the continued self-division of its original cells.

But a far more extraordinary example of these composite vegetable structures, formerly ranked with the Monads, is the famous *Volvox globator*, which has not unnaturally excited more astonishment than any other member of this most strange association of organisms. The Volvox is by no means uncommon in our ponds and ditches, and as it attains a diameter of one-thirtieth of an inch, it may easily be detected by the naked eye when the drop of water containing it is held to the light. Seen in this manner, the Volvox appears a minute green globule gently moving about in the water; but when viewed with a moderate magnifying power, the globule is seen to be a hollow pellucid sphere, studded at regular intervals with minute green spots, from each of which proceed two long cilia, by the united action of which the little globe moves through the water. Ordinarily it moves onward with a rolling kind of motion, a sort of self-bowling cricket-ball; but occasionally it glides along without turning on its axis, and more rarely still, it may be seen twisting round like a top without changing its position. In the interior of the Volvox a number of smaller globes may generally be seen, some adhering to the inner surface of the investing sphere, and others, more advanced, lying freely within the cavity, revolving like satellites, not around, but within the parent sphere. If the observation be continued for a short time, the larger globe will be seen to burst, when the imprisoned globules float freely away to begin an independent existence.

Long after the Volvox was quite familiar to microscopical

observers, the whole exterior globular mass was regarded as a single animal, and the bursting of the globe, and consequent escape of the contained globules, as its ordinary mode of increase. Ehrenberg, however, was the first to ascertain that the Volvox is really a composite structure, made up of an association of organisms in every respect similar to each other; but then he made the mistake of regarding them as true animalcules, and described them as being each possessed of an eye, a mouth, and several stomachs.

The truth is that the Volvox has now been ascertained to be a composite vegetable structure closely allied to the *Protococcus*, and that its growth and development, together with the production of the contained globules, is, as in the case of the various forms of that plant, due to the repeated self-division of its component cells. It can hardly be said, however, that the discovery that the Volvox is a plant rather than an animal at all diminishes the wonderfulness of its structure and history; for in whatever light we may regard it, it is certainly one of the most extraordinary organisms with which even the microscope has made us acquainted. But there is another wonder to be added to its history even yet: the Volvox, it appears, is sometimes found to be infested with parasites; and on one occasion a specimen was observed, in the interior of which two minute Wheel Animalcules were distinctly visible. No opening could be perceived by which they could have found entrance, nor did there appear to be anything within to impede their movements; on the contrary, they swam about as freely as fish in a glass globe, to which, indeed, they are said to have had no faint resemblance.

Mr. Pritchard, in his "History of Infusorial Animalcules," stoutly contends for the animal nature of these beings, and appropriately concludes his account of them with the remark, "Who can behold these hollow living globes revolving and disporting themselves in their native element, with as much liberty and pleasure as the mightiest monsters of the deep, and not exclaim with the Psalmist, 'How wonderful are thy works, O Lord; sought out of all them that have pleasure therein'?"

Nothing is more remarkable in connection with the *Protophyta*, or simplest forms of plants, with which we are now dealing, than the extraordinary and altogether unplant-like shapes which they assume. This is sufficiently striking in the Volvox and its allies

already noticed, but it becomes still more obvious in the two tribes to which we now pass on, namely, the *Desmidiaceæ* and the *Diatomaceæ*, or, as we will style them, the Desmids and the Diatoms, in which stars, crosses, triangles, and other graceful geometrical figures take the place of the more ordinary vegetable forms, and give to these tiniest of plants the appearance of so much mimic jewellery.

The Desmids are green gelatinous bodies, confined exclusively to fresh water. In most cases they consist of a single cell, which is nipped in, in the middle, like a young lady with a small waist, while the outer surface is frequently projected into spines and variously-formed processes, which present a very symmetrical and elegant appearance. It has recently been discovered that a regular circulation of fluid takes place in the interior of these minute organisms; and it may interest the reader to know that the gentleman to whom we owe most of our information on the subject is no other than the redoubtable S. G. O. of the "Times" newspaper, who, it appears, is wont to relieve his severer occupations by an occasional turn to the microscope, or the inmates of the aquarium. The Desmids perpetuate their race in three distinct fashions. In the first place, they multiply themselves by the process of self-division; secondly, by the breaking up of the "endochrome," or coloured contents of the parent cell, into a multitude of granular particles, which are set free by the rupture of the cell wall, and then start in life on their own account; and, thirdly, by the process known as "conjugation," which may be regarded as the first foreshadowing of the true sexual union which takes place in the higher plants and animals.

In many respects the *Diatomaceæ* have a close affinity to the preceding group; but they are unmistakably separated from them by the possession of a bivalve shield, of pure colourless silex, which renders their forms indestructible. It is to the possession of this silicious shield that the Diatoms owe all their beauty and importance. There is a wide diversity of form in the shields of the various species; but in all of them alike the surface is sculptured with a beautiful, well-defined, and more or less complicated pattern of lines and points, which afford a ready means of distinguishing the different species, and at the same time places these minute bodies amongst the most elegant of microscopic objects. In many of the species the individual Diatoms

or "frustules," as they are also termed, are entirely disconnected from each other, but in others they are united together in considerable masses in a sort of gelatinous envelope, and in others, again, they are variously united into composite structures, which sometimes present an appearance of great elegance and beauty. In the more simple of these associated tribes, the frustules are merely held together in long filaments, or zigzag chains; in others, they are arranged, side by side, in flat bands or beautiful screw-like coils; while in some very elegant forms they are mounted on slender foot-stalks, and have the appearance of clusters of tiny fans, every ray of each separate fan consisting of a perfect Diatom enclosed in its silicious shield.

Like their allies the *Desmidiaceæ*, the *Diatomaceæ* increase both by self-division and by conjugation, and so rapidly does their multiplication proceed, that one of the most cautious of microscopical observers has calculated that, in the course of one month, the progeny of a single Diatom would amount to the amazing number of one thousand millions! This extraordinary rapidity of increase will readily account for the sudden appearance of vast numbers of these organisms in localities where, only a short time before, they were either not to be found at all, or occurred but sparingly; it will also help us to account for those vast accumulations of their silicious shields which are being formed in various parts of the ocean at the present day, and the still more extensive deposits of similar exuviæ which originated in remote geological epochs. It has already been mentioned that the shields of the Diatomaceæ are indestructible. Unlike, therefore, to multitudes of higher organisms, which live their day and then disappear, leaving no trace of their existence behind them, every one of these lowly beings deposits in the water it inhabits an imperishable memento of its brief life, and not unfrequently contributes to the formation of rocky strata, which, in the remote future, may give a distinctive character to countries yet unborn.

In some places the accumulations of these remains are exerting an important influence in blocking up harbours, and diminishing the depth of channels; and, according to the observations of Professor Bailey of New York, various portions of the bottom of the North Pacific Ocean are being covered up by deposits of a similar character, in which the two valves of the shield are frequently found still united, and containing remains of the

internal soft parts. But the most remarkable of these deposits of diatomaceous remains, now in process of formation, is that which Dr. W. J. Hooker has made known in the southern seas. Dr. Hooker states that the waters of the Antarctic Ocean, between the sixtieth and eightieth degrees of latitude, abound with Diatomaceæ to such a degree that the sea, over large portions of this wide area, is literally stained with them; and that their shields are gradually producing a submarine deposit which flanks the Victoria Barrier, and covers a surface four hundred miles long by one hundred and twenty miles broad! This immense mass of diatomaceous remains is in close proximity to Mount Erebus, an active volcano, twelve thousand feet high; and the circumstance has suggested to Dr. Hooker whether there may not be some direct communication between the ocean-waters and the internal fires of the mountain, such as would account for the curious but well-established fact, of the occurrence of the silicious shields of the *Diatomaceæ* in the ashes and pumice of many active volcanoes.

These immense submarine deposits of the shields of the Diatomaceæ may be said to be rocky strata now in the course of formation. But similar deposits are found in many of the existing rock-formations of the earth's crust, and in some cases they constitute by themselves beds of considerable thickness. The so-called "infusorial earths" of various parts of the globe are all of this description. One of the best known of these earths is the famous *bergmehl*, or mountain meal of Sweden, which, in times of scarcity, the inhabitants are accustomed to mix with their flour in making bread! The Tripoli or rotten-stone, used in polishing metals, the well-known Turkey-stone, and the Polierschiefer, or polishing slate of Bilin, in Bohemia, are also examples of fossilized remains of the Diatomaceæ, the last-mentioned material occurring in a series of extensive beds averaging fourteen feet in thickness.

Again, the city of Richmond, in Virginia, is said to be built on a bed of diatomaceous remains, eighteen feet in thickness and of unknown extent; while in 1839, Ehrenberg astonished the inhabitants of Berlin with the discovery, that just beneath the foundations of their houses there was an immense deposit of a similar character; excepting that, in this case, to add wonder to wonder, a large proportion of the mass consisted of Diatomaceæ

still alive and active, sustained, no doubt, by the water which finds its way to them from above!

But perhaps the most curious situation in which these remains have yet been found is in the guano which is brought from the coast of Africa and Peru. Great numbers of the frustules have been found in this material; and it has been conjectured, with considerable probability, that the peculiar value of guano in the growth of cereals may greatly depend on the presence of these minute organisms, inasmuch as they supply it with that extra amount of silica which all the corn-plants require. Thus, if this conjecture be well founded, these minute beings, after performing their part in the economy of nature while alive, and then lying entombed amidst a feculent mass of animal exuviæ for perhaps thousands of years, at length reappear, to add fertility to our fields, and to multiply the means of human subsistence.

Leaving, now, those sections of these microscopic forms of life which have been handed over to the botanist as properly belonging to the Vegetable Kingdom, we pass on to the true Animalcules. We have already seen, however, how vague and inappropriate is this term, as referring solely to the minute size of the organisms embraced by it, and in no degree marking their grade in the scale of being. The reader will not be surprised, therefore, to learn that this term is now discarded as of no value, while for the simplest of these truly animal forms which were originally comprehended by it, the name of *Protozoa* has been adopted; thus marking their position at the very base of the animal series, as the corresponding name *Protophyta* expresses the rank of the simplest forms of vegetable life.

Beginning our survey of the *Protozoa* with those lowest in the scale, we take the little Amœba (*Amœba diffluens*), formerly known as the Proteus, and famous amongst microscopical observers for its incessant change of form. This little creature is commonly to be met with at the bottom of ponds of clear water, and to the naked eye appears a mere animated dot of jelly. It is remarkable for the extraordinary simplicity of its structure, consisting wholly of a granular gelatinous substance named *sarcode*, and having neither head, nor mouth, nor stomach, nor special organs of any kind whatsoever. It has not so much even as an investing membrane or skin, its outer surface exhibiting no trace of any structure at all firmer in consistence than the rest of the body.

But although presenting thus scarcely any marks of distinct organization, the Amœba is by no means the dull and uninteresting creature that one would be apt to imagine. Its most obvious peculiarity, indeed, is the facility with which it incessantly alters its form; long finger-like processes being pushed out first from one part and then from another, the body of the animal meanwhile gradually flowing, as it were, into these divergent portions, and so progressing irregularly from point to point of the surface on which it rests.

One would suppose that an animal so exceedingly simple in structure, and so apparently helpless, would be a very inoffensive neighbour; but the truth is that, in its small way, the Amœba is quite a terror at the bottom of our ponds and ditches. Its special weakness in the matter of diet appears to be the Diatomaceæ; but nothing comes amiss: and, as it goes shambling along in its uncertain way, over the surface of the mud or the stems and leaves of the aquatic plants, it no sooner meets with any object suitable for food than it proceeds very deliberately to wrap its body around it, nor is the prize again relinquished until all its juices have been extracted, the entire surface of the animal taking part in the appropriation of the nutriment.

In another of these simplest *Protozoa*, closely related to the Amœba, the finger-like processes, or *pseudopodeæ*, as they are termed, take the form of simple threads, which radiate from the spherical body of the animal, and give it much the appearance of the "Rising Sun," as artistically represented on the signboards of our wayside inns; whence it is no doubt that the animal in question has received the appropriate name of *Actinophrys sol.* The Actinophrys is a far less vivacious creature than its protean ally, and rarely does much in the way of locomotion, while its filamentary pseudopodeæ are usually kept rigidly protruded. It is by these threads, however, that the animal secures its provender, and directly one of the number seizes hold of any minute object of a nutritious character, it forthwith begins to retract itself, and is presently joined by the neighbouring filaments, which coalesce with each other, and thus actually imbed the prey in their gelatinous substance before it has reached the surface of the captor's body. Once there, however, it is carried by means of an opening improvised for the purpose, into the interior of the body, whence the indigestible portions are in due

time pushed out, much after the manner in which they were at first drawn in.

The class of animals to which the Amœba and the Actinophrys belong, comprise two great divisions, in one of which the animals are simple, and in the other associated together in composite structures, forming, as it were, a common body, though it is not improbable that each segment of the composite animal still retains, to a certain extent, an independent existence. Most of the solitary kinds are lodged in a horny capsule or shell, which, in the different species, assumes a flask-like, bell-shaped, or globular form, through a narrow opening in which the enclosed animal projects its gelatinous pseudopeæ, whether in search of food or for the purpose of locomotion. The composite species are all enclosed in calcareous shells, which, though in most of the forms exceedingly minute, are yet of a very complicated structure, and exceedingly beautiful objects for the microscope. These shells are divided into a number of distinct chambers, and are perforated with numerous foramen, or holes, from which characters they derive their two technical names of *Polythalamia*, or many-chambered, and *Foraminifera*, or perforated, shells. The circumstance that these tiny structures consist of several chambers arranged in various spiral forms, like the shells of the Nautilus and its extinct allies, led to the belief at one time that the animals inhabiting them were microscopic members of the Nautilus family. But more accurate examination has shown that, unlike what is seen in the Nautilus, every chamber of these microscopic shells is inhabited; and that the occupant of each chamber is, in some sort, an independent being, which throws out its delicate filaments through the perforations of its chamber-walls, just as the Amœba does from the naked surface of its body.

All the Foraminifera are inhabitants of the sea, and in some parts they abound in such vast profusion as to be gradually producing extensive deposits of calcareous matter by the accumulation of their almost invisible shells. The remarkable elevation which stretches across the bed of the Atlantic, between Cape Clear in Ireland and Cape Race in Newfoundland, and which is now well known as the "telegraphic plateau," from the circumstance that it was upon this ridge that the Atlantic telegraphic cable was laid in the summer of 1858, appears to be thickly

covered with, if it does not in great part consist of, these infinitesimal structures. And Professor Baily, who has carefully examined the soundings brought up from this sub-oceanic table-land, states that they consist entirely of microscopic shells, without a particle of sand or gravel, and that with the exception of a small number of the silicious shells of the Diatomaceæ, the entire mass of the soundings consisted of the perfect calcareous shells of the Foraminifera; a fact which is all the more remarkable from the striking contrast it presents to the deep-sea soundings from the Pacific, before referred to, which are chiefly made up of the silicious shields of the Diatomaceæ.

But this is not all. In former epochs of the earth's history the Foraminifera existed in even greater profusion than at present: and their remains form the principal constituent of some important geological formations. In many of the tertiary strata they occur in the greatest abundance. "It may even be asserted," says Professor Ansted, "that the capital of France, as well as the towns and villages of the neighbouring department, are almost entirely built of Foraminifera." But it is in the chalk more especially that these minute shells chiefly abound; recent observations having shown that this material is everywhere, in great part, and in several districts almost wholly, composed of them, either still perfect, or nearly so, or else broken and ground down to a fine powder. Now, let the reader make an effort to realize this fact in respect to the chalk formation, as it is developed in England alone. Let it be remembered that this material occurs over nearly the whole of the south-eastern part of the island, and that in many places it has a thickness of several hundred feet,—and then let the reader form an estimate, if he can, of the number of these fragile and delicate shells which lie buried within our far-extending ranges of chalk hills.

But turning from these vast accumulations of the microscopic life of the ocean of the chalk epoch, let us come back again to our own ponds and ditches, and to the living wonders with which they abound.

One can hardly characterize as "pets" creatures so excessively minute as those with which we are now concerned; but if there be any one of the number which more than another deserves the name, it is, undoubtedly, the "Bell Animalcule" (*Vorticella*), a prime favourite with every owner of a microscope.

and one of the most curious of that restricted group of organisms to which the term Infusoria is now applied. It is a little bell of glassy transparency, with a broad and thick rim or lip, affixed by a sort of nipple to a slender filament or stem, eight or ten times its own length. The mouth of the bell is surrounded by a fringe of cilia, which can be withdrawn at pleasure, but which, when protruded, are kept in rapid play, producing a sort of vortex in the water, by means of which minute particles of alimentary matter are drawn into the mouth of the animal. The long, slender, and flexible stems of these beautiful animals are attached to the stalks or leaves of aquatic plants, where the Vorticellæ are frequently crowded together in such numbers as to cover the parts with what looks to the naked eye like a delicate white down.

When not disturbed, the little Vorticella stretches out its slender stem to the full extent, and turns gracefully about in the water, keeping its cilia meanwhile in constant motion. But on the least alarm, the cilia vanish, and the stem, with a rapidity which the eye can scarcely follow, is contracted into a beautiful spiral coil, so as to bring the bell close to the point of adhesion, when it again gradually uncoils to its full length. It is hardly possible to exaggerate the beauty of this spectacle, when a group of the Vorticellæ are viewed together by the aid of a powerful microscope. At first the little creatures are seen floating loosely through the water, most of them having their delicate stems fully extended, or showing only slight undulations, and the bells slowly roaming about, now turning the mouth, now the sides, and now the foot, to the eye of the observer: suddenly, however, and at the slightest tap, the entire throng start back, and before the eye is well able to discover what has occurred, the glistening bells may be seen closely nestling around the stalk of the plant to which their stems are attached, gently swaying from side to side, and beginning again to uncoil and stretch out as before.

The history and development of the young Vorticella are fully as curious and interesting as the habits of the mature animal. In all these microscopic beings the ordinary mode of increase is by the parent animal separating into two or more parts, each of which speedily attains to the dignity of a parent itself. In the Vorticellæ this process of self-division begins in a

gradual widening of the bell, which then assumes a globular shape, and next that of a flattened sphere; at which stage of the process a band-like constriction makes its appearance in the middle, and gradually increasing in depth, it at length separates the original animal into two, both of which still remain attached to the stalk. But as only one of the two is to remain in possession of this piece of joint-property, the subsequent development of the two animals is singularly dissimilar. In the one which is to retain possession of the original stalk, the upper extremity opens out into the regular bell-mouth form, around which the fringe of cilia are speedily seen in active motion: in the other, on the contrary, the upper extremity still remains closed, and the cilia are developed at the lower extremity near the junction with the stalk, from which the young Vorticella now speedily shoots away, a free, swimming animalcule. Its roving life, however, is soon over; for looking out a convenient spot for its future home, it speedily settles down, and attaching itself by what was at first the upper part of its body, it gradually rises on a stalk of its own, and in due time becomes a fully developed Bell Animalcule.

Another curious mode of reproduction amongst the Vorticellæ, as amongst some other tribes of these minute organisms, is by what is known as the encysting process. In this mode of obeying the injunction to "increase and multiply," the Vorticella withdraws the ciliated margin of the bell, and contracting itself into a cyst or purse, secretes a gelatinous covering, which gradually solidifies, and forms a sort of capsule within which the animal is completely enclosed. In this state it remains for some time, it may be only a few hours or it may be days, in the course of which the substance of the original animal becomes broken up, so to speak, into a number of minute oval bodies which move about with great activity within the transparent cyst. At length some portion of the cyst wall gives way, and the imbedded embryos suddenly shoot out into the water, where they become diffused, and give rise to a new generation of Vorticellæ.

She power of enclosing themselves in a cyst is sometimes employed by the Vorticellæ for the purpose of self-preservation, when the water in which they have been residing dries up. In such cases the enclosed animals are preserved from injury till the falling rain again fills the pool, and calls them back to active life;

or it may be, they are taken up by the wind with the dust which arises from the parched ground, and conveyed to great distances before they are again brought to the surface of the earth by the descending shower.

The Vorticellæ form altogether a very considerable family of animalcules, and present several beautiful varieties of structure and arrangement. In one section of the family the animals are grouped together on branched tree-like structures, composed of many individual Vorticellæ, each connected at the extremity of its spiral foot-stalk, and maintaining to a certain extent an independent existence, but all united at the base on one common stem. The members of another group, instead of being affixed to spiral foot-stalks, are seated in elegant crystal vases, attached to the stems and leaves of aquatic plants. The animal is united to his tube or vase only at the base, and can at pleasure protrude himself above its open top, or, in the twinkling of an eye, contract himself into a little shapeless ball at the bottom. It is not at all unusual to find two animalcules occupying a single case, this double occupancy being no doubt attributable to some little hitch or misadventure in the process of self-division. It is satisfactory, however, to know that, so far as can be ascertained, the original inhabitant and the half of his former self live very amicably together, and do their best to make each other as comfortable as may be under the circumstances.

In close companionship with the Vorticellæ we may often find some interesting relatives of theirs which we must now briefly notice. In the first place there are the *Stentors* or Trumpet Animalcules, so called from the trumpet-like form which they assume, and large enough to be seen by the naked eye. There are several kinds of these animals, which are distinguished from each other in part by their colour, one variety being little Ethiopians. They are very common in ponds and ditches, where they attach themselves to duck-weed, decaying reeds, and other floating bodies, around which they form a sort of slimy fringe. In swimming about, the Stentors contract themselves into the form of an egg, and row themselves along by the cilia which clothe the entire surface of the body; but when they attach themselves, they stretch out, and stand erect, like so many mimic trumpets. If a number of these animalcules be examined in a small quantity of water, they will often be seen to congregate,

and swim about in company, then apparently to take counsel together, select a particular spot, and all of a sudden attach themselves in a group, where they stretch up to their full extent and begin bowing and salaaming to one another in the most polite and courteous manner imaginable.

Next we have a division of these animalcules, in which the surface of the body is covered with an array of bristling spines and hooks, by means of which their owners creep and climb about amongst aquatic plants; in another group we meet with a singular apparatus, consisting of a circlet of bristles which surround the mouth, and has hence received the name of teeth, but which appear to be organs of prehension rather than of any sort of mastication. Another tribe presents us with animalcules having an oval body and a long flexible neck, which the little creatures throw into graceful curves, like so many microscopic Swans, after which, indeed, they are named, one species giving us a veritable representation of that *rara avis*, the "Swan with two necks!"

The Rotifera or Wheel Animalcules are, as we have already intimated, much more highly endowed than any of the preceding tribes, and excepting as to size, are not to be classed amongst the animalcules at all. But they are much too curious and interesting to be omitted from our survey of the various microscopic forms of life, and are therefore admitted here to the place which they occupied before their true position in the animal series was known. The discovery of the Rotifera was one of the earliest results of the application of the microscope to the study of these minute forms of life, nor is this at all remarkable, seeing that some of the species are as much as the twelfth of an inch in length, and readily discernible therefore by the naked eye.

It is perhaps even yet premature to assume that the true position of the Rotifera has been satisfactorily ascertained; but there can be no doubt that their true affinities are with the articulate sub-kingdom, in which they are now generally placed. The details of structure vary greatly amongst the different species; but in all of them it is exceedingly complicated, and shows a great advance upon the simple forms of life with which they were formerly associated. In all there is a more or less distinct head, furnished with eyes and a mouth, from which a passage leads to a powerful masticating apparatus, in close proximity to the stomach, from which, in many species, proceeds an alimen-

tary canal of a wonderfully complex character. The wheel-like organs from which the class takes its name are most characteristically seen in the Common Rotifer (*Rotifera vulgaris*), and in this case consist of two disc-like lobes at the upper extremity of the body, the margins of which are fringed with long cilia, the organs specially concerned in the apparently rotatory movement.

The singular appearance produced by the continued play of the Rotifer's cilia was for a long time a subject of inexplicable mystery to microscopical observers. It was as opposed to all known movements of organic structures as if a man's head should spin round incessantly on the top of his neck; and yet there seemed to be no possibility of doubting that the two circular organs of the animalcule did thus revolve. After long and careful observation, the source of the illusion became apparent. The supposed wheels were found to be mere circlets of delicate cilia, which bending and unbending in rapid succession, like a field of corn on a windy day, gave rise to that wheel-like rotation which had proved such a fruitful source of perplexity and doubt.

The Common Rotifer and its nearest allies swim freely through the water, rowed along with considerable rapidity by means of their ciliated lobes. They have the power, however, of attaching themselves at pleasure, and at the lower extremity of the body they are provided, for this purpose, either with a cup-like sucker, or with a pair of minute forceps, by means of which they seize hold of the stems and leaves of aquatic plants, and rest for a time from their more active exertions. But, fixed or free, it matters little to the Rotifer, for he has but to set those paddle-wheels of his in motion to produce a vortex in the water, which brings him food in abundance; and you can rarely light upon one whose cilia have been long at work in capturing, or rather collecting, prey, without finding that its masticatory apparatus also is busily employed tearing and pounding away at the mass of food with which its exertions have been rewarded.

Many of the Rotifera are fixed to one spot throughout the entire period of their lives, and amongst these sessile forms are to be found by far the most beautiful species which the race includes. One of the most elegant of these is the *Stephanoceros Eichornii*, which inhabits a delicate gelatinous tube, like the straight glasses used by the confectioners, to the bottom of which it is

attached by a long pedicle or foot-stalk, above which is the body of the animal, of an oval form, and surmounted by five long tentacles, beset with tufts of bristly cilia. This beautiful Rotifer is of common occurrence, attached to aquatic plants, in ponds of clear water, and seen with a good light it is an object of which the observer never grows weary. More curious, perhaps, but less beautiful, is another of these sessile Rotifers, which inhabits a tube built up, particle by particle, by its own unwearied industry. The *Melicerta ringens* is a born brick-maker, and no sooner starts in life as a respectable stay-at-home member of the great Rotifer family, than he proceeds forthwith to build himself a house in which to spend his days. The first step in the process, it appears, is to exude from the body a delicate gelatinous cylinder to serve as a sort of framework on which the more substantial structure is to be formed. This accomplished, the brick-making skill of the Melicerta is at once in request. Beneath a projection on the animal's head there is a small disc-like organ, which, when the ciliary lobes are in full play, revolves like the circular ventilator of a window. This is the brick-making machine; and the animal so modifies the direction of the ciliary currents, as to send into it most of the solid particles which are drawn from the surrounding water. Here they are worked up, probably with some peculiar glutinous secretion, and moulded into little globular pellets; and no sooner is each pellet completed than the animal bends down its head, and applying the pellet-disc to the edge of the tube, deposits the newly-formed brick in its appropriate place. The finished tube consists of many hundreds of such bricks, and as each of them usually occupies about three minutes in making, including the collection of the materials, it is obvious that the Melicerta has no small amount of work to get through before it can complete its dwelling. It makes no undue haste, however, and its work is finished off with a neatness and regularity which are truly admirable.

A very extraordinary circumstance connected with the Rotifera is their power of becoming revivified, after remaining for a considerable period dried up, and apparently dead, on being again moistened with a few drops of water. This extreme tenacity of life is so truly remarkable, that it has excited much attention, and led to many curious experiments. Fontana, an Italian naturalist, kept a number of the animalcules for two years and

a half in dried sand; yet, in two hours after the application of rain-water, the greater part recovered life and motion. Some experimenters have been of opinion that the Rotifera may be really deprived of life, and kept in that state for many weeks, and yet be again restored to animation. Ehrenberg, Humboldt, and all eminent philosophers, however, entirely repudiate this idea; and, quite apart from such testimony, we may be perfectly assured that the mysterious principle of life, no matter how minute the beings in which it has resided, is never once really extinguished without passing irrecoverably beyond all human means of recall, into the care of Him to whom alone belong "the issues from death."

Our hasty survey of the microscopic life of the globe would be imperfect without a passing reference to the various minute organisms which are found floating around us, *unseen*, in the atmosphere. In greater or smaller quantities, the atmosphere always contains these invisible living atoms, their elevation from the earth's surface being sometimes effected by winds, at other times, probably, by ascending vapours. At times vast clouds of these beings are raised into the air, and carried by winds many hundreds of miles from the districts where they originate, rendering the atmosphere thick and heavy, and covering every object on which they fall with what appears to the naked eye a fine impalpable dust. In this manner myriads of forms, both of animal and vegetable life, are dispersed over the earth, and places before sterile and lifeless are converted into abodes of teeming and busy populations.

And now let us prevail upon those of our readers to whom the subject of this Chapter may be to any extent new, to reflect a little on what has been brought before them. In spring and summer, for example, when they walk out by the sea-shore, and cast their eyes over the broad expanse of waters, let them remember that those mysterious depths are peopled with myriads of these minute beings, each as perfectly formed, and as beautifully adapted to the part it has to perform in the economy of nature, as the most exalted of organisms. In rambling, too, among green and shady woods, by fragrant hedgerows, or out upon the breezy heaths and open commons, everywhere let them recall the same fact, that, wherever they see, if it be only a few drops of standing water—in every ditch, and pond, and crystal pool—within and beneath all

that meets the eye—there are multitudes of these tiny creatures, living, as it were, in a world of their own, though equally cared for by Him to whom there is neither great nor small. In view of these facts, we may well say with one of the most eminent of living philosophers, "If the astronomer be led from the contemplation of the countless orbs that traverse boundless space, to the adoration of the Creator in His almightiness, so the observation of the perfection of His minutest works, which, though invisible to ordinary ken, unfold new perfections with every increased power of observing them, ought to impress us with a lively sense of that all-caring-for and all-seeing Providence without whom not a sparrow falls to the ground, and by whom every hair of the head is numbered."

CHAPTER II.

A DISQUISITION ON JELLY-FISH.

"Those living Jellies which the flesh inflame,
Fierce as a nettle, and from that its name;
Some in huge masses, some that you may bring
In the small compass of a lady's ring;
Figured by hand divine—there's not a gem
Wrought by man's art to be compared to them;
Soft, brilliant, tender, through the wave they glow,
And make the moonbeam brighter where they flow."

Poets have rarely deigned to sing the praises of the Jelly-fish, which, perhaps, is one reason why there are so few popular errors to correct concerning them. It is somewhat strange, certainly, but the bay-leaves and the professor's gown seldom do well together. The silk is almost sure to suffer. Perhaps it is that that "fine frenzy" in which the poet's eye is wont to roll has something to do with the matter. But, be that as it may, the fact is clear, and we seldom even expect to find correct science "done into" verse. In the passage quoted above, however, the amiable author of "The Borough" has given us a noteworthy exception to the rule; and, in the compass of a few brief lines, has finely epitomized the leading points of Jelly-fish economy. Bear with us, good reader, the while we discourse to you for a brief space on these curious samples of ocean confectionery.

No one that has paid an occasional visit to the sea-coast can be wholly unacquainted with the Jelly-fish. They are amongst the most familiar objects to be seen in rambling along the shore; and, after violent winds, may often be met with, thrown upon the beach by the fury of the waves. In the calm bright days of summer, numbers of the commoner kinds may be seen gently flapping their way through the still water skirting the shore, their delicate and graceful forms alternately contracting and dilating as they propel themselves along, and sometimes only faintly discernible from the water itself.

It is hardly necessary to say, that the designation "Jelly-fish" is correct only in reference to the apparent nature of their substance, and not at all in respect to any supposed affinity between these animals and true fish. They constitute, in fact, one of the humblest tribes of sentient beings, and appear to come but just within the limits of organic nature. Cast ashore, they exhibit not the slightest sign of life, and often pass amongst fishermen as "sea-blubber." But by far the most general of the popular names under which the Jelly-fish are known, are those which refer to the property which many of them possess, like the nettle, of stinging the hand that touches them. Hence it is that they derive the names of "*stingers*," "*stang-fish*," and "*sea-nettles*," amongst ourselves, and that of "Orties de mer" along the coast of France. It was from this circumstance, also, that Aristotle bestowed upon them the term *Acalephæ*, the Greek word for nettle, which is still retained as the scientific designation of the entire class.

The ocean swarms with these animals, from the equator to the poles; and in the tropic seas the voyager often falls in with vast shoals of them, through which the vessel has to plough its way for many miles. At certain seasons of the year the Jelly-fish visit our coast in countless profusion, resorting principally to the bays and estuaries, whence stragglers are carried by the tides and currents to every part of the shore. In the year 1846, these animals suddenly made their appearance on several parts of our coast, in such extraordinary abundance as to embarrass the fishermen in casting their nets; and, after remaining for a while, they at length disappeared as mysteriously as at first they came. It is only as an occasional haunt, however, that these frail and delicate creatures approach the land; their proper home is the open sea, where, driven by wind and wave, or wandering at their own sweet will, they roam the pathless waste, basking in the sunbeams by day, and at night lighting up the waves with their brilliant phosphorescent fires.

One of the most remarkable things in connection with these animals is the extraordinary character of their composition. Nearly all the commoner kinds consist almost wholly of water. The only thing besides water which the most careful examination of their structure reveals, is an exceedingly small quantity of filmy tissue, which, in the living animal, forms an intricate

network of cells for the retention of the fluid part of its substance. Constituted in this manner, the Jelly-fish are of the most fragile and evanescent character. No sooner are they removed from the water, and no matter how carefully, than their delicate tissues become ruptured, and the contained fluid drains away, so that at the expiration of a few hours, of the whole bulky mass of trembling jelly, nothing remains but a thin pellicle of film, scarcely to be distinguished from an ordinary cobweb. It is a common amusement with boys on some parts of the southern coast, where these creatures are generally known as "water-blobs," to catch the smaller varieties, and hold them in the hand, while they thus gradually melt, as it seems, away. Dr. Carpenter states that large specimens, weighing, when first taken from the water, from fifty to sixty pounds, are reduced to a thin coating of filmy web, weighing scarcely as many grains. And what adds to the wonder is, that the fluid which escapes is in no way to be distinguished, even when submitted to chemical analysis, from ordinary sea-water.

Mr. Patterson, in his "Introduction to Zoology," relates an amusing case of a farmer, who had been in the habit of employing his men and horses in carting away from the sea-shore large quantities of Jelly-fish for the purpose of manuring his fields, and who, happening one day to hear a lecture in which the structure of these animals was explained, was not a little astonished to find, that in every ton of "sea-blubber," which he had been taking so much trouble to obtain, the entire amount of solid matter was scarcely more than he could carry home in one of his coat-pockets.

In none of these animals, so far as is yet known, is there anything like a distinct nervous system. Some few investigators have imagined that they could detect the presence of nervous threads or filaments, but the suspicion has never been verified, and the physiologist still ranks the Jelly-fish with the animals whose nervous matter, if they have any, is indistinct and beyond our powers of discovery. Respiration, too, is carried on by means equally obscure; the probability being, that all the air required for the purpose is separated from the sea-water as it freely passes through the channels of the body. In some species there are some small red spots around the margin of the body, which are regarded as rudimentary eyes, although it is by no means certain that they are endowed with the power of vision. It is

said, however, that some of the smaller kinds have been observed to shun a bright light, and to sink into deep water to avoid it; and our own schoolboy experience assures us that they are quite capable of "dodging" the hand that attempts to grasp them in the water.

In all the more typical forms of Jelly-fish, the body is more or less hemispherieal in shape, with the margin in some species simple, in others beautifully scolloped; while in many cases the animals are furnished with numerous long filaments, tubular tentacula or suckers, and a pedicle or proboscis, depending from the under surface. The stomach, in the form of a simple cavity, usually occupies the centre of the body, and has a small aperture immediately below, answering the purpose of a mouth. In some species, however, the stomach occupies the thickest part of the pedicle; and, instead of a mouth, the creatures are provided with suckers, having minute orifices at their extremities, through which they imbibe their nutriment, as plants do by means of their roots. Stranger still, there are some of these animals in which neither mouth nor stomach can be detected, the invisible food being absorbed by the countless pores with which the body itself is perforated, and in some mysterious manner, appropriated, it would seem, by all parts of the structure alike,

Any one unacquainted with the habits of the Jelly-fish would be apt to form a very erroneous idea of their real character and disposition. Possessed of such a singularly delicate and beautiful frame, we should be disposed to credit them with all that is innocent and amiable, whereas they are in reality distinguished by qualities of a totally opposite charaeter. Frail and lifeless as they seem when cast upon the shore, in their own proper element the Jelly-fish are powerful and destructive, and, in proportion to their size, may fairly be ranked amongst the most rapacious inhabitants of the ocean. By far the larger number of them subsist on living prey, and many of them upon animals far more highly organized than themselves. Even crabs and fish readily fall victims to their attacks; the horny mail of the one tribe, and the shelly armour of the other, being alike ineffectual for safety, when once the captive is enfolded in the graceful marauder's soft embrace.

Nor is it the larger species only which are thus rapacious and destruetive. Professor Forbes thus speaks of the truculent

behaviour of some specimens of a small Jelly-fisn not larger than a lady's thimble, which occurs around our northern coasts :—"Being kept in a jar of salt water with small Crustacea, they devoured these animals, so much more highly organized than themselves, voraciously,—apparently enjoying the destruction of the unfortunate members of the upper classes with a truly democratic relish. One of them even attacked and commenced the swallowing of a *Lizzia octopunctata*, quite as good a Medusa as itself. An animal which can pout out its mouth twice the length of its body, and stretch its stomach to corresponding dimensions, must indeed be a 'triton among the minnows,' and a very terrific one too. Yet is this ferocious creature one of the most delicate and graceful inhabitants of the ocean—a very model of tenderness and elegance."

In worthy Philemon Holland's version of Pliny, there is a passage descriptive of the predaceous habits of the Jelly-fish, which has about it an air of such exquisite drollery that we can hardly help suspecting the dear old fabulist was purposely caricaturing what he professes to describe :—"I verily, for my part, am of opinion," says he, "that those which properly are neither beasts nor plants, but of a third nature between or compounded of both (the sea-nettles, I mean, and sponges), haue yet a kinde of sense with them. As for those Nettles, there be of them that in the night raunge too and fro, and likewise change their colour. Leaues they carry of a fleshie substance, and of flesh they feed. Their qualitie is to raise an itching smart, like for all the world to the weed on the land so called. His manner is, when he would prey, to gather in his body as close, streight, and stiffe as possibly may be. He spieth not so soon a silly little fish swimming before him, but he spraideth and displaieth those leaues of his, like wings; with them he claspeth the poore fish, and so deuoures it. At other times he lies as if he had no life at all in him, suffering himselfe to be tossed and cast too and fro among the weeds, with the waues of the sea : and look what fish soeuer he toucheth as he is thus floting, hee sets a smart itch vpon them, and whiles they stratch and rub themselues against the rockes for this itch, hee sets vpon them and eates them. In the night season he lieth for sea-vrchins and scalops."

It is amongst the true "stang-fish," of course—those, that

is, which possess the power of stinging—that we meet with the most formidable animals the class includes. Only a comparatively small number of the Jelly-fish apparently are endowed with this property, although there is good reason to believe that these much-dreaded species are widely spread. The poisonous fluid with which they are armed is so powerful in its effects, as speedily to deprive the prey of every means of escape, torpifying all its faculties, and causing it to lie paralyzed and motionless, completely at the mercy of its destroyer. The long trailing tentacles of some species are endowed with this venomous property equally with the body itself, and form a most efficient set of organs for the capture of prey. No, sooner, indeed, does some luckless fish but come in contact with one of these delicate appendages, than it is immediately arrested in its movements, and made to writhe with agony ; the other tentacles meanwhile coil and twist around it, emitting the pungent fluid at each fresh point of contact, and speedily reducing the victim to a state of perfect quiescence, when the tentacles slowly contract, and bring the prize within reach of the mouth.

It must be obvious that animals of this sort are best known by man himself at a respectful distance. The reader may judge what kind of companions they make at close quarters from the following notice of one of them by Professor Forbes :—"The *Cyanœa capillata* of our seas is a most formidable creature, and the terror of tender-skinned bathers. With its broad, tawny, festooned, and scolloped disc, often a full foot and more across, it flaps its way through the yielding waters, and drags after it a long train of ribbon-like arms, and seemingly interminable tails, marking its course when its body is far away from us. Once tangled in its trailing 'hair,' the unfortunate who has recklessly ventured across the graceful monster's path too soon writhes in prickly torture. Every struggle binds the poisonous threads more closely around his body, and then there is no escape ; for when the winder of the fatal net finds his course impeded by the terrified human wrestling in its coils, he, seeking no contest with the mightier biped, casts loose his envenomed arms, and swims away. The amputated weapons, severed from their parent body, vent vengeance on the cause of their destruction, and sting as fiercely as if their original proprietor itself gave the word of attack."

The organs concerned in inflicting this "prickly torture," are threads of extreme tenuity, which are coiled up in minute capsules that occur in great abundance in the tentacles of the Jelly-fish and in various parts of the body. The slightest pressure causes the capsules to burst, when the liberated threads shoot out with amazing rapidity and force, piercing the object of attack, and conveying into the wounds they inflict some subtle poisonous fluid with which the animals are supposed to be armed.

Most of the Jelly-fish which commonly frequent our own coasts belong to the *Medusæ*, which may be regarded as the most typical division of the class. The animals belonging to it are distinguished, for the most part, by the possession of an umbrella-shaped disc, by the alternate expansion and contraction of which they propel themselves through the water. From the trivial circumstance that these movements of the disc have a resemblance to the heaving of the chest in respiration, the Medusæ have received the name of *pulmonigrades*, or lung-movers. It is only in calm weather, however, that the feeble strokes of the disc avail the Medusæ for the purpose of locomotion: during the prevalence of high winds the animals either descend to the tranquil depths, or, remaining near the surface, are driven helplessly along, and not unfrequently are cast in myriads upon the shore.

A considerable diversity of form obtains amongst the Medusæ, notwithstanding their general points of resemblance. Mr. Gosse compares them to the glass-shades of the gas-lights which show so conspicuously in the shop windows on a winter evening; and, so far as it goes, the comparison is a good one, only it does not convey an adequate idea of the great variety of shapes which the Medusæ assume. In some species the disc is only slightly convex, and the animal, when seen floating calmly in the water, has the appearance of a mere circular patch of jelly. In others, again, the disc rises proudly in the shape of a beautiful translucent dome, or assumes something approaching to the elegant pointed form of the Turkish minaret, while various leaf-like processes hang from the interior, and long thread-like filaments stream from numerous points around the circumference. Many of the smaller species are like thimbles, both in size and form; while others have the appearance of beads or berries, except

that neither bead nor berry was ever seen of such perfect grace and beauty as these tiny Jelly-fish display. In size the Medusæ differ from one another still more than in form, the group including the largest as well as the most minute of all the Jelly-fish. A huge creature (*Rhizostoma Cuvieri*), which is occasionally thrown upon our own shores, measures three or four feet in diameter; and in the warmer seas, individuals of this size are by no means uncommon. Then, at the other extremity of the scale, there are species so minute as to be truly microscopic, and which swarm in the ocean to an extent perfectly inconceivable.

The Medusæ are separated into two groups or divisions, distinguished from each other by the presence or absence of certain delicate membranes or hoods, which in some of the species are found covering the eye-like spots, already referred to, around the margin of the body. No one has so carefully investigated the structure and habits of the naked-eyed Medusæ as the late Professor Edward Forbes, and, in the splendid work from which we have already quoted, he has given us an elaborate and philosophical, though no less popular, account of the British species of this division of the Jelly-fish. Some day, perhaps, a second Edward Forbes may arise to give the world a monograph of the covered-eyed Medusæ; but for the present that work is a desideratum, and our knowledge of the animals is somewhat meagre and obscure. One of the members of this group is that unwelcome visitor to bathing-places, whose unamiable qualities have already been referred to; another is the *Medusa aurita*, the common Jelly-fish of our coasts, about whose early history we shall have a strange story to tell by-and-by; and a third is the beautiful *Chrysaora hyoscella*, a species by no means uncommon around the southern coast, and one which, with its delicate amber tints, and its long trailing tentacles and elegant furbelowed arms, arrests the attention and excites the admiration of the most incurious of seaside visitors.

The naked-eyed Medusæ also comprise some very beautiful forms. Few of the species are of large size, and some are extremely small. One little fellow, *Oceania globulosa*, is not larger than a pea, and, seen in its native element, a very pretty pea it makes. Another of these tiny Jelly-fish is *Turris neglecta*, not uncommon in the Solent and around the Isle of Wight, and which, sporting in the water, is "brilliant as a bud of

brightest coral." The rapacious little democrat before alluded to, *Sarsia tubulosa*, is also one of the naked-eyed fraternity, and is not without its beauty. But the very pink of perfection in that line is a little fellow, *Modeeria formosa*, found around the Hebrides, and which, though scarcely larger than a split pea, appears to have gone a great way towards turning the head of the worthy Professor who chronicles its discovery. It is, without question, a beautiful creature; but whether its beauty is best indicated by saying that "it is gorgeous enough to be the diadem of the smallest of sea-fairies, and sufficiently graceful to be the nightcap of the tiniest and prettiest of mermaids," may admit of a doubt; although assuredly the enthusiastic Professor may be allowed to describe his own discoveries in his own style.

One of the commonest and most characteristic of the Jelly-fish of the next section—those, namely, which make their way in the world by means of cilia, and are hence known as *ciliogrades*—is the *Cydippe pileus*, a gay and active little creature, and a great favourite with naturalists, who have appropriately named it after one of the sea-nymphs of old. It is impossible to watch this graceful little rover without being struck with admiration at the vivacity and sprightliness of its movements. Of a globular, but slightly elongated form, and about the size of a large bead, the Cydippe dances gaily through the water, its delicate gelatinous body, faintly blue in colour, glistening in the sun, while the rapid play of its cilia scatters the rays of light in lovely rainbow tints about its path. The apparatus by means of which the Cydippe thus speeds its way along, circled with glory, consists of rows of minute cilia, arranged side by side, in the form of broad flat plates, upon eight firm bands, which run from pole to pole of its body, like the meridian lines of a globe. Each of these bands, with its thirty or forty rows of cilia, one above the other, has an appearance something like that of the paddle-wheel of a steam-boat; but, unlike what is seen in that cumbrous contrivance of man, locomotion is effected, not by the revolution of the wheel, but by the separate motion of each of the paddles. Every one of these delicate organs is endowed, in fact, with the property of separate and independent motion, and over the whole of them the little Jelly-fish has the most complete control. It can retard or stop their movements at pleasure, and by arresting the play of one or more rows,

whilst the remainder continue in rapid vibration, it is enabled instantly to change the direction of its course, and to wander through the waves at will.

Nor is this all. In addition to its belts of paddles, the Cydippe is furnished with two long tendril-like appendages beset with delicate filaments, which issue, at the lower part of its body, from two deep cavities, into which they can be completely withdrawn with great rapidity. Sometimes the little fellow may be seen joyously glancing about in the water with both these organs entirely concealed from view, but only a few moments probably elapse before they are shot out to four or five times the length of the body, and while the delicate processes along their course uncoil and twirl about, the tendrils themselves are flung into an endless variety of beautiful curves, with an air of elegance and grace perfectly indescribable.

Not the least curious circumstance connected with this interesting Jelly-fish, is its odd and very original method of procuring food. It might be thought that with no eyes to see, and no special organs for the capture of prey, it would be hard put to it to obtain a living. But, no! It seems to have not the slightest care or concern about the matter, and manages to secure a plentiful supply of provender almost without an effort, and when apparently it is intent upon gaiety and pleasure alone. The fact is, the cavity which forms the Cydippe's stomach perforates its body almost from pole to pole, while the orifice at the lower extremity can be opened or shut at pleasure. All the little fellow has to do, therefore, when in want of food, is to incline its body forward, and keep its mouth wide open the while it dances through the water, by which means a continuous stream of the fluid is caused to pass into the stomach, hurrying along with it, of course, whatever spoil it may chance to contain. In this most convenient manner, the tiny shrimps and other Crustaceans upon which the Cydippe feeds are brought within its power, the mouth closing, of course, the moment a prize enters, and securing it as in a living trap.

It appears from the observations of Mr. Patterson that these—

> "Gay creatures of the element,
> That in the colours of the rainbow live,"

are endowed with a tenacity of life somewhat remarkable for

animals of their class. On one occasion this gentleman cut up a Cydippe, that had been cast ashore in a shattered condition, into portions so minute that one piece of skin had but two cilia remaining attached to it, yet the vibration of these organs continued for nearly a couple of days afterwards. On another occasion he tells us, a Medusa, about as large over as a sixpence, caught hold of a Cydippe confined in the same glass with it, and when at length the little creature had regained its liberty, it was found that the Medusa had cut away a piece fully equal to a sixth of the entire bulk of the body; yet the Cydippe seemed quite unconscious of the mutilation, and evinced no diminution of its activity or its enjoyment!

The same writer states that he once placed some specimens of a species somewhat larger than the little Cydippe of which we have been speaking, in a glass-jar on the chimney-piece, and that their bodies were so transparent that the blossoms of some flowers, which were also there, were distinctly seen through them. "It was impossible," adds Mr. Patterson, "to look upon these bright-tinted blossoms of earth, and on those colourless, yet not less delicate children of ocean, and not feel that *both* must have enjoyed the guardianship of Him from whom all their loveliness was derived;—that He who had for ages preserved the flowers from perishing by frost, or wind, or rain, had likewise saved the Beroës from destruction amid the wild tempest of the ocean."

Another example of the Ciliograde Jelly-fish is the rare and beautiful *Cestum Veneris*, or Girdle of Venus, a resplendent creature resembling a long flat ribbon of translucent glass, some five or six feet in length, by about as many inches in width. The habits of this remarkable animal are but little known, although its affinity to the present group of Jelly-fish is clearly ascertained. Its body is of a delicate gelatinous consistence throughout, and is fringed at the margins with a double row of countless cilia, which, as in the case of the Cydippe, produce when in motion a succession of the most brilliant colours. At night the Cestum is said to glow in the watery depths with peculiar splendour, and to resemble, as it winds its way along, an undulating belt of flame.

In the Jelly-fish of the next section we meet with a peculiarity of structure entirely new. The group is but a small one, and all

the animals belonging to it are distinguished by the possession of a delicate cartilaginous plate, which forms a sort of skeleton or support to the soft gelatinous body. In the majority of this order the body is an oval or circular disc, and has depending from its under surface numerous appendages, termed cirri, by which the animals move through the water, whence the entire order has received the name of *Cirrigrades*. A far more interesting and effective apparatus for locomotion is found, however, in some of these Jelly-fish, in the shape of a thin membrane or sail, which rising from the upper surface of the body, and supported by a sort of mast, is acted on by the wind, and drives the little voyager along, a very "ocean Mab" and "fairy of the sea." Large fleets of these elegant creatures are sometimes met with in the warmer latitudes, gaily scudding before the gentle breeze, in compact order, and presenting a spectacle of singular interest and beauty.

One of the commonest of these sail-bearing Jelly-fish, and one which, during the prevalence of high winds, is occasionally thrown upon our own shores, is the *Velella lata*, in which the disc is of a fine blue colour, and has the cartilaginous plate in the form of a dorsal shield, with the delicate sail-membrane rising obliquely from its centre. The sail is set to the dorsal shield, much in the same fashion as the lateen sail of the Malay boat to the deck, and hence the *Velella* commonly passes amongst sailors as the "Sallee-man." A drawing of this attractive little creature has been made by Professor Allman from the living Jelly-fish, "which sat, or rather *floated*, for his likeness," says the worthy Professor, and "was one of a fleet of countless multitudes which, in the autumn of 1836, was driven upon the coast of the county of Cork. On the subsidence of the gale, which had been blowing strongly from the south-west, the coast for miles round was strewn with the remains of the shipwrecked fleet." In another division of the Jelly-fish, the crest or sail is furnished with muscular bands by means of which it can be raised or lowered at pleasure—a circumstance which has procured for the entire group the very appropriate designation of "bargemen." One of the number is a curious little fellow, which, by the lofty rounded form of its body, has earned for itself the appellation *mitrata* (mitred), although, if it have any ecclesiastical leanings at all in the matter of shape, it approaches most nearly, perhaps,

to that of the odd-looking crimson skull-cap of his Eminence the Cardinal.

All the Jelly-fish of this division have the stomach in the form of an inverted flask, hanging from the under surface of the body, with the mouth at its lower extremity. The cirri immediately surrounding the mouth are adapted rather for prehension than locomotion, and while some of the members are busily employed in seizing the minute prey, others are engaged in holding small shells and stones, the ballast neeessary to trim the little vessel as it calmly sails along the surface of the deep.

The fourth and last section of the Jelly-fish includes the animals which Cuvier termed *Hydrostatic acalephæ*. Aecording to the elassification now adopted, they constitute the order *Physograda*, so named from the inflated air-bags with which they are provided, and by means of which, in part at least, they effect locomotion. In this section of the Jelly-fish we entirely lose the circular radiate strueture, by which the previous orders are distinguished, and have, instead, a sort of lateral symmetry or correspondence between the two sides of the animals composing it.

A well-known member of this division is the *Physalia pelagica*, or Portuguese-man-of-war of sailors. The body of this singular Jelly-fish consists of a large pear-shaped air-bladder, beautifully tinted with blue, green, and crimson. It is surmounted by a fringed crest or sail of the richest purple, and has depending from it a cluster of variously-shaped tentacles, some of great length, and employed in the capture of prey; others short, tubular, and terminated by suckers through which the Physalia, destitute of a true mouth, imbibes its food. This food eonsists, it is said, principally of small fish; and the long tentaeles by which they are caught are truly formidable implements. Aeeording to Dr. G. Bennett, they can be coiled up within half an inch of the air-bag, and then suddenly shot out to the length of twelve or eighteen feet, twining round and round the body of the prey, paralyzing it by means of their acrid secretion, and then contracting so as to bring it within reach of the tubular suckers.

On one oeeasion Dr. Bennett captured some speeimens of the Physalia, which had several small fish entangled in their tentaeles; and by plaeing them immediately in a large vessel of sea-water, the process of feeding by absorption was distinctly observed. The tubular suckers were soon seen to be filled with

portions of the fish, which imparted to the almost transparent coats of the suckers a distinct silvery hue, as though they had been injected with mercury. Dr. Bennett made several careful dissections to ascertain whether these tubular suckers terminated in any common receptacle, or organ at all analogous to a stomach, but no trace of anything of the sort could be found; so that there can be no doubt that these suckers form the Physalia's only digestive apparatus.

With a view to ascertain whether there was any truth in the current opinion as to the stinging powers of the Physalia, Dr. Bennett once seized hold of a specimen by the distended bladder; but he paid a heavy penalty for his daring. The animal at once drew up its long slender filaments, and, entwining them about the hand and fingers which held it, inflicted severe and pungent pain; adhering, at the same time, so tenaciously, that it was only with great difficulty they could be torn off piece by piece. The pain, moreover, extended upwards along the arm, and continued to be felt throughout the day.

As in the case of the *Velella*, vast shoals of the Physalia are often encountered in the tropic seas, where the surface of the ocean is frequently crowded with their bright and glittering forms over an area of considerable extent. Mr. Gosse, in his "Letters from Alabama," has an interesting account of an immense fleet of this interesting Jelly-fish, which he encountered at the entrance to the Gulf of Mexico. They were of all sizes, from an inch to a foot or more in length; and they studded the smooth surface of the sea as far as the eye could reach; the vessel, indeed, was nearly a whole day in getting clear of them. It often happens that in passing just under the lee of a vessel, the sudden lull, caused by the interposition of the ship between it and the wind, causes it for a moment to lie flat on the water, instantly afterwards resuming its upright position. The English Jack-tar, it seems, takes this "dousing its sails," on the part of the "foreigner," as a fitting act of homage to the British flag. It is commonly said, that should danger threaten the Physalia while thus wafted along on the bosom of the deep, it can at once contract its sail, expel a portion of the contents of the air-bladder, and descend in security to the depths below. But this seems to be a mistake. All who have examined the animal in a living state concur in the statement that it has no apparent means of discharging the con-

tents of the air-bladder; nor is it possible, even by the application of pressure, to force out the contents, excepting by bursting the bladder itself, and producing an explosion. And that the animal has not the power of descending in the water, at pleasure, seems to be proved by the fact that numbers of them are sometimes found on the shore, thrown up by the violence of the waves. Professor Owen mentions that he has seen a whole fleet of them wrecked on the coast of Cornwall, to which iron-bound region they had been buoyed by their air-bladders.

Naturalists have been sadly puzzled what to make of another section of these animals, known as the *Diphydæ*, or Jelly-fish of a double form. They are diminutive little creatures, and composed of two pieces which easily separate, and when detached, will swim about independently for hours together. Hence arose the difficulty whether to regard these compound bodies as two animals united into one, or as one animal which, for a time, might be separated into two. Cuvier, and most zoologists following him, adopted the former opinion, regarding the two pieces as two independent animals. It has lately been very satisfactorily shown, however, that the two pieces do, after all, constitute but one animal, although our knowledge of these singular creatures is still very incomplete. Considerable diversity of form prevails amongst them, and frequently, also, between the two portions of the same animal. They are so beautifully transparent as to be almost invisible in the water, and occur chiefly at great distances from the shore in the seas of warm climates, where they abound in great profusion.

Nothing connected with the Jelly-fish more truly deserves to be characterized as wonderful than what has of late years been discovered with respect to their mode of reproduction. Two distinct modes of increase have been ascertained to prevail amongst these animals—one by the development of eggs, the other by the process of budding, or gemmation. According to the latter mode, which was first observed by Sars, a Swedish naturalist and clergyman, the young Jelly-fish sprout from the bodies of their parents like the leaf-buds of a plant, and after attaining to a certain stage of advancement, become detached, and swim away, to enjoy a free and independent existence.

The singularity of this mode of increase is apt to be under rated, because of the insignificance of the creatures amongst

which it obtains. But Professor Forbes, in his elaborate work before quoted from, helps us to estimate the oddity of the process, by supposing it to be observed amongst animals somewhat more bulky, and higher in the scale than Jelly-fish. "Fancy," he says, "an elephant with a number of little elephants sprouting from his shoulders and thighs, bunches of tusked monsters hanging, epaulette-fashion, from his flanks, in every stage of advancement. Here a young Pachyderm, almost amorphous; there one more advanced, but all ears and eyes; on the right shoulder a youthful Chuney, with head, trunk, toes, no legs, and a shapeless body; on the left, an infant, better grown, and struggling to get away, but his tail not sufficiently organized as yet to permit of liberty and free action! The comparison seems grotesque and absurd, but it really expresses what we have been describing as actually occurring among our naked-eyed Medusæ. It is true that the latter are minute, but wonders are not the less wonderful for being packed into small compass."

No less than four species of Jelly-fish found around our own shores have been observed to reproduce their kind in this manner; one of the number being the graceful little *Sarsia gemmifera*, in which the young brood may be seen sprouting from the stomachal pedunele of the parent.

It is to the development of the ova of the Jelly-fish, however, that the chief interest pertains, the germs being now ascertained to pass through a series of the most remarkable transformations before assuming their mature form.

The extraordinary history which follows is that of the common Jelly-fish of our own coast (*Medusa aurita*) which every visitor to the sea-shore must have often seen, and will at once recognize by the four pinkish rings in the centre of its almost colourless disc. The eggs of this species are produced within the body of the Jelly-fish in regular ovaries—the rings above mentioned—whence they are transferred to a number of curious pear-shaped sacks, which are developed from the under surface of the arms which surround the mouth. Here they are retained for a time, and then, the sacks bursting, the embryos escape in the form of minute oval bodies, covered with cilia, and, to all appearance, a swarm of infusorial animalcules. In this state the young brood remains for some days, sporting gaily in the water, and subsisting apparently in just the same manner as the creatures they so

closely resemble. In due course, however, one end of the germ begins to contract, and gradually is developed into a sucker-like base, whereupon each of the little creatures attaches itself to some fixed object, and becomes for a while settled and stationary.

And now a new character is assumed. The cilia, no longer needed, disappear. A cavity is formed at the upper extremity of the body, and, gradually deepening and enlarging, it becomes at length a capacious mouth; around this four arms sprout forth, which being soon succeeded by four more, and these by another four, we have at length—from the egg of a Jelly-fish—an animal, which is to all appearance an ordinary hydra-form Polyp!

Nor is it in form alone that the correspondence holds: the disguised Jelly-fish actively discharges all the functions of Polyp life, twirling its arms about to entrap prey, gorging the prey it secures, and ejecting the indigestible parts of its food through the mouth, precisely as is done by the Hydra itself. It has, moreover, all the Hydra's power of renewing lost parts, and reproducing the entire body from a single portion; and, lastly, it multiplies itself, as do the true Polyps, by buds or gemmules, so as often to produce a whole colony of similar beings; add to all which, that the creature has been known to remain in the Polyp state for nearly two years, and no one can wonder that it should often have been mistaken for an animal in its mature form, without the remotest suspicion of its true character.

After the lapse of a considerable interval, however, important changes take place, and the extraordinary nature of the seeming Polyp gradually becomes apparent. The body lengthens; its skin begins to shrivel; ring-like depressions appear around it; and in a little while the entire Polyp seems as if cut into a number of horizontal sections or slices, which turn up at the edges, and present the appearance of a pile of watch-glasses standing one within the other. Tentacles now grow out from each of the upturned edges, and the several sections become less and less firmly attached to each other. In one or two days more, the connection between the different sections altogether ceases, and one by one, beginning at the top, they swim off, and become a brood of young Jelly-fish!

It is upon these remarkable facts, and others of a like character, observed in the reproduction of some of the compound zoophytes, that Steenstrup, a Danish naturalist, has founded his

novel doctrine of "Alternation of Generations." According to this doctrine or hypothesis, the successive stages of advancement through which certain of the lower forms of life pass, are to be regarded, not as different phases of a process of metamorphosis or transformation, like that of the caterpillar into a butterfly, or the tadpole into a frog, but as *distinct generations*, in which the parent animal produces an offspring totally unlike itself, but which begets a progeny that returns in form and nature to that of the original stock; so that, as the originator of the idea himself puts it, the maternal animal does not meet with its resemblance in its own brood, but in its descendants of the second, third, or fourth degree of generation.

The question which this hypothesis opens up is a much larger one than can be properly discussed here; nor is it possible, perhaps, in the present state of our knowledge, satisfactorily to explain all the facts which relate to it. It must be borne in mind, however, that the facts themselves are already fully established, and that whatever interpretation may be put upon them, they must undoubtedly be ranked amongst the most wonderful phenomena which recent investigations in natural history have brought to light.

Reference has already been made to the luminosity of some of the Jelly-fish. There is reason to believe that all these animals are endowed with the property of emitting light; and it is mainly to their agency that we owe the beautiful phenomenon known as "the phosphorescence of the sea." "When on a summer's evening," says a writer before quoted, "the waves flash fire as they break upon the shore, or glow with myriads of sparks as they curl and froth around the prow of the moving ship, or under the blade of the striking oar, it is to delicate and almost invisible Medusæ that they chiefly owe their phophorescence." It has never been clearly ascertained what organs are concerned in the production of this phosphoric light, nor has the most careful examination ever availed to detect the secretion itself, although there can be but little doubt that the animals are enabled to exhibit the phenomenon at will. In many of the species, the phosphorescence may be evoked when the animals are kept in confinement. "On being touched or otherwise irritated," says Mr. Gosse, "they suddenly become illuminated, the light appearing in rings or circles of luminous points, which alternately

flash and die like gas-jets on a festive gala night." The phenomenon is most frequently witnessed when the surface of the sea is ruffled by some gentle breeze, dead calms and very rough weather being alike unfavourable to its production.

It is well described, as seen around our own shores, by Sir Walter Scott in his "Lord of the Isles:"—

> "Awaked before the rushing prow,
> The mimic fires of ocean glow,
> Those lightnings of the wave;
> Wild sparkles crest the broken tides,
> And, flashing round the vessel's sides,
> With elfish lustre lave,
> While far behind, their livid light
> To the dark billows of the night
> A gloomy splendour gave."

Over all parts of the ocean alike the waves are lit up at times with these animated fires; but in the warmer latitudes the spectacle assumes an aspect of extraordinary sublimity and splendour. "Between the tropics," says Humboldt, "the ocean simultaneously develops light over a space of many thousand square miles. Here the magical effect of light is owing to the forces of organic nature. Foaming with light, the eddying waves flash in phosphorescent sparks over the wide expanse of waters, where every scintillation is the vital manifestation of an invisible animal world." According to the enthusiastic accounts of voyagers, the appearance of the ocean on these occasions is grand and beautiful as it is possible to conceive. Far as the eye can reach, the crest of every wave, which during the day is white with foam, becomes transformed by darkness into a swelling ridge of light, while here and there, where the billows dash with greater violence, the spray flies up, sparkling and glittering like a shower of stars, and falling again, is lost in a sea of effulgence. Occasionally, too, while the more minute forms of the Acalephæ produce this diffused luminosity at the surface of the ocean, the larger kinds are seen below, illuminating its mystic depths—some gleaming through the water with a pale and steady light, like submerged moons, others glowing with dazzling brightness, like balls of molten metal, or shooting by like the fiery meteors of the heavens above.

CHAPTER III.

INSECTS, AND THEIR HUNTERS.

"—— Is not the earth
With various living creatures, and the air
Replenished, and all these at thy command
To come and play before thee? Know'st thou not
Their language and their ways? They also know
And reason not contemptibly; with these
Find pastime."

The readers of the "Tatler" will remember that in one of the famous lucubrations of Isaac Bickerstaff, Esq., the study of the insect tribes is held up to ridicule in the person of a certain *virtuoso*, one Nicholas Gimerack, who having spent a large fortune in making a collection of insects and other "natural rarities and curiosities," at his death bequeaths the accumulated treasures to his family and friends. In his lifetime the "whimsical philosopher" is made out to have set a greater value on a collection of spiders than on a flock of sheep, and to have sold his coat off his back to purchase a tarantula; while in the details of the will, which is given entire, the satire is carried to its height by the absurd gravity with which the poor enthusiast is represented as distributing his trifles in the immediate prospect of death.

It was thus that the wits, in days gone by, made merry with the poor *savants* who gave their attention to the insect world; and though many and marvellous changes have taken place since the time when the "Tatler" and the "Guardian" made their appearance, damp from the printing-office, on the breakfast-tables of our forefathers, there has been but little change in the popular estimate of the dignity or advantage of entomological pursuits. The opinion of most men is still pretty much what Addison gives us as his judgment on the subject, that "observations of this kind are apt to alienate us too much from the knowledge of the world, and to make us serious upon trifles;" a

result, he goes on to say, which "exposes philosophy to the ridicule of the witty, and the contempt of the ignorant."

In one respect the entomologist is no doubt a much more tolerated character now than formerly. He may hoard up the treasures in his cork-lined cabinets with never so much care, and may even make away with a "considerable estate" in getting them together, and yet incur no risk of being exposed to public ridicule as another Nicholas Gimcrack. But this immunity is granted him only so long as he keeps his predilections to himself, without exposing them openly to the eye of the world. The man who would venture abroad, net in hand, in pursuit of his favourites, must still expect to be looked upon by the majority of mankind as a sort of lunatic at large, who is allowed to have his own way only because his whim is an innocent one, that does no harm to his neighbours.

It is given to but few amongst us to bear with equanimity the pity or contempt of our fellow-creatures; and it is not surprising that many persons have been deterred from the study of entomology by a fear of incurring the penalty attached to it. But, in spite of this drawback, the science has long had a devoted band of adherents, and within the last five or sive years their number has considerably increased. It would appear indeed that the study of the insect tribes is at length becoming extremely popular; for the entomologists are fast growing to be an important body, and now have not only an Annual of their own, but a small weekly newspaper, the "Entomologists' Intelligencer," which is conducted with much spirit, and regularly chronicles all the noteworthy observations and doings of the body.

This result is in great part, no doubt, attributable to the republication, in a cheap and compact form, of the famous "Introduction to Entomology," by Kirby and Spence, a book which, for now nearly half a century, has been a standard authority on the subject. It is almost impossible to read this engaging volume without becoming enamoured of the study of the little creatures whose habits and instincts it details; and the rapidity with which the new edition has been sown broadcast over the land may reasonably be expected to produce before long an abundant crop of incipient entomologists. But it is not young people merely who are taken captive by the book; we have lately met with two instances in which it has exerted a similar

influence over persons in advanced life, and devoted to pursuits which it would be supposed were little calculated to leave room for any enthusiasm on behalf of insects. In one case an erudite black-letter friend of ours, who has recently been exploring, and with good results, among the Syriac MSS. of the British Museum, was so delighted with the book, on dipping into a copy which accidentally fell in his way, that he straightway purchased one for himself, read it with avidity, and has since become a most attentive student of insect life. The other instance was that of one of our most popular metropolitan clergymen, who, having had occasion to refer to the book for the elucidation of some passage of Scripture relating to insects, was so deeply interested in what he read, that he publicly recommended the work from the pulpit, with a warmth of commendation which somewhat surprised his hearers. The truth is, that, to a person who has never before given attention to the subject, the reading of Kirby and Spence opens the eyes to a new world of interest and beauty, which appears to be only the more wonderful from the circumstance that it has been so long unheeded.

There can be no doubt that one of the great attractions of entomology lies in the fact, that it thus invests with an attribute of wonder the most common and familiar objects. The little creatures that have crossed our path a hundred times, and which we have before regarded merely as so many sources of injury or annoyance, all at once become transformed into objects of great interest, astonishing us by the variety and beauty of their structure, and, at the same time, exciting our admiration by the wonderful instincts with which they are endowed. It is a great advantage, moreover, in the study of this science, that the objects of investigation are everywhere accessible. No one need lack the opportunity of observing and studying the habits and history of some members of the insect tribes. Much may be done without stepping beyond one's own threshold ; and the possession of a garden, even though it be no bigger than the extraordinary six-feet-square enclosures so designated, which one sometimes sees attached to suburban Cockney cottages, opens up to investigation more wonders than most men would be able to explore in half a lifetime. Nor is it merely in verifying the observations of others that the beginner in the study may employ himself. There is no branch of natural history in

which there is more room still left for original research, or in which such research is more likely to conduce to the general advancement of the science. It has been said, indeed, that the field of entomology in Britain is already fully explored; but no idea could be more erroneous. Not only are new facts in the economy of insects already known continually being discovered, but every year is adding to our list of native species a considerable number of insects not previously recognized as indigenous to the British Islands.

Before proceeding further, it may not be amiss to remind our readers that all are not insects which are insects called. The entomologist takes no heed of a number of little creatures which popular phraseology everywhere assigns to his care. The more precise and discriminating knowledge of the present day cuts off large sections of the animal world, which naturalists themselves, the great Linnæus included, formerly ranked with the insect tribes. The "Model" insect is an animal which, in its mature form, has a body separated into three distinct regions, six legs, two antennæ or feelers, and one or else two pairs of wings. Let the reader make prisoner for a time of the first House Fly that settles on his nose, and he will see that the gentleman corresponds to the description we have given. The Common Wasp, a Cockchafer, or a Butterfly, would answer the purpose equally well, and would also show how wide the range of variation may be, while still preserving the same general typical form. It is only in their mature or perfect state, however, that insects exhibit these distinctive characteristics, and before that mature form is reached, they have, for the most part, to undergo a more or less complete series of transformations.

Nothing in the whole range of natural history excites the wonder of the observer more powerfully than these transformations or *metamorphoses* of the insect tribes. "If," say Kirby and Spence in one of their most frequently-quoted passages, "a naturalist were to announce to the world the discovery of an animal which for the first five years of its life existed in the form of a serpent; which then penetrating into the earth, and weaving a shroud of pure silk of the finest texture, contracted itself within this covering into a body without external mouths or limbs, and resembling, more than anything else, an Egyptian mummy; and which, lastly, after remaining in this state with-

out food and without motion for three years longer, should at the end of that period burst its silken cerements, struggle through its earthly covering, and start into day a winged bird,—what, think you, would be the sensation excited by this strange piece of intelligence?" What indeed? And yet the supposed case differs but in matters of detail from the actual history of by far the larger proportion of the members of the insect world.

In some of the tribes the metamorphosis is only partial, and the insects which belong to them exhibit pretty much the same appearance, and lead an almost identical mode of life throughout the entire period of their existence. Amongst other tribes, the Moths and Butterflies especially, the reverse of this obtains; and no degree of familiarity with the subject is sufficient to destroy in the mind of a thoughtful person the feeling of wonder, and almost awe, to which the observation of the extraordinary changes which these creatures undergo gives rise. The interest of entomology as a study consists, to a great extent, in noting the endless variety of procedure amongst insects while preparing for, or actually undergoing, these transformations. The history of every individual insect, from the moment when the little caterpillar or grub makes its escape from the egg, through each subsequent incident and stage in its career, till it finally comes forth from the pupa, a winged denizen of air, is replete with interest to the curious observer, and could hardly fail to impress a devout mind with the sentiment expressed by Bonnet:—"It seems to me that I am at a spectacle where the Supreme Artist is hid behind the curtain."

Much misapprehension prevails as to the precise character of these insect transformations. And strangely enough, an error which was not altogether unnatural when the general subject of the embryonic development of animals was less perfectly understood than it is at present, is still propagated by some of the leaders in entomological science. The error to which we refer is thus stated by Kirby and Spence:—"A caterpillar is not, in fact, a simple but a compound animal, containing within it the germ of the future Butterfly, enclosed in what will be the case of the pupa, which is itself included in three or four more skins, one over the other, that will successively cover the larva." According to this notion, which is supported by several great names amongst the naturalists of

former days, the metamorphosis of an insect is nothing more than a repeated casting off of its external skin, the perfect insect existing all the while in its proper form, beneath and within its different external wrappers. But surely, as Professor Rymer Jones remarks, it can be no more necessary to suppose the pre-existence of so many skins in order to explain the moults of a caterpillar, and its subsequent changes to a chrysalis and a Butterfly, than to imagine that we ourselves have several skins one beneath the other, because, when the cuticle is removed by the application of a blister, a new layer of epidermis is again and again renewed. The error arises from a mistaken idea, that the metamorphosis of the insect is something singular and exceptional in the animal world, combined with a misconception as to the true nature of the epidermic investment. The proper explanation of the phenomena appears to be this, that the successive changes which the insect undergoes are, in principle, the same as obtain amongst most other creatures in the earlier stages of their existence ; and that the repeated moults and changes of form are due to the living skin or cutis beneath the external epidermis gradually developing itself, and expanding into variously-shaped organs, in accordance, in every case, with the law of being, if we may so speak, of each individual species. The popular notion is, no doubt, by far the most attractive of the two ; but, unfortunately, nature and truth do not always square with our ingenious fancies, which injure quite as often as they advance the cause of science.

Let us pass, however, from this somewhat dry and abstruse topic to the history of an insect familiar to all our readers, and which has long occupied the attention of naturalists.

The *Aphides*, or plant lice, the "green fly" of the gardener, have as wonderful a history as any members of the insect tribes ; and with a small expenditure of trouble our readers may trace the entire wonderful history for themselves. It appears that, in autumn, the swarms of Aphides which infest our plants are composed of both male and female insects, which, after pairing, and the deposition of the eggs by the females for a fresh brood, speedily die. In the following spring, as soon as the sap begins to flow, the eggs which have survived the rigours of winter are hatched, and a brood of fully-formed young lice is produced, which beginning immediately to pump up sap from the tender leaves and

shoots, rapidly increase in size, and soon come to maturity. In this state is it found that the whole brood, without a single exception, consists of females, or, let us say, of individuals capable of reproducing their kind. In a short time these animals give birth directly, and without the deposition of eggs, to a second brood of females like themselves, which again produces a third brood in the same way, and of precisely the same description; and this process goes on throughout the summer without the appearance of a single male insect. In the autumn, however, insects of both sexes are again produced, and the females deposit eggs, to continue the species in the same manner through the next summer.

This extraordinary mode of reproduction amongst the Aphides was first made known by Bonnet, who traced the development of nine successive generations of the asexual forms. In the same way Duvau subsequently followed the course of eleven generations; whilst Kyber, by keeping a colony of the insects in a warm room, continued this process of virgin reproduction for no less than four years.

It is no wonder that circumstances so truly remarkable should have excited great attention amongst naturalists, or that various theories should have been advanced to account for it. Réaumur indeed endeavoured to elude the difficulty altogether by asserting that Aphides were androgynous; while Leon Dufour referred the phenomena to spontaneous or equivocal generation. The true explanation in all probability is that suggested by Steenstrup, who gives the reproductive virgins the curious name of *ammen*, or wet-nurses, and treats the matter as a case of "alternation of generations." It is quite clear, however, that much has yet to be done before the matter can be regarded as settled, and any enterprising entomologist may, if he will, turn to good account the little vermin which batten on his geraniums and calceolarias, by still farther following up the subject.

Closely connected, and in many respects, no doubt, identical, with this anomalous mode of reproduction among the Aphides, is the phenomenon which has been designated *parthenogenesis*, or reproduction by virgins, which are indisputably true females. Professor Siebold, of Berlin, has greatly added to our knowledge of the insect wonders of this kind by his essay "On a True Parthenogenesis in Moths and Bees," a work which has been given to the English public in a translation by Mr. Dallas, one of our

ablest entomologists, and in which this extraordinary mode of reproduction is shown to obtain amongst the Silk-worm Moth, and some others; and also amongst the Honey-Bees.

In the classification of insects, the wings, which are the grand and characteristic endowment of the tribe, serve as the basis for their distribution into separate orders. It is not necessary here to go into the details of the classifications generally adopted, though it will not be out of place to mention briefly some of the more prominent divisions. The Moths and the Butterflies constitute the order *Lepidoptera*, or scale-winged insects; the so-called down or feathers with which the wings of these insects are clothed being nothing less than an almost infinite number of beautiful symmetrically-formed scales, attached to the membrane of the wing in regular rows, like the slates or tiles covering the roof of a house. "The shard-borne beetle" and his allies form the *Coleoptera*, or sheath-winged order; the said "shards," in all their endless variety, being literally the sheaths or shields under which the real organs of flight are neatly folded up when not on "active service." Bees, Wasps, Ichneumon-flies, and the like, have simple membranous wings, and are therefore the *Hymenoptera*; the Dragon-fly with its gauzy wings, the frail Ephemera and others of the kind, form the *Neuroptera*, or nerve-winged order; and so on—the number, nature, or degree of development of the organs of flight being the guide throughout for the arrangement of the mighty host of animated forms which constitute what is fitly termed "the insect world."

One of the few insects which do not readily fall into rank and file in the ordinary systems of classification is that little rogue often very well known where his acquaintance is never acknowledged, the Common Flea. *Pulex irritans* is his name, and very irritating fellows they are generally allowed to be; though that genial old lady, mentioned by Kirby and Spence, who thought them "the prettiest little merry things in the world," appears to have regarded them with great favour. It has often occurred to us, by the way, that the old lady in question must be the same that is referred to in another part of the "Introduction," who declared she could always hear when a Flea walked over her nightcap, and that it clicked as it went along, as if walking on pattens! If we may credit the statement of a very respectable matron of our acquaintance, the extraordinary summer of 1857 called forth these

little pests in great abundance, and rendered it a difficult matter to dislodge them from their quarters. Any one again afflicted in this manner would do well to remember the advice given by old Tusser in his "Points of Goode Husbandry:"—

> "While wormwood hath seed, get a handfull or twaine
> To save against March, to make flea to refraine:
> Where chamber is sweeped, and wormwood is strown,
> No flea for his life dare abide to be known."

But if that remedy should not suffice, it would not be amiss, perhaps, to eateh a few of the ringleaders, and make an example of them, by plying then with round shot, in the way Christina, Queen of Sweden, is said to have done with the Lilliputian piece of ordnance still exhibited to the curious in the arsenal of Stoekholm.

Not long since, at one of the meetings of the Entomological Society, Mr. Westwood exhibited what was described as a new species of Flea, of monstrous size, whieh had just previously been found in a bed at Gateshead. The name proposed for the monster was *Pulex imperator*, a style and title the perfect propriety of whieh was unquestionable for a monster twenty times larger than the Common Flea! It did not appear whether the stranger was a nondescript species imported from abroad, or a native Briton then first brought to light. In either ease the prospeet was not an agreeable one. The eommon Bed-Bug was a stranger amongst us onee, though in many of our London lodging-houses —we will of course assume that it is never seen elsewhere—it is now very literally a "terror by night;" and who was to say that this imperial blood-sucker might not get a footing amongst us? Fortunately we need be under no anxiety: a few months after the discovery was first announeed, Mr. Westwood again brought his gigantic Flea before the Entomological Society: this time, however, it was for the purpose of explaining that *Pulex imperator* turned out to be no Flea at all, but the mutilated body of a young Cockroach! The origin of the mistake was satisfactorily aceounted for, and the Imperial Flea was erased from the list of British inseets—a great loss to science, no doubt, but one which, domestically speaking, we can bear very complacently.

If there be any one insect which more than another deserves

to be called the universal favourite, it is surely the Honey-Bee. Little children sing about it in the nursery; it is an everlasting theme with those grown-up children the poets; and the philosophers find in it abundant scope for their profoundest study. It ranges at large over the new world as well as the old, everywhere known, and everywhere an object of interest, and even affection. "A bee among the flowers in spring," says Paley, "is one of the cheerfullest objects that can be looked upon. Its life appears to be all enjoyment; so busy and so pleased." And what a picture there is in that line of Keats'—

"A May bush with the bees about it;"

and in that other exquisite touch, humming the very sound, as well as painting the scene—

"—— The bees bustling
Down in the blue bells."

But it would be as impossible to insert here the thousand beautiful allusions to the Honey-Bee to be found in the poets of all time, as to go into the wonderful details of Bee history. Nor is it needful; for who has not read them again and again? With one choice and chaste, though seldom-quoted passage from Leigh Hunt, therefore, we will send the little fellow about his business—the business our fragment so prettily alludes to:—"Wax-lights, though we are accustomed to overlook the fact, and rank them with ordinary commonplaces, are true fairy tapers—a white metamorphosis from the flowers, crowned with the most intangible of all visible mysteries, fire. Then there is honey, which a Greek poet would have called the sister of wax—a thing as beautiful to eat as the other is to look upon; and beautiful to look upon too. What two extraordinary substances to be made by little winged creatures out of roses and lilies! What a singular and lovely energy in nature, to impel those little creatures thus to fetch out the sweet and elegant properties of the coloured fragrancies of the garden, and serve them up to us for food and light!—honey to eat, and waxen tapers to eat it by."

The proper place for this beautiful passage is surely not the author's "Table Talk," whence we take it, but amongst the other sweet and pleasant thing in that famous "Jar of Honey from Mount Hybla."

We have now something to say about the Honey-Bee's numerous kinsfolk and acquaintance. Novices in this matter will perhaps be surprised to learn that the Bee brotherhood is a very numerous one, something like two hundred species being found in Britain alone. If anybody desires to cultivate the acquaintance of this large circle, we recommend him to procure at once the "Catalogue of the Bees of Great Britain," by Mr. Frederick Smith, of the British Museum—a book which, though published in the official blue, and in fact, no less than in name, a catalogue, is yet so full of interesting facts, the fruits of some twenty years of loving study and observation, that it seems to have a perpetual hum of Bees about it, and sends the mind off perforce to the wide-spreading heaths and commons, all aglow with the "bonny blooming heather," where the air is ever filled with bee melody.

Next to the Honey-Bee, the best-known members of the tribe are doubtless the Humble-Bees, which are amongst the first to greet us in early spring. In Hampshire these insects are "Dumbledors;" in other districts "Bumble-Bees" and "Hummel-Bees;" while in Scotland the brown species are known as the "Foggie-Bee,"—no idea apparently existing that there is more than one species of that colour. The Humble-Bees are all social insects, and live in communities, consisting, as in the case of the Honey-Bee, of males, females, and workers, the number of individuals in each nest being small, however, in comparison with the teeming population of the hive, and never exceeding two or three hundred. The nests of these insects are for the most part constructed on the surface of the ground, in meadows, pastures, and open woods, the material employed being moss, when the builders can get it, and when not, any convenient material that comes to hand. Mr. Smith mentions a case in which a knowing "Foggie-Bee," being hard driven for material for her domicile, repaired to a stable, and gathering up little bundles of the short hair which had been curried from the horses, set about composing her nest entirely of horse-hair. In the case of some of the Humble-Bees, the nests are built under ground; and this difference in habit is marked, it seems, by a great difference in the spirit of the architects, for while the above-ground builders exhibit very little courage or pugnacity, the dwellers below defend their nests with much resolution.

The Solitary-Bees exhibit great diversity of taste in the matter

of house-building. In the pleasant pages of Kirby and Spence they stand arranged as Clothier-Bees, Carpenter-Bees, Mason-Bees, Upholsterer-Bees, and Leaf-Cutting Bees, to which ample list of Bee tradesmen Mr. Rennie, in his "Insect Architecture," very properly adds the Mining-Bees. These designations are of course somewhat fanciful, though there is sufficient foundation in fact to allow of their use; and there is this further resemblance between the human and the bee worker, that when, from local circumstances, one trade fails, or cannot be followed, the industrious insect can, as easily as the industrious man, turn his hand to another: the carpenter becomes mason, or the mason, miner. In the situations chosen for the construction of the nest, and the manner in which the nest is formed, there is an almost endless diversity. The Mining-Bees form their excavations very commonly in the sunny sides of cliffs and sandbanks, or in hard and beaten pathways—this latter fact having been noticed so long ago as the days of Homer. The Carpenter-Bees tunnel out old posts and railings, or the decaying trunks of trees. The Masons build their nests in the holes of trees and the cracks of walls, and sometimes in such curious places as the empty shells of snails, that lie half-buried in hedge-banks. Some of the smaller species tunnel out the pith of bramble stems; while others find a convenient abode in the hollow tubes of straw thatch. No place that can in any way be made available comes amiss; and he who "loves to hear the wild bees' hum," and follows them in their various haunts to study the details of their history, will often be struck with their strange and wonderful devices in obviating difficulties, and accommodating themselves to circumstances.

In the summer of 1857 we discovered a most singular habit in one of the Carpenter-Bees, which, so far as was known at the time, had never before been observed. The Bee in question is a little fellow, with a thin, elongated body, and rejoices in the name *Chelostoma florisomne*, which, however frightful it may look in entomological Latin, is both pretty and appropriate when rendered into English, as the "lip-mouthed flower sleeper." The first part of this name speaks for itself, and the second is thus explained:—Our little Bee is of a convivial turn, and is given to staying out at nights. Occasionally, therefore, of a summer evening, instead of returning home to the old post or rail in which his nest is

tunnelled out, it betakes itself, with some half-dozen boon companions, to a capacious dandelion, and there makes a night of it. The darkness coming on—the flower, of course, shuts up; and then the boozy company, huddled up together, have to pass the night as best they can. In early morning, when the flowers are first opening to the sunshine, you may often light upon these little knots of topers, in that stupid, half-awake condition which plainly warns you they have had a jovial night. The thing is of constant occurrence, and hence the name the little tipplers bear.

Now for our discovery, which relates, indeed, to another and still stranger manner in which this little Bee sometimes passes the midnight hours. In searching along a hedgerow one afternoon, we came upon a spot where a number of small Bees were flying about a dead bush of hawthorn, which had been thrust into the hedge to stop a gap. Looking closely at the dead and leafless bush, we were surprised at seeing a considerable number of the Bees impaled, apparently, on the points of the thorns; but a nearer inspection showed us that the little fellows were voluntarily holding on to the thorn points with their mandibles, their bodies being held out straight and rigid, and their legs folded placidly beneath. Our presence seemed in no way to interrupt them, and continual fresh arrivals at the bush came and settled within a few inches of us. It was a curious spectacle, and we watched it intently. The little fellows all assumed their attitude of repose in the same manner, first alighting on a twig of the bush, then getting on the chosen thorn, with their heads towards the point, and when at the very extremity, turning themselves round, seizing the point with their mandibles, and stretching out their bodies straight and stiff. It was getting late, and suspecting the insects were settling themselves for the night, we visited the place again early the following morning, when, to our astonishment, the thorns were still bristling with Bees, that had apparently remained motionless throughout the night, still holding on by their jaws alone! We wrenched off a twig with a dozen of the Bees attached to it, and yet not one of them relaxed its hold: we held it up, swung it as we went along, and still they held on, and kept their bodies out as rigid as before!

Never having seen any record of this singular habit, we wrote to Mr. F. Smith on the subject, and he brought the matter before

the Entomological Society as a circumstance equally new to himself. Oddly enough, however, a few months later, Mr. Smith received a notice of similar observations on several allied species of these insects from M. Gueinzius at the Cape of Good Hope, and twelve months after these observations of M. Gueinzius were published, and nearly two years after the publication of our own, Mr. Edward Newman inserted in the "Zoologist," a short note, in which he announces that he has been familiar with the fact for nearly thirty years. It seems, therefore, that, curious as it is, there is nothing absolutely new in this discovery of "Bees roosting by the mandibular process."

No order of insects perhaps exhibits a greater variety of forms and of corresponding habits than the *Coleoptera*, or Beetle tribe —not including, however, the so-called Black-beetle, that pest of most London houses, and of many country ones to boot, which in reality is not a beetle at all, but a near connection of the cricket and the grasshopper. In exchange for the "Black-beetle," the coleopterist claims the Glow-worm, which is his of right, with a good many of the "fire-flies" of tropic lands. It is now pretty well known that it is the female Glow-worm alone that lights up the little lamp to be seen in our hedgerows in summer, although the poets have very commonly assigned the function to the male, which is only slightly luminous, and is rarely seen. Thus Shakspeare has—

> "The glow-worm shows the matin to be near,
> And 'gins to pale *his* ineffectual fire."

Cowper also, in his verses on the insect, does the same—

> "'Tis power Almighty bids *him* shine,
> Nor bids *him* shine in vain."

And Rogers, in his verses on the fire-flies of the Tusculan groves, in his poem "Italy," gives us "him" and "his" throughout, in his references to our own Glow-worm. Both Montgomery and Moore, however, give the lady-beetle the credit that is her due, and assign the true reason for the display, when, as the former says, she lights her lamp

> "To captivate her favourite fly,
> And tempt the rover through the dark."

The light is most intense in those females which have only re-

cently emerged from the pupa state ; and on calm dewy evenings, in June or July, they may frequently be discovered wandering restlessly about in their favourite haunts—mounting the blades of grass and other slight eminences—twisting their bodies right and left—and flashing out their light into the darkness of the night, to signalize the roving males of the whereabouts of their situation.

The two sexes of the Glow-worm differ greatly from each other in appearance ; the female being a wingless, elongated, flat-bodied creature, possessed, however, of six legs, and in other respects very unlike a "worm ;" while the male is a true beetle, endowed with wings and wing-cases, and a pair of immense eyes, which are evidently intended to facilitate the discovery of his more brilliant mate. But those fine eyes are apt at times to deceive the gentleman, for he is easily lured by artificial light, and sometimes wings his way to swift destruction. We have two of these insects which flew to us one summer night while sitting with a lamp at an open window ; the little rovers having doubtless been attracted by what they mistook for an unusual display on the part of some fair lady.

It is a pity to say anything ungracious about a little creature so wrapped up in poetical associations and pleasant memories as the Glow-worm, and yet the truth must be told. It feeds, then, good reader, not on violets and primroses, not even on the common greenery of the hedgerows, but on flesh—the flesh of snails, and eats it most voraciously ! The Glow-worm strikes at the snail as it crawls along, and by repeated bites speedily paralyzes and kills its prey, which it then commences devouring, and seldom leaves for more than a few minutes until the whole of the body is consumed. The voracity of the little creature is extreme, and one may sometimes see four or five of them together in a snail-shell, feasting and gorging upon their prey, plunging their little heads and erected mandibles into the viscera of the snail, and continuing thus for hours together. And this fierce and ravenous little creature is the Glow-worm ! Well may we say with Mr. Douglas, "Let us draw a veil over the scene, and, as with some examples of human genius, be content with the ultimate lustre, without inquiring into the minutiæ of its origin and support."*

* The World of Insects : a Guide to its Wonders. Van Voorst. London

The attention of coleopterists has been a good deal directed of late years to a tribe of small Beetles, which are found in the nests of various species of Ants, by whom they are watched over and provided for with the greatest solicitude. The loves of the Ants and the Aphides having long been celebrated, and the connection between these Beetles and the Ants, in whose nests they are retained, appears to be of a very similar character, and scarcely less remarkable. It is extremely curious to observe the anxiety which the Ants manifest for the safety of the Beetles, when a nest containing any of them is disturbed. Immediately the covering of the nest is removed, the Ants seize the Beetles in their mouths, and run off with them to the interior chambers of the nest in great alarm: and if, in the confusion of the moment, one of the Beetles should chance to escape beyond the boundaries of the nest, some of the Ants, directly it is seen, set off in pursuit of the runaway, and bring him back—nor are they at all disposed to part with their burthen to the collector. The subject is by no means fully investigated as yet; but so far as is at present known, the Ants retain these Beetles, as they attend the Aphides, solely for the sake of the secretion they obtain from them. It appears that the Beetles are for the most part kept quite secluded from the outer world, and are wholly dependent for support on the Ants, who are said—rather fancifully we suspect—to feed them with the juices of flowers.

These Ants'-nest Beetles being but sparingly represented in most of our collections at present, the poor Ants have their establishments sadly tumbled about in the eagerness of collectors to secure specimens. The ardour of the search is considerably enhanced by the fact, that some of the species already found here are extremely rare, and that it is quite possible others not yet known as British may turn up in a lucky moment. But if the prizes are great, the expenditure of time and trouble to secure them is not small. The instructions that are given as to the proper mode of securing these pigmy treasures, are rather discouraging. In order to go to work successfully, the first business is to convey a supply of large rough stones or bricks to the wood which is to be the scene of action; that done, three or four of the stones are to be placed around the sloping sides of every ant's nest, and then your traps are laid. Now visit the nests as often as possible—distance of course not to be thought of: tie your

trouser-legs and coat-sleeves tightly about your ankles and wrists, and turn up the stones. If the objects of your search are to be had, they will be found on the under surface of the stone, or beneath it. If not successful with one stone, or one nest, try another, and another, and still another. In the search after rarities, patience is indispensable, for not more than one nest in twenty contains beetles; and in the case of special rarities, the collector may have to wait for years before his eyes are gladdened by the sight of the long-desired prize.

If any reader should fancy he could improve upon this "patient" system by opening up the Ants' nests, and prying narrowly into their recesses, let him beware. In the first place, the Ants themselves would resent this procedure in a fashion not comfortable to the collector; and, in the second place, so great would be the ire of the whole brotherhood of beetle-catchers, that the innovator, if detected in the act, would be in danger of a ducking in the nearest horsepond. The truth is, that by upsetting the Ants' nests, the Ants themselves are destroyed, and all possibility of future profit from them taken away. It is like killing the goose that laid the golden eggs. In France, moreover, this wanton destruction of Ants' nests is now strictly prohibited for another reason. The proprietors of woods, and others interested in the preservation of game, discovered that the reckless proceedings of the entomologists threatened speedily to extirpate the Ants, and thus to deprive the young pheasants and other game birds of their chief source of subsistence. On this account, an interdict has been laid upon all further entomological havoc. Let all collectors, therefore, either adopt the "patient" and "laborious" system described above, or leave the Ants'-nest Beetles alone.

The great body of the collectors of insects in this country give their attention more or less exclusively to the single order *Lepidoptera*. The Butterflies and Moths are so much more gaily coloured than most other insects, and make such an attractive display in the drawers of a cabinet, that it is no wonder they hold the first place in popular favour. In the literature of entomology, too, these insects hold the first rank; the splendid works that are devoted to their illustration more than eclipsing all that are published on all the other orders put together. The grandest book of this sort yet published is Dr. Herrich-Schaffer's

great work on the "Lepidoptera of Europe," completed only two or three years since, and now to be had in six quarto volumes for the sum of thirty pounds! No less remarkable in its way, however, is Mr. Stainton's "Natural History of the Tineina;" a work which, though elucidating only one section of small moths—those, namely, allied to the Clothes-Moth, and which are for the most part much smaller even than that little depredator—is yet published in four different languages—English, French, German, and Latin—printed in parallel columns, and in illustrated octavo volumes, of which there will probably be upwards of twenty before the series is complete!

The little Moths which are thus being honoured with a polyglot history, and portraits executed in the highest style of art, are amongst the most beautiful, and, in the details of their private lives, the most interesting members of the entire lepidopterous order. In the larvæ state they are very generally what are termed "leaf miners," the minute caterpillars living on the fleshy pulp of leaves, between the under and the upper skin, where, like the students of our Inns of Court, they eat their way, producing those white blotches and tortuous lines so often seen on the foliage of plants by the way-side. There is, however, an almost endless diversity of habit among these "micro" larvæ, some species feeding externally, others in rolled-up leaves, others again patching out for themselves little cases from the old clothes in our cupboards, or the linings of our sofas; while several species creep, snail-like, over old walls and palings, in cases constructed of bits of grass or particles of earth. Some of these case-bearing larvæ, besides eating the soft pulp of the leaf, make use also of the skin itself, out of this constructing their conical teat-like cases, in which they wander about, always in danger, apparently, of having their houses toppling over, and looking the oddest little creatures imaginable. It is wonderful, too, to notice with what careful instinct these little tent-dwellers spin down their cases to the surface of the leaves, when about to moult or pass into the pupa state; though Messrs. Kirby and Spence, with a love for the marvellous which is always apt to carry them astray, have in one instance singularly misunderstood the nature of this precautionary measure. "The caterpillar of a little moth," we are told, "knows how to imitate the air-pump, producing a vacuum, when necessary for its purpose, without any

piston beside its own body;" the simple fact being that the caterpillar in question spins down its case a little firmer than its fellows, though by the same means, and without in any way imitating the action of the air-pump.

It is due to the historian of the Tineina, before passing away from his protégés, that we should make mention of his eminent services to the cause of entomology. No one living has laboured more arduously than Mr. Stainton on behalf of the science he loves so well; and though, as we have before intimated, the new edition of the "Introduction to Entomology" has greatly contributed to the present increased popularity of entomological studies, it is in a great measure to Mr. Stainton's previous exertions that the republication of that work is due. In his capacity of editor of both "Annual" and "Intelligencer," Mr. Stainton is exerting a wide-spread and powerful influence over the rising race of entomologists; and though it is very probable he may have amongst his readers many more mere collectors than earnest students of insect economy, it will not be his fault if, with repeated wise counsels and intelligent advice, they do not all become entomologists worthy of the name.

One thing which greatly pleases us in Mr. Stainton is, that, while he can be precise and technical when occasion requires, he has yet the knack of infusing a genial pleasantry into all his writings, and with a keen relish for the beauties of nature himself, contrives very happily to set them forth for the benefit of his readers. In the little volume, "June," most appropriately called "A Book for the Country in Summer Time," there are many passages which bear out what we have said; and that our readers may judge for themselves, we will insert here a little word-picture from another source, which, though meant for children, has about it a charm that older people will admire. It is one of the passages from the "Educational Sheet of Butterflies" which should find a place in every schoolroom and nursery:—

"It is the summer-time, the pleasant, happy summer-time. The lattice cottage-window stands open; the caged thrush sings merrily on the outside, half concealed by the bower of roses and honeysuckle. The good wife comes to the door, to see if her husband is yet returning for his mid-day meal. She glances round the garden, and spies, sitting on a marigold, a butterfly,

gorgeous with all the colours of the rainbow—in short, a peacock butterfly.

"Just then John puts his hand upon the gate. 'Oh, John, such a beautiful butterfly!'—'Where?' says John.—'There,' says Jane, pointing to the marigold, on which something like a leaf of a dull brown-black colour was sitting.—'Call that beautiful?' said John; and he lifted up a stone to throw at it.—'Yes, John; see, see!' and as she spoke it opened it wings, and again displayed its glories. It walked across the flower, turning round the while.—'It *is* beautiful,' said John; and he let the stone drop, half ashamed. They both stood watching the butterfly for some minutes, and saw it unfold its long spiral tongue to suck the honey from the flower.

"Presently another butterfly, much smaller, came to the very flower on which the peacock was sitting. The peacock rose to repel the intruder; but the new-comer, which was a small copper, and not a fourth of the size of the original occupier of the flower, was not to be easily intimidated, and fiercely gave battle. 'Eh! there's pluck for you,' said John.—'True,' said Jane; 'I wonder at the impudence of the little creature.' But the battle was ended; the peacock had gone into a neighbour's garden; and the small copper returned in triumph to the marigold, and displayed its splendid livery of burnished copper, now seen in all its glory, as the sun shone brightly from behind a cloud. John took more notice of butterflies after that day."

A small matter, reader, truly; but is there not a glow of sunshine upon it?

The Small Copper and the Peacock, however, beautiful as they are, belong to the commonalty of the butterfly tribe, and may be had almost everywhere, and without much trouble. It is just the same with some others that are equally pretty, as, for example, the Common Blue, and the dainty Orange Tip, not to forget the showy Alderman or Red Admiral, which, in their favourite haunts, may be found in abundance throughout the country.

Not so is it, however, with others of the number; and great is the flutter amongst the green gauze nets when the season approaches for any of the rarities to appear. The reader may judge of the excitement that obtains amongst collectors when anything particularly "good" is to be had, by the following announcement, taken just as it stands, from one of the numbers of the "Intelligencer;"—

"LATEST INTELLIGENCE.

"*Colias Hyale* and *Edusa* have both just been captured near Bognor. Further particulars in our next."

Further particulars in our next! One could almost fancy it was the first intimation of some fearful railway accident; and it certainly does look like being "serious upon trifles." Still, the Clouded Yellows are fine butterflies, and those who know them, and how difficult they are in some years to obtain, will not be surprised at a little enthusiasm. One of the greatest prizes amongst our native butterflies is *Apatura Iris*, which occurs in the woods of the south. This is the insect of which Crabbe sings—

> "Above the sovereign oak a sovereign skims,
> The *purple emp'ror*, strong in wing and limbs;"

and, unfortunately for the collector, it is high up above the oaks and quite out of reach that the Emperor is most frequently seen. Like some other imperial personages, however, *Iris* is said to have a gross appetite, and has at times been captured while feasting on garbage by the side of muddy pools; and a case is recorded in which a collector captured no less than eighty of these insects, within a few days, by the simple expedient of nailing against the side of a house, in a wood where they occur, a bit of rabbit-skin and the wing of a bird! One would hardly have thought that such a commonplace device would have so gone to the heart of an emperor.

In collecting Butterflies, the course is easy enough, the collector having the daylight in his favour. But how shall he obtain the Moths, which, for the most part, fly only at night? Well, in the first place, he can collect the caterpillars, or dig for the pupæ, which he can do by daylight, and then rear his specimens, and so obtain them in a much finer condition than any he can get by other means. But the Moths themselves may readily be captured. The ingenuity of collectors has not only overcome the difficulty which the nocturnal habits of most of the tribe interposed, but has rendered it even easier to obtain the night-fliers than those that flit about by day. The first and principal device employed is that of "sugaring." The collector, armed with a mixture of sugar and beer, goes to the woods or

lanes, or stays at home in his own garden, and as the dusk draws on, spreads the tempting mixture in broad patches on posts, and palings, and the trunks of trees; and, before long, lo! the sweet aroma has reached the keen sense of the Moth community, who come forth from their secret hiding-places, and flock in troops to the spread-out banquet. But alcohol *is* alcohol, even to Moths; and when, after a while, the collector goes his round with his bull's-eye lantern, the *bon-vivants* who have been lured so easily to suck his sweets are boxed without resistance.

The revolution that has been wrought in our collections since this mode of capture came into use, has been extraordinary. Insects which were before accounted rare, are taken in abundance; and new species have been added to our list, which the cunningest collectors before had failed to capture.

But there is one tribe of Moths, containing some of our largest and most beautiful species, for which the sugared post has no attractions. They practise the most rigid total abstinence, and are never once to be seen amongst the alcoholic revellers. But the collector knows them, and their weak points too. For them he has the open window, and the lamp upon the table. Light now does what sugar failed to do before; and the collector will sometimes have a levee, in which fresh comers continue to arrive the whole night long. The largest of our native Lepidoptera, the great Death's Head Hawk-Moth (*Acherontia atropos*), is sometimes taken in this manner, and occasionally pays an unwelcome visit to houses, where his huge form and his ominous squeal spread terror amongst the inmates. In some places the street gas-lamps attract a considerable number of Moths; and one of Mr. Stainton's correspondents has lately been expatiating on the advantages to be gained from "making friends with the lamplighter."

Another method employed by collectors—a method which sometimes does what neither sugar nor light can accomplish—shall be given in the words of Mr. Douglas:—"In May the Fox-moth careers madly over the fields—now close to you, now out of sight; yet there is 'method in his madness;' he is fiercely in love, and is in search of his bride, who rests passively expecting his attentions, and good-naturedly or pettishly waiting till her lover's vagaries are over. Observe the spot he most affects, and by looking carefully, you will probably see his lady-love deep among the heather, or ascending the stems; then station yourself

Sugaring for Moths.

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near, and you will soon have a chance of catching the rover; but, as he comes like a whirlwind, it is most likely you will miss him if you strike too soon: the Fabian policy is the best, and you will succeed by delay." It is a common plan with the collectors in the north, when they have reared a female of the Fox-moth, or any of its allies, to take her to some locality frequented by the species, and, by means of her attractive powers, gain possession of many of her gallant admirers. The lady, of course, is safely secured from her suitors, who, with a marvellous power of discovering her whereabouts, come hurrying on from all points of the compass, and crowd about her cage perfectly regardless of their own safety. There are several of these wild, day-flying Moths, including the beautiful Kentish Glory (*Endromis versicolor*) the males of which may be taken by this means far more readily than by any other, though it generally happens that their headlong flight has considerably damaged their appearance.

In addition to these modes of capture, which the collector devises for himself, twice in the year, at least, he finds a glorious opportunity of adding to his store provided ready to his hands. The first of these comes with

"—— The satin-shining palm,
On sallows in the windy gleams of March,"

and the second, towards the close of autumn, when the ivy puts out its rich clusters of colourless blossoms. "Sallows" and "ivy," therefore, are most suggestive words to the collector of our nocturnal Lepidoptera, reminding him of occasions when, with little trouble, he may gain possession of several much-coveted species, not otherwise easy to obtain. The truth is, that the "palm" of the sallows, and the more ordinary blossoms of the ivy, not only attract the Moths in great abundance, but seem to have the same intoxicating influence over them as the prepared "sugar," so that the collector has but to go with his lantern after dark and beat the bushes over his net to make sure of a plentiful supply of incapables, from which he can select the prizes at leisure.

Nothing is more curious than the striking differences which obtain with respect to the area over which certain insects are

distributed. It has already been stated that some of our native Lepidoptera are to be had in almost equal abundance in all parts of the country alike, but there are several species whose range is just as restricted. Thus one of the Skippers—a group intermediate between the typical Butterflies and the Moths—is confined almost exclusively to a spot on the Dorsetshire coast known as Lulworth Cove; although it there occurs in such profusion, that Mr. Douglas once caught a hundred in about two hours, frequently taking five or six in his net at one stroke. But a far more curious case is that of a little Moth (*Boletobia fuliginaria*) that from its colour deserves the name of the chimney-sweep, and which has occurred in this country nowhere but in the metropolis, the only recorded localities for it being, of all places in the world, Blackfriars Bridge, Fleet Street, and a coal-cellar at Chelsea!

Between this extreme of restriction in range and the almost universal diffusion of our commoner species, there is every possible variation. The beautiful Hawthorn Butterfly, or Black-veined White (*Aporia crataegi*), is now one of our most local species; but some years ago it appears to have been widely distributed, and in the neighbourhood of London its caterpillars used every spring to do great damage to the fruit trees. Occasionally it happens that insects, which are usually accounted somewhat rare, make their appearance in great profusion. The Clouded Yellow already noticed is one of these; so also is the great Death's Head Hawk-Moth, which a few years since occurred in such abundance, that the pupæ were turned up by the hundred in potato-fields in all parts of the country. But a still more remarkable instance is that of the Convolvulus Hawk-Moth (*Sphinx convolvuli*), which, though almost unknown in the larva state, and generally an insect of rare occurrence, has yet on two or three recent occasions been taken in abundance all over the country; one specimen which fell in our own way, having been found one morning comfortably settled on the knocker of a street door in the classic region of Shoreditch!

The old collectors say that these seasons of profusion come round periodically, and they point to the lovely Painted Lady (*Cynthia cardui*) as an insect which swarms in this way every seventh year. Our own experience, however, would lead us to doubt the truth of this assumption; and, in so far as *Cardui*

herself is concerned, who, by-the-way, is a *bonâ fide* "beauty *without* paint," we have always found her far too coy and uncertain to be able to count upon her special appearance with any such regularity.

Gilbert White states that a little attention would enable an observer to distinguish the different species of birds by the character of their flight; and the same remark holds good of insects, but more especially of the Butterflies and Moths. The Skippers tell the story of their flight in the name they bear; and in the same way that gay little visitor to our gardens, the Humming-Bird Hawk-Moth has earned its name, its habit of poising itself over flowers, and the vivacity of its movements as it darts from point to point, giving it a striking resemblance to the tiny feathered gems of the American tropical forests. In the dusk of evening, the snowy Ghost-Moth oscillates to and fro over the tops of the long grass, in the fields and churchyards; and in broad daylight, in crowded city thoroughfares, the little Vapourer-Moth hurries wildly along in its zigzag path, and like that famous pig immortalized by Leigh Hunt, in his essay "On the Graces and Anxieties of Pig-driving," dances "up and down all manner of streets." The insect most famous for the elegance of its flight is the White Admiral, so named from an oblique white band which stretches across the sooty upper surface of its wings; and there is a story told of a veteran collector, who when no longer able to take the field afoot, used regularly to drive out to the woods and take his seat on a gate, where he could feast his eyes in watching the graceful evolutions of his favourite fly.

One day, perhaps, we shall see this old gentleman on canvas, "happy as a king;" and the picture will form a capital companion to that of the gouty Waltonian, muffled up in his bath-chair, plying the angle in a water-butt.

But we must pause. Let us say, in concluding, that the pleasures of entomology are only half enjoyed by the stay-at-home student. In order to know what the delights of the science really are, one must go forth afield, and study the busy tribes in their own proper homes; and there is this additional advantage in so doing, that, besides attaining his special object in observing or collecting insects, the entomologist enjoys, as few

others can, the beautiful scenes amid which he plies his vocation. It is quite true, as Gentleman Waife puts it, "Fortune and Nature are earnest females, though popular beauties; and they do not look upon coquettish triflers in the light of genuine wooers."

CHAPTER IV.

AN APOLOGY FOR SNAILS.

"An inadvertent step may crush the snail
That crawls at evening in the public path;
Yet, he that has humanity, forewarned,
Will step aside, and let the reptile live."

It will be better, perhaps, to begin by frankly confessing that we have ourselves a great partiality for Snails. We admire them, make pets of them, and feel rather pleased than otherwise; therefore, when they make themselves at home in our little back garden, which is very neat and pretty, the neighbours say, notwithstanding.

The admission we have made will be a very damaging one, no doubt, in the estimation of all grave, sober-minded people; and we are not sure that it is altogether politic to be so forward with the avowal. But as it is, we openly acknowledge the predilection. Nay, more than that, we are prepared to defend it; and make bold to assert that there is not one person in a hundred—always excepting, of course, market-gardeners and amateur floricultural monomaniacs—who, if he (or she) were better acquainted with the Snail fraternity, would not regard them with something more of kindly tolerant feeling, even if they did not go the length that we do, of positively admiring them.

The truth is, we have been so led away by prejudice and foolish antipathy against the little familiar things that are constantly before our eyes in fields, and gardens, and hedgerows, that we assume, as a matter of course, there can be nothing worth knowing about them; and if they at all incommode us, or do the slightest harm to our possessions, they are straightway doomed to a pitiless extermination. But surely it is high time that we began to understand these matters a little better. If there be one thing more than another that the researches of our

savants and philosophers have taught us of late years in respect to natural history, it is that there is, so to speak, nothing "common or unclean" in Nature's works; and that, if we only use our eyes to see it, we may often find more of interest and beauty in the little and unheeded objects at our feet, than in those that men have gone to the ends of the earth to obtain. Who ever dreamed what a world of wonders there is in the strip of shore laid bare by every ebb of the tide, till Johnston, and Forbes, and Gosse pointed it out to us? And, to go a little further back, could anybody ever have imagined that the insect tribes would furnish the material for such a treasure-house of pleasure and of profit as that dear old "Introduction to Entomology" by Kirby and Spence? And so it is all through the animal series; in the most familiar and insignificant members of it there is still much to surprise and gratify—to wonder at and admire.

But, not to deal too much in these generalities, let us return to our subject, and affirm, that the Snails, much despised, be-kicked, and be-crushed as they have been and are, do really deserve more considerate treatment,—to be got rid of undoubtedly, if their rations are of consequence, but still to be looked at and understood. Our partiality for the race has led us to study their history, their curious structure, their habits, and general economy; and not satisfied with the British representatives of the family, we have tried to pick up some information with respect to the Snails of other lands, and especially those of the "glorious tropics," where the family has its head-quarters, and puts on a very imposing appearance. The reader will bear with us, perhaps, for a brief space, while we discourse to him on these matters—in no very serious vein, of course; but still so as to make good our position, that your little, despised Mollusc is worthy of attentive consideration.

We will open the case by claiming for the Snails the respect that is always accorded to old and long-established families. There were Snails before the Flood—before Adam even—in those far-remote eras of the past, when the lower orders of the animal creation had the world all to themselves. The family seems to have "come in" somewhere about the time when the huge Dinotherium wallowed in the rivers of central Europe; and it is not at all improbable that some of the earliest members of it

may have banqueted on the self-same herbage which sustained the enormous bulk of that unwieldy monster. Later down, in the classic days of Greece and Rome, the Snails were not only known, but held in great repute, and regularly had the honour of appearing at the tables of wealthy epicures, fresh from contact with a silver gridiron. It was in those days, indeed, that the tribe derived the family name by which it has ever since been known—*Helix*, a spiral, being the name that was given to the dainty morsel; while the same term, metamorphosed into *Helicidæ*, now stands, all the world over where the science of Zoology obtains, as the distinctive appellation of the wide-spread family. All that by the way, however: what we want to impress upon our readers is, that if there be any honour attached to long descent and distinguished connections, then that honour can fairly be claimed by the Snail family.

It may be as well, too, to observe at once, that though the representatives of the family which make themselves at home in our fields and hedges have nothing particularly attractive in their appearance, that is not by any means the case with those branches of the family that reside abroad. In "foreign parts" there are Snails to be found as far exceeding our own in delicacy and beauty of colouring as there are birds and insects that excel in brilliancy the winged tribes of our woods and fields.

But these gaily-coloured individuals belong, of course, to the rich pastures and the sunny skies of tropic regions; and we do not mean to call in their aid just yet, in order to make good our position as to the claims of the family. Let us come back, therefore, to the little fellow with the dusky spotted shell that crawls across our garden-path, and to his somewhat prettier companions of the hedgerow. We will introduce them in due form—*Helix aspersa*, the Garden Snail; *Helix nemoralis*, the yellow or banded Snail of the wayside banks and hedges. And now observe that they make their way in the world by means of an expanded disc or foot, which, as it is in close contact with the ventral region of the body, has procured for the tribe a place amongst the great class of *Gastropods*, or belly-footed Molluscs. The foot itself is a very curious organ, and consists of a nearly uniform mass of muscular fibres, interwoven much in the same way as those of the human tongue. The regular gliding motion with which the common Snails crawl along, is due to a pair of

muscles extending along the centre of the foot; but in some of the species the surface of the foot is divided by a longitudinal line along the centre, the muscles on the two sides of which act in rotation, and so cause the animals to progress in a perpetual zigzag. The glistening slimy tracks which they leave behind —"the silver-slimy trails," as poor Clare calls them—are produced by a discharge of mucus, designed to protect their tender bodies, and smooth the asperities of their way. It must be a very comfortable thing for the Snails to be able to carpet their path in this easy off-hand manner, and we confess we like to see the silvery line on posts and palings or gravelly walks; but when, as happens sometimes, the little fellows pay us a visit, in our parlour, where the place is carpeted beforehand, they might be considerate enough to wipe their feet before coming in.

We must not omit to mention in this part of our discourse, the pretty conceit that obtains in some parts of the country as to the power of the Snail to reveal to tender-hearted maidens the names of their destined sweethearts. May-day morning is the auspicious occasion on which the disclosure can alone be made, and never do the entire Snail family meet with so much consideration as on that happy day. The poet Gray alludes to the subject in his lines beginning—

> "Last May-day fair I search'd to find a snail,
> That might my secret lover's name reveal;"

and Croker, in his work on "Irish Fairy Legends," informs us that in Ireland it is the common practice of boys and girls on May-day, to place the little soothsayer on a piece of slate lightly sprinkled with flour or fine dust, and to cover it over with a large leaf, when it never fails to describe by its mazy wanderings the initial of the much-desired name.

A good deal of discussion has taken place amongst naturalists, as to whether Snails have any eyes or not. The popular notion, of course, is that the little knobs at the extremity of their long feelers or horns are eyes; and though several writers have questioned or boldly denied the truth of this opinion, it seems to be now pretty generally conceded, that the little club-shaped projections are true visual organs. Swammerdam, indeed, long ago demonstrated the matter to his own satisfaction, and pointed out the five distinct parts of which the eye consists. But then he

made the mistake of calling the great nerve of the tentacle, and which is really the nerve of touch, the optic nerve; and so his statements were all put aside together. Professer Owen speaks very confidently on the subject, and in the Museum of the Royal College of Surgeons he has one of those wonderful preparations with which he has enriched that noble collection, in which the tentacles of *Helix pomatia* are extended so as to show the eye at the side of each extremity. In this position the eyes, the professor very justly observes, although destitute of appropriate muscles, have the advantage of all the mobility with which the tentacles themselves are endowed; while, by the admirable construction of the tentacles, they are securely defended from external injury.

It would be a difficult matter, probably, to find a person anywhere who had never seen a Snail draw in its horns on their being touched; but how many, we should like to know, have ever closely watched the Snail's manner of doing it? Those little horns, as the learned professor above mentioned properly says, are "admirable" contrivances, and the way in which they are so nimbly drawn in is not a little curious. The thing is easily seen, and any schoolboy may ascertain how it is done, the next time he stops a Snail in his travels across the footpath, and admonishes him, in the words of the old doggerel, "to shut up his house and go away home." The secret is, that the tentacle is a hollow tube, and in being withdrawn, it is simply inverted and retracted like the finger of a tight glove; only that the extremity, with the eye-spot upon it, is always the first part to disappear. The manner of it is best seen, perhaps, when, after the tentacle has been withdrawn, it is again protruded; as you can then readily discern that the organ is lengthened, not by being pushed out from its base, but by gradually unfolding itself, or being everted at the extremity till the clubbed point appears, and the tentacle is fully extended. One cannot but admire the wisdom which thus gives the little Mollusc such a ready and effectual means of defending its rather oddly located visual organs. We speak of the wonderful contrivances connected with the human eye, but surely there is something here that is not much less wonderful.

If we may rely on the experiments of Swammerdam, the Snail tribe have the sense of smell, as well as that of sight. The late

Dr. Johnston inclines to this opinion, and assigns as his reason the fact, that when the little fellows have been snugly stowed away inside their shells, he has sometimes tempted them out by bringing near to them a little fresh food. But one thing is very certain—they have the sense of taste, and are doubtless good judges of flavour. M. Gaspard (a great authority on Snails) disallows the tribe all the senses save those of taste and touch, the latter of which he admits they possess in an extreme degree of delicacy. The sense of taste ought to be well developed; for, as the whole family are extraordinary eaters, one large source of pleasure would be lost to them if they did not enjoy their food. Mr. Gosse has a very graphic description of the Periwinkle in the act of mowing down his dinner of minute *confervæ* from the glass sides of an Aquarium: the Snail is an equally interesting subject at dinner-time, though his method of feeding is a somewhat different one. On the upper side of the opening of his mouth there is a semicircular horny jaw, which, by pressing against a sort of pad on the floor of the mouth, cuts off the fragments of its leafy food. But, besides the jaw and its pad, there is a pair of very serviceable lips, and a little membranous tongue, roughened over with minute prickles, all set in regular array, and pointing backwards, so as to retain more securely the food it has to manipulate. A Snail's tongue, by the way, is an object of no little interest; and if any one doubts the statement, let him ask the opinion of any microscopical observer, and he will say you could hardly have a more interesting object to look at. The little points or prickles above mentioned are arranged so orderly and methodically, and in such pretty patterns—moreover, the different sorts of Snails exhibit such a great variety in the shape of the tongue itself—that they deserve to be ranked amongst the fairest specimens of Nature's dainty handiwork.

But we were going to exhibit a Snail in the act of dining. When the little fellow is about to eat, then, it pushes forward its prickly tongue, at the same time protruding the lips on each side, till they both come in contact with what is designed to form the first mouthful. The lips then seize hold of the food, and draw it towards the aperture of the mouth, the tongue at the same time keeping it secure by the array of reverted prickles. Brought in this way within range of the horny jaw, the food is pressed upwards, and a small portion—a Snail's mouthful—detached;

this portion is then passed along the tongue, is torn and rasped by the sharp prickles, and finally pressed backward to the entrance of the gullet. Having a good deal of work to do in the way of eating, the little fellows manage to get along pretty quickly, and sometimes make a very audible noise while about it. Perhaps some of our curious readers the next time they meet with a Snail on the look-out for provender, instead of crushing it or flinging it away, will be good enough to present it with a fresh cabbage leaf; in which case it is highly probable that, if they will only listen attentively, they will hear the little Mollusc lustily munching the proffered dainty, and smacking his lips with great satisfaction thereat.

We spoke above of flinging a Snail away—unfortunately a calamity to the members of the Snail fraternity which they often have to bear; but against all irremediable injury from which they appear to be specially guarded. The consequence to the Snail of such flinging is, of course, in most cases, a fall that makes a perfect wreck of the shell; and no humane person, that once sees how painfully the poor creature writhes and sputters after such a crushing fall, would repeat the act. Not even a Snail may be put to needless pain; kill it, by all means, but do not maim it merely, and doom it for weeks or months to bootless torture.

The remedial powers of the Snail are truly remarkable. The repair of a broken shell is a small matter that is soon accomplished; while, under favourable circumstances, and in course of time, the most serious injuries or losses are made good. The Abbé Spallanzani, who had a strange taste for putting out the eyes of bats, and other scientific cruelties of the kind, cut away the tentacles of *H. pomatia* and *nemoralis*, and in about two months found them perfectly renewed, even to the eyes at the tips. In other experiments he removed not only the tentacles but the entire head, including the brain, the mouth and its appendages, and a mass of the muscle, and yet the whole of the lost parts were reproduced, and with such perfection that it was impossible in some cases to distinguish any difference between the newly formed parts and those that had been cut away. The poor Snails that were thus experimented upon retired into their shells the moment the operation was over, and there remained for many weeks and in some cases for months, in perfect quiescence.

The year 1766, in which Spallanzani published the results of his experiments, inaugurated a perfect reign of terror for the Snails. The ardent Abbé, indeed, did for them just what Galvani, some years later, did for frogs and rabbits: he led to their being immolated by thousands upon the altar of science, with the view, apparently, of ascertaining how far it was possible to go in maiming and mutilating the poor Molluscs, without actually destroying life. The first result of these experiments was to throw discredit upon the extreme cases that Spallanzani had mentioned; but more careful operators, in after-years, fully established the truth of his statements, and demonstrated the existence of those extraordinary powers of reproducing lost parts which he was the first to announce to the world. It is to be hoped that no ambitious young naturalist who may read these pages will be tempted to repeat the above experiments for himself, because we can assure him the facts are well established, and any further snail mutilation to confirm them would be only wanton cruelty.

It would hardly be suspected that little fellows, with such cold and sluggish natures as the Snails possess, would manifest much warmth of passion. So it is, however; and the Loves of the Snails has always been an attractive subject with *savants*, from the very singular circumstances connected with it. In reading Professor Rymer Jones's graphic account of the matter, with its curious details of love darts and tender demonstrations—the coyness on the one side, and the ardour on the other—one is half inclined to think that you are again going over the story of the amours of the Olympian gods.

In the great majority of the *Helicidæ*, the young are produced in eggs, which are always globular in shape, and in some of the larger kinds enveloped in a hard calcareous shell. The eggs of the common Garden Snail are often exposed to sight on turning up a stone, or slate, or piece of decaying wood, that has been lying long in some dank, unfrequented part of the garden; and by an inexperienced person they would be very liable to be mistaken for some out-of-the-way curiosity of Nature's making. They are about the size of small peas, and being of a beautiful pearly white, might be made into a very pretty string of beads, were they only durable enough for the purpose. We have sometimes watched both *Helix aspersa*, and her cousin *nemoralis*, when

they have been prying about for a suitable spot wherein to deposit their ova, and have more than once disturbed them in the midst of the operation; and, despite all their frothy protestations, have been tempted to despoil them of their little pearly globes. The spot selected for the purpose is generally some such an one as we have already mentioned, or else the eggs are buried beneath the soil, or in heaps of decaying leaves; the particular habit in this respect varying greatly amongst the different species and genera of which the family is composed. The eggs of some of the larger tropical species are deposited in little clusters, high up on the foliage of stately trees, the parent Snail managing to curl up two or three of the leaves, one upon the other, so as to form a sort of nest for their protection.

It is not necessary to do anything in the way of tracing the course of the young Snails from infancy up to old age—and they do attain to a venerable age at times—since, long as the Snail's life may be, it is by no means an eventful one. The only thing in it that need detain us at all, is the curious winter hybernation in which all the members of the *Helicidæ* in temperate, and in some of the warm, latitudes indulge. Almost everybody is familiar with the fact, that in the winter time our common Garden Snails are to be seen, by the dozen or the score, snugly stowed away in the cracks and holes of old walls and trees, under the eaves of barns and outhouses, and in other equally sheltered situations, where they remain, fixed and motionless, till the advent of spring. Other members of the family bury themselves in the banks of the hedgerows, amongst the moss at the roots of trees, or secrete themselves in the chinks and fissures of the naked rocks. *Helix pomatia*, with very high notions of its own dignity, is satisfied with nothing less than a comfortable hybernaculum, which it constructs with great art and skill in the sides of ditches, in thickets, and similar places, and in which it sleeps soundly all the winter through, very little concerned as to what may be going on above ground.

It is curious to observe that this period of inactivity, which in temperate latitudes is rendered necessary by the cold of winter, in the arid regions on the western side of the Andes is equally imperative on account of the terrible droughts which there obtain during the dry season. Heat here acts in one respect just as cold does amongst ourselves: the herbage withers

and disappears, and the land is to a great extent denuded of its vegetable covering. The Snails of these regions, therefore, bury themselves, as the dry season comes on, in the sand or under stones, and covering the mouth of the shell with a sort of parchment epiphragm, like that formed by our own Snails in their winter retreat, remain in a torpid state till the return of a more genial season.

Mr. Lovell Reeve, in his great work on shells, the "Conchologia Iconica," gives a curious anecdote illustrative of the peculiar character of the sterile region west of the Andes, and its effect on the Snail tribes. In 1829, when Mr. Cuming, the famous collector of shells, arrived at Copiapo, where the large *Bulimi* are to be found in considerable numbers, he desired one of the solitary inhabitants of the place to obtain for him as many of the living animals as he could get. When the native returned with his Snails, Mr. Cuming was surprised to find that there was scarcely one living specimen amongst them all, and reproved the man accordingly. "Only wait till the dews come," said the man, "and they will be all alive again." And when Mr. Cuming rejoined, "The dews! I suppose you mean the rains," the poor fellow, with a look of astonishment, asked what he meant. He was a sexagenarian, but he had never heard of *rain* before!

In the British Islands there are in all between fifty and sixty species of the Snail family. The largest of our British Snails is the famous *Helix pomatia*, the Roman Snail, as it is sometimes termed, from the high estimation in which it was held by the Roman epicures. It is considerably larger than *H. aspersa*, more faintly coloured, and confined with us almost exclusively to the chalk districts of the south of England. On the Continent, however, it takes the place of our Common Snail, and in the wine countries does great injury, by its partiality for the buds and tender leaves of the vine. Our prettiest species is, without doubt, *H. nemoralis*, which is either yellow, chocolate-brown, or flesh-coloured, and abounds in every hedge and ditch-bank, throughout the spring and summer. It is often beautifully variegated in the neighbourhood of the sea. We have a number of the shells of this Snail now before us; and sure we are there is no young lady living, who, if she were told that these shells were brought by some celebrated naturalist from China or Japan, would not pronounce them beautiful. Another of our widely-

distributed species is *H. arbustorum*, which is generally found in woods and shrubberies, or amongst the willows on the banks of ditches and rivers. It is rather famous for extending its range, however, high up on the sides of mountains, on the Alps approaching the line of perpetual snow. *H. virgata*, *H. caperata*, *H. ericetorum*, and one or two others, affect the dry stunted vegetation on heaths and commons. According to Dr. Turton, they go down to the roots of the plants, and come up again after the summer rains, when they are so abundant, that, like the young frogs that leap in thousands over the same sort of places, they are supposed to come down from the clouds with the rain! *Cyclostoma elegans*, and several little fellows of the genera *Pupa*, *Clausilia*, and *Bulimus*, keep clear of all but initiated conchologists, secreted in woods and shady situations, under nettles and other plants not pleasant to handle; *Helix rupestris* passes its days between the bricks and stones at the tops of walls, or in the earth on the higher parts of rocks; the dainty little *Pupa marginata*, *Achatina acicula*, and one or two others, bury themselves alive among the moss at the roots of trees. *H. crystallina* is a pretty little Snail, with a delicate, glassy shell, to be found under stones in damp places, where also, with sharp eyes, we may find the dusky-coloured *H. pygmæa*, no bigger than the head of a good-sized pin. Not to extend this list to too great a length, however, let us bring it to a close with the much-prized *H. revelata*, one of the rarest of our British Snails. It has a shell about a quarter of an inch in diameter, of an olive-green colour, and occasionally gladdens the hearts of collectors at Nottingham, in Cornwall, and in Devonshire, but more especially in the latter county, where, with true aristocratic predilections, it confines itself to the select society of Torquay.

We have been thus particular in referring to our British Snails, because studies of this sort, like acts of charity, should always "begin at home." But now that we have attended to the Snails of our own land, let us glance as rapidly as may be at some of their high and mighty relatives abroad—especially at those of tropic lands, that go about clothed in gold and purple, and other fine colours, and which, according to some enthusiastic conchologists, look, as they cling aloft amongst the glossy foliage, like the golden fruits in the Garden of the Hesperides.

It is as well to know, perhaps, that the common Snail (*H. as-*

persa) is by no means confined to ourselves. It has, indeed, pretty much of a cosmopolitan turn of mind, and makes itself quite as much at home, though not in such great abundance, in the olive groves of the south of Europe, on the Asian and African shores of the Mediterranean, in the dense forests of Guayana and Brazil, and at the foot of Chimborazo, as in our own hedges and gardens. Nowhere, however, but amongst ourselves does it hold the rank of the "common" Snail—that distinguished position being held in different lands by different members of the family. On the Continent of Europe, *Helix pomatia* takes the lead, and as we shall find by-and-by, is a much-prized Mollusc. In Africa, very generally the genus *Achatina* takes the place of the more typical genus *Helix*, and presents us with some of the most monstrous creatures belonging to the family. In Liberia there is an immense fellow, *A. variegata*, which, if it were to make its appearance on the banks of some English road-side ditch, would probably create a panic in all the neighbourhood around. In Guinea and Natal there is another monster, striped with black and brown like a zebra; while all along that part of the African coast, these immense and richly-coloured *Achatinæ* abound, crawling like most of our own Snails on the ground, or on the low herbage in swamps, and in the vicinity of lakes and rivers. Some of the smaller, but still very beautiful, species of this genus occur in Central America and the West Indies; but in this part of the globe another genus takes the lead, and the reigning monarchs of the Snail world belong to the *Bulimus* dynasty, which, being a very important one, merits accordingly our special attention.

Our knowledge of these animals is in a great degree the result of the very extended and careful observations of a gentleman to whom we have already alluded in this Chapter—Mr. Hugh Cuming, who for several years past has been in the habit of fitting out a tight little vessel at his own expense, and setting off for a twelvemonth's or a two years' trip to South America, Borneo, the Philippine Islands, or some other far-off part of the world, there to amuse himself in picking up shells, collecting ferns, and suchlike scientific trifles, and also in noting the ways and doings of the thousand things that he comes across, and then returning to this country to dispose of his accumulated spoils, and prepare for a fresh adventure. Mr. Cuming's roaming

days are pretty well over now, unfortunately; though we hope he may yet live many years to enjoy the fruits of his labours, not the least agreeable part of which to him, perhaps, is the gratitude of all loving students of natural history for the many valuable additions he has made to their knowledge.

But the *Bulimi!* In the first place, then, in some of these creatures the animal itself is curiously spotted with conspicuous colours, as may be seen by a model of *B. rosaceus* in one of the cases in the British Museum. The animal is of considerable size, and over every part of its deep-green body there are, closely set, bright-red spots, which give one the idea that the poor Snail has been seized with a violent attack of the measles! According to Mr. Cuming, this Snail hides itself away in the dry season under stones among bushes, and close at the edge of the sea-shore, where at times it gets sprinkled with the spray. On the hills they live on the leaves of an aloe-like plant, to which the giant humming-bird also comes to sip the honey from the brilliant flowers; and we are inclined to think that the strange-looking plant, with its bright flowers, and the Snails, and the humming-birds together, must make a very attractive tropic picture. Some years ago several of these Snails were brought to this country alive, and were sent to spend their days amongst the palm-trees in Mr. Loddiges' nursery at Hackney, where for eight months they tried to forget the rich juices of their native aloes, by eating greedily of English cabbage-leaves; but it would not do, and they died miserably at last, within a few days of each other.

One of the most beautiful of the *Bulimi* is a species that comes from the Solomon Islands—of large size, and clothed with a shell of the purest and most delicate yellow, while the lip, or the rim around the mouth, is of a brilliant orange red. The head-quarters of the tribe appear to be in Venezuela and New Granada, where great warmth and moisture give a wonderful development to vegetation, and where, accordingly, Snails abound and banquet on the luxuriant pastures. No less than sixty different species of *Bulimi* alone may be found in these parts; and at the head of the list there are the monstrous species, *maximus*, *ovatus*, *valenciennesi*, and *hæmastoma*, big as the clenched hand of a full-grown man, and beautifully coloured—Snail giants that cling in bunches to many a splendidly-flowering cactus, eating into the very middle of its spiny leaves and stems,

and adding by their own strange appearance to the singular aspect of the ungainly plants on which they feed.

The pretty pink-mouthed Snail-shell, adorned with broad bands of white and chocolate-brown, that finds a place on many a mantelshelf and sideboard, is a species common in Ceylon, and which, though christened *H. hæmastoma*, the pink-mouthed Helix, is quite as often *black*-mouthed as pink, and sometimes, though much more rarely, white-mouthed. Another pretty Cingalese is the dainty *H. melanotragus*, arrayed in pink or white, with delicate shades of brown; but, as its name may serve to denote, *H. elegans* carries off the palm for beauty from all the Snails within sight of Adam's Peak.

In no part of the world, perhaps, do the shells of the *Helicidæ* present a greater variety of rich and delicate tints than in the luxuriant open forests of the Philippine Islands, which seem to be a sort of Paradise for the terrestrial Mollusca, as the shores of those islands are for such as live upon the borders of the "vasty deep." But we might as well attempt to describe an Italian sunset, or the glories of our autumn woods, as to convey in words an idea of the beauty of these beautiful shells of the far-off islands of the tropic seas, on which nature seems to have lavished her richest wealth of pure and delicate colouring. We are strongly inclined to suspect, that the fact of which Mr. Cuming gives us intimation—namely, that none of the birds of the Philippines ever touch the superb *Helix polycroa*, the many-coloured Helix —is no other than the result of a common understanding amongst the feathered tribes there, that, by thus refraining from all molestation of one of the number, they would fitly express their high appreciation of the beauty of the entire Snail family.

We ought, perhaps, before going further, to caution our *un*conchological readers against assuming that all the different sections of the *Helicidæ* carry about the same sort of globular or semi-globular shells as those of the species common in our own gardens and hedges. It is far otherwise, and is indeed somewhat singular, that, while the animals of this family are themselves substantially alike in form and structure, the shelly coverings which they secrete exhibit most remarkable deviations from the typical character.

Not the least curious part of our subject is that which pertains to the Snail tribe as an article of food. It has already been

mentioned that *H. pomatia* was one of the delicacies that found its way to the table of the Roman epicure; but long before Romans or Rome, not only *H. pomatia*, but Snails of all sorts—saving and excepting, of course, that one notable case of *H. polycroa*—served as dainty morsels for a variety of birds and quadrupeds, which are now asserted to thrive and fatten on the slimy fare. The hedgehog is well known to make great havoc amongst their ranks during his nocturnal rambles. Vast numbers of the smaller kinds are eaten by the sheep which graze upon the scant herbage of some of our waste lands; and there is still a doubt in our mind whether we ought not to attribute to this circumstance the superior flavour of South Down and Dartmoor mutton. Again, what country schoolboy is there who has not seen the thrush and the blackbird a snail-gathering in winter, and cleverly cracking the shells on some convenient stone to get at the dainty morsel within? In the vast forests of South America, the huge *Bulimi* are roasted and eaten by the natives as a frequent article of food: and one of our own childish recollections is of a terrible goggle-eyed, idiotic sort of white Indian, as we suppose he must have been, whom we often used to come across in the bowery Devonshire lanes, picking Snails and cracking them, and, all frothy and sputtering as they were, bolting them outright, for the benefit of his "chest."

The Romans not only ate Snails; they reared them and fattened them up with as much care as we do our poultry. Pliny, indeed, has immortalized the individual—one Fulvius Hirpinus—who invented the "cochleariæ," or sties in which the dainty fare was fattened for the table. There were several compartments in the sty, and each compartment had its occupants from some particular district; so that your cultivated epicure, with his nice discrimination of flavours, could select his Snails pretty much as the modern man of fashion can select his wine. The great perfection to which the Snails were brought under this system of fattening led to a hot competition as to who should have the biggest; and in the end, as Pliny tells us on the authority of Varro, they were brought to such a size, that some of the shells would hold ten quarts! The usual method of cooking the overgrown monsters appears to have been that of frying them, or else grilling them on a silver gridiron. In France, and some of the countries of southern Europe, *H. pomatia* has been eaten

from the time of the Romans to the present day. Only a few years ago the *habitué* of the inns of Vienna could as easily obtain his dish of Snails as a joint of mutton or beef; and in Switzerland they are still regularly fattened for sale, and during the season of Lent become an important article of trade. In former times, indeed, the Snail—always of course understanding that *H. pomatia* is the individual meant—was admitted to our own tables: and Robert May, the Soyer of his time, has left us several receipts for cooking them, amongst the curiosities of his fifty years' experience. Ben Jonson, again, in his "Every Man in his Humour," mentions the dish as a delicacy :—

—— "Neither have I
Dress'd snails or mushrooms curiously before him;"

while Lister, in his "Historia Animalium Angliæ," refers to the Snail as, in his day, an ordinary article of food. But, for some reason or other, the much-prized delicacy of former days has now lost its repute amongst us, and—excepting in the case of the Newcastle glass-blowers, who are said to hold an annual feast, in which the common Garden Snail furnished the central dish—is entirely banished, it seems, from our tables, without the remotest prospect of its ever again appearing thereon.

Once, indeed, two great philosophers, lamenting over the perverse and unreasonable antipathy of the age in rejecting an article of food at once so abundant and nutritious, determined to set the example of a return to the wiser custom of former days; and with the story of that patriotic resolve, we must bring to a close this already too extended dissertation. The benevolent individuals in question were the two great chemical philosophers of Scotland, Dr. Black and Dr. Hutton—particular friends, though extremely opposite in their appearance and manner, and in nothing more than in their style of language. Dr. Black spoke with the English pronunciation, with punctilious accuracy of expression both in point of manner and matter—while, on the contrary, Dr. Hutton's conversation was conducted in broad phrases and expressed with a broad Scotch accent, which often heightened the humour of what he said. The two doctors were agreed that it was the height of folly to abstain from Snails, and would show their superiority to such a vulgar prejudice. Some Snails were accordingly procured, dieted for a time, and then

stewed for the benefit of the two philosophers, who had either invited no guest to their banquet, or found none who relished in prospect the *pièce de résistance*. And philosophers are but men, after all. When the huge dish of Snails came to be placed before them, the stomachs of both doctors began to revolt against the proposed experiment. Nevertheless, if they looked with disgust on the Snails, they retained their awe for each other; so that each, concealing the symptoms of internal revolt peculiar to himself, began with infinite exertion to swallow, in very small quantities, the mess which he secretly loathed. Dr. Black at length showed the white feather, but in a very delicate manner, as if to sound the opinion of his messmate :—"Doctor," he said, in his precise and quiet way, "doctor, do you not think that they taste a little—a very little *green ?*" Whereupon the other, starting up from the table, and giving full vent to his feelings of abhorrence, vociferated, "—— green, —— green, indeed! tak' them awa'; tak' them awa'!" prefixing, we are sorry to say, certain epithets which a sense of propriety forbids our inserting here.

And so ended all hopes of introducing Snails into the modern *cuisine ;* so philosophy gave way and prejudice gained another victory.

CHAPTER V.

THE NAUTILUS AND ITS ALLIES.

"The tender Nautilus who steers his prow,
The sea-born sailor of his shell canoe,
The ocean Mab, the fairy of the sea,
Seems far less fragile, and, alas! more free.
He, when the light'ning wing'd tornadoes sweep
The surge, is safe—his port is in the deep—
And triumphs o'er the armadas of mankind
Which shake the world, yet crumble in the wind."

No department of natural history has been more fully and assiduously investigated of late years than that which relates to the lower forms of animal life, and especially to such as people the teeming waters of the ocean. The broad tidal belt of the sea-shore, alternately covered by the waves and left bare by the tide, in all its varied aspects of sand-flats and shingles, oozy shallows, and rugged festooned rocks, has in particular been diligently explored; and the observations which have been made on the structure and habits of the different animals thus obtained have made a new and quite wonderful addition to our knowledge of organic life. A multitude of creatures have been brought to light whose existence was previously unsuspected, and amongst those which have long been familiar, but unheeded, the discovery has been made of a world of interest and beauty, which is hardly surpassed throughout the whole extent of the animal creation. In many cases, too, these observations and researches have led to the most important results in correcting and enlarging the current views of natural history, as a philosophical study—at one time exploding some ingenious and long-cherished theory—at another handing over a whole tribe of creatures from one division of nature to another; now compelling a total revision of the accepted systems of classification—and now disclosing a fact which has let in, as it were, a flood of light on some obscure point in the animal economy, and gone

far to revolutionize and reform the whole compass of zoological science.

It is not alone in the immediate neighbourhood of the land, however, that these investigations have been carried on, or that important discoveries have been made: the deeper waters at a distance from the shore have not been neglected, nor their inhabitants allowed to pass unnoticed. On the contrary, the "drag" and the "dredge" have been plied so industriously in groping up the contents of the sea-bottom, and the "trawl" and the "towing-net" in searching the upper waters, that, around our own coasts at least, those coveted prizes, "species new to science," are now becoming exceedingly rare; although it does still happen occasionally that some indefatigable professor has the good fortune to fish one up from the deep, and so to win for himself a niche in the temple of fame as a discoverer in science. In consequence of this rummaging and ransacking of the deep, and, in great part also, in consequence of the unintentional assistance of Old Ocean himself, in flinging upon the shore, during his angry moods, the spoil which has been washed landwards from far out at sea, we are rapidly extending our acquaintance with the life of the waters, and shall probably soon have the means of becoming almost as familiar with the "sea's abundant progeny" as we now are with the more accessible inhabitants of the upper worlds of earth and air.

In so far as it concerns the thousand little creatures which people the shore, nestling in the rock-clefts and tide-pools, the Aquarium and the studies which it has made so popular have done already well-nigh all that could be desired. There is no danger now that they will any longer be passed by in neglect. But there is some reason to fear, that with the enthusiasm that prevails for these "wonders of the shore," others not less interesting, but more seldom seen, will be overlooked and forgotten. On behalf of one of these too much neglected tribes, we now ask for justice—justice to the Cephalopods, which have been almost entirely kept out of sight in our popular literature, while other and far less interesting races have been pushed into favour. A Chapter, then, for the CEPHALOPODS, or, in other words, for the Nautilus and its allies.

But it will be better, perhaps, to begin with one of our native Cephalopods, by far the most familiar of which is the common

Cuttle-fish. Come with us, then, good reader, down amongst the rocks at low water, where, half concealed by the weeds in some little hollow, we are pretty sure to find a specimen that will suit our purpose. Precisely; here is the very one we want —dead, it is true, but full grown and in capital condition, evidently as yet undiscovered by any of his agreeable but hungry neighbours, who, greatly as they relish a dead Cuttle-fish, have a wholesome dislike of getting too near a living one.

Observe, then, that the Cuttle-fish is of a soft, flabby consistency, and that its body, o an oval form, is bagged up in a sort of sack or pouch, something after the manner of those ingenious youths who, tied up in sacks, hop a race, to add to the diversions of a village fair. The Cuttle-fish, however, has this advantage, you perceive, that its arms, or, as they are technically termed, its *feet*, are ten in number, and quite free; and that, oddly enough, they are arranged in a circle around the top of the head; thus accounting for the designation of the class as the Cephalopods, or, more properly, the *Cephalopoda*, which in plain vernacular is simply *foot-headed*. Turn these arms apart, and two things will be noticed—that the mouth of the Cuttle-fish, which is armed with a pair of powerful jaws, shaped like the beak of a parrot, occupies the centre of the circle formed by the junction of the arms,—and that the arms themselves are covered on their inner side with a multitude of little circular discs, slightly raised above the surrounding surface. The eyes, you perceive, are large and prominent, and, though somewhat dull just now, and of a "lacklustre" appearance, had the Cuttle-fish been alive and in the water, instead of lying dead upon the beach, they would have been bright and staring, and expressive of some considerable degree of intelligence. Such, on a hasty glance, is the Cuttle-fish; and in the main, and allowing for unimportant deviations from this the common type of the class, and especially for the shell with which some of the species are protected, such are all the Cephalopods.

Examine the Cuttle-fish a little more carefully, however, and many curious details of structure are perceived, which, on a mere cursory inspection are unnoticed. Cease poking it, therefore, with the point of your parasol or the end of your walking-stick, and stoop down to it, or take it up boldly in your hand. Now press your finger against its back. There is something firm

and hard, you perceive, beneath the skin. That is the dorsal plate or gladius of the Cuttle-fish, the well-known "pounce-bone" that you see about on the sand, and in the druggists' shops. If you are not over fastidious, and have a mind to turn dissector for once, your penknife will readily lay open the Cuttle-fish and show you the "bone" in its natural position, where it protects the vital organs, and at the same time serves, by its light and buoyant character, as a sort of float to aid the animal in its vivacious movements in the water. The common Cuttle-fish is the only Cephalopod that has this internal float, although in the common Calamary, or Squid, there is a thin and flexible cartilaginous plate in the form of a feather, which equally answers the purpose of defence, and also aids in locomotion.

Now, look at the mouth of the sack, where the head protrudes, and you will see projecting, just beyond the opening, the end of a tube or pipe, which, if the dissection be proceeded with, will be seen to be the mouth of a funnel-shaped structure, connected, in the interior of the body, with the branchiæ or breathing organs. These branchiæ are lodged in hollow cavities or chambers, and communicate with the surrounding water by valves, through which the fluid is admitted to aërate the blood, by the dilatation of the muscular investment of the body. When, however, the purpose of respiration has been effected, and the water has to be got rid of from the branchial chambers, the valves through which it entered refuse it egress, and it has to be forced out through the funnel—smartly or slowly, as the animal may choose. Now, observe: if the Cuttle-fish exerts but little pressure, and ejects the water slowly, all is well—the chambers are emptied, again refilled, and respiration goes on without stir or commotion. But if, on the contrary, the muscular investment be suddenly and violently contracted, the water is then made to rush out of the funnel in a violent jet, while the Cuttle-fish, by the mere reaction of the surrounding medium, shoots backward through the water, on the same principle, and with almost as much rapidity, as a rocket mounts into the air. In the same manner all the Cephalopods, naked and shell-bearing alike, dart along through the water, repeating the movements at pleasure, with intervals between, or in quick and continued succession; and thus beautifully, by one and the same contrivance, is the double purpose effected of respiration and rapid locomotion. Moreover, as these

movements are made with the head directed backwards, the eyes of the Cephalopod are always turned towards the point from which it darts away, a circumstance which, in times of danger, and when pursued by an enemy, is obviously of great advantage.

The ease with which the Cuttle-fish can let go its hold, and dart off from threatened danger, is very well shown by the following incident mentioned by Dr. Roget in his Bridgewater Treatise. Once, when a boy, he tells us, he went out with an old fisherman of Dawlish to visit the floating nets which he had laid for Pilchards. On looking down into the clear blue water, they could easily see that the number of fish entangled was great, but, much to the discomfiture of the fisherman, almost every other Pilchard was locked in the embrace of a Cuttle-fish, plying his parrot-like mandibles to some purpose. The old man, who seemed to regard these unbidden guests as an incarnation of all evil, carried a capacious landing-net, but so quick was the sight of the Cephalopods, so ready were they in letting go, and so agile in darting backwards or sideways, clear of the net, that, though the greedy creatures held on to the last moment, not more than three or four were secured out of the crowds that had spoiled the haul.

But to come back to our friends on the beach : there is another purpose served by the funnel which we noticed, equally curious with that already referred to. If our dissecting friend were to proceed with his work, and lay open the entire body of the Cuttle-fish, he would come upon a small flask-shaped bag, filled with an inky fluid, and connected by a duct with the funnel aforesaid. The use of this ink is very singular. Expert as the Cuttle-fish is in jerking about, and in making off from threatened danger, there are times when he needs have all his wits about him, and exert every means at command to make good his escape. Let us see how he manages. Some hungry Dog-fish, we will suppose, is in hot pursuit. The poor Cephalopod shoots and darts along, but his powerful and ravenous pursuer is rapidly approaching, and in a moment more the monster will be upon him. But just at the nick of time the ink-bag is suddenly compressed, when out through the funnel spirts a jet of the contained fluid, which, mingling with the water in a murky cloud, baffles the pursuer, and gives the Cuttle-fish time to make for the bottom, where he conceals himself, and lies quiet till the danger is over.

The ink which thus plays such an important part in the economy of the Cephalopods, furnishes the well-known "sepia" of the artist, while it is also believed to constitute the principal ingredient in the Chinese or Indian ink. It is an interesting fact, too, that in the Belemnite (a fossil Cephalopod allied to the Cuttle-fish, whose remains have been entombed in the solid rock for countless ages), the ink-bag has frequently been found in an almost perfect state of preservation, with the ink itself retaining much of its original character. Dr. Buckland once gave some of this fossilized ink, if we may so term it, to the late Sir Francis Chantrey, requesting him to try its power as a pigment. A drawing was made with a portion of the ink, and shown to a celebrated artist, who immediately pronounced the sepia to be of excellent quality, and begged to know by what colourman it was prepared.

But enough about the funnel, and what pertains thereto; let us look now at the arms of our Cuttle-fish.

Observe, then, that two out of the ten arms are much longer than the others, and that, instead of tapering to a point, they are of the same thickness throughout, excepting at the extremity, where there is a broad flattened expansion, studded on the inner side with similar circular discs to those observed on the other arms. And now examine one of those discs. Look at it attentively, for ——. Stay, though; there is another Cephalopod to be met with on the shore here, in which we may see these discs to greater advantage than in the Cuttle-fish; and, as it is now dead low-water, we shall probably find one of them lurking somewhere in the tide-pools, or else prowling among the rocks.

Leave the Cuttle-fish to the Crabs, and let us commence the search. Never mind a few drops of salt water, but turn up the clustering sea-weeds, and look into every hole and cranny, for the gentleman ensconces himself in them sometimes. Here, clamber this way, and—but look! there is one of the fellows under that ledge of rock. See how he drags himself over the sand, his great arms twining about as he moves along. What eyes! what a frightful beast! Jump down, and let me introduce him to you, *Octopus vulgaris*, ladies and gentlemen: the common Poulpe or Preke, the famous Polypus of the ancients. Now, sir, move this way, and show yourself. We have here, you perceive, a Cephalopod of a different pattern from the Cuttle-

fish. The body is much smaller in comparison, and almost globular, while the arms are much longer, only eight in number, all uniform, and united at the base by a thick membrane or web, which greatly aids our friend in his natatory operations.

And now turn to the inner face of the arms, and look attentively at the discs. Observe that they each consist of a muscular membrane with a thick fleshy circumference, presenting when expanded a number of radii converging around the circular orifice of an inner cavity. In this cavity is a movable muscular piston, which, when not in action, is on a level with the circular aperture; but which, when the disc is closely applied to any object, is drawn strongly back, and the cavity it filled converted into a vacuum; each separate disc being, in fact, an admirably contrived pneumatic apparatus, which firmly adheres, wherever it is applied, on the same principle as a surgeon's cupping-glass or a school-boy's sucker. The purpose of these "suckers" is to act of course as agents in seizing prey; and of so terrible a character are they, says Professor Jones, that, "armed with these formidable organs, the Poulpe becomes one of the most destructive inhabitants of the sea; for neither superior strength nor activity, nor even defensive armour, is sufficient to save its victims from the ruthless ferocity of such a foe. A hundred and twenty pair of suckers, more perfect and efficacious than the cupping-glasses of human contrivance, crowd the lower surface of every one of the eight flexible arms. If the Poulpe but touch its prey, it is enough; once a few of these tenacious suckers get firm hold, the swiftness of the fish is unavailing, as it is soon trammelled on all sides by the firmly-holding tentacula, and dragged to the mouth of its destroyer. The shell of the lobster or of the crab is a vain protection, for the hard and crooked beak of the Cephalopod easily breaks to pieces the frail armour, and even man himself, while bathing has been entwined by the strong arms of gigantic species, and struggled in vain against a grasp so pertinacious."

It is stated by Dr. Roget, that so long as the muscular fibre of the piston is contracted, it is easier to tear away the substance of the animal's arms than to release the suckers from their attachment, and that even after the animal is dead, these organs still retain a considerable power of adhesion.

We have hitherto spoken of the tentacula of the Cephalopheds

as arms, although they are equally entitled to their technical designation of feet, as they serve the animals for crawling along the sea-bottom. All the Cephalopods of the genus *Octopus*, the Poulpe and its cousins, are especially adapted for this kind of progression, and habitually resort to the sea-shore, where, crawling along in an inverted position, they have a very odd and repulsive appearance. They move along, however, with considerable ease, and progress, it has been ascertained, at the rate of about seven feet in a minute. Should they wish to accelerate their pace, it is said that they inflate the body until it resembles a distended bladder, and, then leaving go their hold, and casting themselves forward, they roll over and over with great velocity, and often effect an escape which would otherwise have been impossible. Let the curious reader, however, beware. It is not always prudent to push matters to an extreme, in trying to induce a display of this odd procedure; for, as the following adventure abundantly proves, your Cephalopod is apt, at times, to turn crusty, and pursue a totally different course of action.

Mr. Beale, in his "Natural History and Fishery of the Sperm Whale," tells us that on one occasion, while searching for shells upon the rocks of the Bonin Islands, he came across one of these animals crawling towards the surf which it had only just left. It was creeping on its eight legs, which bent considerably under the weight of its body, and lifted it only a small distance from the rocks. The animal appeared much alarmed, and tried hard to escape. Mr. Beale, however, endeavoured to stop it, and pressed with his foot on one of its legs; but the strength of the animal was so great that it several times liberated itself, in spite of all the efforts he could employ on the wet and slippery rocks. Mr. Beale then laid hold of one of its tentacles, and held it so firmly, that it appeared as if the limb would be torn asunder between them. He then gave the animal a violent jerk, wishing to disengage it from the rocks to which it clung so forcibly by its suckers. The Cephalopod, however, kept its hold; but the tug was too much for its temper; for, the moment after, the apparently enraged animal lifted its head, and, letting go the rocks, suddenly sprang upon its assailant's bare arm, and clung to it, with great power, endeavouring to get its beak in a position to bite. Mr. Beale declares that a sensation of horror pervaded his

frame, when he found that the animal had fixed itself so firmly upon him. He describes its cold slimy grasp as extremely sickening; and one can well believe him when he says that he loudly called to the captain, who was also searching for shells at some distance, to come to his assistance. The captain, fortunately, was soon at hand, and speedily released his companion from the awkward predicament into which he had got himself, by destroying the animal with the boat-knife. The poor Cephalopod, however, stuck on to the last, and had to be cut away piece by piece.

Our readers, probably will think with Mr. Beale, that this affair was sufficiently horrible; although it sinks into insignificance beside the frightful stories that are told of these animals by some of the early navigators. Modern naturalists, it is true, make short work of these accounts, and set them all down as fabulous; though it is admitted that Cephalopods of enormous size do exist. It is notorious, indeed, that the pearl-divers of the Indian seas, and the coral-divers of the Mediterranean, are constantly liable to be attacked by these monsters, and that occasionally they have been carried off in their arms. The largest Cephalopod of which any remains are preserved in our museums was one obtained during Captain Cook's first voyage in the Southern Pacific Ocean. The dead carcass was found floating on the sea, surrounded by aquatic birds, which were feeding on its remains. Comparing the parts of this animal now existing in the museum of the Royal College of Surgeons with those of smaller perfect animals, Professor Owen estimates that its body must have been, at least, four feet long, and its arms three feet more, making seven feet from the end of the body to the points of the tentacles, a length diminutive, indeed, compared with that ascribed to the fabulous Kraken of Pontoppidan, but still amply sufficient to render a Cephalopod, with its array of suckers, a truly formidable monster.

In systematic zoology, the Cephalopods stand at the head of the Mollusca, and exhibit many interesting points of analogy to the higher or vertebrate division of the animal world. This advance in organization is much more obvious in one section of the Cephalopods than in another, but in both alike it is of a very marked and decisive character. Thus all these animals have the rudiments of a true internal skeleton, and there is a perfect symmetry

throughout their animal and vital organs. The muscular system forms a large proportion of the body, with various arrangements and complications unknown in the lower Mollusca. The strong hooked jaws work vertically as in the vertebrate animals, and are accompanied by a thick muscular tongue covered with spines. The respiratory apparatus is enormously developed; the nervous centres in the head receive a marked increase in bulk, constituting them a true brain, which is enclosed in a cartilage, and gives off nervous cords on each side to the organs of vision; while these, again, are of an exceedingly complex structure, like those of the vertebrate animals. In the higher Cephalopods there are distinct organs for hearing, and the heart is three-chambered; while in several of the groups, the external conformation of the animals, and many of their habits, bear a strong resemblance to what is observed amongst the superior class of fishes.

Professor Owen separates these animals into two great divisions, according to the number of their branchiæ or gills, and christens them respectively the *Dibranchiata* and the *Tetrabranchiata*—the two-gilled and the four-gilled Cephalopods. The two-gilled division takes the highest rank, and includes all the naked Cephalopods, together with the little Argonaut, or Paper Nautilus—

"The sea-born sailor of his shell canoe,"

which has ever been such a pet with the poets, and such a puzzle to the philosophers. The four-gilled branch of the family is represented in our existing seas only by the Pearly Nautilus (*Nautilus pompilius*), and one other closely-related species—these two being now the sole survivors of that multitudinous host of Orthoceratites, Ammonites, Hamites, Baculites, Turrulites, and other allied forms, which swarmed in the ancient ocean, and at one time held the undisputed empire of the seas.

It will be but dealing with our subject after the approved "historical" fashion, if, before entering more into detail on the Cephalophods of our own time, we now glance for a brief space at those ancient representatives of the race whose former existence is known to us from the fossilized remains of their shells alone.

The Cephalopods were amongst the most numerous and powerful inhabitants of the ancient ocean. It may truly be

said, indeed, that, just as there was an "age of reptiles," and, preceding that, an "age of fish," when these two classes of animal life reigned supreme over the rest of the creation, so, at a still earlier period, there was an Age of Cephalopods, when the sea was peopled with monstrous creatures of this class, and there were either no animals of a higher grade in existence, or only such as were feeble and powerless in comparison with these rapacious monsters of the deep. The whole vast variety of early Cephalopods belonged to the inferior or four-gilled division of the group, and were thus closely related to the Pearly Nautilus of the present day. It is not to be understood, however, that they all resembled the Nautilus in form and figure. On the contrary, there is the utmost diversity of form amongst the shells, though all of them consist of a similar succession of chambers, and were once tenanted by animals agreeing no doubt in all essential particulars with the existing Nautilus. The most abundant of the ancient Cephalopods were those of the different species of Ammonites, so called from the fancied resemblance of their shells to the horns of Jupiter Ammon. In the neighbourhood of Whitby, the lias rocks abound with these shells, which, varying in size from that of a sixpence to that of the fore-wheel of a coach, are popularly known as "Snake stones," the supposition being that they are veritable petrified snakes. The reader will no doubt recall the passage in "Marmion," in which Sir Walter Scott puts a legend to this effect into the mouths of the Whitby nuns, who tell their "stranger sisters :"

——"How, of thousand snakes, each one
Was changed into a coil of stone,
When holy Hilda prayed ;
Themselves, within their holy bound,
Their stony folds had often found."

It so happens, however, that the petrified snakes are always found minus the head, a circumstance which Sir Walter Scott, in the Notes to his poem, satisfactorily accounts for by stating that, at the abbess's intercession, the snakes were "not only petrified but beheaded." The dealers in such wonders not being aware, apparently, of this part of the miracle, and anxious of course to demonstrate the truth of the current story, always contrive to have on hand a few choice specimens of "perfect" snake stones, in which the head of the snake is either formed of

cement and stuck on the shell, or shaped out of the shell itself by means of a file!

In the Museum of the Royal College of Surgeons there is preserved the solitary specimen of the animal of the Pearly Nautilus which the country can boast, and which enabled Professor Owen to prepare the admirable "Memoir" on the species, which gives the only recent and certain information we have of the organization of this interesting Cephalopod. It was taken in 1829, in a bay on the south-west coast of the Island of Erromanga, in the South Seas, "where," says Dr. George Bennett, who described its capture in his "Wanderings," "it was seen floating on the surface of the water at some distance from the ship. To many it appeared like a small dead tortoise-shell cat, which would have been such an unusual object to be seen in this part of the world, that the boat, which was alongside the ship at the time, was sent for the purpose of ascertaining the nature of the floating object. On approaching near it was observed to be the shell-fish commonly known by the name of the Pearly Nautilus. It was captured and brought on board; but the shell was shattered from having been struck with the boat-hook in capturing it, as the animal was sinking when the boat approached, and had it not been so damaged it would have escaped." The idea of sending off a boat to look after a dead cat may appear somewhat absurd, but locality must be taken into account, and the reader who is at all versed in the geographical distribution of animals will know that, thirty years ago, a dead cat in the South Pacific would have been as much a marvel as a dead elephant in Southampton Water.

Nothing very definite appears to be known as to the habits of the Nautilus. It appears to spend its time chiefly at the sea-bottom, where it creeps along with its house upon its back; occasionally, however, it ascends to the surface and floats upon the water, though, when there, it is totally incapable of directing its course, except by the action of the ordinary respiratory currents expelled through the funnel.

The shell of the Nautilus, banded with alternate stripes of orange and white, and to be seen in every "naturalist's,"—that is to say, bird-stuffer's—window, is an exceedingly complicated and interesting structure, and has given rise to much discussion among scientific men. Externally it presents nothing remark-

able in its appearance, and might be mistaken for the domicile of an overgrown snail, only that its sides are considerably flattened, and that it is somewhat too artistically finished off at the mouth. Cut into halves, however, and exposed thus in section, it is seen to be divided into a series of chambers, the outermost of which is large and roomy, and contains the body of the Nautilus, whilst the others are occupied only by air, and gradually decrease in size as they approach the inner extremity of the shell. The partitions between the chambers are firm plates of shelly matter, which, as they are continued from the side walls, make every compartment perfectly air-tight, and thus convert the shell into a float, which buoys up the Nautilus in the water. A communication is kept up between the several chambers by means of a membranous tube, termed the *siphuncle*, which, originating in the body of the Nautilus in the outer chamber, passes through all the partitions in succession, and has been supposed, though apparently without much reason, to be the principal agent actively concerned in that alteration of the specific gravity of the Nautilus, by which it is enabled at will to ascend to the surface from the sea-bottom, or instantly sink again if danger threaten.

This ascending and descending in the water is an interesting point in the economy of the Nautilus, and one which has abundantly shown that philosophers are not exempt from the common failing of preferring novel and fanciful methods of accounting for unusually curious phenomena, even when familiar and commonplace explanations would equally answer the purpose. Thus the most ingenious theories have been propounded to explain the *modus operandi* of these visits of the Nautilus to the sunlight and back, the siphuncle being in all of them alike credited with the chief share in the transaction.

But there is good reason to believe it has little or nothing to do with the matter, and that the change of place is effected by a simple contrivance, which, any day in summer, may be seen illustrated by another little Mollusc common in almost every roadside ditch in the country. The fact is, that, as Professor Owen has satisfactorily shown, the Nautilus, contracted within its buoyant shell, is so little heavier than its own bulk of water, that by protruding its body beyond the aperture of the shell, and spreading itself abroad so as to displace a greater volume of the fluid, it

reduces its specific gravity considerably below that of the surrounding medium, and is able to mount almost without an effort to the surface; while, when there, the mere act of withdrawing itself within the shell will instantly suffice to send it again to the bottom.

It is not necessary, therefore, to suppose that the siphon is in any way concerned in these movements; and in the absence of proof, all theorizing based on the assumption that it is so is a mere gratuitous exercise of ingenuity. By far the most probable function of the tube is, that it helps to maintain the vitality of those portions of the shell which are furthest removed from the body of the animal, and which, if deprived of all vital connection with it, would speedily become fractured, and thus totally destroy the hydrostatic balance of the Nautilus, and doom it for ever after to remain at the sea-bottom.

The two-gilled Cephalopods comprise the *Octopods*, distinguished by the possession of eight arms or feet, and the *Decapods*, which boast the possession of an additional pair of those organs.

Let us glance at the ten-armed gentlemen first. In all these animals two of the ten arms are greatly prolonged, and provided at the extremity with a thick fleshy expansion covered with suckers, and, in one family, with powerful hooked claws, for holding on firmly to their slippery prey. The Common Cuttle-fish may be taken as the type of this division of the Cephalopods, which also includes the Calamaries or Squids, the Spirula, and that engaging little fellow, the smallest of the Cephalopods, the common Sepiola. In many of these animals we meet with the rudiments of an internal shell, as in the "bone" of the Cuttle-fish, and the "pen" of the common Calamary, while in the Spirula there is a true chambered shell, though only partially enclosed in the body. The Cephalopods of this section are furnished along each side of the body with a powerful muscular fin, which greatly aids them in their movements through the water; and, in some of the Calamaries, these lateral fins are so largely developed that the animals can project themselves above the surface of the water, and, like the flying-fish, dart for a short distance through the air. Immense numbers of these "Flying Squid" annually visit the shores of Newfoundland, where they form the principal bait employed in the Cod-fishery.

Do any of our readers know the little Sepiola? It will be no disrespect to our readers to assume that not one in ten of them know anything about it. The fact is, this engaging little creature, although by no means uncommon around our southern coast, was all but unknown, excepting by name, even to naturalists themselves, until Mr. Gosse fished it up from Weymouth Bay, and gave us that most entertaining account of its habits in his book on the "Aquarium."

Hardly an inch in length, with an almost globular body furnished with prominent fins, the Sepiole is described as a sprightly and beautiful little creature, altogether unlike what one would expect in a genuine Cephalopod. It darts about in the aquarium with the greatest vivacity and grace, and occasionally poises itself in mid-water, hovering like a Moth over a flower. As a general rule, it keeps its two long tentacula coiled up out of sight between its shorter arms, but the little Cephalopod can shoot them out to their full length when occasion requires, and make good use of them too, as Mr. Gosse once had proof—one of his little pets having seized hold, with these organs, of a poor shrimp, on which the tiny beak was soon seen busily at work. But perhaps the most interesting circumstance connected with the Sepiole is the singular manner in which it perpetually changes its colour; and, as this property is common more or less to all the Cephalopods, we will give in full the passage in which Mr. Gosse refers to it.

It is almost impossible, it seems, to name any definite colour as that proper to the animal. "Now it is nearly white or pellucid, with a faint band of brown specks along the back, through which the internal viscera glisten like silver. In an instant the specks become spots that come and go, and change their dimensions and their forms, and appear and disappear momentarily. The whole body—arms, fins, and all—the parts which before appeared free, display the spots, which, when looked at attentively, are seen to play about in the most singular manner, having the appearance of a coloured fluid injected with constantly varying force into cavities in the substance of the skin of ever-changing dimensions. Now the spots become rings, like the markings of a panther's skin; and, as the little creature moves slightly, either side beneath the fins is seen to glow with metallic lustre, like that of gold-leaf seen through horn. Again,

the rings unite and coalesce, and form a beautiful netted pattern of brown, which colour increasing, leaves the interspaces a series of white spots in the rich dark ground. . . . But here is a change! One is hovering in quiescence, his colour pale, almost white: one of his fellows shoots along, just over him; with the quickness of thought the alarmed creature turns from white to a uniform deep brown, the rich full colour suffusing the skin in a second, like a blush on a young maiden's face."

There can be but little doubt that the power with which the Cephalopods are endowed, of thus incessantly changing their colour, is designed to serve as an additional means of protection against discovery. The larger species, indeed, are commonly observed to harmonize their colour to that of the surface over which they pass, so as to render their detection at a short distance a matter of some difficulty.

Octopus vulgaris, the common Poulpe, already introduced to our readers, is the model Cephalopod of the eight-armed group. This animal has been famous from the earliest ages, and the most marvellous stories are told of its habits. Pliny has a long account of its various accomplishments, and amongst other things, credits it with "keeping of house and maintaining a familie," for whose behoof it is said to carry home to its nest all that it can take; and, he goes on to say, that, "when they have eaten the meat of the fishes, they throw the empty shels out of dores, and lie as it were in ambuscado behind, to watch and catch fishes that swimme thither." He says it is a "meere tale, that they gnaw and eat their own clees and arms; for they be the congres that do them that shrewd turn; but true it is, that they will grow againe like as the taile of snakes, adders, and lizards." But the best thing he gives us is a story of our friend's partiality for cockles, which is so particularly good that, he tells us, he "cannot ouerpasse" it. "They are most desirous and greedie of cockles, muscles, and such like shel fishes: and they, againe, on the contrarie side, so soone as they feele themselues touched of the Polypes, shut their shels hard and therwith cut asunder their clawes or armes that were gotten within: and thus fall they to feed vpon those who sought to make a prey of them. These Polypi, foreseeing all this, lie in wait to spie when the said cockles, &c., gape wide open, and put in a little stone between the shels, but yet beside the flesh and bodie of the fish,

for feare lest if it touched and felt it, she would cast it forth again : thus they theeue, without all daunger, and in seeuritie get out the fleshie substance of the meat to deuoure it; the poore eockles draw their shels together for to claspe them between (as is aboue said) but all in vaine, for by reeson of a wedg between, they will not meet close nor eome neere together." To whieh story he adds the sage refleetion, "See how subtile and craftie in this point these creatures be, which otherwise are most sottish and senselesse."

By far the most interesting of all the Cephalopods is the little Argonaut, improperly called the Paper Nautilus. This famous little creature has come down to us from antiquity, stigmatized on the one hand as a pirate and usurper that has no right to the shell it inhabits, and lauded, on the other, as an active and skilful *voyageur*, and the first instructor of mankind in the art of navigation. Both these matters have been thoroughly investigated of late years, and on neither of them now is there the slightest doubt remaining. As the character of the little favourite is involved in the former point, we will examine into that first.

Is the Argonaut a pirate? The point has been a disputed one from the time of Aristotle downwards, although the majority of voices has always been with the "ayes;" the assumption being that the Argonaut picks up its shell at the sea bottom, and appropriates it to his own use, just as that crusty little oddity, the hermit-crab, is known to appropriate the shells of the eommon whelk.

But on what ground was the assumption made? What is the evidence?

In the first place, then, the Argonaut is in no way attached to the shell it inhabits, and has often been seen, when alive, to quit the shell of its own accord. Again, it was alleged, that the position of the animal in the shell is by no means regular and constant, the head being sometimes turned towards one extremity of the shell, and sometimes towards the other—a circumstanee which certainly seemed to show that the shell was not expressly fitted to its occupant. Further, the body of the Argonaut is just as deeply coloured as that of the naked Cephalopods, which would seem to show that it was not permanently covered from

the light. In the last place, the eight-armed Cephalopods were known to be a set of prying, inquisitive fellows, fond of poking their tails into every hole and crevice where they could, by any possibility, manage to squeeze them; and, on one occasion, one of them was actually taken with its body wedged into a small butter-jar, in which it had, no doubt, gone proudly careering through the water, till at last, attracted by the tempting appearance of a baited hook, it ventured a nibble, and so got caught.

Evidently the case of the Argonaut was a suspicious one. What had its friends to say on the other side, and to show that the shell it occupied was really of its own fabrication? Two things, and two only they could advance:—first, that the shell had never been found on any other animal; secondly, that the Argonaut had never been found in any other shell. The defence was a meagre one certainly, but it was to the purpose; and, notwithstanding that the general voice went against it, the Argonaut had many champions on its side, who stoutly maintained that it was both architect and rightful owner of the graceful little bark in which, by general consent, it sailed so proudly on the bosom of the deep.

Thus had the question stood for centuries, no new facts of any moment being added, and the disputation going on as stoutly as ever, when at length, and only a few years ago, a lady entered the field, and, by a few simple experiments and observations, put the philosophers to open shame, and for ever set at rest the long-disputed question.

Madame Jeannette Power, a French lady residing on the shores of the Bay of Messina, where the Argonaut is of frequent occurrence, enclosed several of the animals in a sort of cage, fenced off from the sea at the water-side, and there studied their history in all its stages. In this way Madame Power ascertained that the Argonaut is the indisputable fabricator of the shell it inhabits; that the shell regularly increases with the growth of the animal; and that its first formation, and all subsequent repairs that it may need, are effected by the broad membraneous expansions which the Argonaut was reputed to hoist as sails to catch the breeze. The results of Madame Power's investigations came upon the scientific world as a perfect surprisal; and, in

1839, the lady put the cap of completeness on her labours, by forwarding to the principal learned societies of Europe sets of specimens of the Argonaut and its shell of all sizes; hoping, no doubt, to teach the disputatious philosophers how much better than theory or argument is a little patient watching and painstaking examination of actual facts.

It was enough for a lady to do, to clear the character of the Argonaut, and to establish its title to the shell in which it had won such renown as a navigator. It would have been an unseemly thing for those fair hands to have stripped the little Cephalopod of its laurels; and Madame Power was content to believe with the rest of mankind, that, far out at sea, as the poet sang, the Argonaut—

> "Put out a tier of oars on either side,
> Spread to the wafting breeze a twofold sail,
> And mounted up and glided down the billow
> In happy freedom, pleased to feel the air,
> And wander in the luxury of light."

But there was double justice to be done. The Argonaut had been proved innocent of piracy, and now, by the same stern rule of right, it was to lose its reputation as a sailor.

Nearly at the same time as Madame Power was attending to her little protégés in the Bay of Messina, M. Sander Rang was carrying on a somewhat similar course of observations on the opposite shores of the Mediterranean at Algiers. The researches of this gentleman are entirely corroborative of those of Madame Power as to the secretion of the shell by the so-called sails; but they go further, and show, beyond all reasonable doubt, that the Argonaut has no such power, as is commonly supposed, of hoisting these expanded membranes to "catch the driving gale," and so to sail along the deep. The little Cephalopod can certainly raise itself from below, and sport about at the surface of the water, but it does this with its membraneous flaps closely wrapped about its shell, and by precisely the same means as the Cephalopods in general—namely, by the forcible ejection of water from the funnel. M. Rang, therefore, completely upsets the Argonaut's reputation as a sailor; but, then, he makes him known to us in a new character—that of a crawler at the sea-bottom, where, it appears, the animal creeps along with its head

downwards, and its shell upon its back, much after the manner of the common snail. Most terribly true, therefore, is it here, that—

—— "All charms fly
At the mere touch of cold philosophy."

Once we had a little *voyageur* all elegance and grace—

"The ocean Mab, the fairy of the sea;"

but "cold philosophy" comes and touches it; and, lo! the favourite of the poets becomes a mere commonplace crawler at the sea-bottom.

But let us be consoled. Philosophy has revealed more wonders than it has marred; and, with all deference to the author of "Lamia," prosaic truths are far better than poetic fictions.

Pets of the Aquarium.

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CHAPTER VI.

THE AQUARIUM AND ITS INMATES.

PART I.

"Pellucid pools, and rocks in miniature,
With their small fry of fishes, crusted shells,
Rich mosses, tree-like sea weeds, sparkling pebbles
Enchant the eye . . . . . .
. . . . . a fairy paradise."

The popularity of the Aquarium has considerably abated of late, but a few years since it was something altogether extraordinary. It may be a harsh way of describing this popularity to speak of it as a "mania," but a passion so prevalent and intense is certainly nothing less. The tendency to these peculiar mental epidemics is one of our national weaknesses, and is sure to exhibit itself again and again at longer or shorter intervals. It is no great while ago that it showed itself in connection with those preposterous bipeds, the Cochin-China fowls; and before we had well become reconciled to those ornithological oddities, a still more virulent craze broke out, for converting plain glass jars into magnificent specimens of porcelain and pottery ware. It was our fair friends more especially who were affected by this latter mania, and so entirely did it get possession of them, that, for awhile, there was nothing that took so amazingly at fancy fairs and bazaars, nothing that was in such great request for wedding and birthday presents, as choice samples of this home-made mimicry of the costly wares of Sèvres and Dresden. But Potichomania, like other manias that had gone before it, speedily ran its course, and had to give way to the stronger attractions of a rival novelty. The narrow-necked jar gave place to the capacious tank; the corpulent Chinamen, the landscapes with impossible perspective, and the brilliantly-coloured butterflies, birds and flowers, unknown to science, all disappeared before a

sudden invasion of Tadpoles, "Tittlebats," and Sea-Anemones; and Aquarium-keeping became the order of the day.

The chemical principles involved in this ingenious and beautiful contrivance are now too well known to require any lengthened explanation. It is a matter of familiar knowledge, that in the process of respiration, animals consume the oxygen or life-sustaining principle of the atmosphere, and give back in return a quantity of carbonic-acid gas, which is as deleterious to animal life as the oxygen is healthful and invigorating. It thus happens that when animals are confined by themselves in a limited quantity of air, this double process of deterioration speedily renders the fluid absolutely poisonous and destructive of life. But in respect to plants, a precisely opposite state of things obtains. By a process somewhat analogous to the respiration of animals, though not to be confounded with it, the vegetable world is continually appropriating the carbonic acid of the atmosphere, and giving back oxygen. In their relation to the atmosphere, therefore, the two great divisions of the organic world beautifully balance one another—each taking and appropriating to its own use what would be injurious to the other, and each giving back that which the necessities of the other require.

In respect to the free atmosphere this mutually counteractive influence of the animal and vegetable kingdoms has long been familiar; we owe the Aquarium to the discovery that it equally holds good with respect to the atmospheric air contained in water.

The gentleman to whom the world is mainly indebted for this discovery, and for its practical application to natural history purposes, is Mr. Warington, of Apothecaries' Hall, who may fairly claim to be the originator of the Aquarium.

But about the same time that Mr. Warington was engaged in his experiments, Mr. Gosse was busily carrying on a similar series, and with the same object in view; and though not quite so successful as Mr. Warington at first, he was so far satisfied of the practicability of the Aquarium as to suggest the establishment of a series of them in the Zoological Gardens, Regent's Park. The suggestion was readily adopted, and early in the summer of 1853 the "Fish House," which for more than twelve months previously had been in preparation, was opened to the public. The success of the novel exhibition was extraordinary.

All London was eager to look at the wonderful little creatures from the sea-shore; and, for some months, the Gardens were daily the scene of as much excitement as followed the arrival of that now enormous beast, Obaysh, the Hippopotamus.

The publication of Mr. Gosse's elegant volume, "The Aquarium," opened up a new source of interest in connection with the subject. It suggested the establishment of the "Parlour Aquarium," by means of which private persons might have in their own houses, and under their constant notice, similar collections of animals to those which attracted such attention in places of public resort. The idea was no sooner suggested than it was eagerly caught up, and forthwith the Aquarium was elevated to the first rank amongst the ornaments of the parlour and the drawing-room. The expense, however, was something considerable at first; and, for a while, it was only in those "desirable residences," as the auctioneers phrase it, the substantial mansions of the people well-to-do in the world, that you had any chance of meeting with the Aquarium. But an increase of dealers, and the competition between them, soon made matters different; so that before long the man who had only a few shillings to spare could yet have his collection of pet Anemones, and keep, if he would, a whole aquatic menageric inside his parlour window. Nor did it matter in the least, apparently, where, or at what distance from the coast he might reside; for like those famous bedsteads one sees announced at the railway stations, the Aquarium, it seems, is expressly adapted to be "sent free by post," and might anywhere be had to order by simply addressing a letter to one of the London dealers. In London itself the passion for the Aquarium raged for a while at fever point. The new invention quickly dispossessed the shop windows of all the old-fashioned globes of gold fish, and created such obstructive crowds upon the footpaths, as to call for a speedy interference of the police. In West-end squares, in trim suburban villas, in crowded city thoroughfares, in the demure houses of little, unfrequented back streets, and inside the flat, sill-less windows of poverty-stricken Spitalfields and Bethnal Green, everywhere you saw the Aquarium in one form or another, and had abundant proof how ardently the cockney of every grade was attached to "the new fancy" which had come into fashion.

But it is time that we turn our attention from the history

of the Aquarium itself to the habits and history of its various inmates—the little creatures which all of a sudden became so immensely popular, and which, had they but the gift of speech, might very well say, with a certain bygone celebrity of a higher grade, that they awoke one morning and found themselves famous.

One or two words here, however, by way of explanation. It is with the marine Aquarium, exclusively, that we propose to deal: furthermore, we shall refer not merely to those animals, which, with proper care and attention may be permanently domesticated, but occasionally also to those more delicate races, which, excepting under the most favourable circumstances, are to be regarded rather as casual and temporary occupants, than as regular and settled inmates of the establishment.

Let us begin with one of these "casual and temporary" races, the most characteristic of the so-called "zoophytes." The little Hydra of our ponds and ditches is the fresh-water representative of an extremely interesting class of these animals, known as the Hydroid-Polyps, which are in reality neither more nor less than associated Hydras enclosed in little horny cups, and supported on a branched tree-like structure of the same horny consistence, termed the *polypidom* or Polyps' house. It is to these creatures that Crabbe alludes in the well-known lines :—

> "Involved in sea-wrack, here you find a race
> Which science, doubting, knows not where to place;
> On shell or stone is dropt the embryo-seed,
> And quickly vegetates a vital breed."

"Science" has long ago settled "where to place" these animals, and has assigned to them a position but a step or two above the very bottom of the animal series. It was long doubted, indeed, whether they could properly be ranked with animals at all; and the arborescent forms which the polypidom assumes, still leads to their being popularly classed with sea-weeds.

Individually, these little creatures are far too insignificant in size to make any figure in the Aquarium, where indeed they can seldom be kept alive for more than a few days, and for even that time only when the water is extremely pure. But they are abundantly worth all the trouble they cost, for however short a

period they may remain alive; and if inspected through an ordinary lens their beauty becomes at once apparent. The entire structure then has the appearance of a miniature plant, profusely decked with living flowers; from which circumstance, indeed, it is that one family of these Polyps derive their name of "Sertularian," from *sertulo*, a little nosegay or chaplet of flowers. The tiny Polyps are seen protruding from their cells, with their tentacles fully expanded, now rigidly outstretched, and perfectly motionless, and now suddenly bending and twirling about, as they come in contact with some invisible object floating in the water; and now, perhaps, taking sudden alarm, they disappear, as if by magic, and shrink to the bottom of their cup-like cells. Very beautiful, too, are the cells themselves; and in days gone by, when the animal nature of these Polyps was first proclaimed by Ellis, it was these cells which the animals occupied that attracted most attention. "As for your pretty little seed-cups or vases," says Hogarth, in writing to Ellis on the subject, "they are a sweet confirmation of the pleasure Nature seems to have in superadding an elegance of form to most of her works wherever you find them. How poor and bungling are all the imitations of art! When I have the pleasure of seeing you next, we will sit down, nay, kneel down if you will, and admire these things."

The number of these Polyps which are sometimes united together in a single polypidom is almost incredible; the occupants of a little feathery tuft attached to the shell of an oyster or a mussel often outnumbering the entire human population of the largest cities. And every Polyp of the vast multitude has a vital connection with all the rest. It is united at its base to a sort of medullary pith, which runs through the whole extent of the polypidom, and, in reality, connects the entire society into one compound animal, which, although having an almost infinite number of separate mouths and separate sets of arms to supply them with food, can properly be considered as only a single organism. In one respect, the individual Polyps seem less entitled to the character of independent existences than the blossoms of a plant; for when one of the number dies and drops out of its little cup the medullary matter at the bottom of the cell speedily buds out afresh, and the vacant cell is soon occupied by a new tenant.

But here, as elsewhere, the crowning wonder pertains to the process of reproduction. In all these Polyps the ordinary mode of increase is by the process of gemmation, the medullary pith continually pushing out new buds of the horny polypidom, which eventually become developed into regular cup-shaped cells, from the bottom of which new Polyps make their appearance. But in several species, at certain seasons of the year, peculiar closed capsules of a larger size than the ordinary cells are produced, and in these a pulpy mass is gradually developed into a number of minute ova, which ultimately make their escape as tiny Medusæ—the eggs of the Polyp thus producing a swarm of indisputable Jelly-fish! But this is only half the wonder. In process of time these Medusæ, themselves produce eggs, from which spring, not young Medusæ, but Polyps in every respect identical with the original stock. Thus the Polyps produce Medusæ, which again produce Polyps; as in a former chapter we saw that the Medusæ produced Polyps, which in due time resolved themselves into Medusæ.

It is evident, therefore, that the relation between these two classes of apparently most dissimilar forms of life is of the closest and most intimate nature; nor is it surprising—extravagant as the idea may appear at first—that many naturalists should regard the class of Polyps, of which we have been speaking, as nothing more than the early immature forms of *bonâ fide* Jelly-fish.

But marvellous as is the structure and history of these tiny Polyps, they make such an insignificant show in the Aquarium, that by incurious observers they would be passed by as undeserving of attention. Not so is it, however, with the Polypes of another order, which are the most conspicuous and attractive objects that the Aquarium contains, and are pre-eminently the *pets* of the establishment. It would never do, however, to play one's best card thus early in the chapter; so that merely entering an appearance for them here, we must postpone for a while all that we have to say on those popular beauties, the Sea-Anemones.

Between fish and Star-fish there is a wider interval in nature than the names alone would indicate. The two races, indeed, have very little in common, and stand, in somewhat analogous positions, at nearly the two opposite extremes of the animal king-

dom. The non-zoological reader will understand, therefore, that it is only in the sense of that comprehensive phrascology which makes everything "fish" which lives in the sea, that the Star-fish have any connection with the finny tribes. The Star-fish and their allies constitute the spiny-skinned fraternity known as the *Echinodermata*, a designation, however, which, like many more of our scientific terms, only partially applies to the animals which bear it. The common Star-fish (*Uraster rubens*) may be taken as the type of its race. It is a well-known creature on most parts of our coast, where it passes under a variety of popular names, as Cross-fish, Star-fish, Five-fingers, and the like, and may often be seen clinging to the half-submerged rocks and boulders at the time of low water, or, dead and partially decomposed, mingled with the line of refuse which marks the highest advance of the tide. People who know the Star-fish only in the form of the stiff and dried specimens of a museum, will be surprised to see them in the Aquarium, clambering over the blocks of stone, bending to all the irregularities of the surface, and moving along with considerable facility. Look attentively and you may see how these movements are effected. From the under surface of each ray protrude a host of minute worm-like suckers, which are seen groping and feeling about, extending and contracting themselves, some fastening on to the surface of the stone, others loosening their hold to stretch forward and attach themselves afresh; the whole acting, the spectator is apt at first to think, without concert or unity of purpose, and yet, more closely observed, all evidently obeying a common impulse, and enabling the animal by their united efforts to draw itself along.

By means of these curious organs, the Star-fish mounts the glass sides of its prison-house just as easily as the blocks of stone; and thus exhibiting itself, the whole of its under surface is exposed, and every movement of the suckers may be watched. The animal has now a very curious appearance. Its mouth is seen in the form of a circular orifice in the centre of the disc from which the rays diverge; each of these rays is seen to be traversed by a deep groove; and from alternating rows of minute perforations in these grooves issue the tubular suckers, which form the Star-fish's only organs of locomotion.

But locomotion is not the only purpose to which these curious members are applied. They are equally serviceable in the

capture of prey; and, fixed to the shell of any luckless crab, hold him with a firmness of grasp, against which his most violent struggles are totally unavailing. Armed with these formidable appendages, it is no wonder that the Star-fish acts the part of a petty tyrant at the sea-bottom, and makes short work of whatever shell-fish or crustacea come in its way. Much of its food, indeed, is derived from animal matter which is already dead and decaying; but it is equally well pleased to kill its own game; and sometimes seizes upon a passing neighbour, which, despite all its protestations and entreaties, is relentlessly held fast, the rays of the tyrant bending in upon it meanwhile, pressing it nearer and nearer to the fatal mouth, which, dilating for the purpose, soon engulfs the hapless wretch, and irrevocably seals its doom.

Amongst fishermen, the Star-fish has the reputation of being extremely fond of oysters; and it is said that, when it wishes to indulge itself with one of these delicacies, it lies in wait till it sees an oyster gaping, and then adroitly inserting one of its rays between the open valves, literally eats the poor mollusc "out of house and home." Now, there can be no doubt that the Star-fish *has* a weakness, not merely for oysters, but for shell-fish in general; though it is equally certain that it does not adopt the above impossible mode of gratifying its predilections. The truth of the matter, however, is even more wonderful than the current fiction. It seems that when inclined for an oyster supper, the Star-fish clasps the mollusc in its arms, and by means, as it is supposed, of some poisonous secretion, speedily reduces it to a state of perfect helplessness, when the valves of the shell gape wide apart. The gourmand now resorts to the very original and ingenious expedient of pouting its stomach out of its mouth and projecting it bodily into the open shell of the oyster, where the digestive apparatus does its work quite as well as in its own proper place. It is no uncommon circumstance to meet with the Star-fish in the very act of performing this most extraordinary gastronomic operation; and occasionally three or four of the animals may be found clustered together about some poor mollusc, whose vitals they are unitedly sucking out, and with which they form a sort of foot-ball, which the waves roll to and fro upon the sand.

The name of "Five-fingers," by which the common Star-fish is known, sufficiently indicates that five is the normal number of

its rays; and it is a curious circumstance, in connection with the entire fraternity of Echinoderms, that this same number, five, seems, in almost everything, to reign predominant in the details of their organization. It is not unusual, however, to meet with Star-fish having only four or even three rays; and not long since there was a specimen of *Uraster rubens* in one of the tanks in the Regent's Park Gardens which had but two rays, and those on exactly opposite sides of the central disc, so as to give the animal a spindle-form. The truth is, the Star-fish and their allies are endowed with the most extraordinary powers of voluntary dismemberment; and when they have the misfortune to injure any of their members they very deliberately fling them away, or rather crawl off and leave them behind. But it is only for a time that the Star-fish goes with less than its full complement of members, as new rays speedily sprout out, and, in due time, the animal regains its normal condition.

In so far as is known, the habits of all the true Star-fish are pretty much alike, though in form and appearance there is a considerable difference between the various species. One of the most elegant of those found around our own shores is the well-known Sun-star (*Solaster papposa*), a magnificent fellow, with from twelve to fifteen rays, and which, decked as it is in rich tints of scarlet and purple, has a truly gorgeous appearance as it clings to the rocks with the waves curling and playing around it.

Brittle-stars and Sand-stars are Star-fish with a difference. These animals are distinguished by the greater length and slenderness of the rays, which, possessing neither groove nor suckers, differ essentially from the corresponding parts of the true Star-fish. When the Fish House in the Zoological Gardens was first opened, several of these odd-looking little creatures were exhibited in one of the tanks, and the singularity of their appearance attracted much attention. It was speedily discovered, however, that they were not of a kind to be successfully treated in the Aquarium, and no new supply has been obtained to take their place. The Brittle-stars are extremely abundant around most parts of our coast, most of the species inhabiting deep water, where they appear to spend an active existence, swimming and crawling about with considerable facility, by means of their elongated spiny rays—their only organs of locomotion. The common

name of these animals is derived from the extraordinary delicacy of their arms, which break away at the slightest touch, so as to render it a difficult matter to procure specimens in a perfect condition. And what adds to the singularity of the matter is, that this mutilation is a perfectly voluntary act; for it frequently happens that, when these animals are brought up from the deep, they leap and twist about, snapping off their arms piece by piece, sometimes till there is nothing left but the small central disc. Professor Forbes tells us that he once saw a dredge come up completely filled with specimens of the Common Brittle-star (*Ophiocoma rosula*), and that, when they were emptied into the boat, they began creeping about in all directions, writhing with the strangest contortions, flinging their arms about in broken fragments, and putting themselves into a variety of snake-like and threatening attitudes. The boatmen, the Professor says, by no means relished the sight, and begged permission to shovel the little fellows overboard, declaring their belief that the "things weren't *altogether right!*"

By far the most famous of these animals for this propensity to voluntary dismemberment, is one of the true Star-fish, an enormous fellow nearly two feet in expanse, which bears the most appropriate name of *Luidia frangilissima*. The graphic pen of Edward Forbes has given us the following racy sketch of the characteristic peculiarity of this prince of Star-fish: "The first time I ever took one of these creatures, I succeeded in getting it into the boat entire. Never having seen one before, and quite unconscious of its suicidal powers, I spread it out on a rowing bench, the better to admire its form and colours. On attempting to remove it for preservation, to my horror and disappointment I found only an assemblage of rejected members. My conservative endeavours were neutralized by its destructive exertions, and it is now badly represented in my cabinet by an armless disc and a discless arm. Next time I went to dredge on the same spot, determined not to be cheated out of a specimen in such a way a second time, I brought with me a bucket of cold fresh water, to which article Star-fishes have a great antipathy. As I expected, a *Luidia* came up in the dredge, a most gorgeous specimen. As it does not generally break up before it is raised above the surface of the sea, cautiously and anxiously I sank my bucket to a level with the dredge's mouth, and proceeded,

in the most gentle manner, to introduce *Luidia* to the purer element. Whether the cold air was too much for him, or the sight of the bucket too terrific, I know not; but, in a moment, he proceeded to dissolve his corporation, and, at every mesh of the dredge, his fragments were seen escaping. In despair, I grasped at the largest, and brought up the extremity of an arm with its terminating eye, the spinuous eyelid of which opened and closed with something exceedingly like a wink of derision."

The most ambitious owner of an Aquarium will hardly be very sanguine of adding *Luidia* to his stock of "marine stores;" but, as Mr. Lloyd, the spirited dealer in aquarian objects, has chosen it as his crest, and has thus "set to his seal" that the thing may be done, it may be that we shall yet succeed in inducing the sensitive beauty to make himself at home in our crystal enclosures.

If you bend the rays of a Star-fish under the disc, so that the sides may meet, you will form a sort of spherical or orange-shaped box, and see how an ordinary Star-fish is transformed into an Echinus, or Sea-hedgehog, another of the spiny-skinned fraternity, which belongs to the pets of the Aquarium. Like its namesake of the furze-brake and the hedge-row, the Echinus has its coat thickly beset with prickles, which need be delicately handled, if you would avoid their points. Each of these spines is attached, by a kind of ball and socket-joint, to a little tubercle on the shell of the Echinus, and as the whole of them move freely in every direction, they enable the animal to get out of harm's way when it pleases, by burying itself in the sand. They also assist in locomotion; but for this purpose the Echinus is provided with far more efficient organs in the shape of long tubular suckers, like those of the Star-fish, which issue from minute orifices in the shell, and, extending beyond the spines, enable the Echinus to creep along the shore, or climb the rocks in search of its diminutive crust-covered prey.

The spherical box which forms the shell of the Echinus is an exceedingly curious structure. It is made up of an immense multitude of five-sided pieces, arranged in regular rows, five pairs of which are pierced with minute orifices for the protrusion of the delicate worm-like suckers, while the remainder are studded with tubercles for the attachment of the spines. The plates all fit together with the greatest accuracy, and give the shell the appear-

ance of being formed of a single piece; but, notwithstanding this apparent solidity, a delicate formative membrane everywhere intervenes between the edges of the plates, and by the gradual deposition of calcareous particles to their margins, adds to the size of each in a regular and uniform manner. It matters nothing, therefore, to the Echinus that it is shut up for ever in a hard, unyielding stony box, for, in virtue of this simple but beautiful contrivance, by the same means that it adds to its bodily substance, it also pushes apart the shelly plates of its crusty environment, and makes for itself the additional room it requires.

There are several species of the Echinus found around our shores, one of the commonest in many parts being the little Purple Egg Urchin (*Echinus miliaris*), which thrives very well in captivity, and makes an interesting addition to the Aquarium. At large on the sea-shore, it is generally found in holes and crevices of the rocks, not unfrequently taking up its abode in a deserted hole of that rock-boring mollusc, the pholas; but in the Aquarium it is very fond of covering itself with bits of gravel, which it holds on by means of its suckers, and, thus adorned, it marches about the bottom of the tank.

Nothing, in relation to these animals, is more extraordinary than the amount of injury they can sustain without being materially affected thereby. A remarkable instance of this insensibility to mutilation is given by Mr. Patterson, who once cut an Echinus horizontally into two nearly equal parts, for the purpose of examining the intestines and ovaries, which nearly fill the shell. These vital portions of the animal's organization were taken out, and the divided shell was thrown aside; but, being put into a vessel of sea-water some time afterwards, Mr. Patterson was not a little surprised to see the two portions of the empty shell put out their suckers and walk about, "apparently as unconcerned as if the loss of intestines and ovaries had been an every-day occurrence." Let there be no mistake, however. It was a mere piece of bravado on the part of Master Echinus to exert his power of locomotion under such circumstances; and there can be no doubt, though the fact is not mentioned, that before long the poor fellow got to the end of his journey and walked no more.

If we do not mistake, some ancient erudite somewhere declares

that all the manifold productions of the land have their counter parts in those of the mighty deep. In proof, here we have the *Sea-cucumber*, which, though grown upon no hot-bed, and unrecognized in Covent Garden, is yet, if Chinese epicures and needy Neapolitans may be permitted to decide, not unfit to eat The name is not inaptly chosen, for the larger species of these animals—the great Sea-cucumber (*Cucumaria frondosa*) of our northern coast, for example—closely resemble cucumbers in form; and yet, furnished at one extremity with a gaping mouth, surrounded by plumed tentacula—which however can be swallowed out of sight at pleasure—and dull and disagreeable in colour, they could hardly be mistaken for those cool delicacies, and it would certainly tax the skill of the most accomplished *chef de cuisine* to make them acceptable to a British palate.

No one unversed in the classification of animals would suspect for a moment that these elongated flabby creatures belonged to the class of prickly skins; and yet it is, unquestionably, with that division of the animal world that they are properly to be ranked. The affinity of these animals to the *Echinodermata* is to be found, however, not so much in the character of the skin, which is only sparingly furnished with calcareous matter, and never in the form of spines, as in that of the organs of locomotion, which are delicate worm-like suckers, similar to those of the Star-fish and Sea-urchins. In the more typical species of the Sea-cucumbers, moreover, these locomotive suckers are so disposed as to divide the body into five longitudinal segments, thus affording another indication of the true affinities of these singular creatures.

The Sea-cucumbers, or the *Holothuriæ*, as they are termed by the zoologist, are not uncommon around our coasts, and specimens of the smaller species may readily be found at the time of extreme low water, attached by their suckers to the under surface of projecting rocks, and blocks of stone. The species most commonly met with in such situations is the Angular Sea-cucumbers (*Cucumaria pentactes*), which delights in dark crevices and other obscure retreats close to the low-water mark, where it sometimes occurs in considerable numbers. It is extremely variable in colour, ranging from nearly a pure white to dark purple or black, the same animal assuming a variety of shades in the course of a few months. Of all the Sea-cucumbers this is by

far the best for the Aquarium, where, with a little care, it will continue to thrive for years and occasionally present its owner with a family of little ones. The common Sea-cucumber (*Cucumaria communis*) is another of our smaller species well adapted for confinement; although, living for the most part below the tide marks, it is not so easily obtained. It is curious to observe the movements of these animals in the Aquarium, locomotion being effected partly by means of the tubular sucker-feet, and partly also by the alternate extension and contraction of the body, as in the case of the common earth-worm and its allies.

This worm-like mode of progression is characteristic of the *Holothuriæ*, and shows, more clearly than anything else, the nearness of their approach to the Articulate animals, which stand next above them in the scale of creation. It is mainly owing to the highly contractile nature of their muscular system, which is so strongly developed and complicated as to enable these animals to alter their form and appearance in the most remarkable manner at pleasure. Thus, while the great Sea-cucumber already mentioned is only about a foot long in a state of rest, it can quickly elongate itself to a length of nearly three feet, and then, it may be, suddenly contracting, it will puff itself out in the form of a globe, when, taking another whim, it nips itself in at the middle, and quickly becomes an animated hour-glass! Let no humane observer attempt, however, to provoke a display of this singular propensity; for your *Holothuria*—far from being "as cool as a cucumber"—is hot and irritable to an extraordinary degree, and not unfrequently, on the slightest alarm or provocation, will throw itself into such violent contortions as to burst asunder and discharge the whole of its viscera. "But," facetiously remarks Professor Rymer Jones, "the most wonderful part of the tale is, that the catastrophe, so grievous to the spectator who witnesses such a tragedy, seems to be of very small importance to the actor, as the creatures seem to get on just as well without any bowels as when possessed of such trifling additions to their economy; and, what is more, can reproduce them in a most convenient manner, so as again to become furnished with a complete set."

It has already been hinted, that the Sea-cucumbers are used in some parts as an article of food. In China they rank as great

dainties, and, with sharks' fins, edible birds'-nests, cats, puppies, and similar delicacies, are made into choice dishes, only available to people well-to-do in the world. The great fishing-ground for the *trepang*, as the animals are termed, is the northern coast of Australia; and the extent of the traffic, and the annual slaughter of the *Holothuriæ* which it involves, may be inferred from the fact, that considerably more than eight thousand hundredweight of trepang annually finds its way to the China market, to gratify the delicate appetites of the celestial epicures.

The uninitiated reader would hardly have looked to the Worms as a class of animals at all likely to furnish the Aquarium with any of its pets; and yet it is to that humble and despised race that we owe some of its most interesting occupants. The truth is, the Marine Worms are a far more engaging race than most people are aware of; although, now that the Aquarium has given them an opportunity of showing themselves, they are rapidly rising in public estimation. A plea, then, on behalf of the Worms of the Sea-shore.

Be it understood in the first place, then, that these Marine Annelids form two distinct groups, in one of which the animals are sedentary in their habits, dwelling in tubes of their own construction, while in the other they are unprotected by any such convenient domicile, and roam at large in their native haunts, abundantly provided with organs of locomotion. It is to the tube-makers more especially that the worms adapted for the Aquarium belong, although two or three of the more erratic fraternity occasionally share their captivity, one of the number being a gorgeous fellow very well known on some parts of our coast as the Sea-mouse!

By far the most attractive of the tube-making worms are those popular favourites, the Serpulæ. No less than eight or nine distinct species of these animals are to be found around our shores, and though they all have a certain beauty of their own, it would seem to be a well-understood thing amongst them, that the large and showy species, *Contortuplicata*, is to take the lead and chieftainship of the family: for while the rest lie prostrate at its feet, or meekly cling to it for support, attaching their tubes by their entire length to the shell or stone to which they are affixed, this more ambitious beauty boldly stands erect for full the half of its length, and woos and wins the admiration of all beholders.

In one of the marine tanks in the Regent's Park Gardens, there stood for a long time a common glass bottle completely encrusted with the tortuous tubes of various species of Serpulæ, but chiefly with those of the one just mentioned; and when the worms were all protruding, and their brilliant plumes displayed abroad, the bottle presented an extremely curious and beautiful appearance, as though it had been overgrown by some strange ungainly plant of ocean, leafless, but decked with gorgeous flowers.

These flower-like expansions are the Serpula's breathing organs, and consist of a series of stiff threads, arranged in the form of a funnel deeply infolded on one side, and beset on their inner sides with a double row of minute bristles like the teeth of a comb. In the centre of this brilliant array of branchial plumes there is a curious stopper-shaped body seated at the end of a long slender stem, which serves the purpose of a trap-door to the Serpula's domestic establishment, and neatly blocks up the entrance when the little worm finds it convenient to retire out of sight. It does this with wonderful celerity, and at the slightest alarm; for though the Serpulæ belong rather to the "still life" of the Aquarium, so long as all things remain quiet, let some eager gazer give the vessel but the slightest shock, and, quick as thought, the little beauties start back into their tubes, leaving their would-be admirer in open-mouthed wonder at their sudden disappearance.

Notwithstanding that the large and showy species of Serpula already named is almost universally regarded as the beauty of the race, we are by no means sure that the quiet, unassuming grace of the little triangular-tubed species (*S. triquetra*) does not entitle it to a higher place in our favour. It is small in size, it is true, and not very gaily coloured, but the rich tints of brown, gray, and ruby with which its branchial plumes are mottled and banded, give it a very elegant appearance when viewed with a lens, while its operculum or stopper is shaped very much like the cup of the well-known toy, the cup and ball. On first looking at a group of these curious Annelids in a well-kept Aquarium, the observer is pretty sure to be struck with the perfect stillness which they maintain, and the idea of a cluster of flowers is instantly suggested to the mind. But within a moment or two, in all probability, the long whip-lash extremity of one of the bristles will be seen to give a sudden twitch, then the bristle itself is slowly raised, then another and another partakes of the movement, and

presently the entire plume is twisted round in the mouth of the tube, and it will be a wonder if, in a moment after, some slight movement of the observer himself do not send the little worms, quick as lightning, out of sight.

Not unfrequently, groups of Serpulæ may be found, in which two or three individuals of the larger species have secreted their tubes in a sort of coil, which stands up nearly erect from some stone or shell, while several of the smaller species cling on to them in various positions, like climbing plants attached to the trunk of a tree. We once had a group of this description, in which the central support was formed by three large specimens of *S. contortuplicata* lovingly embracing each other, and putting their heads close together at the top, while attached to them, at different points, there were no less than ten individuals of smaller species of Serpulæ, and two tube-making worms of another order; and we can assure our readers that when the entire group were in good humour, and put out to the full their variously-tinted plumes, they formed a spectacle of rare interest and beauty. It was really nothing less than a bouquet of worms.

In another race of tube-making Annelids, closely allied to the Serpulæ, the domicile is formed, not by the secretion of lime from the body of the worm, but by a sort of masonry, the worm regularly building up its tube with particles of sand and fragments of shell. By far the best known of these worms is the Terebella (*Terebella conchilega*), which is extremely abundant on sandy shores between the tide marks, and may often be seen in shallow depressions of the surface, waving about its numerous thread-like tentacles, very busily engaged, apparently, in doing nothing. But it is not at all times that the Terebella is thus idle; and when the business of house-building is on hand, it has to be its own hodman and bricklayer both. Its tentacles, however, are fully equal to the task, for as they are capable of great extension and contraction, and are also provided with an adhesive glutinous secretion, the animal is enabled to sweep the sand for building materials for several inches around its burrow, and to bring them home to the mouth of the tube. Here the selected materials are regularly arranged, and attached to the tube, by means of a kind of cement secreted by the worm, and which forms at once the lining of the tube and the matrix in which the fragments of which it is built are embedded.

Although grains of sand, small pebbles, and shells, or fragments of shells, are the materials usually employed in the formation of the tube, the Terebella is by no means indisposed to make use of other substances when they come to hand; and in one of these tubes now before us, the spine of an echinus, several fragments of sea-weed, and even small portions of wood, have all been worked into the structure.

We can say nothing as to the behaviour of the Terebella in the Aquarium, having no experience of it in confinement; but we have somewhere seen it stated that with care it may be kept alive for a considerable period, and that by skilfully managing the supplying of materials, it may be got to construct its tube in bands of various colours.

One of the most minute of these tube-making worms is the little *Spio ceticornis*, which may be found in abundance on old shells, and is sure to turn up, if looked for, in any long-established Aquarium. It derives its name from the two long thread-like tentacles, which protrude from the mouth of the tube, and are kept in almost constant motion. The Spio is quite of a social turn, and usually occurs in colonies of several individuals; and when they are all in full play, twirling about their tentacles together, they make quite a commotion on a small scale.

These little worms are large enough to be seen in a good light quite plainly with the naked eye, but when viewed through a glass, they have an extremely interesting appearance. The tubes, which stand erect for a good part of their length, are seen to be formed of minute particles of sand and dirt, and terminate in a circular orifice, from which the worms protrude their two long and almost translucent tentacles. The movements of these tentacles are somewhat peculiar; at one movement they are seen almost erect and but slightly divergent, then one of them suddenly contracts itself with a singular quirk, and makes a flourish at right angles to its fellow, crinkling and twisting in all sorts of curves as it goes; meanwhile the other tentacle is twitching and jerking itself as it still stands upright, and then, bending down, it joins the first, and the pair sweep through the water together, outstretched to their full extent, when they stand erect again, to twitch and twirl about as before.

But what has more particularly interested us in watching the movements of this tiny animal, is the singular power which it

has of bringing home to its mouth the various matters laid hold of by its outstretched tentacles. These organs are endowed with an adhesive property which enables them by mere contact to hold fast minute particles of matter. They may often be seen stretched out to their full length, pulling and straining at some minute object, which they are endeavouring to dislodge; presently the object gives way, and is seen adhering to the tentacle. But now, strange to say, the object which has thus been torn off is seen quickly travelling along the surface of the still outstretched tentacle towards the mouth of the worm, which is protruded from the tube, and may be seen distinctly to open to receive the expected morsel. It is just as though the surface of the tentacle was furnished with an invisible railroad, trucks and locomotive all complete. But it is not merely for the conveyance of provender that this curious system of traction is of service; it is equally available for the conveyance of the materials with which the tube is gradually built up, and the attentive observer will often see the little worm bringing home the minute particles of sand and dirt which lie within the sweep of its tentacles, and then, withdrawing within its tube, employing the tips of its tentacles in adjusting the materials in their proper position.

The little Spio is minute and altogether unattractive in appearance, but it is extremely hardy, and need never be wanting amongst the inmates of the Aquarium. In every respect a contrast to this, is the gorgeous Annelid already alluded to, the Sea-mouse (*Aphrodita aculeata*), which is the largest of our native worms, being between three and four inches in length, and half as wide as it is long. It is of a flattened oval form, and is covered along the sides on the upper surface with a dense coating of bristles, which are adorned with brilliant iridescent colours, that rival the glowing tints of the Humming-bird. But unfortunately for the Aquarium-keeper the Sea-mouse speedily languishes and dies in confinement, and not only so, it has no idea at all of making the most of itself. Its proper home is in the deep water, and it is no sooner dredged up from its muddy haunts, and honoured with a place in the Aquarium, than it slinks away into some obscure corner, and there remains apathetic and motionless, without giving one a single glance at its beautiful robe of many colours. It is very common on some parts of the coast, and after high winds may constantly be found cast

up by the waves amongst the line of refuse which marks the highest advance of the tide.

One of the most insignificant occupants of the Aquarium, but by no means one of the least interesting, is the little Balanus, the inmate of the small conical shells known as sea-acorns, which on many parts of our coast thickly stud the rocks and the timbers of our piers and jetties. This little creature can boast of no great beauty, and has nothing to commend it to our attention but its curious movements and its still more curious history. Its thickly clustering shells look like a mere warty excrescence on the objects to which they are attached, and to most sea-side visitors are, no doubt, far better known for their keen and cutting edges than for any more interesting qualities.

But let any of these incurious personages, the next time they are down upon the sands or the pebbly beach at low water, take the trouble to pick up one of the many stones, or limpet, or mussel-shells they will find encrusted with sea-acorns, and place it in a vessel of sea-water, and then watch the result. In a minute or two the little shells will be seen to open at the top, and immediately thereafter they are wrapped in a sort of misty obscurity, which will very probably tempt the observer to rub his eyes, under the impression that some temporary dimness has impaired his sight. But let him look steadily, and the secret will be explained. The truth is, the *Balani*, now in active play, are every moment whisking out from their open shells a bunch of beautiful feathery organs, in form not unlike a tiny half-opened hand, and again withdrawing them out of sight; and it is this perpetual and rapidly executed movement which, to the unpractised eye, gives the blurred and confused appearance of which we have spoken. It is easy to watch these curious movements in the Aquarium, and such are the grace and regularity with which they are executed, that one turns to the spectacle again and again with ever new delight.

And what, pray, may be the object of this singular procedure? There is a double purpose to be served, good reader. In the first place, this is the mode the Balanus adopts of getting his "breather"—respiration being quite as important to him as to his betters; and next, it is thus that the little fellow gets his food. That feathery apparatus, indeed, is properly the casting-net of the Balanus, and, at every throw, the tiny fisherman

brings home more or less of those invisible atoms of organic matter upon which it feeds. It is in no idle play, therefore, that the *Balani* are engaged while they thus sweep the water with their feathery plumes: on the contrary, they are doing battle for very life; and, like many more important people above water, they have to fight hard, or go hungry.

The history of the inmate of the acorn-shell is one of the wonders of marine natural history. In the first stage of its existence the Balanus is a totally different being from what it becomes in after life. Instead of being immovably fixed to one spot at the sea-bottom, it roams the waters in perfect freedom, impelled by the action of six pairs of swimming legs, which keep stroke like so many oars, and send it along by a succession of bounds, much after the fashion of the water-flea. At this stage the young Balanus is also provided with eyes, and a large pair of prehensile antennæ, which serve the little rover as a means of attachment to submerged bodies, when, at any time, it wishes to rest for a while from its more active exertions. All through the spring and summer months, myriads of these juvenile *Balani* may be found disporting themselves in the water, making the most of their temporary powers of locomotion. In due time, however, the young Balanus selects a permanent resting-place, and driving at it head foremost, sticks fast, at first merely by the antennæ, but, before long, a sort of cement, which pours out from those organs, securely glues the animal to its home, and it becomes a fixture for life. The eyes and the antennæ, now no longer needed, are cast aside, the feathery arms receive their full development, the shelly covering is gradually secreted, and the inmate of the acorn-shell attains his majority.

In selecting specimens of the *Balani* for the Aquarium, they should always be taken from situations in which they are never left wholly uncovered by the retiring tide. On many parts of the coast they cover the rocks by myriads far up towards the high-tide level, and are consequently left bare by the sea, and exposed to the air and burning sunshine for several hours daily. This it appears they bear unharmed; but if a cluster which has been thus exposed be placed in the Aquarium, and constantly immersed in water, they speedily languish and die; nor will a daily removal from the water for a few hours suffice to keep them long in health and activity. On the other hand, specimens taken from

permanent tide-pools or from deep water are very hardy in confinement, and give no trouble whatever. One may often obtain good specimens on oyster-shells; and we have now in our possession a solitary individual which was procured in that way, and which has now been nearly twelve months at the bottom of a tank, where it still puts forth its beautiful feathery cirrhi with great animation and vigour.

Not the least of the many pleasures which the Aquarium affords are the agreeable surprises which continually arise from the discovery of some member or other of the aquatic community which has previously escaped observation. It not unfrequently happens that discoveries of this sort are made by the naked eye, as it ranges casually over the interior of the tank; juvenile Anemones, Annelids, and Crustaceans often turning up in out-of-the-way crevices and corners, where and when they are least expected. But more commonly it is when carefully searching over the enclosure with a lens, that these unsuspected treasures are brought to light; and great indeed, sometimes, is the joy with which they are greeted.

It was during one of these investigations, lens in hand, that we made our first acquaintance with living forms of the Bryozoa or Moss Corals, and our delight at the beauty of the spectacle which they presented, combined, of course, with the thought that they formed part of our own live stock, was perhaps a little extravagant. Our attention was first arrested by a small patch on an old overgrown shell of what looked like white mucor, but which, on being brought nearer and after a while examined more attentively, resolved itself into a crowd of minute creatures standing erect, from little nipple-like prominences, each surmounted by a funnel-shaped coronet of tentacles of pearly whiteness and exquisite beauty. Within a smaller space than would be covered by a split pea, some thirty or forty of these elegant polyp-like creatures were crowded together. And their movements were as curious as their appearance was beautiful. Every moment one or more of the number were twitching and starting, now disappearing within their cells, and now again protruding, the stiff bristle-like tentacles being closely appressed, until fully pushed out, and then springing apart into the open-funnel form with a sudden start. It was some time before we could make out what our new-found treasures were; but before long the beauties were

identified, and we looked and looked again with increasing pleasure at our first specimens of Moss Corals.

It has been usual, until of late years, to rank these animals with the Hydraform Polyps, to which in external form and appearance they have a strong resemblance; but more careful research has shown that they possess a far higher type of organization than the Polyps, and that their true affinities are with the great Molluscan sub-kingdom. There is a great diversity in the form and arrangement of the cells of the different species of Bryozoa, although there is but little difference in the form and structure of the animals themselves. In all of them alike there is a complicated and highly elaborate digestive apparatus, to which access is had by a sensitive and contractile gullet, situated at the bottom of the funnel or bell-shaped circle of tentacles. These organs are rigid bristle-like bodies, incapable of contraction, and beset on their inner side with a double row of vibratile cilia, upon the action of which, in producing a vortex in the water, and so bringing it food, the animals depend for their subsistence.

It is an extremely interesting sight to watch the behaviour of these tiny creatures when with a pocket lens and a good light you get them well into view. We will suppose that on the projecting corner of a block of stone, covered with the delicate lace-work of their clustering cells, a hundred or more of the little funnel-shaped circles of tentacles are seen upstretched. At first sight all seems still and absolutely motionless; but in a moment you perceive one and another suddenly starting and half closing their tentacles. In a moment more, and with a steadier look you see the floating atoms in the water above whirling and dancing round, and hurrying towards the bottom of the funnel, where the mouth perceptibly dilates to receive them. But not unfrequently atoms unsuitable for food are brought by the ciliary currents as well as acceptable provender; against these the mouth keeps resolutely closed, while the tentacles twitch and start, and make great efforts to shoot them forth out of the way, sometimes struggling quite convulsively in the endeavour, so as to suggest to the observer that the little creatures are positively in danger of choking.

The Mollusca, to which the Bryozoa introduce us, are not, generally speaking, very well adapted for the Aquarium. There are some few species, however, which are extremely useful, and which may be looked upon, indeed, in some sort as the local Board

of Health. Thus small specimens of the Oyster and Mussel are very serviceable in keeping down the number of the spores of the sea-weed, which float in the water, and upon which these animals mostly subsist. In the same way the Periwinkles, and the *Trochi*, or Top Shells, do good service in mowing down the confervoid growth, which coats the glass and obscures all that is passing within. The manner in which the Periwinkle sweeps off this minute vegetation is extremely interesting, and has been compared to the action of the tongue of an ox in licking up the grass, or to that of a mower cutting swathe after swathe as he passes along in the hay-field. The work is by no means cleanly done, however; and as the little Mollusc moves on, bringing the white disc of his foot over the spot where he has been browsing, the small square patches which have been swept by his tongue are rendered very distinct by their contrast to the surrounding parts that have not been touched. The most curious perhaps of the Molluscs which readily accommodate themselves to the Aquarium are the Chitons, which, clad in their coats-of-mail, adhere like so many scales to the blocks of stone, although occasionally they mount the glass sides of the vessel and help the Periwinkles in clearing away the growing crops of confervoid plants.

But by far the most attractive of the Mollusca are certain shell-less animals popularly known as "sea-slugs," which, with a little care and attention, may easily be induced to make themselves at home in the Aquarium. To the naturalist these animals are known as the *Nudibranchiata*, or naked-gilled mollusca, their branchiæ, or breathing organs, being open and exposed, arranged symmetrically along the back in tufts, plumes, or variously-shaped papillæ. The common name the Nudibranchs have won for themselves, sufficiently indicates their general form, and their mode of progression; but let nobody imagine that these "sea-slugs" have anything like the repulsive aspect of their namesakes of our gardens and hedgerows. On the contrary, they are for the most part more delicate and beautiful than words can well describe, and when seen in a vase or tank of clear water, wandering over the bright-green fronds of the sea-weeds, they call forth expressions of surprise and admiration from the most phlegmatic and unimpassioned of observers.*

* The British Nudibranchiata have been made the subject of a splendid monograph by Messrs. Alder and Hancock, and the coloured illustrations of

The favourite haunts of these beautiful creatures are the weed-covered rocks which are laid bare only at the lowest ebb of the tide; and in such situations one may occasionally find them quietly at rest amongst the dripping algæ, or actively perambulating the rock pools. Here, too, the explorer will often come across the curious coils of spawn which they attach to the rocks, and with which, when kept in confinement, they prettily bedeck the sides of the Aquarium, where, by-the-way, it answers the double purpose, first of ornament, and then of provender for the Nudibranch's companions in captivity. In most cases the spawn is deposited in a loose coil of delicate gelatinous ribbon, standing upright, and attached by its lower edge. But in some species the ribbon form is substituted by a simple waved thread, one pretty little fellow disposing this thread in tortuous undulations, like a succession of figures of 8; while *Doris pilosa*, one of the "Sea-lemons," and some others, deposit the spawn in the form of a little cup or goblet, as delicate and beautiful as the most exquisite of sea-nymphs could desire.

In the Aquarium these animals are frequently observed to mount the blocks of stone, or the glass sides of the vessel, and to launch themselves out upon the surface of the water, where they float bottom upwards, much after the fashion of the common pond snails in our ditches and stagnant pools. Occasionally they vary the performance, and let themselves down from the surface by a delicate and almost invisible thread of mucus, and so suspend themselves in midwater, as the caterpillars of the little bell-moths are seen suspended from the oak-trees in the summer sunshine. If disturbed, however, when suspended in this manner, unlike the little caterpillars, which forthwith begin to twist themselves about, taking in coil after coil of their silken cables, until they have climbed up out of reach of danger, the Nudibranchs at once let go their hold and sink to the bottom. The whole of these delicate creatures appear indeed to be extremely sensitive to external influences, and become agitated and alarmed at the least suspicion of danger.

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this work are some of the most accurate and beautiful representations of living beings which have ever been produced; and yet it is no disparagement to say that even these illustrations convey but a very inadequate idea of the transparent delicacy and beauty of the animals themselves.

It would be a great mistake, however, to suppose that the Nudibranchs are at all distinguished for gentleness or amiability. On the contrary they are rather remarkable, like some favourites of a higher grade, for petulance and irritability; and in the matter of feeding they are not only carnivorous, but guilty at times of positive cannibalism. One beautiful little Nudibranch (*Eolis coronata*), common on our northern coasts, is perfectly ferocious in its way; and it is said that, if a number of them are kept together without food for a short time, they set to and battle with each other in the most truculent fashion. In preparing for the attack, they angrily raise and shake their numerous *papillæ*, and then laying back their horns, as a vicious horse lays back his ears, they dash together, and maul and mutilate each other like tiny beasts of prey. The larger ones, in their tussles with each other, seldom do more than tear from each other's backs the gaily-tinted breathing organs; but if a large one falls upon a weaker brother, the doom of the latter is sealed, as he is pretty sure to make a meal for his more powerful assailant.

One of the commonest of the *Nudibranchs*, and one of the best for the Aquarium, though by no means one of the most elegant, is *Eolis papilosa;* it is about an inch and a half in length, and is very lively in its habits, creeping about very quickly over the weeds and stones, and exhibiting a singular predilection for squeezing its delicate body into every crack and crevice it can discover. But let the owner of the little beauty look well to its provender; for if there be any remissness on that point, you will find *papilosa* foraging for himself, and in all probability feasting on some pet Anemone, for which kind of fare the entire race of *Nudibranchs* have a most inconvenient partiality.

CHAPTER VII.

THE AQUARIUM AND ITS INMATES.

PART II.

"Meantime with fuller reach, and stronger swell,
Wave after wave advanced;
Each following billow lifted the last foam
That trembled on the sand with rainbow-hues.
The living flower, that, rooted to the rock,
Late from the thinner element,
Shrank down within its purple stem to sleep,
Now feels the water, and again
Awakening, blossoms out
All its green anther necks."

THAT is no imaginary scene, good reader, but a genuine sketch from nature—the picture of an every-day fact in sea-side natural history. The "living flower rooted to the rock," is a Sea-Anemone; and so faithfully is the portrait given, that you can pronounce unhesitatingly as to the particular species which sat for the likeness. And it is no wonder that the author of Thalaba was warmed up into poetic fervour at sight of the beauty; for the owner of those "green anther necks" is one of the loveliest of its lovely race, and many a time has roused people, far more unimpressible than poets are wont to be, to a pitch of temporary enthusiasm.

The Actiniæ, or Sea-Anemones, are the great ornaments of the Aquarium, and have now become such general favourites, that there are comparatively few well-read observant people who have not to some extent made their acquaintance. It is only a few years since, however, that these animals were all but unknown even to the regular *habitués* of our watering-places; and so little were they understood by naturalists themselves, that our zoological text-books were full of the most ridiculous blunders in reference to their habits and economy.

The ordinary form of the Anemones is that of a cylinder,

truncated, as the geometrician would say, at both extremities; the lower extremity being attached to the rock, while the upper extremity, or disc, is perforated with an orifice which forms the mouth, around which are several concentric circles of tapering tubular tentacles or arms. It is mainly on the form, number, colour, and arrangement of the tentacles, that the more obvious difference between the various species of Sea-Anemones depends; but the foregoing may be taken as a fair general description of the form and appearance of these animals—that is to say—when in a contented state of mind, they stand erect and properly display themselves. But it is not at all times that they are thus amiably disposed; and the beauty which at one time you find spread abroad like some full-blown flower, at another time will be reduced to half its former size, its tentacles all withdrawn, and the body contracted to a fleshy knob or "button."

The Sea-Anemones are no doubt far better known to the majority of sea-side visitors in this closed-up "button" shape, than in the expanded form of a full-blown flower. It is scarcely possible, indeed, for the most incurious of people to walk along the strip of shore, left uncovered by the tide, without noticing here and there on the rocks and boulders small hemispherical patches of what looks like flesh, of a dull red or liver colour, with probably one here and there of a green colour, or mottled with green and red. These are closed-up specimens of the common Smooth Anemone, which—perhaps because it is common—is dignified with the tremendous name of *Actinia mesembryanthemum*. If one of these attached to a pebble be gently taken up and placed in a pool of clear water, it will gradually put out its tentacle and show its mouth, in the shape of a long slit bounded by a pair of pursed-up lips, in the centre of the disc. Two minutes' search in the tide-pools near would probably lead to the discovery of several of the animals fully expanded; and now, if our explorer likes, having seen the button open out into the flower, he may see the opposite phase of the proceeding, namely, the flower contract into the button. One touch of his walking-stick will be enough. Immediately the outspread tentacles are withdrawn and the animal shuts himself up in evident displeasure. It is precisely—to use Keats's beautiful simile—

"As though a rose should shut, and be a bud again."

The button, indeed, of some varieties of this Anemone have no slight resemblance to the bud of a large flower; though one of them, the pretty Strawberry Anemone, derives its inviting *alias* from its fancied resemblance in this contracted form to that most luscious of summer fruits.

The rapidity with which many of the Anemones contract on being disturbed is very great, and has the effect in some situations of instantly withdrawing the animals altogether from view. You are searching along the shore, we will suppose, at low water, and, glancing into a little tide-pool at your feet, you see a beautiful star-like flower spread out at the bottom. You stoop to admire it; and, eager to secure the prize, you reach out your hand; but before it has well touched the water, the beauty has vanished out of sight, sinking, as if by magic, down beneath the sand or shingle. The truth is, the animal was attached to the rocky floor of the pool, and had to stretch itself up through the sand at the bottom to reach the surface where you saw it displayed abroad; the moment, therefore, that it contracted itself, it sank out of sight; and had you searched for it at the bottom you would have felt nothing but a little fleshy mass that unpractised fingers would never recognize as the charming Anemone of a moment before.

Several of the Anemones are in the habit of burying themselves in the sand in this fashion, not only when at large in their native elements, but also in the Aquarium. This is especially the case with the pretty Cave-dwelling Anemone (*Sagartia troglodytes*) and the huge Thick-horned Anemone (*Tealia crassicornis*), which seem to delight in situations where they can attach themselves at the bottom of a layer of sand, beneath which they can readily shrink out of sight when occasion requires. We have now in our possession five distinct varieties of the Trog (diminutive for *troglodytes*), which have been attached to the bottom of a vase, beneath a layer of sand nearly three inches thick, for more than twelve months, and without budging a hair's breadth from the spot where they were first placed. The stationary habit of this Anemone may be turned, indeed, to good account by the Aquarium-keeper; for as they readily attach themselves where they are placed, and are very variable in colour, you may regularly "plant" them in your Aquarium, and with the same regard to harmony or contrast of colour, as

you plant your dahlias, or the anemones, vegetable namesakes, and thus contrive a very pretty submarine parterre of animal flowers.

The resemblance of the fully-expanded Actiniæ to flowers is in many cases very striking; and Dr. Johnston, in his History of British Zoophytes, mentions, as a curious illustration of the fact, that, on one occasion, a bee wandering near a specimen of *crassicornis*, covered merely by a rim of water, was seen to dart straight at the mouth of the animal, evidently mistaking it for a flower. The poor insect soon discovered its mistake, of course, and struggled hard to get free; but the Anemone kept fast hold of his prisoner, and speedily swallowed him. No doubt insects are sometimes far from discriminating in matters of this sort, and we have ourselves seen a butterfly knocking itself against a shop window in obvious anxiety to get at some gaily-coloured prints of flowers which were exhibited inside. But the resemblance of *crassicornis* to a full-blown flower is certainly very great; and Mr. Gosse is quite justified in accepting for it the name of the Dahlia, by which it has been christened by some of his fair pupils. In size, beauty, and variety of tints it is more than worthy of the name, though it is by no means singular in this respect, the entire race of Anemones having more or less of the same beautiful and flower-like appearance.

Let nobody imagine, however, that the Anemones spread abroad their tentacles in vain conceit of their own beauty. It is hunger, not vanity, which prompts the display; and in the Aquarium one has to be careful with the tit-bits of oyster, or the over-fed beauties will shut up, and turn their backs upon you in sheer indifference. In the matter of feeding, the secret is, a little at a time, and not too often; your pets will then be almost constantly on the look-out for provender, exhibiting their charms to the greatest advantage. In this condition the animals readily grasp at any small object that may float or fall within reach of the outspread tentacles, and if adapted for food it is immediately drawn towards the mouth, which dilates to receive the expected morsel, and again slowly closes over it. The tentacles have a strongly adhesive power sufficient to retain small objects by mere contact; but in addition to this the Anemones are possessed of a poisonous property of such potency, that when they choose to put it forth they can easily overpower and retain animals of considerable size.

The agents concerned in this adhesive and poisonous power are thread-cells of the same general character as those of the jelly-fish, which crowd the tentacles and various parts of the body, where they are accumulated in special organs, and from which they are projected at the will of the animal with lightning-like rapidity.

In none of the Anemones are these organs more potent than in the species whose portrait stands at the head of this chapter, the owner of the " green anther necks," *Anthea cereus.* One of these beauties is now before us, twitching and twirling about his long snaky arms, attached to the side of an Aquarium, and it is only a few days since that his poisonous powers deprived us of one of the greatest pets of our marine establishment. The victim was a fine hermit-crab which we had incautiously introduced to the vase at the bottom of which Anthea was then seated. Master Pagurus, as is his wont, began restlessly to promenade the enclosure, and once or twice, before the fatal mishap, had been made to wince by a slight touch from the tentacles of Anthea. But, disregarding these gentle admonitions, at length he backed right upon the Anemone. At first his whelk-shell domicile protected him from all injury ; but presently moving a little on one side, and slightly protruding his body, he brought his sensitive under-surface fairly down upon the tentacles of Anthea. No movement of these organs was seen ; but the poor Pagurus had barely exposed himself to the attack before he sprang off from the Anemone with a sudden and convulsive start, which left no room to doubt what had happened. The poor fellow at once sidled away to the shelter of an overhanging block of stone, and the next morning he was found there dead.

Mr. Gosse gives a still more striking illustration of the venomous power of this lovely Anemone. One day in collecting he dropped a young conger-eel about six inches long, into a jar containing two large Antheas ; and before the fish had reached the bottom of the jar, the tentacles of one of the Anemones were entwined about its head, which was almost instantly dragged to the cavernous mouth, and partially engulfed. The fish was then withdrawn from its assailant by force, and though it had been kept prisoner by the Anemone less than five minutes, it was already flaccid and helpless, and survived its release for only a few moments.

In the Aquarium, Anthea is ever a great favourite; the singularity of its form, the sprightliness of its movements, and the delicate beauty of its colouring, all contributing to its popularity. It has, moreover, this additional recommendation, in which it has no competitor amongst our native Anemones, that its disc is almost constantly open, and its beautiful pea-green tentacles, tipped with pink, habitually displayed abroad.

Notwithstanding the formidable weapons with which the Anemones are armed, it is by no means certain that they are such rapacious and destructive creatures as they are commonly represented. It is hardly safe, perhaps, to judge of them by their behaviour in the Aquarium; but there they exhibit, for the most part, no disposition to capture living prey, and will even allow themselves to be hustled and robbed with impunity. We have repeatedly seen food taken, literally, out of their mouths by little rascally crabs, scarcely larger even than split peas; and the only notice the Anemones have taken of the theft has been to shrink down in the sand, or partially shut themselves up, out of the way of their plunderers.

On the shore we have often come across them quietly engulfing dead and partially decomposed crabs, and we are strongly inclined to suspect that a great part of their food, in a state of nature, is of this description, that is to say, dead animal matter casually floated within their reach. Nothing is more common after returning from a day's hunting than to find that your Anemones have thrown up the claw or shell of a crab in your collecting can; and from the circumstance that it is generally portions of the animals only which are thus rejected, there is reason to believe that it was in this divided state that it was at first appropriated.

Not that the Anemones are at all nice as to the size of the mouthfuls they take, or in anywise disposed to forego a dainty because it may require a little exertion to get possession of it. On the contrary, there are few animals whose "maw" is proportionately more capacious, or who are less averse to testing the capabilities of that part of their structure in accomplishing an object on which they have set their hearts. One of Mr. Gosse's correspondents mentions a *crassicornis* which bolted a sea-urchin, spines and all, and another which discharged, as the remains of his evening's meal, a whelk shell and a mass of nereids and

shrimps, "which," says the writer, "exhaled such a fearful smell as killed all my tank-ful."

But those feats are nothing compared to the performance of another Anemone of this species mentioned by Dr. Johnston:— "I had once brought to me," he says, "a specimen of *Actinia crassicornis*, that might have been originally two inches in diameter, and that had somehow contrived to swallow a valve of the great scallop (*Pecten maximus*), of the size of an ordinary saucer. The shell, fixed within the stomach, was so placed as to divide it completely into two halves, so that the body, stretched tensely over, had become thin and flattened like a pancake. All communication between the inferior portion of the stomach and the mouth was of course prevented, yet, instead of emaciating and dying of an atrophy, the animal had availed itself of what undoubtedly had been a very untoward accident, to increase its enjoyment and its chance of double fare. A new mouth, furnished with two rows of numerous tentacula, was opened up on what had been the base, and led to the under stomach; the individual had, indeed, become a sort of Siamese twin, but with greater intimacy and extent in its union."

In the Aquarium, *crassicornis* seems disposed to put up with almost any sort of fare that is offered to it. A magnificent specimen which graced one of our tanks for some time made his last meal on a piece of uncooked sole, and a day or two before he appropriated the greater part of a small mussel. On one occasion, we tried him with a portion of the tender posterior of a hermit-crab which had been lying dead for two or three days; but that he positively and very peremptorily refused. He clutched at it, indeed, at first, and dragged it towards his mouth, which partially opened to receive it; but by this time it seems the flavour of the morsel had become apparent, and the mouth again closed, shortly afterwards pouting itself up so as to roll the offensive object off the disc, the tentacles on one side bending down to expedite its progress. It would appear from this incident that *crassicornis*, at any rate, is careful not to eat his game too high, however much he may prefer it for a little keeping.

Whatever may be the kind of food swallowed, the undigested portions are always thrown up within about twenty-four hours afterwards, covered with a slimy mucus like the white of an egg. Sometimes, indeed, the most delicate morsels are returned within

a few minutes after being swallowed, but from what motive it would be difficult to say.

The locomotive powers of the Anemones are not great. Many of the species, indeed, remain attached for months together to the spot where they are first placed ; though others are comparatively restless and frequently change their position. This is especially the case with *Anthea cereus;* and as this species is very fond of attaching itself to the glass sides of the Aquarium, its movements may easily be watched. It glides along upon its base with a slow and equable motion, in the same manner as a slug or snail, but much more slowly ; occasionally, however, it has been seen to progress by a series of somersaults, employing base and tentacles alternately as a means of attachment. The common Smooth Anemone is also of a vagrant disposition ; and on one occasion a specimen of the Strawberry variety, now in our possession, travelled a distance of more than twelve inches in one night. It is said, moreover, that when this species is confined in a tank in which there are blocks of stone projecting above the surface of the water, it will sometimes climb up high and dry to give itself an airing for a few hours, and then descend again to its proper element—no doubt intending by this procedure to compensate itself for the loss of that alternate exposure to air and water, which, more than any other species, it obtains by the regular ebb and flow of the tide.

Dianthus is another of the Anemones which at times seems to take a pleasure in exhibiting its powers of locomotion, being on these occasions almost as fond of wandering over the perpendicular sides of the Aquarium as *Anthea cereus.* As a general rule, however, *dianthus* is rather stationary in its habits, first seeking out a good position, and then, as we shall presently find, very literally *sticking* to it. Its most favourite position, perhaps, is high up on the side of the Aquarium, close to the surface of the water, where it stretches itself out horizontally, enjoying in its own fashion the luxury of an air bath.

We have now in our possession two individuals of this species, which have been seated thus on the sides of a large vase for nearly eight months ; and what is not a little curious, as showing their partiality for being just at the surface of the water, they have two or three times during this period shifted their position up and down as the level of the water has been altered.

There is one circumstance, however, in connection with the movements of *dianthus* which is of a very remarkable character, and which conducts us to another branch of our subject, namely, the reproduction of the Anemones.

It frequently happens that, when a large specimen of *dianthus* has been attached for any length of time to the same spot in the Aquarium, on moving away it leaves small portions of its extended base still adhering to the glass or stone, as though the animal found it easier to tear its body asunder than to remove these portions from the spot to which they had become so firmly rooted. The fragments thus left behind soon contract, become smooth, and spherical or oval in outline, and in the course of a few weeks may be seen each with a well-developed disk surrounded with tentacles, transformed, in fact, into perfect though minute Anemones. Occasionally the larger portions which are torn off from the base of the parent animal gradually separate into two pieces, each of which in due time grows up to be a perfect *dianthus*. This mode of reproduction has been observed not only in *dianthus*, but also, on rare occasions, in the beautiful *Segartia venusta*, or Orange-disked Anemone.

The process of reproduction by spontaneous division, of which the above mode of increase is only a phase, obtains more or less amongst all the Anemones. In most cases, however, the division of the animal is into two parts only, and longitudinally from above downwards; the separation commencing at the margin of the disk, and gradually extending across and down the column, until the division is complete, when the two portions close, and before long become perfect Anemones.

We have ourselves observed this phenomenon in *Anthea cereus* though from the expedition with which the business was effected, we missed the first stage of the actual process of separation. The animal was attached to the perpendicular side of a tank, against the light, and with its base towards us, so that we had a most favourable opportunity of witnessing its procedure. Not an hour before the separation of the two portions was nearly completed, the only indication to be seen of the approaching change was an unusual lateral elongation and flattening of the body, the tentacles along the two straightened sides being curled in and bent down to the glass, while the base showed a divergence of the dark contents of the internal cavity towards the two extremes of the

elongated body. We had no suspicion of the impending change, and therefore gave but little heed to the animal, notwithstanding the singularity of its appearance. But an hour afterwards the body of the animal was partially separated into two nearly equal semicircular portions, which were connected together by a number of cords, that for the most part were stretched tensely across between the diverging portions.

Watching the progress of the change with a lens, these cords were seen to be gradually pulled in by one side or the other, until the only ones remaining were the two which connected the upper and the lower edges of the now widely separated portions of the divided animal; and on each of these there hung a flaccid and perfectly helpless tentacle, that on the upper cord being suspended midway between the two severed portions of the animal. Half an hour after this the two portions had become entirely disconnected from each other. A little later, the smaller of the two detached itself from the glass and dropped to the bottom of the tank, where it lay utterly prostrate and helpless, giving no other indication of life than an occasional slight movement of one of the tentacles. In about two hours, however, it had so far recovered its strength as to be able to attach itself again to the glass, when it slowly crawled up the vertical side of the vessel, and took its place near the other half of its former self. The other portion maintained its place on the glass, and eagerly caught at a small piece of whiting that was offered it; but swallowing was out of the question, for they had divided the original mouth between them; and after holding the fish for a while it let the prize go, and feebly drooped its tentacles, the perfect picture of an invalid. Before many days had passed the sides of both animals had regularly closed up, and within a fortnight the half mouth had in each case become a very efficient swallowing organ, and the animals ate and grew apace quite as well as before the dissolution of their partnership.

It sometimes happens that specimens of *dianthus* and the common Smooth Anemone are found, in which two mouths, each with its own set of tentacles, spring from a common body; a state of things brought about probably by the self-dividing process having been commenced and then permanently stopped short. In still rarer instances the division of the Anemones has been observed to take place horizontally, the upper half of the animal moving

off and developing a new base, and the lower half forming a new disk and tentacles.

Ordinarily, however, the reproduction of the Actiniæ is carried on by the production of germs, or embryos, which, after being partially developed in the spaces between the stomach and the outer wall of the body, known as the interseptal chambers, are discharged from the mouth, frequently with the undigested remains of the food, twenty to thirty young Anemones sometimes appearing thus at a single litter. Sir John Dalyell states that an Anemone which he had in his possession for six years gave birth during that time to two hundred and seventy-six young ones in this manner. It is by no means uncommon to see some old patriarchal *dianthus* surrounded by a numerous colony of his descendants in various stages of growth, children, grandchildren, and great-grandchildren all clustering closely together, and not unfrequently exhibiting an unmistakable family likeness. In an Aquarium, in which some of the more freely propagating kinds have been kept for a time, numbers of these tiny creatures may be seen attached to the shells and blocks of stone; and with their thin gelatinous bodies tinged with the faintest indication of the distinctive colour of the species, and their disproportionately long tentacles pertly stretched out, they have an extremely curious appearance.

Another mode in which the increase of these animals is effected is that of budding, the young Anemones sprouting out from the sides of the parent in the manner already described in the chapter on Jelly-fish.

Most of the Anemones of which we have hitherto spoken are readily to be found by an industrious explorer within the strip of shore laid bare by the ebb of the tide; *dianthus* perhaps being the one least likely to be met with, since, for the most part, it is an inhabitant of deep water. But now, in closing our notice of these extraordinary animals, we will introduce to our readers a gentleman which habitually keeps aloof from the shore, in quiet depths, where he can only be reached by the dredge. *Sagartia parasitica* is one of the largest of our Anemones, and derives its specific name from its habit of attaching itself to the shells inhabited by the Hermit Crab. Occasionally it is found on shells not thus tenanted, and still more rarely on stones; its proper home, however, is the domicile of *Pagurus Bernhardus*

and it would be a difficult matter to find another such an odd-looking couple.

Mr. Gosse, in his beautiful "Actinologia Britannica," gives the following humorous sketch of the ways of this loving pair, as furnished by one of his correspondents :—

"The following scene was witnessed by my much lamented friend, Dr. R. Ball. One of the specimens referred to, attached to the shell of a whelk, *Buccinum undatum*, which had from its appearance been in all probability just deserted by a *Pagurus*, was placed in a glass Aquarium ; in a short time, the Anemone left the *Buccinum* and attached itself to the side of the tank ; it next deserted this position and fixed itself on the side of a large stone that filled the centre of the Aquarium. After the lapse of some weeks a Hermit Crab was dropped into the tank. Well, if these Hermits can't live without hiding themselves in the shell of some poor Molluse, I think it is equally true that they can't live happy until they hide both themselves and their shells in some quiet little hole in the rock-work of an Aquarium, from whence they can look out ; and, thinking that the superimposed stone-work adds vastly to the strength of their fortifications, experience sundry intense feelings of safety. Be this as it may, the Hermit in question was not long ere he walked up to a little grotto that was in the rock-work of the Aquarium (quite close to *Sagartia parasitica*), and after a slight survey, to see that all was right, he turned his left shoulder forward, and "backed in ;" then he began to whisk his antennæ and foot-jaws in a dreadful manner, and looked evidently quite content. I suppose this was a state of things the Parasitica perched on the rock above had long been waiting for ; for it was not long in moving its disc over the top of the small whelk, and before the Crab knew where he was, the big *Sagartia* had pitched his tent on the roof of the Hermit's house. Where the Hermit Crab goes, there goes the *Sagartia:* a quiet life it led before, a restless one it has to lead now. But doubtless it knows what's best for it."

Our friend the Hermit Crab having thus been brought upon the scene, we will now turn to him, and to the very entertaining race to which he belongs.

The lowest members of the series are the little Balani, discoursed of in a previous chapter. Next in order to the Balani

amongst the Crustaceans adapted for the Aquarium, come the Shrimps and Prawns, which are extremely interesting creatures, and contribute in no small degree to the gaiety and animation of the pent-up community. Pale and ghostly in appearance, they glide through the water like the dim and shadowy creatures of another world, their beautiful plumed false legs gracefully beating the water as they sweep along.

But these animals are as valuable in the Aquarium as they are beautiful. Their incessant movements help not a little to produce that constant motion in the water which is so conducive to the health of the establishment. Much more effective, however, is the service which they render in this respect by hunting out and devouring the minute portions of animal matter that lie concealed amongst the sand and gravel at the bottom. It seems that they are guided to these atoms by their sense of smell, which appears to be remarkably acute. Mr. Warington, indeed, states that when either a Shrimp or Prawn cuts with his antennæ the column of water through which a piece of food has fallen to the bottom, it becomes immediately cognizant of the fact, and turns to find it; and we have ourselves seen this gentleman produce quite an interesting display by merely dropping a few morsels of food into the centre of a tank containing a number of Shrimps, the little fellows immediately crowding to the spot, and eagerly catching at the food like a flock of barn-door fowls.

But there is a mistake abroad as to the respective predilections of the Crustacean fraternity, in regard to this matter of feeding. It is commonly stated that the Crab feeds on offal, but that is an error, no animal being more particular in his diet. Rather than devour food which is far advanced in decomposition, the Crab would die of starvation. The fishermen know this fact well, and always bait their crab-pots with fresh meat; while, for the Lobster, the more highly flavoured the bait, the better it is likely to succeed. It may be received indeed as a general rule, that the short-tailed Crustacea are clean feeders, and that the true *depurators*, or scavengers, of the waters, are the long-tailed section of the class.

The common Shrimp (*Crangon vulgaris*), for example, is one of the grossest of feeders, and a swarm of them speedily reduces a drowned cat or dog to a skeleton; a fact which is hardly cal-

culated, perhaps, to give rise to any very appetizing reflections on the part of those who think with Pennant that the animal affords the "most delicious" fare of all the Crustacea, and yet useful to be known. People who want to get the skeletons of small birds or other animals perfectly freed from the flesh, frequently put them into ants' nests, but the end may be gained just as well by mooring them in the sea where the Shrimps are known to congregate. The naturalists of the Arctic expeditions have frequently profited by the knowledge of this fact, and by placing beneath the ice the specimens of which they wished to have the skeletons preserved, have had them rapidly prepared as they desired by the myriads of small Crustacea living there.

Whether the sense of hearing is as well developed in these long-tailed Crustaceans as the sense of smell, it is not so easy to determine; but in their near allies the Lobsters, there is every reason to believe that the one sense is fully as acute as the other. Mr. Bell, in his History of the British Crustacea, says that these animals will sometimes throw off their limbs at the report of a cannon, and in a thunderstorm whole cargoes of them have been known to do the same, to the great detriment of their marketable value. But the best illustration of the fact is that given in the following story of an old fisherman of Govran Haven in Cornwall, a story, however, which it must be confessed has a somewhat apocryphal air, though it certainly deserves to be true:—One day, going the round of his crab-pots, the man saw a number of young Lobsters swarming together. He watched them for some time without attracting the attention of an old one which, lodged in a hollow of the rock, seemed to be keeping guard over the young ones at play. No sooner, however, did the old Lobster perceive there was danger near, than it rattled its claws together, as if to sound an alarm, and they all fled to their holes!

Intermediate between the long-tailed Crustaceans and those whose caudal extremity is *cur*-tailed, there is a group of these animals with tails that are strictly speaking neither long nor short exclusively, and which, therefore, stands christened in the text-books as the *Anomura*, or irregular tails.

Let nobody think meanly of these worthies; they supply the Aquarium with its most amusing occupants.

Oversights and mistakes or practical jokes are hardly likely to

occur in the works of Him of whom we speak as the author of Nature, or we might be inclined to suspect that it was to something of that kind that the Hermit Crab owes his peculiar conformation. In this unfortunate Crustacean the shelly armour which covers as with a coat-of-mail the claws and the whole of the fore part of the body, is altogether wanting on the extended tail, and the poor Crab, painfully conscious no doubt of his natural defect, resorts to a contrivance of his own to make good the deficiency. His plan is to seek out the empty shell of some defunct Mollusc of convenient size, and into this he thrusts his exposed and most vulnerable posterior, maintaining his hold of the borrowed domicile by means of two or three pairs of rudimentary feet and a pair of terminal clippers.

The common Hermit Crab of our own shores (*Pagarus Bernhardus*) is commonly to be found in the tide-pools at low water, and shuffles away with great agility if an attempt be made to capture it. Not unfrequently, however, instead of making off, it quickly withdraws within its shell, and endeavours to escape detection by "shamming dead."

We have already given some of our Aquarium experience of these worthies. There is something exceedingly grotesque and almost human in the expression of these animals, and in their peculiar movements. The way in which they catch at the food that is dropped upon them, and their mode of holding it firmly in one claw while they pull off piece after piece and carry it to the mouth with the other, is so exactly like the procedure of some hungry urchin eating his dinner in the street, that no one can fail to be struck with the resemblance. And then there is the tremendous stir they make at feeding-time, twiddling the various organs around the mouth at a great rate, and shooting out fragments of the food sometimes to a distance of several inches; irresistibly reminding one of the wry faces and the sputterings of some over-fastidious epicure who has inadvertently offended his palate.

A very critical period in the Hermit Crab's history is the time for the important business of house moving; and though it is tenant at will, yet as the shell it inhabits is incapable of being enlarged to suit its own increasing bulk, the incident is of periodical occurrence. It is always a business attended with a good deal of anxiety to the poor Hermit; for while it is no easy

matter at times to find an empty house that will suit, it may so happen that when at length the "neat commodious residence" has been hit upon, a rival claimant appears upon the scene, and there is no alternative but to search further or fight for possession, a contigency which sometimes gives rise to most amusing scenes in the Aquarium. The right of the strongest is fully as much acted upon below water as above; and amongst the fraternity with which we are now concerned it is the only recognized principle of action. If therefore Master Bernhardus major finds Master Bernardus minor in possession of a domicile of more convenient dimensions than his own, he very deliberately proceeds to dislodge his weaker brother from his dwelling, and having accomplished his object, slips his own tail into the vacant habitation.

But when possession has once been obtained, the mere act of changing houses is very easily performed. We were not a little surprised, indeed, the first time we witnessed the proceeding at the agile off-hand style in which the thing was done. It is true there is a good deal to be done in the way of examination before the old shell is cast aside and the new one occupied, and the care which the Hermit takes to be quite sure there is nothing in the new domicile at all calculated to hurt or irritate his tender posterior is extremely amusing. But when at length the gentleman has satisfied himself on that point, he brings the mouth of the new shell into a suitable position by the side of the old one, and planting his large claws one on each side of it, he whisks out his little bagged-up tail from the old shell and pops it into the new one in the twinkling of an eye. The animal literally jumps out of the one shell and into the other; and no better illustration can be given of its mode of doing it than that of a person placing his hands on the top bar of a gate and springing over.

It is not at all times, however, that the Hermit Crab feels at ease in his new house when he has got there, and we have repeatedly seen them within a few minutes after they have taken possession of a new shell, jump back again into the old one, and commence a fresh examination of the too hastily adopted domicile.

Mr. Bell conjectures that the Hermit Crab sometimes attacks living Molluscs for the purpose of getting possession of their shells. But Mr. Lewes, in his "Sea-Side Studies," denies the charge, and in an attempted disproof tells a story of a Hermit in his own

keeping, which, having ensconced himself in the shell of a whelk still in occupation of its house, but withdrawn out of reach of the Crab's inquisitive claws, suffered himself to be repeatedly ejected from the premises without making any attempt to kill and eat the proper occupier. It is obvious, however, that a single experiment of that sort proves nothing to the purpose. The Hermit Crab may very well decline to play the burglar in a glass case in a gentleman's drawing-room, and yet be nothing loth to act the part when left to himself at the sea-bottom. Mr. Lewes attaches too much importance, therefore, to his solitary experiment, when on 'the strength of it' he tells us that Mr. Bell's conjecture "must be erased from all hand-books." But let us be just to the Hermit Crab; as nobody appears to have actually witnessed the perpetration of the deed, we may charitably hope that, low as Crustacean morals are, Master Bernhardus is really innocent of the villany imputed to him.

The little Hairy Porcelain Crab (*Porcellana platycheles*) is another of the irregular-tailed Crustacea, and forms a true connecting link between the long tails and the short tails. In its general form and appearance it is altogether Crab-like, although its great hairy nipper claws give it a very distinctive character of its own; but when you come to examine its structure, you find that, bent in under the broad round carapace, or crust which covers the body, there is a very decided swimming tail, which proclaims its affinity with its long-tailed allies. The habits of this curious little Crab in confinement are extremely interesting, though rather more shy and retiring than one could wish. It is easily preserved, and speedily becomes a favourite.

When the Fish House in the Regent's Park Gardens was first established, a bold attempt was made to domesticate representatives of well-nigh the entire fraternity of Crustaceans. Mr. Mitchell even laid hands on a fine Lobster, which did its best to make itself at home in one of the tanks, where, if we do not mistake, it passed its days for several months. But the best part of this Crustacean exhibition was a tank in which a motley gathering of Crabs of all kinds were confined together, some of the most curious of the number being the long-legged Spider Crabs from deep water. A very monkey-cage was this tank for the drollery of the tricks you saw; some of the little fellows, like pigmy pugilists, saucily squaring at you close to the glass front, others

sparring and scuffling with each other, and scrambling over one another's backs, or stepping daintily about like superfine dandies picking their way in a dirty road. Not even the Anemones, then in the first flush of their popularity, attracted more eager attention than these strange yet familiar forms, and great was the loss to the Fish House when this feature of the exhibition could no longer be maintained.

Amongst the most hardy of the Crustacea, and the best adapted therefore for the Aquarium, are the small Swimming Crabs (*Portunidæ*) which have dilated, oar-like feet, by means of which they are enabled to perform a sort of natatory movement which gives them a very odd appearance. This is best seen at feeding-time, when they pursue each other for the morsels of food, and rush about over the blocks of stone, making the most extraordinary flying—or rather swimming—leaps, striking out with their feet the while in a very grotesque fashion. These little Crabs are the *gamins* of the Aquarium, and for cool impudence and clever trickery have no equals. What with their squabbles with one another, and their raids upon the rest of the community, they form a perpetual source of amusement. They rob the Anemones of their food in the most barefaced manner imaginable, taking it out of their very mouths, and even when it has all but disappeared from view. In the winter they very commonly bury themselves in the sand or gravel at the bottom of the tank, usually under some overhanging ledge of stone, and leaving only the front edge of the carapace with the eyes and the ever-jerking antennæ above the surface. In this condition they will frequently remain for several days without stirring a limb, although in warm weather they are most troublesomely active. But even during these sluggish seasons a morsel of oyster dropped into the tank will speedily rouse them, for in some way or other they quickly become aware of its presence, and search about until they find it. And then should it so happen that two of them come upon the prize at the same moment, the battle that ensues is something to see—such fencing and sparring, and fierce tussles together as would delight the heart of Lord Palmerston himself.

One of the most interesting circumstances in the economy of these animals is the periodical moulting or throwing off of the shelly armature in which they are encased. In all the Crustacea alike these moults regularly take place at longer or shorter in-

tervals, the removal of the old crust being necessary to admit of the growth of the animal. In the early stages of life, when growth is most rapid, the change takes place at intervals of only a few weeks' duration; but as the animal advances in age, the shell is cast with less and less frequency, and there is reason to believe that after a certain period the moults cease altogether. All parts of the animal immediately expand on being liberated from the old crust, between which and the new one there is always a very perceptible difference in size.

The most curious thing in this moulting of the Crustacea is the remarkably perfect condition in which the old crust is thrown off; the covering of every part of the body and its appendages being left whole and entire, so as to give the rejected crust a striking resemblance to the animal itself. In the ordinary Crabs, indeed, no unpractised eye could detect the difference, and the uninitiated observer who finds the empty shells of one of these animals in his Aquarium is pretty sure to look at it regretfully as the dead body of one of his pets; and very frequently the mistake is not discovered until some hours, or it may be a day or two afterwards, when, to the utter confounding of the owner, the animal which was supposed to be dead and gone is again seen stalking about, a veritable ghost. A similar mistake sometimes occurs with the Hermit Crab; but in this case, unless there be some other carnivorous inmate of the Aquarium to account for the disappearance of the fleshy tail, the observer is considerably perplexed at the absence of that important part of the Hermit Crab's structure.

Our own first acquaintance with the moulting of the Hermit Crab was made under circumstances which rendered this disappearance of the body doubly perplexing. There were two Hermit Crabs confined by themselves in a dish; but they were by no means neighbourly, and seldom met in their walks without having a spar, which sometimes took the form of a regular fight. One morning they both lay dead (as it seemed) at the bottom of the dish; and most unaccountably, in both alike, the fleshy body was clean gone. It was the tragedy of the Kilkenny cats over again, with the difference that in this case the tails were the only parts eaten. What could it mean? The mystery was soon explained. There, amongst the weeds, at the side of the dish, were the real Hermit Crabs, still alive, winking and blinking; and

those tailless forms outstretched on the sand were nothing more than the gentlemen's cast-off clothes.

But small space now remains in which to speak of the highest class of animals for which the Marine Aquarium is at all adapted, namely, the fishes; and it is the less necessary that we should dwell upon them, as but few private persons probably will attempt their preservation. The Aquarium is not the place for animals of such free and diseursive habits as the fish, which require a wider range and the constant stir and motion of the open sea in order to maintain their health and vigour. In the large tanks in the Zoological Gardens, it is true, they are more at home; and there the Mullet, the Basse, the Flounder, and a variety of other fish have been preserved with great success: a specimen of the Common Conger (*Conger vulgaris*) having occupied one of the cases for more than seven years. It was only five inches long when first put into the tank; but it has since then grown to upwards of two feet in length, and has become so far tamed as to come out from its hole to be fed at a signal from the attendant.

It is only with wide space and various facilities at command, however, that success like this is attainable. But there are some few species of fish which, from being more restricted in their range than the race generally, are tolerably adapted for aquarian purposes, and to these we may briefly refer, premising that of the in-door life of none of them can we speak from our own experience.

The most attractive of the number are the Wrasse or Connors, distinguished by their gay and brilliant tints of green, purple, and gold, and by their thick fleshy lips, which, only partially covering the teeth, give the fish a snarling, surly look, like that of certain ungainly curs. The larger Wrasse are rather too bulky for conve nient management in the Aquarium; but some of the smaller species may be kept without much difficulty, and make a very attractive addition to one's in-door live stock. The best adapted for the purpose perhaps is the little Corkwing or Goldfinney (*Crenilabrus cornubicus*), which, though rather of a washed-out appearance in comparison with the bright mail of some of its relations, is yet a fish of some beauty, and a very Paul Pry for its inquisitive habits.

The Wrasse may often be seen in fine still weather during ebb-

tide gliding about over submerged rocks close to the shore, their own bright colours beautifully contrasting with the darker hues of the sea-weed. No fish, however, are a greater source of trouble and annoyance to the inexperienced angler. Let him attempt to fish where the water is but shallow, or place his float only a little too high upon the line, and scarcely does he "throw out," before the bait is taken by some hungry Connor; which, the moment it feels the hook, darts to the nearest cluster of weeds, and nestling amongst the stems, or wedging itself into some hole or crevice in the rock, bids defiance to the young sportsman, who might tug till the crack of doom without inducing the rogue to stir. Loss of gear is the invariable consequence, with sometimes the additional penalty of a broken rod. With practised fishermen of course these mishaps seldom occur, the Wrasse rarely getting hooked without being brought ashore. They are but little valued however, most anglers pronouncing them unfit for the table—a dictum we make bold to *contra*dict; and aver that, when taken in the proper season, and judiciously cooked (an operation, be it remembered, on which very much depends), they form, as Cockney epicures are wont to say, "most excellent good eating."

No fish adapted for the Aquarium are more curious and interesting than the Pipe-fish, of which five or six different species are to be met with around our shores. The long attenuated body and the projecting snout of these fish give them a very singular appearance, which is, however, admirably in keeping with the eccentricity of their behaviour. When first introduced to the Aquarium they are very wild and troublesome and if the tank is not covered they are by no means unlikely to jump out and commit suicide. After a while, however, they become reconciled to their confinement, and they are then very entertaining. You are perhaps watching one of them prying about inquisitively amongst the weeds and stones at the bottom of the tank, when all of a sudden, as if tired of his work, he mounts towards the surface, but half way up, stops short, and coiling his long tapering tail once or twice round one of the larger sea-weeds, he supports himself thus in mid-water like a miniature acrobat. Occasionally two of them will very amicably twine their tails together in a sort of lover's knot, and attaching themselves side by side, stretch up towards the surface together, remaining for hours in the same posture.

But the point of chief interest in connection with these fish, is the extraordinary circumstance that the male undertakes the principal duties of the maternal office. In summer, when the Pipe-fish commence the business of rearing their young, the female fish, instead of depositing her eggs like other fish mothers, transfers them bodily to the guardianship of her partner, and thenceforth has no further care or responsibility of the family. The gentleman Pipe-fish receives the eggs in a sort of marsupial pouch, which runs along the under surface of the body, and there the precious burden is retained until the young fry are duly hatched and able to take care of themselves. For some time after their birth the young fish regularly resort to the paternal pouch when danger threatens, and Mr. Yarrel says he has been assured by fishermen, that if when the fish are caught the young ones are removed from the parent and placed in the water, they will keep close to the boat, and again enter the pouch if the old fish is held towards them in a favourable position.

It has never yet been clearly ascertained how the transference of the ova is effected; but it is no unusual circumstance at low tides and in shallow water to find these fish seated very amicably in pairs side by side under the shelter of some boulder or projecting ledge of rock, and the probability is that it is on these occasions that the female Pipe-fish makes her partner happy.

One of these fish is a sort of special favourite of ours, from the circumstance that many years ago, when a youngster still at school, it brought us in a very sudden and unexpected manner into a position of what we thought most flattering notoriety. It happened in this wise. We were exploring one day far out among the shallows left bare by an unusually low ebb of tide, when, in a snug little pool, we discovered a pair of odd-looking and, to us, unknown fish, searching among the weeds, sailing from side to side, and evidently intending to remain in present quarters till next flood. But as

> "The best laid schemes o' mice an' men
> Gang aft agley,"

so in this instance it chanced with the scheme of two Pipe-fish, for such they were. Not without some trouble we secured the double prize, and bore it straightway to a distinguished *savant* we knew, who had often before accepted our living plunder in exchange for

what we valued far more—some of his own deep acquaintance with their habits and economy. Then it was that we first learned the remarkable facts related above, and saw with wondering eyes the bright orange-coloured ova packed away in triple rows in the pouch of the male fish. Thus we bartered our Pipe-fish, esteeming ourselves richly rewarded by the strange and wonderful history we had had in exchange. But what was our astonishment some months after this, to receive from our sage instructor a handsome little volume he had just published on the natural history of the neighbourhood, in which, when speaking of the Pipe-fish, he referred at length to our gift in a paragraph beginning as follows:—"I have a pair of these fish, presented me by my young friend *Mr.* (and here our name was given at full length, in *print* too, and with such a prefix), taken in," &c. &c. It may be a weakness of ours, but from that time forward we always looked upon the little Worm-shaped Pipe-fish as a decidedly handsome fellow.

One of the most conspicuous results of the popularity of the Aquarium is the impetus it has given to the study of seaside natural history. People have become so pleased with what they have seen of the indoor life of Periwinkles, Prawns, and Sea-Anemones, that they are now bent on cultivating an acquaintance with them in their own proper homes, in the rock-clefts and tide-pools along the shore. The consequence is, that quite a new element has been introduced into the occupation of the visitors to our fashionable watering-places. There are the same groups of listless dawdlers along the sands, the same boating parties, donkey-drivers, absorbed readers, and enthusiastic young ladies in rapt admiration of "the deep and dark blue ocean," as of yore; but, in addition to these, there is now another class of visitors, carefully studious of spring-tides and the exact time of low water, whose talk is of "Trogs" and "Gems," *Balani* and *Serpulæ*, who affect hobnailed boots, dresses that won't spoil, and collecting baskets stored with jam-pots and wide-mouthed doctors' phials, and whom you may see coming landwards with every advancing tide, wet and soppy, and with a saline odour about them, as though they were themselves but metamorphosed sea-monsters of some sort just advanced to the human form, and now first emerging from the deep.

But let no precise, well-dressed individual think to abash

such collectors of "marine stores" by sidelong glances of affected pity for their weakness. They have been initiated into the mysteries of the modern fairy-land, and have made the acquaintance of Aphrodita, Eunice, Beroe, and the rest of the sea-nymphs; and instead of feeling at all ashamed at being seen dabbling amongst the dripping weeds, and groping in the pools and rock-clefts, they only wonder that anybody can still be found indifferent to the thousand objects of interest and beauty which there have their home, bearing silent but eloquent testimony to the wisdom and benificence of the great Author of Life.

CHAPTER VIII.

THE ANCIENT ORDER OF BATRACHIANS.

"The swimming-frog, the toad, the tadpole, the wall-newt, and the water."

The Batrachians are not by any means such strangers as some people may imagine. The reader who has forgotten his Greek, or who never had any Greek to forget, may fail to recognize them, but they have amongst them many old familiar faces for all that.

Let nobody therefore run away with the notion that this same ancient order is some old, broken-up, dead-and-gone fraternity, similar to those illustrious orders of Odd Fellows, Green Foresters, Ancient Druids, and the like, which still find countenance and support amongst the children of men. The idea is altogether beside the mark. The Batrachians do not belong to the human family at all. They are a race, not of men, but of reptiles, the best known members of the order being the "small deer" enumerated above, from that extraordinary list of dainties which the banished Edgar palms off upon his father as his "food for seven long year."

No one will dispute that these little fellows are for the most part familiar enough; and yet how far removed are they from being familiar friends! The truth is, the Batrachians have but few admirers. They labour under that direst of misfortunes—a bad name. Innocent and inoffensive, and doing no small amount of good in their way, they are yet misrepresented and maligned, their good qualities denied, and bad qualities from which they are wholly exempt, obstinately laid to their charge. There is perhaps hardly another race of creatures in existence which is so unanimously hated, and hunted to death, as this poor obscure race of reptiles. It matters not that Homer has sung of their exploits, that Aristophanes has embellished them with his wit, that their history is one of the most wonderful on record,—no-

thing avails to overcome the settled antipathy of mankind; and the Batrachians will probably go on to the end of their days maltreated and maligned, an unoffending but cruelly persecuted race.

It generally happens that injustice of this sort brings about its own punishment, and this is certainly the case in reference to the hard measure so undeservedly meted out to the Batrachians. The world looks down upon them, gives them ill names, affects a sort of horror of them, and does its best to kick them out of sight; and the consequence is that the world knows next to nothing about them, and thus misses one of the most marvellous chapters in the whole range of zoological science. The Batrachiophobia is at length giving way in one direction, it is true; for the Aquarium has made it manifest that the Water-Newts, spite of a long-cherished belief to the contrary, are perfectly harmless little creatures, elegant withal in their appearance, and very engaging in their behaviour. If prejudice did not stand in the way, we should be ready to admit that others of the order were equally deserving of our attention, and that "horrid" and "odious" as they are generally voted, it would be well worth the while of the curious in such matters to inquire into the details of their habits and economy.

We propose, then, to put in a plea on behalf of the Frog and his friends, and to show cause why the entire fraternity of Batrachians should henceforth be dealt with in a more humane and considerate fashion. It will be no difficult task to accomplish, nor will it involve us in anything like a dull and disagreeable discourse; for however repugnant it may be to the notions prevalent on this side of the English Channel to introduce any of these little fellows upon the dinner-table, there can be no question as to the excellence of the literary *pièce de résistance* they furnish, if only it be concocted with a little artistic discrimination and care.

It may be as well, perhaps, to begin by informing such as are disposed to look down upon the Batrachians, that in the estimation of some of the first naturalists of the day, these animals are entitled to a considerably higher rank than that to which they are generally supposed to belong. The common idea of course is that they are neither more nor less than reptiles; the entire group being regarded as one of the "orders" or principal divisions of

that class of animals. The opinion, however, is now very generally entertained that they ought properly to be regarded as constituting by themselves a distinct *class*, equal in relative importance to each of the other great classes of the animal world, and occupying an intermediate position between the true reptiles and the inferior class of fishes. If this view of the matter be allowed, our little friend the Frog and his allies will part company with their quondam associates of the reptile tribes,—the snakes, the lizards, and the tortoises,—and, raised to a higher level, will take their place on terms of equality with the other great divisions of the vertebrate animals. The Batrachians themselves are no doubt sublimely indifferent as to which way the decision may go on this very grave question, and would be but little elated, it may be presumed, should their elevation to the dignity of an independent class be ultimately agreed to by a unanimous vote of all the zoological professors of Christendom. But, for all that, the question is not without its interest to the student of nature; and as the Batrachians do really stand as candidates for this elevated post, they ought certainly to be regarded with becoming deference and respect.

But, whatever may be the true style and title of the Batrachians—whether they continue to be regarded as a subordinate group of the reptile class, or be raised to a class by themselves—one thing is quite certain, namely, that they do differ very materially from ordinary reptiles, and approximate in many particulars to the class of fishes. The group, as a whole, forms a clear and unmistakable transition from the one class to the other. In the lower divisions of it we meet with creatures so completely fish-like in character, that they can be separated from the fishes only by fixing on some point of distinction which is purely arbitrary in its nature; and from these questionable forms we advance, step by step, to the higher divisions, the members of which make a close approach to the character of true reptiles. It is obvious therefore that the Batrachians form a strictly intermediate and transitionary group; and so completely do they bridge over the difference between the fishes adapted for a purely aquatic life and the true air-breathing land reptiles, that they obliterate, so to speak, all essential distinction between them.

If there be any one thing which more than another shows the true character of the Batrachians, it is the remarkable changes

they undergo in the early period of their history. The transformation of a Tadpole into a Frog exhibits, in the successive phases of the life of an individual animal, substantially the same stages of advancement towards a higher type of organization as are marked by the mature forms of the several members of the group as a whole. It will be interesting therefore to notice by what steps this progressive improvement of structure is made; and as there is no lack of Tadpoles in our ponds and ditches throughout the spring and early part of summer, any of our readers who choose to do so may readily verify our statements for themselves.

In the beginning of March, then, the Frogs which all the winter through have been comfortably "conglobulated" together, as Dr. Johnson said of the swallows, in the mud at the bottom of the ponds and ditches, wake up from their protracted sleep, and make their appearance at the surface of the water. In a little while they are all busily engaged in their nuptial rites, with respect to which the only remark we have to make is, that we wish they were somewhat less obtrusively thrust upon our notice. The eggs are deposited in large masses at the bottom of the water; but as each egg is surrounded by a covering of glutinous matter, which readily absorbs water, the entire mass speedily swells, and becoming lighter than the surrounding medium, it rises to the surface. In this stage the eggs appear as little black dots, separated from each other by a globular investment of transparent colourless jelly; and it is only by bearing in mind the extraordinary abundance in which this spawn is to be seen in the water in spring, that one can account for the myriads of tiny Frogs to be found hopping about the margins of the ponds later in the year. For about a month or five weeks the eggs gradually increase in size; at the end of that period the young Frogs—as yet, however, far otherwise than Frogs in form—burst the envelopes of the eggs, eat their way through the gelatinous walls that imprison them, and make their escape into the water.

In the condition in which the little creature commences its active life, it is known to every village urchin in the land as the Tadpole, or Loggerhead. The Cockney schoolboys give it the more expressive name of Tiddler. The little thing seems all head and tail. "It is provided," says Cuvier, "with a long fleshy tail and a small horny beak, and has no other apparent members

but little fringes at the sides of the neck." These fringes are the Tadpole's breathing organs, and one of the earliest changes it experiences is the shrinking of these organs, and their subsequent disappearance beneath the skin, where they discharge the functions of the gills of a fish. The mouth of the Tadpole is placed low down in the front of the head, so that when the little fellow wishes to seize anything floating on the surface of the water, he has to throw himself on his back like a shark; and so nimbly does he execute this manœuvre, that the eye cannot without difficulty follow it. Thus expert in appropriating food, the tadpole rapidly increases in size, the tail acquires greater breadth, and the limbs slowly make their appearance. The hind feet are developed first, increasing by little and little, and then the fore feet also appear. The beak now falls off and exposes the true jaws, which were before soft and concealed under the skin; the tail is gradually absorbed, and the young Frog begins to assume something like his mature form. In a few days more the little fellow, advanced to the dignity of positive froghood, takes his leave of the water, and steps ashore, thenceforth repudiating the shrivelled remnant of his once ample tail, which is now speedily disposed of after the manner in which Lord Monboddo and his disciples would have us believe that our own quadrumanous progenitors disposed of theirs.

While these external changes are in progress, modifications of still more importance are taking place in the whole of the internal organization.

In the first place, let us look at the development of the spinal column or back-bone. In the newly-hatched Tadpole this part of the structure consists of little more than a simple fibro-cartilaginous cord. As the little creature grows, this cord begins to ossify, though only in that portion which is to be retained in the future Frog. After the process of ossification has gone on for a short time, the cord becomes converted into a distinct vertebral column; both faces of the separate vertebræ in this early stage, however, are concave, and between each pair of vertebræ there is precisely the same sort of hollow filled with fluid as that which distinguishes the vertebral column of fishes. But ossification proceeds; and now gradually filling up the hinder cavity of each vertebra, and projecting the newly-formed bone into the front cavity of the vertebra behind, it finally converts the entire series

into a vertebral column, connected throughout by the true ball-and-socket joint characteristic of the higher reptiles.

The changes which take place in the circulatory and breathing apparatus are not a whit less remarkable. In the first instance the condition of these organs is in all essential particulars precisely the same as in the class of fishes. Thus the blood, driven from the arterial bulb through the branchial arteries, circulates freely through the gills, and is again collected in the branchial veins, of which two pairs unite in forming the great aorta of the body, whilst the other pair is distributed in the head. The pulmonary arteries first make their appearance in a very rudimentary form, springing from the branchial vessels. But as the lungs are developed and aërial respiration commences, these arteries rapidly increase in size, whilst the branchia and their vessels gradually diminish in the same proportion. The change still proceeding, the branches which unite the branchial arteries acquire a much greater development, and gradually divert more and more of the blood from the branchiæ, which now speedily disappear altogether, and leave to the pulmonary arteries the task of carrying on the entire business of respiration. In this way the little fish-like Tadpole, adapted exclusively for an aquatic life, gradually becomes metamorphozed into a being possessing every requisite for a strictly terrestrial existence; though, whether it be from the strength of early associations, or from some more recondite cause, the Frog seldom wanders far from his original home, and appears his life through to prefer to either land or water, strictly so called, that convenient compromise between the two afforded by the swamp or ditch.

The progressive changes related above obtain of course only in the young of the higher grades of Batrachians. In the lower forms the metamorphosis is arrested at various points, so that the mature condition of these animals marks, so to speak, the successive stages in the development of the young of the more advanced members of the order.

But there are some rather curious and some truly extraordinary circumstances in connection with the early history of some of these higher members which must be referred to here. In the rst place, there is a Toad common enough throughout the Continent, and well known in the neighbourhood of Paris, which has obtained for itself the name of the Accoucheur Toad (*Bufo*

obstetricans), from a singular habit which the male has of assisting the female in the exclusion of the eggs, which he afterwards attaches to his own hind-legs, and carries about with him till the young Tadpoles are ready to escape, when he conveys his charge to the water, where henceforward the young make their way in the world just as Tadpoles that are less highly favoured with parental care. Still more extraordinary is the procedure of the monstrous Surinam Toad (*Pipa Americana*). The eggs of this species are deposited by the female at the margin of the water, and are then carefully collected by the male and deposited upon the back of his partner in a number of singular pits or cells which stud the skin. A single egg is pressed by the male Toad into each of these cells, which are then closed with a sort of lid. The development of the Tadpole proceeds in these confined spaces in exactly the same way as with those of the other Batrachia which roam at large in the water; and when the young animal has completed its changes, it comes forth at once a perfect Toad. In the Salamanders, again, the early part of the development of the young takes place within the body of the parent. It is not a little singular, too, that in the conversion of the bi-concave into cup-and-ball vertebræ, in the development of the Tadpole of the Salamander, the newly-formed bone fills up and extends from the *front* cavity, so that in the adult vertebræ the ball is anterior and the cup posterior, as in some of the more reptile-like fishes. The Water-Newt, instead of depositing its eggs in patches or masses like the Frog, or in long chains like the common Toad, doubles them up singly in the leaves of aquatic plants. In the young Newts, again, the development of the fore-legs precedes that of the hind pair, while, as we have already stated, the reverse of this takes place in the young Frog, which, by the way, appears from observations communicated to Mr. Patterson of Belfast, to be in the habit of literally "putting its left leg foremost," the left fore-limb being perfectly developed, while the other is still "nowhere."

Mr. Bell, in his "History of British Reptiles," brings a serious charge against the Tadpole of the Frog, accusing it of no less a crime than downright cannibalism; and what is not a little odd in the matter is, that the horrible propensity is said to manifest itself only when the limbs first make their appearance in any of the Tadpole's companions. Suspecting that this was the case,

Mr. Bell placed in a large glass globe of water several Tadpoles nearly approaching their final change, and he observed that, as surely as one of them acquired its limbs, it would soon afterwards be found dead at the bottom of the water, and the other Tadpoles feeding upon it. This took place with all of them successively, excepting the last, which not being able, or perhaps disposed, to eat himself, lived to complete his change, and doubtless grew fat upon the ruin of his fellows.

One of the popular errors which have come down to us from the remotest times, and one which still has vitality enough to secure an occasional paragraph in its support in provincial newspapers, is the belief in showers of Frogs. The origin of this belief is no doubt to be found in the extraordinary abundance in which young Frogs, just after the completion of their transformation from the Tadpole state, and especially after rain, are seen in the act of migrating from the pond or swamp in which they commenced their career, into the surrounding districts. Enormous numbers of these tiny creatures are sometimes to be met with in this manner, the ground being at times literally covered with them over a considerable area; and as this curious spectacle is most frequently observed after heavy showers, accompanied, as such showers occasionally are about the middle of the year, by thunder and lightning, it is not at all extraordinary that the notion should have arisen that the animals in question came from the clouds. Incidental allusions to this idea are to be found in many of the writers of antiquity; and Aristotle goes so far as to assert that the Frogs so seen are a peculiar sort, which he terms διοπετὴς, "sent by Jupiter."

In later times, when philosophers were more ambitious of accounting for the supposed facts of popular belief than of testing their accuracy, a variety of ingenious reasons were assigned for the phenomenon. The celebrated Cardan, in his book "De Subtilitate," maintained that it was the violence of the wind which carried the Frogs from the tops of the mountains and bore them to the plains. Another idea was, that the *eggs* of the Frog were taken up by the winds, and, being hatched in mid-air, the young Frogs fell to the ground; but against this theory, Scaliger urged very conclusive objections, that the eggs of the Frog produce, not perfectly formed Frogs, but Tadpoles, which no one pretended had ever come down from the clouds.

Ray, in his "Wisdom of God in Creation," fully discusses this "shower of Frogs'" question, and shows how entirely groundless is the common opinion on the subject. But, more than this, he gives us, on the authority of his friend Mr. Derham, an account of one of the said "showers," which clearly shows how the popular notion originated. Mr. Derham relates, that one afternoon, while riding in Berkshire, he came upon an immense multitude of minute Frogs crossing the road. There had been a shower of rain only an hour or so before, and he immediately thought of what he had heard of the raining of Frogs. But not being a believer in that sort of thing, he determined to search into the matter. On examining the neighbourhood, he found two or three acres of ground nearly covered with a vast "black regiment," which was proceeding all in one direction towards some woods and ditches at a short distance in front, and which he traced back to a large pond that in spring-time, he ascertained, always abounded with Frogs—from which circumstances he very properly concludes that the little wayfarers had come, not from the clouds, but from the pond whence they were marching; that they had been tempted to set out on their journey by the recent shower, and were going bodily in search of fresh provender.

Let us now glance briefly at some of the less familiar forms of the Batrachia, preparatory to giving our attention more at length to the little fellows with whom we are better acquainted.

At the very bottom of the series, if in the series at all, and on the very boundary line between the fishes and the Batrachians—if such a boundary line be really allowable—stands the singular creature first exhibited alive in this country at the Crystal Palace, Sydenham, and now numbered amongst the treasures of the Zoological Gardens as the "Mud-fish" (*Lepidosiren annectans*). There is a dispute amongst naturalists as to whether the "Mud-fish" should be classed with the fishes or the Batrachians. Dr. Natterer, the discoverer of the animal, regards it as a Batrachian reptile, and in this opinion most of the writers on natural history agree; but Professor Owen, relying, we believe, chiefly on the peculiar character of the animal's nose, places it amongst the fish. It would be more correct, perhaps, to say *placed*, for since Professor Owen has had the opportunity of examining the specimens recently living in this country, he appears to incline to the opinion that the creature is properly neither fish nor reptile,

but something strictly intermediate between the two—one, in fact, of those "connecting links" in nature which some people laugh at as mere creations of the fancy. The *Lepidosiren* is extremely fish-like in appearance, having an elongated tapering body covered with scales, and furnished along the back, and both above and below the tail, with a thin membraneous fin, precisely as in some of our commonest fishes. It differs from fish, however, in the broad flattened head and obtuse muzzle, and still more obviously in being furnished with two pairs of rudimentary limbs in the shape of long tapering filaments. Three species of this curious animal are known, all of them being confined to the tropical rivers of Africa and America, where, at the approach of the dry season, they bury themselves in the mud at the bottom of the water and remain in a state of torpidity for several months. It was in this condition, enclosed in balls of hardened clay, and cut off from all communication with the external air, that three of the animals were brought to this country from the Gambia, and presented to the Crystal Palace Company by Captain Chamberlyne.

In the famous Siren (*Siren lacertina*), an eel-like creature which inhabits the marshy rice-grounds of Carolina, and several allied forms, a single pair of limbs only is developed, and in addition to true lungs for aërial respiration, they are furnished throughout the entire period of their existence with external tufted gills for respiration in the water. No wonder, therefore, that for a long time these animals were regarded as Tadpoles of higher forms of Batrachia. Cuvier, however, has satisfactorily shown that they are mature animals, though, as he says, they are amongst the most remarkable in the whole range of the animal kingdom. Our information as to the habits of these animals is most meagre. The best known species is the one mentioned above, and which has occasionally been exhibited alive in the Zoological Gardens in the Regent's Park. It appears to keep pretty much to the mud and muddy waters of the rice-swamps, and feeds upon worms and insects. Dr. Garden, the original discoverer of the animal, circulated wonderful stories of its feeding habitually on serpents, as also of its extraordinary vocal powers, whence Linnæus gave it the name it bears.

One step higher in the series than the Siren, and we reach the Proteus (*Proteus anguinus*), the extraordinary inmate of the

subterranean pools in the caverns of Illyria and Carniola. In this animal two pairs of limbs are developed; the external gills continue in addition to the true lungs, and the creature makes a still nearer approach to the ordinary reptilian form. The Proteus is in its natural state of a flesh-whiteness and transparency of colour, and decked around the neck with the brilliant scarlet fringes of its branchiæ, it has a most remarkable appearance. Living perpetually in total darkness, organs of vision would be perfectly useless, and its eyes are accordingly reduced to mere points, and hidden by the skin. Closely allied to Proteus is the curious Axolotl of the Mexican lakes, an animal, it appears, regularly exposed for sale in the Mexican markets, and which, at the time of the invasion of the country by Cortez, is said to have afforded food to his army for some time. In this connection, too, we must mention, though it is barely possible to do more, the Menobranchus of the great North American lakes, the Amphiuma, the Menopome, and the Sieboldia, or Gigantic Newt of Japan, of which several nearly full grown specimens have recently been added to the magnificent collection of animals in the Regent's Park Gardens.

We come now to those lately adopted pets, the Water-Newts and their allies. These animals belong to the family *Salamandridæ*, which comprehends, besides the Newts, the true land Salamanders, which figure so grimly in the pages of the ancient writers on natural history. Of these redoubtable worthies we will speak in due course; for the present, let us look at our little Newts, or Aquatic Salamanders. The Newts share not only the name of their more celebrated congeners, but their fame also; and so widely spread and deep rooted is the belief that they are endowed with poisonous properties, that scarcely a village lad could be found who would venture boldly to grasp them in his hand. We suspect, moreover, that even amongst those who have lately adopted them as household pets, there are very few who would not, like the old lady pictured in "Punch," prefer the tongs to their fingers if occasion should arise for handling them.

It appears that we have only two distinct species of Newts in Britain; though, from the constant variation in their appearance, the number is supposed to be at least double. Our largest species (*Triton cristatus*) measures, when full grown, about six inches in length, and in colour is brown above and a bright

orange beneath. The smaller species (*Lissotriton punctatus*) is more faintly coloured, and hardly more than half the length of the preceding. In both species alike the males are adorned during the breeding season with a membraneous fin-like crest, which runs along the back and tail, and greatly adds to the beauty of their appearance. It appears from the interesting observations of Mr. Higginbottom, communicated to the Royal Society, that these little creatures are by no means so entirely aquatic in their habits as is commonly supposed. The larger species is undoubtedly the more strictly aquatic of the two, the smaller one, the "Wall Newt" of Shakspeare, having more of a roving disposition, and being particularly fond of the damp moss-grown walls of old buildings. Both species, however, pass a great part of their time on the land, and remain permanently in the water only during the period in which they are engaged in the great business of propagating their kind. If one may judge from the crowds which used to gather around the windows of the Aquarium dealers in which these little fellows were exposed to view, they have hitherto been but slightly known to our town-dwellers, notwithstanding their abundant distribution throughout the country. In Ireland only one species appears to be generally distributed, and according to Mr. Patterson of Belfast, it is well known in that part of the country as the "man-keeper," the ignorant part of the population regarding it with great horror, from the notion that it never fails to jump down the throat of any body that it finds asleep.

The true Salamanders are strictly terrestrial in their habits, and differ from the Newts in having a rounded instead of a flattened tail. The body of the Salamander is covered with warty glands, which secrete an acrid, milky fluid, the abundance and the poisonous properties of which have given rise to some of the most marvellous stories that the mind of man ever imagined.

That the fluid secreted by the Salamander is really poisonous to small animals appears certain from the experiment of Laurenti, who provoked two lizards to bite one of these animals, in order to ascertain the effects of the supposed poisonous secretion. The Salamander at first attempted to escape, but being still persecuted by the lizards, it ejected some of the fluid into their mouths. One of the lizards died instantly; the other fell into

convulsions for two minutes, and then it expired also. In another case, some of the fluid was introduced into the mouth of a lizard by the hand of the experimenter, and in this instance the animal first became convulsed, then paralyzed on one side, and soon afterwards it died. There appears to be no reason therefore to doubt that the Salamander is really endowed with poisonous properties.

But now, let us see how this simple fact was magnified and adorned by the ancient philosophers. No better idea can be given of the extravagant opinions of the ancients on this point than that conveyed by the following passage from Pliny.

"Of all venomous beasts, there are not any so hurtfull and dangerous as are the Salamanders. As for other serpents, they can hurt but one at once, neither kill they many together; to say nothing how, when they haue stung or bitten a man, they die for very griefe and sorrow that they haue done such a mischiefe, as if they had some pricke and remorse of conscience afterwards; and neuer enter they againe into earth, as vnworthy to be receiued there: but the Salamander is able to destroy whole nations at one time, if they take not heed and prouide to preuent them. For if he get once to a tree, and either claspe about it, or creepe vpon it, all the fruit that it bears is infected with his venome; and sure they are to die, whosoeuer eat of that fruit, and that by the meanes of an extreame cold qualitie that his poyson hath, which doth mortifie no lesse than if they had taken the Libard-baine call Aconitum. Moreouer, say that she doe but touch any peece of wood, billet, or hedgestake, wherwith either a loafe is baked, or a shiue of bread tosted, as many as eat thereof shall catch their bane by it; or if one of them chance to fall into a well or pit of water, looke whosoeuer drinke thereof, shall be sure to die vpon it; and that which is more, if there happen neuer so little of the spittle or moisture which shee yeeldeth, to light vpon any part of the body, though it touched no more but the sole of the foot, it is enough to cause all the haire of the body to fall off."

It appears, however, that notwithstanding these frightful attributes of the Salamander, "swine eat them safely;" from which fact our author thinks "it soundeth to good reason" that the flesh of the pig should haue power to "mortifie" the terrible venom. But more on that point anon. Suffice it to say here

that the same race which furnishes the "bane" affords also the "antidote;" and though in Rome it was a common proverb, "If a Salamander bites you, put on your shroud," it was not from any deficiency of sovereign remedies.

But the grand absurdity of all was the belief that the Salamander was incombustible; that it not only resisted the action of fire, but could live in the midst of it without inconvenience, and extinguish it at pleasure. It is somewhat remarkable, however, that while some of the ancient writers express themselves with evident reserve and hesitation on this point, the belief appears to have held its ground long after the exaggerated idea entertained by the ancients of the animal's poisonous properties had begun to decline. Aristotle has often been quoted as giving his sanction to the belief which obtained in his time, but the language he employs—"For the Salamander (*as they say*), walking through the fire, extinguishes it"—clearly shows that he had some doubts about the matter. Pliny expresses his doubts still more unequivocally, and this is the more remarkable, since, as a general rule, the more extraordinary the stories he relates, the more ready he is to adopt them. He puts it thus: that if what the magicians report of the Salamander's power to extinguish fire had proved true, it would have been long since put in practice at Rome; and then he addnces the authority of Sextius, who, as he says, "denieth flatly that it doth extinguish and put out the fire." It seems strange that long ages after this, Lord Bacon should be found, as in his "Sylva Sylvarum," expressing himself as in doubt whether the animal really possessed the extraordinary power over the flames that was ascribed to it. But that the popular belief in the incombustible nature of the Salamander still obtained appears evident from a curious reference to the subject in "The Plaine Man's Pathway to Heauen"—a book, by the way, to which John Bunyan was probably indebted for the original idea of the "Pilgrim's Progress," and which, in his "Grace Abounding," he mentions as one of the two books that formed the only dowry of his wife—where it is said, "As the Salamander is alwaies in the fire and neuer consumeth, so the wicked shall be alwaies in the fire of hell, and neuer consume." The last remnant of this ancient belief appears now to have passed away, its disappearance having, no doubt, been greatly expedited by what, according to the high authority of Sydney Smith, has

been mainly instrumental in freeing us from the visits of ghosts and hobgoblins, namely, the smell of the printer's ink.

It is hardly necessary to say that the Salamander is not a native of Britain; though several species are found on the Continent. The animal rarely exceeds six inches in length; and now that it has fallen from its high estate, it receives scarcely as much notice as, from its former fame, it properly deserves.

The various members of the Batrachia which we have hitherto introduced to the reader in this review of their principal forms, are all distinguished by the possession of the caudal appendage throughout the entire period of their existence; but we now advance to the highest section of the order, the members of which, with very exalted notions of their own importance, disencumber themselves of this badge of inferiority on their first emergence from the water, and ever afterwards walk (or rather hop) the earth, as the Anourous Amphibia or Tailless Batrachians.

In the forefront of these Batrachians *par excellence* stands a race of tongueless, triangular-headed Toads, represented by the monster already alluded to, the *Pipa Americana*, or Surinam Toad. Captain Stedman, in his "Narrative of the Expedition to Surinam," describes this monster as "the most hideous of all creatures upon earth, covered over with a dark-brown scrofulous skin, very uneven, and marked with irregular black spots," and in size "often larger than a common duck when plucked and pinioned." The reader will please be so good as notice that it is Captain Stedman who is guilty of this horribly incongruous association of "the most hideous of all creatures upon earth"—and *roast duck*. The captain had evidently a "strong stomach," or the mere making of such a comparison would have taken away his appetite for a week. And yet we are bound to state that, after all, the comparison is just; for "tastes differ," and, however incredible it may seem, your genuine Surinamese regards the *Pipa* as a very "duck" for the table, and, hunting it out from the dark corners of his house, makes a feast of the scrofulous monster.

It is Voltaire, we believe, who somewhere says, that if a Toad were asked his ideal of beauty, he would most likely describe himself, and dwell complacently on a cold clammy

yellow belly and a brown warty and corrugated back as the very *ne plus ultra* of a comely presence. In the matter of personal appearance we have all of us a little weakness, and we don't know why, in the supposed case, the Toad should not have the same privilege as ourselves. But assuredly the world at large would not acquiesce in the poor wretch's complacent estimate of himself; for if there be one creature which, beyond all others, is loathed and detested by mankind, it is this poor unoffending reptile. Its very name, indeed, has for ages past been a byword of reproach, associated with all that is hateful and loathsome. The poor frenzied queen in the play, in the wildest fury of her passion, can find no more biting words in which to express her utter detestation of the Duke of Glo'ster than—"this poisonous hunch-backed toad;" and Shakspeare has still more emphatically marked the Toad's pre-eminence in horror, by placing it first amongst the ingredients that are cast into the witches' caldron in "Macbeth"—

> "Toad, that under the cold stone
> Days and nights has thirty-one,
> Swelter'd venom, sleeping got,
> Boil thou first i' the charmed pot."

The only foundation for this old-established belief in the venomous nature of the common Toad (*Bufo vulgaris*), is the acrid liquid exuded from the skin, which is certainly capable of slightly affecting any very tender or wounded surface, but beyond this is quite destitute of poisonous properties. The truth is, the ungainly aspect of the Toad, more than anything else, has earned him his traditional ill repute; and so long as the world *will* look upon the poor creature with such deeply prejudiced eyes, there is no hope of his winning their good opinion. And yet the Toad has his good points, nor are they difficult to discover. That mild beautiful eye of his, for example,—where will you find its equal? It appears to us that in that placid, gentle expression of the eye, we may find the origin of the popular notion that the Toad carries a jewel in his head:—

> "Sweet are the uses of adversity,
> Which, like the toad, ugly and venomous,
> Wears yet a precious jewel in the head."

The comparison is apt and beautiful, and we are not sure that the Toad himself does not afford a good illustration of the deep

moral truth it contains. Most certainly the poor creature has had no lack of "adversity," and it is no unfair inference that his mild and chastened disposition has in part at least been induced thereby. The Toad repays us for a reputation for all that is bad, falsely and maliciously put upon him, with a willingness to be of use to us, and a readiness to receive our kindness and to reciprocate our friendship, which fairly entitle him to a higher place in our regard. The London market-gardeners know his value well, and we little think that some of their choicest and most dainty productions come to our tables in such good condition as they do, only because this little outcast has been keeping diligent watch and ward over the insect pests that assail them. Moreover, let those fair dames who shudder with disgust at the sight of a Toad on the garden path, remember, that but for its presence, their borders and parterres would often present an appearance not at all to their liking. It ought long ere this to have become universally recognized, that the Toad is not only inoffensive and harmless, but positively and eminently useful; that in fact it is one of the most efficient members of that great army of repressive agents, whose business it is, in accordance with the wise and beneficent arrangements of the great Author of nature, to check and keep under the teeming abundance of the lower forms of animal life.

But the Toad is not only one of our appointed servants, he is also willing to become an intimate and confiding friend.

Numerous instances have been recorded of Toads that have been rendered tame and attached to those who have treated them kindly. Mr. Bell mentions that he possessed one which would sit on one of his hands, and eat the food offered to it on the other. And Dr. Lankester speaks of having repeatedly seen them made the domestic pets of the children of a naturalist. But perhaps the most interesting case of this kind, is that of the Toad mentioned by Pennent, in his "British Zoology;" and though the story of this worthy has often been told, it well deserves to be told again. The animal first made its appearance on the steps before the hall door of a gentleman's residence in Devonshire. The owner of the mansion and his family seeing the creature, frequently gave it food, and, by gentle treatment, gradually rendered it so tame, that, when they came out of an evening with a candle, it would creep out of its hole and look

up, as if expecting to be taken into the house and fed. It was frequently gratified in this way, being carried into the parlour, placed upon the table, and there treated to a supper, in the presence of the assembled household. The favourite food of the pet was the common flesh-maggot, a supply of which was regularly kept for it in bran. In taking its food, it would follow the maggots on the table, and, when within a proper distance, would fix its eyes and remain motionless for a while, apparently preparing for the stroke; and then, quicker than the eye could follow, it darted out its tongue, and, catching the maggot on the point, the tongue was as rapidly withdrawn, and the maggot swallowed. This sort of exhibition excited, as a matter of course, great curiosity in the neighbourhood, and often brought the Toad a number of visitors. For the long period of thirty-six years the pet continued to occupy his hole under the door-steps of his benefactor and friend; but one fatal day another pet, in the shape of a tame raven, espied the poor Toad at the mouth of his retreat, and, pulling him out, wounded him so badly that, no great while after, he died: and thus terminated a career, the record of which has probably done more than the most eloquent appeals to the humanity of mankind, to redeem the race from the cruel persecution to which they are exposed.

The frog stands at the head of his order, the original *Batrachos* of the Greeks, the type and perfect model of the entire race to which in later times his name has been applied. And as the Frog stands thus at the top of the list, so his family is the most numerous of any of the sections in the order.

Let us take the common Frog (*Rana temporaria*) as the representative of his tribe; and the first thing to be said of him is, that he is lighter and more elegant in form than his cousin the Toad, from which also he differs in having his upper jaw armed with teeth. It is to the former of these features, by which the Frog is distinguished from the Toad, that he no doubt owes in part his exemption from those ill-natured and offensive epithets which are continually launched at the head of that poor unfortunate. But though neither "ugly" nor "venomous," the Frog is no more of a favourite with the world at large than his puffy congener. Never, however, was a more innocent, inoffensive, and deserving creature cut off from the protection and favour that he merits. And the misfortune is, that not man alone, but numbers

of the lower animals as well, conspire to thin the ranks of the Frog fraternity, and to put them in constant peril of their lives. The special terror of the Frog is the common snake, which pursues its victim with relentless perseverance, and will even take the water after it, in the ardour of the chase, and secure the Frog in what may be considered its own element. The Frog appears fully conscious of its danger when pursued in this manner, and utters the most piteous screams during its efforts to escape; and according to Mr. Bell, these cries are sometimes continued, not only after the Frog has been captured, but after it has been positively swallowed.

If any of our readers desire to make proof of the Frog's terror of the snake, they have but to wriggle a walking-stick snake-fashion, after the first of these animals they find in a grass field, and before they have proceeded many yards, the wails of distress that the Frog will raise will abundantly convince them of its alarm. But experiments of this sort are not much to our liking, and we think it is only fair to the Frogs that whoever terrifies them with these imaginary dangers, should henceforward feel bound to succour them as far as possible from all real ones.

The great advocate and champion of the Frog family is the Count de Lacépède; and certainly they owe a debt of gratitude to this enthusiastic naturalist and true Frenchman for the eloquent defence he has made in their behalf. The only thing to which we take exception in the matter is, the Old Bailey spirit in which it is conducted—the disposition, we mean, to revile one poor wretch in order to make out a better case for another in a like predicament.

M. de Lacépède is so good as to say, that the prevailing antipathy to the Frog is mainly the result of its resemblance to the Toad, and that if this "ignoble being," with its "revolting habits, disgusting qualities, and dangerous propensities," &c. &c., had never existed, we should have thought the Frog a very paragon of excellence. Now, besides that all this is not true, it is far too obviously a mere piece of over-strained special pleading; and if the Frogs can only be praised at the expense of their nearest allies, they might as well, we think, be allowed to remain out of favour altogether. It must be borne in mind, however, that M. de Lacépède was a frog-eater, and that in thus

endeavouring to establish a broad and marked difference between the two animals, he was, perhaps, all the while, though unconsciously to himself, writing with an eye to the dinner-table.

But let us see what M. de Lacépède has to say. In his estimation, then, the Frog is "as agreeable in its conformation as distinguished by its qualities, and interests us by the phenomena which it exhibits at the different periods of its career. We behold in it a useful animal from which we have nothing to fear, whose instinct is harmless, which unites an elegant form with supple and slender limbs, and which is adorned with pleasing colours, rendered more vivid from a kind of natural varnish with which the animal is constitutionally provided. And who can regard with pain a being whose form is light, whose movements are nimble, and whose attitudes are graceful? Let us not deprive ourselves of an additional source of pleasure, and in our walks through the smiling fields, let us not regret to see the banks of the streams adorned by the colours of these harmless animals, and animated by their lively gambols." Frenchman-like, M. de Lacépède is particularly emphatic on the subject of movements and attitudes, and thus caps the climax of his frog-eulogy:—"When a Frog leaves the water, so far from moving with his face turned towards the earth, and basely wallowing in the dirt like the Toad, he advances by lofty leaps. One would say that he desires to associate himself with the air as the purest element; and when he rests on the ground, he always does so with his head erect, and his body raised upon his forefeet, an attitude which gives him the upright appearance of an animal whose instincts have in them something noble, rather than those which belong to the horizontal position of a vile reptile." It is clear, we think, as we have already suggested, that this rhapsodical praise is intended quite as much for the advantage of frog-eaters as of Frogs; for is not the inference irresistible, that if an animal really have all these superlatively good qualities, it must be, as the Cockney phrase is, "most excellent good eating!"

The Edible Frog of the Continent (*Rana esculenta*) is also a native of this country, although it is by no means generally distributed. It is larger than the common Frog, and is readily distinguished by the presence of a light line along the centre of the back. Our versatile and lively neighbours across the Channel

do not, as is generally supposed, eat the whole of the Frog, but its hind-quarters only ; and, dressed with wine and choice sauce, they make a better dish than John Bull with his obstinate preference for the "noble sirloin" would be willing to admit. It appears, however, that our neighbours themselves are losing their relish for their traditional dish ; for though the Frog is still regularly exposed for sale in the markets of France, its consumption has greatly diminished, and is still on the decline.

One of the "things not generally known," is, that the Frog, equally with the Toad, is capable of forming an attachment to its benefactors. A case is mentioned by Mr. Bell, of a Frog which made its appearance in the kitchen of a gentleman's house at Kingston, and which for some years used regularly to come out from its hole in the skirting of the kitchen and lie down to bask in the heat of the fire. It picked up an acquaintance, too, with an old cat, and would frequently nestle under its warm fur, while the cat, on its part, would allow no interference with the comfort of its incongruous companion.

Ireland, as the reader is probably aware, is singularly free from reptiles. One of our Water Newts, it is true, is generally distributed throughout the island, and the small species of Toad known as the Netter Jack, is also found in some parts ; but the common Toad, the Snake, and the Viper are unknown throughout the country, as was also the case with the common Frog until towards the close of the seventeenth century, when it was introduced from England. According to popular tradition, this exemption of the "sister isle" from "varmint" is due to the malediction pronounced upon them by St. Patrick, in the days of the great King Macdonald the First, when,

> "The frogs went 'hop,' and the toads went 'flop,'
> As they dropt into the water ;
> And the snakes committed suicide
> To save themselves from slaughter."

In one of the later numbers of the *Tatler*, an amusing account from the pen of Addison is given of the circumstances connected with the introduction of the Frog into Ireland ; and as the paper was intended as a satire upon the proceedings of the Royal Society, the incidents of the affair are made to appear sufficiently ridiculous. The plain facts of the case appear to be, that a number of Frogs were taken over to Dublin, from this country,

and placed in the University Park, and that as the animals al perished, the ditches in the park were afterwards stocked with frog-spawn, several bottles full of which were imported for the purpose. In this way it was, that the Frog became established in the island. But at first it spread very slowly, for so late as the year 1720, the animal was nowhere to be seen in Ireland excepting in the neighbourhood of the spot in which it was first planted—the University Park. From about this time, however, its distribution seems to have gone on more rapidly, and to have attracted some little attention, as may be gathered from a curious allusion to the subject in an anonymous pamphlet of Dean Swift's, published about the year 1726, in which, speaking of the habit then becoming common of insuring houses against fire, he says,—"The (Insurance) Society marks on our houses (under which might properly be written—'The Lord have mercy upon us') *spread faster and farther than the colony of frogs.*" At the present day, the Frog is firmly established in almost every part of the country, and it would task the powers of any modern St. Patrick to expel him from his haunts.

The Tree-Frogs have no representatives amongst our native Batrachians, being confined exclusively to the warmer climes of the south. They are usually smaller in size, brighter in colour, and more elegant in form than their terrestrial allies; and they live during the summer months almost exclusively on trees. They are distinguished from the ordinary Frogs by having the extremities of their toes dilated into little knobs, which usually exude a sticky secretion, of the greatest service to the animals in their arboreal evolutions. In pursuing their insect prey on the trees and bushes they move about with great activity; sometimes stealing softly towards the intended victim, in the manner of a cat towards a mouse, and then seizing it with a sudden spring. When satisfied with food, and desirous of a little rest, the Tree-Frogs frequently suspend themselves by their hind feet, or, more curious still, attach themselves by means of a glutinous secretion to the under surface of a leaf, and so rest concealed beneath its shade.

Both Frogs and Toads are regular croakers, as everybody knows, but everybody is not aware how various and diversified in the different species is this vocal performance. The croak of the common Frog is a rather dull and uninteresting affair, but his

cousin, the edible Frog, has a much more sonorous voice, and in our fen counties where they occur, have earned the names of Whaddon Organ and Cambridgeshire Nightingales. In France, where, of course, this Frog is abundant, it was a common custom up to the time of the first revolution, for the menials belonging to the great castles of the nobility, to lash the water in the ditches and moats every morning, in order to quiet the Frogs and keep them from disturbing my lord and lady. The Tree-Frogs utter a shrill treble note; and it is probably to one of this kind that Mr. Wallace refers in his "Travels on the Amazon," which had, he says, such an agreeable whistle, that could it have been brought into civilized society, it would probably have had as many admirers as the singing mouse, or the still more marvellous whistling oyster described by "Punch." Mr. Darwin mentions one of these American Tree-Frogs, which, he says, sits on a blade of grass about an inch above the surface of the water, and sends forth a pleasing chirp, several of them sometimes getting together and singing in harmony in different notes. At the vocal antipodes of the Tree-Frog, is the Bull-Frog, whose deep hollow voice resembles the bellowing of a bull. In Germany there is the Laughing-Toad, a dapper sort of creature that can leap like a Frog, and utters a noise like that of a man laughing But for this variety of the croak, the most famous of the race is the Jocular Toad of the desert shores of the Caspian and the Volga, which appears, of an evening, to become so exceedingly hilarious, that the traveller in those solitary regions is apt to fancy he has come unawares upon a company of men and women laughing heartily together, and is not a little surprised to find that the boisterous merriment proceeds from a number of huge Toads celebrating their nuptial rites.

We have no space now to discuss at proper length the great "toad-in-a-hole" question, which has recently been revived by Mr. Gosse, and which has long attracted the attention of the curious. Is it true that Toads and Frogs have been found alive enclosed within masses of stone and clay, or similar substances, where they have been wholly cut off from air and food, and immured for perhaps thousands of years? That is the question; and, in spite of all alleged discoveries to the contrary, we must persist in believing that the question answers itself. The thing is impossible. No doubt many remarkable cases have occurred

in which these animals have been discovered in situations where they have been in great part enclosed in solid substances, and more or less deprived of food and air for considerable periods; but that any animal can live for a lengthened time wholly and entirely deprived of food and air, is so diametrically opposed to all that we certainly know on the subject, that the supposition is too extravagant to be entertained for a moment. The truth is, the discoveries, curious and remarkable enough, no doubt, on which the popular belief on this subject is founded, have generally been made by persons quite incompetent to decide on a matter requiring such careful and accurate observation.

Mr. Jesse, in his "Gleanings in Natural History," argues strongly in favour of the popular notion, and mentions several instances in which not only Frogs and Toads, but Snakes and Eels are said to have been discovered alive enclosed in solid blocks of stone. But, as is almost invariably the case, nothing but "hearsay" evidence is given, and that, too, of the loosest and most unreliable character. In so far as actual experiments have thrown any light upon the subject, those instituted by Dr. Buckland establish conclusively that the Toad, when deprived of food and of all access to the external air, is incapable of subsisting, at the longest, for more than about twelve months. What seems thus to be proved with respect to the Toad is no doubt equally true of the Frog; and we may rest assured—all supposed discoveries to the contrary, notwithstanding—that no ante-diluvian Frog or Toad has ever yet been seen, in our day, alive. There are real wonders enough in nature without our making fictitious ones of our own, and with this latter class must certainly be ranked the popular notion on this subject.

It has already been hinted, that, as the ancients regarded some of the Batrachia as highly venomous, so also they found amongst them some whose curative powers were no less remarkable. It was to the various kinds of Frogs especially that these extraordinary curative powers belonged; and if we may take the statements of Pliny as our guide, it would appear that these animals were able, in one form or another, like some of our modern panaceas, to remove nearly "all the ills that flesh is heir to." We cannot, of course, go into this matter at any length, and shall, therefore, notice only some of the more curious forms in which the Frog remedy was administered.

In the first place, then, there is, in addition to remedies of other kinds, a couple of sovereign Frog remedies against the poison of the Salamander—"the flesh of sea-tortoises, mixed and incorporat with the flesh of frogs," and "the decoction of sea-frogs sodden in wine and vinegre," which last, it appears, is "soueraine" also for the venom of the "hedge-toad." The "broth" of fresh-water frogs is very good against the prick of scorpions, the poison of the "sea-hare," and the sting of serpents. If any reader should after this suffer from toothache, the following remedies are highly recommended:—If the pain proceed from loose teeth, cut off the feet of two frogs, lay the bodies to steep in wine, and then wash the teeth with the infusion; or which is doubtless still better, apply the frogs "whole as they be, legs and all, outwardly, to the chawes, and keep them fast thereto." If the entire side of the face be affected, "take the hearts of thirty-six frogs, and bake or boile them in one sextar of old oile, vnder a pan or ouen of brasse," and then pour the "grauie or liquour" into the ear of the side affected. If the "grinders and great jaw teeth do ake," a "speciall medicine" for them may be had by seething frogs in vinegar and then holding the liquor in the mouth. "But," says our author, "because many a man's stomack lothed and abhorred such a medicine, Sallustius Dionysius found the means to hang many of them by the hinder legs ouer a vessell or pan of seething vinegre, that out of their mouth there might fall the humour within their bodies into the said vinegre. But to those who had good stomackes, and were of stronger complexions, he prescribed to eat the very frogs broth and al wherein they were sodden." Oil in which frogs have been boiled is a certain cure for the gout. "The fat of frogs dropt into the eares allaieth their paine presently." But in truth, every part of the frog would appear to be wonderfully medicinal, and that, too, not only when taken internally, but even when worn about the person. The eye of the frog wrapped in russet cloth and hung round the neck, cures an inflamed or bleared eye; the heart of a frog hung round the neck, or tied to the arm, diminishes and shortens the cold fit of an ague; while either frog or toad ("the nails whereof have been clipped"), hung anywhere about the body of "one that is sicke of a quartan ague, riddeth away the disease for euer." But perhaps the most wonderful cure after all, is that of an ordinary cough, in order to be rid of

which one has but to catch a certain "little frog that vseth to climb trees, and from thence crieth and croaketh," and having caught it, to spit into its mouth and let it go again! Our readers will perceive that whatever may be thought of frogs and frog remedies in these days of hydropathy and homœopathy and universal panaceas, they held a high and distinguished position in the ancient pharmacopœia.

No one who has visited the geological restorations in the grounds of the Crystal Palace at Sydenham can fail to recall the ungainly figure of the huge frog-like beast that is represented grimly eyeing the spectators across the water, from the extremity of the first of the three islands in the lake. In this monster, Mr. Waterhouse Hawkins has given us the probable figure and dimensions of the great original and herald of the Batrachian order. For a considerable while, indeed, the Labyrinthodon, as the monster has been christened, was regarded not only as the first introduced of Batrachians, but as the earliest or most ancient form of all air-breathing vertebrated animals. The first-discovered traces of the monster occurred in the form of footprints in rocks belonging to the new red sandstone formation, and their discovery astonished the geologists of the day almost as much as the human footprint in the sand astonished our old friend Robinson Crusoe. It was a circumstance for which no one was prepared. The universal belief amongst geologists, up to the discovery of these footprints was, that prior to, and during that period of the earth's history represented by the new red sandstone rocks, no animals higher in the scale of being than fishes had been called into existence; in other words, that up to that time, the entire life of the globe was confined to the waters of the ancient ocean, and that such portions of the solid crust of the earth as were raised above the waters, and constituted dry land, were altogether desolate and void of life. Here, however, in the newly discovered footprints, was unquestionable evidence that, all unsuspected by the geologists, a large land animal had walked the earth in those early times; although, so far as was then known, no other memorials remained of it than the impressions of its feet, left in what was once the outspread sands of the ancient sea-shore. Nothing more of course was at first known of the monster than could be gathered from the prints of its large hand-like feet; but after a while, teeth, bones of the extremities,

portions of the skull, and other remains were brought to light, and being submitted to a careful scrutiny by Professor Owen, he demonstrated that they belonged to one and the same creature, an enormous extinct Frog.

The strictly Batrachian character of the Labyrinthodon is evidenced by many structural peculiarities of great importance; and the fact that an enormous Frog was thus, as it was then supposed, the first of land animals that had appeared on the surface of our planet, gave a weight of evidence to the once-famous "hypothesis of development" of which its advocates were not slow to avail themselves.

But unfortunately for this ill-starred speculation, the argument it drew from the structure and time of appearance of the Labyrinthodon has since experienced a double break-down. In the first place, other and higher forms of reptilian life have subsequently been discovered in formations older by far than the new red sandstone rocks; and secondly, the Labyrinthodon itself has now been shown to have been, not a Frog *pur et simple*, as was first supposed, but a Frog of mixed character, so to speak—a creature combining with its Frog-like characters, others which give it a close and intimate relationship with the highest order of reptiles.

It is obvious, therefore, that the man-monkey theory is not only not supported, but sadly discountenanced by this most ancient of the Ancient Order of Batrachians.

CHAPTER IX.

OUR FEATHERED FRIENDS.

"Birds, the free tenants of the land, air, and ocean,
Their forms all symmetry, their motions grace."

THE Tory Fox Hunter, of whom Addison has given such a racy sketch in the "Freeholder," is a right sensible old gentleman in some respects after all; and nowhere does he show to greater advantage than there in the park, "at the side of Rosamond's Pond, pulling a handful of oats out of his pocket, and with a great deal of pleasure gathering the ducks about him." It gives one an immense advantage over the crowd of mere lookers-on at such a place to be able to deal out the contents of a well-stored pocket, and with a little skill in the distribution of your favours, you may easily get up a very pretty aquatic entertainment in which feathered performers from all the "five" quarters of the globe do their best to amuse the company.

The water-fowl in St. James's Park are old friends of ours, and have often beguiled us into idling away an hour under the fine old elm-trees which adorn the banks of the lake. The place itself is a very agreeable one, and seated there beside the water on a summer afternoon, with the Club Houses, the Royal Palaces, and the venerable old Abbey, all in view between the trees, the roar of the great city mingles pleasantly with the rustling of the leaves overhead, and gives one a comfortable sense of security against all interruption from the noisy world outside the park gates.

It sometimes happens, indeed, that what with the comparative quiet and seclusion of the place, the heat, and the glare from the water together, we drop off into a sort of waking dream, and, all unconscious of the human accompaniments round about us, fancy ourselves far away on some distant shore or river bank, attending to one or another of our vivacious friends upon the water in their own proper homes. There is one thing, however,

of which we sadly feel the want in these open-eyed excursions into dreamland, namely, some convenient ornithological "Who's Who?" to supply us with the names and the original geographical whereabouts of the different members of the feathered fraternity. With most of the party we can get along pretty well by ourselves, but the appearance of a single strange fowl is enough at times to put a stop to our musings, and to make us feel how acceptable would be a plain, practical "handy-book" of aquatic ornithology.

"If this should meet the eye" of the Rt. Hon. gentleman who is charged with the care of Her Majesty's woods and forests, we would humbly submit to him that this is a matter in respect to which he might very appropriately afford us a little of his official assistance. That assistance is given in one direction, and it ought to be given in the other. The case is this:—In the park gardens every tree or shrub of any interest is carefully indicated by an iron label, duly setting forth its scientific and its English name, the family of plants to which it belongs, its native country, and the date of its introduction into Britain; and yet, from one end of the park to the other, there is not so much as a painted board to guide us to a knowledge of the splendid collection of aquatic birds which disport themselves on the ornamental water. But why should not the birds have their labels as well as the bushes? If there be any conceivable reason for providing a label specially to tell the world that yonder scrubby-looking bush is "*Buxus sempervirens*, The Common Evergreen Box, An Euphorbiaceous Shrub, Native of England," surely there is just as good a reason for telling us in the same fashion that the Duck making off from under the said Buxus is no other than *Anas mollissima*, the Eider Duck which weary heads will never fail to bless, or that those Geese sailing along under the bank there are the famous Bernicle Geese (*Anser leucopsis*) which, in days gone by, used to grow upon trees, like apples, and when they were ripe for the change, dropped into the water and swam away, true feathered fowl!

We do not forget, of course, that our feathered friends are endowed with rather active powers of locomotion, and that unless they were made to wear the labels round their necks—which it is highly probable that neither the birds themselves, nor their owners, the Ornithological Society, would very well like—a set of

labels would be of little service in enabling uninitiated people to indentify the different species. That is very true; but a little help is better than no help at all; and we are by no means sure but that, properly arranged along by the side of the water, in some suitable and conspicuous position, a series of labels would teach a great deal more than might at first be supposed. It will certainly do no harm to try the experiment; so, pray Mr. Woods-and-forests, be so good as give us the names of our friends, and tell us, too, whence they originally came.

It would open the eyes of a good many of the *habitués* of the park to see it duly set forth that there are no less than four or five distinct species of those noble birds, the Swans, to be seen upon the ornamental water; but with eyes open to the fact the points of difference between the different species would soon be recognized. The tame Swan (*Cygnus olor*), distinguished from its congeners by the *caruncle* or berry on the bill, as also by the graceful carriage of its neck, which, when the spirit of the bird is up, gives it such an air of grandeur on the water:—

> "The Swan with arched neck,
> Between her white wings mantling, proudly rows
> Her state with oary feet."

It is commonly said that this graceful peculiarity in the bearing of the Swan is owing to the fact that it has an unusual number of vertebræ in the neck; but that explanation, although a true one so far as it goes, is not of itself sufficient. All the Swans are similarly endowed in that respect, and yet none but *Cygnus olor* knows how to throw its neck into the elegant curve in question. How shall we account for the difference? It is very heterodox zoologically no doubt, but we are ourselves inclined to think that it is simply the result of good breeding, one of those courtly airs which the bird has caught from its long association with royal and other courtly beauties. But that it early caught the trick we have the most positive evidence; for in an ancient cameo representing Leda and the Swan, the bird has the same elegant bending carriage as is now observable.

The ornithologists have revenged themselves upon the ancient and mediæval writers or their fables respecting the vocal powers of the Swan, by dubbing it the *mute* Swan. In this, however, they have simply gone from one extreme to another. It was no doubt

very absurd in Albertus Magnus to speak of the Swan as the "largest of singing birds," but it is not much wiser to call it a mute. That it is not absolutely voiceless may be ascertained without trouble; and it is well known to those acquainted with the habits of the bird, that in spring and summer, when leading about its young brood upon the water, it breathes a soft plaintive cry, which, coming from an aquatic bird, is no bad apology for a song.

It is not at all improbable that the exaggerated notion which formerly obtained on this subject may have originated in part from confounding *Cygnus olor* with the Hooper or Whistling Swan (*Cygnus ferus*), and thus attributing to the former the qualities of both. Not that the Hooper can make any great pretensions to song either, though he does constantly make himself heard, "clangingly on sounding pinions," as Homer expresses it; and what is still more to the purpose, is found to this day about "Cayster's flowery side." That the loud trumpeting call of the Hooper is not an unmusical sound is vouched for by Bechstein—no mean authority on singing birds—who proposed to give it the specific name of *musicus*. But as priority is everything in the nomenclature of science, Linnæus's appellation of *ferus* is still retained in preference. The main point, however, in the ancient story, is not that the Swan was vocal, but that its vocal powers were greatest, and that it sang most melodiously, just before its death. "It never smokes but there is fire," says the proverb, and though there is no doubt a great deal of poetic dressing in this "Swan song" story, we are yet strongly inclined to suspect that there is truth at the bottom if we could only get at it.

Let us try. Bechstein's Musical Swan will still help us.

The Hooper is an occasional winter visitor to the British Islands, and Mr. St. John, in his "Wild Sports and Natural History of the Highlands," gives a very interesting account of its habits. Amongst other things he treats us to a spirited description of a Swan-shooting adventure, of which the following is the conclusion:—

"I was not above forty yards from them, so gently raising myself on my elbow, I pulled the trigger, aiming at a forest of necks. To my dismay the gun did not go off, the wet or something else having spoilt the cap. The birds—a herd of between fifty and

sixty Hoopers—were slow in rising; so without pulling the other trigger, I put on another cap, and standing up, fired right and left at two of the largest Swans as they rose from the loch. The cartridge told well on one, who fell dead into the water: the other flew off after the rest of the flock, but presently turned back, and after making two or three graceful sweeps over the body of his companion, fell headlong, perfectly dead, almost upon her body. The rest of the birds, after flying for a short distance away, also returned, and flew for a minute or two in a confused flock over the two dead Swans, uttering their bugle-like and harmonious cries; but finding that they were not joined by their companions, presently fell into their usual single rank, and went undulating off towards the sea, where I heard them for a long time trumpeting and calling."

Now it strikes us that in the incidents of this adventure we have all the materials that are necessary to account for the ancient story, and we have little doubt that it really did originate in some such fashion. Eley's cartridge, swan-shot, and double barrels are all modern inventions of course, but there were well-feathered arrows and trusty bows even in Homeric times; and sacred though the Swan was to Apollo, it no doubt often fell a victim to "crack shots" thus primitively equipped. If this be granted, and that the habits of the bird were the same then as now, there is nothing more required. For what would be more natural than that the affectionate solicitude of the birds for their slaughtered companions, prompting them, regardless of their own safety, to linger lovingly about the dead bodies, "uttering their bugle-like and harmonious cries" the while, should strike the attention, and be celebrated in song, and that the story once set going should grow and grow, as stories always do, until at length it assumed the shape in which we know it? It is thus that stories of the kind commonly arise, and we see no reason to doubt that such was the origin and history of the famous story of the dying Swan's song.

The Black Swan (*Cygnus atratus*) is an Australian bird, and was first made known by the early navigators who visited that insular continent in the south. Although it was first introduced into England not more than sixty years ago, it has now become so thoroughly acclimatized and hardy, that it breeds with us even more freely than the common Swan. In 1858 a pair of these birds

in the possession of Samuel Gurney, Esq., of Carshalton, hatched no less than three broods of cygnets, numbering in all twenty-one young ones, in about ten months. The third brood was produced towards the middle of November, when the weather was intensely cold; and one morning, when the young birds were between three and four days old, they were found actually frozen into the ice, although they did not in any way suffer from it.

Our Australian colonies have long since sent us their Black Swans and Emeus, and their brilliant Parrots and Cockatoos, and they are now getting back some of our own feathered friends in return. For some time past, great efforts have been made to introduce into Australia not only our ordinary game birds, but many of the little songsters that enliven our woods and fields. A certain yearning after the old home pleasures lies deep in the heart of the emigrant, and it is no doubt with a view to the gratification of this longing that so much spirit and determination is shown in the endeavours to stock the Australian colonies with the common singing birds of this country. Many hundreds of English singing birds, including Larks, Goldfinches, Linnets, Thrushes, and Blackbirds, have been imported for the purpose; and there is good reason to believe that the Lark, if not one or two other birds as well, is now firmly established in the country. The matter is still being prosecuted with great spirit by the colonists, and large sums of money are subscribed for the purpose. It is by no means improbable, therefore, that before long the Australian "bush" may be vocal with the songs of many of the little choristers which lend such a charm to our own fields and hedgerows.

The introduction of some of our game birds has already to a certain extent been accomplished. The Pheasant is now bred with ease in several parts of the country; the Partridge is being attended to with good prospect of speedy success; and in Tasmania the Peacock itself already breeds wild in the woods. Before long, therefore, we may expect to hear that the favourite field sports of Old England are being pursued at the antipodes as part and parcel of the ordinary life of the Anglo-Australian people.

The race of web-footed birds is somewhat remarkable, as comprising within itself the two extremes of the feathered tribes in respect to their qualifications for flight. In some of these birds,

as the Albatross (*Diomedea exulans*) and the Frigate-bird (*Fregata aquilus*), the wings receive their highest degree of development, and become such effective organs of aërial locomotion as to enable these birds to live almost continuously in the air, frequently at the distance of a thousand miles or more from the land. In others, as the Penguins, the wings are reduced to mere flippers, which, powerless for the purpose of flight, serve the birds in the water as fins for swimming, and on the land as a fore pair of limbs, by means of which they hobble along on all fours, after the fashion of an ordinary quadruped. The bird which is best known for this quadrupedal procedure is the famous Jackass Penguin (*Aptenodytes demersa*), and it has this additional claim to its elegant appellation, that it makes a loud and most discordant noise, very like the braying of its namesake.

The Penguins belong exclusively to the south, and are represented in the northern hemisphere by the Auks, to one of which the attention of naturalists is now directed in a very especial manner.

It appears that the Great Auk (*Alca impennis*), a noble bird nearly three feet in length, and once an occasional visitant to the British Isles, is on the point of becoming extinct, if, indeed, it be not already a thing of the past. The fact of a large bird thus dying out apparently in our own day, has naturally excited great interest, and has led to a careful investigation of all the circumstances of the case.

In early times the principal haunts of the Great Auk appear to have been the eastern coast of Newfoundland and Labrador, where they existed in immense profusion. On the Newfoundland fishing-banks the Great Auk was two centuries ago to be found in great abundance. Its appearance was always hailed by the mariner approaching that desolate coast as the first indication of his having reached soundings on the fishing-banks. During the sixteenth and seventeenth centuries, these waters, as well as the Iceland and Faroe coasts, were annually visited by hundreds of ships from England, France, Spain, Holland, and Portugal; and these ships actually were accustomed to provision themselves with the bodies and eggs of these birds, which they found breeding in myriads on the low islands off the coast of Newfoundland. Besides the fresh birds consumed by the ships' crews, many tons were salted down for future use. In the space of an hour, these old voyagers tell us, they could fill thirty boats with the birds.

It was only necessary to go on shore, armed with sticks, to kill as many as they chose. The birds were so stupid that they allowed themselves to be taken up on their own proper element by boats under sail; and it is even said that on putting out a plank it was possible to drive the Great Auks up out of the sea into the boats. On land the sailors formed low enclosures of stones into which they drove the birds, and as they were unable to fly, kept them there enclosed till they were wanted for the table. It is said, too, that as the birds were fat and burnt well, they were actually used for fuel, as the dried bodies of the Auks and Guillemots are still employed on the Westermann Islands.*

As may be supposed, this wholesale slaughter of the birds speedily reduced their numbers, and there is no certain information that any individuals of the species have been seen on those coasts during the present century. The last known breeding-places of the bird are two isolated rocks, extremely difficult of access, off the south coast of Iceland; and at long intervals, sometimes of ten or fifteen years, a few individuals have been obtained thence up to the year 1844. In that year a pair of the birds, male and female, were shot at their nest on a little islet near to one of the former breeding-places, and since that time, notwithstanding that the most careful search has everywhere been made for it, the Great Auk has nowhere been seen alive.

It is conjectured that the bird may still be an inhabitant of the inaccessible shores of East Greenland, though none of the vessels passing that way ever come across it, nor has it ever been seen by any of the Arctic exploring expeditions. It may of course yet be discovered on some part of that ice-bound coast; but it is by no means improbable that the Great Auk has now ceased to exist, and has thus taken the place till now occupied by the Dodo, of the last in the series of extinct birds.

The most generally diffused, perhaps, of all our birds of passage are the different members of the Swallow tribe, which everywhere in northern lands are welcomed as glad harbingers of approaching summer. Of the four species of these birds which regularly migrate to the British isles, two species, the Swift, the largest, and the Sand-Martin, the smallest of the four, are com-

* On the Great Auk. A Paper by Edward Charlton, M.D., in the Transactions of the Tyneside Natural History Society; and republished in the "Zoologist."

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paratively but little known; while the other two, the Chimney-Swallow and the House-Martin, are very generally confounded with each other. It will not be out of place therefore to say a few words here by way of pointing out to the non-ornithological reader the distinctive marks of these most familiar of our feathered friends which come to us from afar with every returning summer.

Our first visitor is the Swallow (*Hirundo rustica*), which generally makes its appearance just before the middle of April, preceding the other members of the tribe by a few days. As its name implies, it is somewhat of a rustic in its habits, and seldom ventures to take up its residence in the immediate vicinity of large towns. The Martin (*Hirundo urbica*), on the other hand, is quite a town dweller, constantly haunting the busiest thoroughfares of our largest cities, and is almost as familiar in Cheapside and Fleet Street as the Sparrows themselves. It is not insensible, however, to the quiet and the purer atmosphere of the country, and is even there much more commonly seen than the Swallow, for which it is mistaken. There is no difficulty in distinguishing the two birds even on the wing, the Martin being at once recognizable by the snowy white of its throat and breast, and by the conspicuous patch of the same colour on the back at the base of the tail. The distinctive marks of the Swallow are its forked tail and the patches of rusty red on its forehead, chin, and throat.

Another point of distinction between the two birds is the place selected for nesting; the Swallow invariably building in chimneys or against the rafters of barns and out-houses, while the Martin constructs its nest under the eaves of houses, the sills of windows, and other similar situations. The boldness and presuming confidence of the Martin in selecting exposed and easily accessible situations for its nest has often been noticed; but we never met with a more remarkable instance of this sort of daring than is displayed by a colony of these birds which, year after year, attach their nests to the pillars that support the roof of the railway station at Worthing. It is a long row of slender iron pillars, about eight or ten feet high, and scarcely more than a yard distant from the rails on which trains are continually passing, and yet almost every pillar in the row has a nest on each side of it, the nests being supported in some cases by pro-

jecting pieces of wood which the railway men have fastened up to secure the establishments of their little confiding friends. Notwithstanding the bustle and noise that precedes and follows the stopping of a train, the birds fly backwards and forwards to their young broods without the least hesitation; stopping only while the trains are at rest at the station, during which time the bright-eyed, white-throated little fellows look out of their doorways and very composedly survey what is going forward.

In the four charming letters devoted to the Swallow tribe in White's "Selborne," the manners of these engaging birds are described with a fulness and minute particularity of detail which has left little or nothing for subsequent observers to record, as it gives them little or nothing to correct. On one point, it is true, the historian of Selborne gives his countenance to a fallacy respecting these birds which finds but few supporters at the present day:—we allude, of course, to the opinion once commonly entertained that, at the approach of winter, the Swallows retire, not to the warmer regions of the south, as is now known to be the case, but to the bottom of ponds and streams, there to remain, buried in the mud, in a state of torpidity until the return of spring.

The accounts which have from time to time been given of the discovery of Swallows in a state of torpidity, in caves and hollow trees, and such like places, are for the most part of the same apocryphal character as the stories already noticed of showers of Frogs, and Toads embedded in the solid rocks, and are entitled to about the same amount of credit.

Some of the most striking cases on record are those mentioned by Bishop Stanley in his "History of Birds;" but they are in no respect more explicit and reliable than Old Gerard's or Sir Robert Murray's personal testimony to the Goose-bearing qualities of the Barnacle-tree, or to the authorities that could be cited for a dozen other popular delusions of the same character, which are now altogether exploded.

One of the most amusing of these stories of hybernating Swallows is that told by Derham in his *Physico-Theology*, in which "an ancient fisherman, accounted an honest man," is represented as having discovered at a very low ebb of the tide on the coast of Cornwall, a great number of Swallows and Swifts hanging by their feet to one another, and adhering to the rocks, "where

they were covered commonly by the sea-waters, but revived in his warm hand and by the fire." It is a great pity that these "ancient fishermen" and other fortunate individuals of the sort never come in the way of anybody competent to pronounce on the value of their wonderful discoveries.

It is not improbable that these stories of hybernating Swallows may have originated in the occasional discovery of individuals which, having been left behind when the autumnal migration has taken place, have retired at the approach of winter to some secluded retreat, and there perished with the cold. But there is no reliable evidence that in any single instance have Swallows been discovered in such circumstances alive.

The Swallows and their nocturnal ally, the Goat-sucker, or Nightjar (*Caprimulgus Europæus*), form the lowest section of the great order of Perching Birds, which includes by far the largest proportion of our more familiar feathered friends, some of which Shakspeare, anticipating of course our modern classification, has thus lightly strung together :—

"The ousel-cock, so black of hue,
With orange-tawny bill;
The throstle with his note so true,
The wren with little quill;
The finch, the sparrow, and the lark,
The plain-song cuckoo gray."

The extraordinary habit of the Cuckoo (*Cuculus canorus*) in depositing its eggs in the nests of other birds, and leaving to them the entire care of its offspring, has naturally excited great attention; and though it would be too much to say that the reason of this strange procedure has been satisfactorily ascertained, yet the examination of the structure of the bird to which it has led, has certainly thrown a good deal of light upon the subject.

It appears that owing to the peculiar conformation of the Cuckoo, its eggs are not only small for a bird of its size, but that they are developed singly, and at intervals of six or eight days each; so that if the bird were itself to hatch the eggs it lays, it would be involved in the predicament, supposing such a thing possible, of having the threefold business of oviposition, incubation, and feeding one or more already hatched young, all on its hands at once. The situation of a poor bird so circumstanced would certainly not be an agreeable one, and that no such

catastrophe may occur, the Cuckoo, wisely taught, relieves herself of all the trouble and anxiety of nest-building and nursing, and depositing her eggs, each as it is ready, in the nest of some small bird, and never more than one in the nest of the same bird, has her family brought up for her after a fashion not more conducive to her own ease and comfort than to the comfort and safety of her offspring.

And the same wise instinct which thus leads the Cuckoo to distribute her family in the nests of other birds, leads her unerringly to select as their foster parents such birds only as subsist on the insect food adapted for her young. The Hedge-sparrow is the one usually selected, but the Reed-sparrow, the Titlark, the Water-wagtail, the Yellowhammer, and the Linnet, are all of them occasionally pressed into the service, and a case is mentioned in which the burden was laid upon a poor diminutive Wren. Thus much as to the parent Cuckoo; but the procedure of the young bird is no less remarkable. It is no sooner hatched than it begins to shoulder out of the nest all the eggs or young birds which may happen to be there, and it is qualified for the ungrateful business in a very peculiar manner. Its back, it appears, is very differently shaped from that of other newly hatched birds, being unusually broad from the shoulders downwards, with a considerable depression in the middle, which seems specially designed for giving a secure lodgment to an egg or a young bird. No wonder that, being thus specially adapted for the work, the young Cuckoo easily contrives to get the eggs or young birds in the nest on its back, and then raising itself with a sort of jerk, tosses them over. It is a very noteworthy circumstance, moreover, that the depression in the back, intended as it would seem for the express purpose of aiding the young bird in getting rid of its companions, fills up and disappears in about ten or twelve days, by which time of course the Cuckoo has got the nest to itself.

Pliny has an entire chapter devoted to the Cuckoo, and as a matter of course he has a good many curious things to say about it, which read none the worse for the quaint dressing of our friend Philemon. The best part of the story is that which relates to the young bird and its hapless foster parent, which it appears pays a terrible penalty for its attention to the young ingrate. But here is the story :—"And this young Cuckow being greedy

by kind, beguiling the other young birds, and intercepting the meat from them, groweth thereby fat and faire-liking; whereby it comes into speciall grace and favour with the dam of the rest, and nource to it. She joieth to see so goodly a bird toward; and wonders at her selfe that she hath hatched and raised so trim a chick. The rest which are her owne indeed, she sets no store by, as if they were changelings; but in regard of that one, counteth them all bastards and misbegotten; yea, and suffereth them to be eaten and deuoured of the other euen before her face: and this she doth so long, untill the young Cuckow, being once fledge and readie to flie abroad, is so bold as to seize on the old Titling, and to eat her up that hatched her. And by that time there is not another bird again for goodnesse and sweetnesse of meat comparable to the young Cuckow."

The food of the Cuckoo consists almost exclusively of insects of various kinds, but principally caterpillars, though it appears occasionally to vary its diet by partaking of berries and garden-fruits. It is commonly believed by country people that the Cuekoo occasionally indulges also in the eggs of small birds. Hence the allusion in the well-known rhyme:—

"The Cuckoo's a fine bird,
She sings as she flies;
She brings us good tidings,
She tells us no lies.
She sucks little birds' eggs
To make her voice clear;
And when she sings 'Cuckoo'
The summer is near."

There is some reason to believe that this eharge is really true. Mr. Jesse mentions the case of one which was kept in a cage, and fed regularly on fresh meat cut small and mixed with soaked bread and raw egg, and whieh at length killed itself by attempting to swallow a Yellowhammer's egg, at which it eagerly caught. Moreover Audubon says distinctly that the yellow-billed Cuckoo of Ameriea (*Cuculus Americanus*), which, by the way, is an occasional visitor to our own shores, constantly robs the nests of smaller birds of their eggs, which it sucks with great avidity.

One of the most brilliant of British birds is the Kingfisher (*Alcedo ispida*), the Haleyon of the ancients, which aceording to Aldrovandi is "the most celebrated and besung" of all feathered fowl, real or imaginary.

No words can do justice to the Kingfisher; and if you would know what he really is, you must make your way cautiously to some quiet stream overhung with bushes, where, on a projecting bough, you may chance to see him as he sits motionless, shining in the sun like a sapphire gem watching for his prey. Be still, and in half a minute you will have proof of his skill as a fisherman. See! he darts from his station—a line of bright green light, at the end of it a splash in the water, and he is gone. But only for a moment, for now he emerges from the stream, and in his bill is a little fish, whose scales glisten in the sun for an instant, when it is beaten to death against a stone and swallowed whole.

In far less time than it has taken to describe, the fish is caught and swallowed, and the bird is back to its station again, where it sits and waits as before, till another plunge marks the capture of another fish, for the Kingfisher rarely misses its prey, and so on, till perhaps half a dozen are captured in little more than as many minutes.

It is somewhat strange, considering the high-flown description which the ancients have given of the Kingfisher's nest, that it is still an undetermined question with naturalists whether the bird really builds any nest at all. Its general habits are very well known, but there is still a doubt as to its procedure in this one particular. The question at issue, however, is a very narrow one. It is well known that the birds rear their young in the banks of the streams they haunt, either digging a hole themselves, or taking possession of that of a water-rat, which they afterwards enlarge to suit their convenience. The direction of the hole is always diagonally upwards, and it generally penetrates from two to three feet into the bank, the end being scooped into a sort of hollow, at the bottom of which there is always a quantity of small fish-bones mixed with earth, on which the bird lays its beautiful transparent pinkish-white eggs.

The point in dispute is, whether these bones are to be considered in the light of a *bonâ fide* "nest," or merely as a casual accumulation cast up by the parent birds irrespective of any view to nidification.

Mr. Gould, who in his "Birds of Europe" advocates the latter view, has recently communicated to the Zoological Society the particulars of a discovery he has made, which leads him to adopt the opposite opinion, namely, that the parent birds pur-

posely deposit the fish-bones "as a nest," to defend their eggs from the damp earth. The discovery which has led to this change, was that of a nesting-place of the Kingfisher in the banks of the Thames, from which a nest and eggs were twice dug out. A fortnight after the first nest was taken, the female bird was seen to leave the hole again, as though she had returned to her old breeding quarters : a week later the hole was examined, and the old bird was ascertained to be inside. "I then took," says Mr. Gould, "a large mass of wool from my collecting-box, and stuffed it to the extremity of the hole, in order to prevent the eggs and nest from damage during my again laying it open from above. On removing the sod, and digging down as before, I came upon the cotton wool, and beneath it a well-formed nest of fish-bones, the size of a small saucer, the walls of which were fully half an inch thick, together with eight beautiful eggs and the old female herself. This nest and eggs I removed with the greatest care : and I now have the pleasure of exhibiting it to the Society, before its transmission to the British Museum, the proper resting-place of so interesting a bird's nest."

By the kind permission of Mr. Gray of the British Museum, we have been allowed to inspect this interesting specimen, and we must say, that if it really be a nest in the proper sense of the word, the difference between a bird's nest and a mere mass of fish-bones and loose earth is much less than we had anticipated to find it. But Mr. Gould is not merely an authority ; he is the *highest* authority on all matters ornithological, and if he is satisfied that what he has discovered *is* a nest, nobody else is entitled to say nay.

The Kingfisher is by no means an uncommon bird, and is very generally diffused over the country. We have met with it in Devonshire and also in Hampshire ; in the latter county, especially in the various creeks and arms of Southampton Water, it is even abundant, although it is never once mentioned, so far as we remember, in White's "Selborne." In the North of England it is also common ; and at Bolton in Lancashire we met with a factory operative, a thorough enthusiast in ornithology, and the owner of a very respectable collection of birds of his own mounting, who assured us that he regularly captured a dozen or more of them every season. His plan is to go early in the morning before daylight to some stream known to be frequented by the bird, and

to suspend across it, in a suitable spot, the open mouth of a bag net made of fine silk; then going along the stream, he beats the bushes to start the bird, which shooting along in the dim light, rushes into the net, and is securely bagged.

A curious superstition has long obtained that if the stuffed skin of the Kingfisher be suspended by a thread to the ceiling of a room, however closely shut up, it will yet turn its bill weathercockwise to the quarter whence the wind blows. Hence honest Kent, in "King Lear," in his rage against the insolent steward, declares that—

> "Such smiling rogues as these
> * * * * *
> Renege, affirm, and turn their halcyon beaks
> With every gale, and vary of their masters;"

and again Barabas, in Marlowe's "Jew of Malta," says:—

> "But now, how stands the wind?
> Into what corner peers my halcyon's bill?"

It appears that this superstition still keeps its ground in some parts. Charlotte Smith tells us that she has once or twice seen the Kingfisher hanging thus as a weathercock from the beam of a cottage ceiling. It has lately been seen suspended for the same purpose at Botley near Southampton; where some of the country people also believe that if a dead Kingfisher be suspended by its bill, it will regularly turn its breast to show the ebb and flow of the tide.

The *Corvidæ*, or Crow family, are far better known than liked, although, as we shall find, that much may be said in their favour.

Very few people, it may be presumed, need the help of good Mrs. Ford "to know Turtles from Jays" of the non-figurative kind, though it is not at all unreasonable to suppose that there are many who would fail to recognize in the gaily-coloured Jay of the ornithologist (*Corvus glandarius*), a confrere of the sable fraternity above mentioned. One of the Crows, however, the Jay undoubtedly is, and a near ally of the Jackdaw (*Corvus monedula*), which, as Cowper reminds us, is—

> "A great frequenter of the church,
> Where, bishop-like, he finds a perch,
> And dormitory too;"

but between this zealous church-goer and the wood-haunting Jay, stands that Ishmael of the feathered tribes, the Magpie (*Corvus pica*), which, harassed and persecuted by almost everybody, repays his ill-usage by wholesale depredations and a sort of instinctive love of mischief. It is rather a suggestive circumstance, however, that in Norway and Sweden, where this bird is extremely common, and is taken great care of by the people, it bears an opposite character. In Norway especially, where it is a great favourite, it has little of the sly cunning and suspicion which it exhibits with us, and lives on the most familiar terms with the inhabitants, picking up its food at their doors and frequently entering inside their houses.

With us the Magpie has certainly a most unamiable reputation. It seems to be equally fond of animal and vegetable food, now helping itself to the newly-sown grain or the gardener's fruits, and now sharing with the Rooks their grubs and worms. But no sort of animal food comes amiss; and most ruthlessly does it go to work to gratify its appetite. It storms the nests of small birds, and robs them of their eggs and young; it carries off the young broods from the poultry yard and the game preserves; it attacks young hares and rabbits; and at times will even attempt the destruction of lambs and weakly sheep, first plucking out their eyes. But with all this truculence and rapacity, the Magpie has still a tender place in its heart. Gamekeepers know well that when once they are in possession of its young the old birds may easily be lured to their own destruction.

The nest of the Magpie is a very bulky affair, constructed of small branches and twigs interlaced together, generally placed high up on some tree-top where few people having a regard for their necks care to venture, how light soever they may make of the wise saw which avers that no good ever comes to man or boy who takes a Magpie's nest. It does sometimes happen, however, that where high trees are few and far between, the Magpie will build in low bushes; and Bishop Stanley tells an interesting story of a pair of these birds, which, in a remote and barren part of Scotland, had for several years built their nest and brought up their young in a gooseberry bush. But perfectly conscious of the dangers to which they were there exposed, they barricaded not only the nest, but the bush itself, all round with briers and thorns firmly entwined together, and nearly a yard in thickness;

and every spring they carefully repaired their fortress, using for the purpose rough, strong, prickly sticks, which sometimes required the assistance of both the birds together before they could be adjusted in their proper places. In this way the nest was surrounded with such a formidable *chevaux-de-frise* as to be secure not only against the attacks of foxes, cats, hawks, and other predatory creatures, but even of more important foes, for without a hedge-knife, bill-hook, or something of the sort, even a man would have had great trouble to get at the young.

We must not conclude our account of the Magpie without some notice of its imitative and loquacious powers, and of the ridiculous use to which it sometimes turns them. A book might be written on the subject; but one story must suffice for us here. It is pleasantly told by the writer of a series of most agreeable papers on birds in "Fraser's Magazine" for 1857, and pertinently illustrates the truth of Sydney Smith's observation, that whatever powers of oratory a parson may possess he loses all command over his audience the moment a bird makes its appearance in the church.

It was certainly the case when Jack, a Magpie well known in the village of ———, in the county of Kent, for his mischievous propensities, entered the village church in the afternoon of Sunday, July 25th, 1852, during the time of divine service. The rogue hopped quietly in at the open door, and for a time surveyed the congregation, recognizing many a friend who was wont to greet him with words of kindness and familiarity; but upon this occasion Jack was surprised at finding that no notice was taken of him. At last he seemed determined that he would not be thus overlooked, and down the middle aisle he marched, knocking at the door of each pew, and announcing his presence with a clear, loud—"Here am I!" This move had the desired effect, for in a very few moments every eye was turned upon our hero. The worthy parson finding himself in a decided minority, and perceiving broad grins coming over the before solemn faces of his flock, at once stopped the service, and desired the clerk to eject the intruder. But the order was more easily given than executed. Jack was determined not to leave, and so, finding himself pursued, took refuge in a forest of legs belonging to his young friends the school children, who did not appear at all unwilling to give him shelter. The clerk rushed on, intent upon

catching the enemy, and putting an end to this unorthodox proceeding, and over first a bench and then a child he stumbled in his attempts to pounce upon the fugitive, who easily evaded his grasp, and always appeared just where the clerk was not, informing him ever and anon of his whereabouts by the old cry—"Here am I!" At last, with the help of two or three of the congregation who had joined in the pursuit, a capture was effected, and Jack was ignominously turned out and the door closed upon him. After the lapse of a few minutes, order and solemnity were restored in the church, and the prayers were re-commenced and ended without further disturbance.

The parson in due time ascended to the pulpit, gave out his text, and commenced his discourse. But he had not proceeded far when he was interrupted by a loud noise accompanied by rapping at the little window at the back of the pulpit. Turning round to ascertain the cause, he saw friend Jack peeking away at the window, flapping his wings against it, and screaming at the top of his voice—"Here am I!"—"Here am I!"—a fact which no one could gainsay or resist laughing at. The worthy parson, finding his own gravity and that of his congregation so entirely upset by what had occurred, brought his sermon to a speedy conclusion and dismissed the congregation.

Poor Jack had sentence of death recorded against him, but upon the petition of a number of the parishioners, his punishment was commuted to banishment for life from the scene of his crime.

The family of Finches introduces us at once to the song-birds; and with them comes that much debated question, what is the special motive that prompts our little feathered friends to the exhilirating strains with which they greet us when spring comes round with its blue sky and bright tinted flowers?

It has very commonly been argued that these bursts of song are due almost entirely to the exercise of the imitative faculty in birds; but we are inclined to think that this is a very insufficient explanation of the matter. No doubt the natural and, as we should say, instinctive notes of birds may be greatly modified, or even altogether changed, by education, especially when man himself directs the process and entirely alters the conditions under which the young birds attain to maturity. The Hon. Daines Barrington tried several experiments with the view of

ascertaining how far this change of song might be effected, and the results at which he arrived certainly show that the influence of education is very great.

Thus he tells us that he educated nestling Linnets under the three best singing Larks, the Skylark, Woodlark, and Titlark, and in each case the young birds adhered entirely not to the song of the Linnet but to that of their instructors. In the case of the Linnet that had learned the Titlark's song, he tried if the note could be again changed, for this purpose leaving the bird in a room with two common Linnets which were in full song, for four months; but not a passage was borrowed from the new instructors, the Titlark-Linnet continuing steadfastly to the song that it first learned. Other cases are mentioned—that of a Linnet which learned the song of an African Vengolina so perfectly that it was impossible to distinguish the song of the teacher from that of the taught—of a Goldfinch that learnt of a Wren—of a Sparrow that acquired the joint song of the Linnet and the Goldfinch—and of a Redcap that studied under a Nightingale. In this last case, however, the learner was not so apt as some of the others; for after at first breaking down he ultimately sang three parts in four of the song of the Nightingale, and the rest what the bird-catchers call rubbish, or no particular note whatever.

Mr. Barrington states that to be certain that a nestling will not have even the call of its species, it should be taken from the nest when only a day or two old, because, though the young birds cannot see till the seventh day, they can hear from the moment they are hatched, and that as the call-note of the parents announces the arrival of food, that would be the first sound the young birds would learn. He also admits "that a great deal depends upon circumstances, and perhaps caprice in the scholar," and that no general rule or inference can be laid down as to the result of such experiments.

The most remarkable cases of variation as the result of training are those in which the young bird acquires, not the song of another bird, but fragmentary snatches of human speech. A case of this sort is mentioned by Mr. Barrington, in which a Linnet which had been taken from the nest when only two or three days old, learned almost to articulate the words *pretty boy*, without acquiring either the note or the call of any bird whatever.

A far more interesting case of this kind, however, has recently been recorded by Mr. Leigh Sotheby. In this instance the bird was a Canary, the only one hatched out of a nest of four eggs, and which, for some cause or other, was immediately deserted by its parents, who commenced a new nest upon it. On being removed from the cage, where it was found half dead, it was carefully placed in flannel near the fire; and after much attention it was fully restored to health and strength, and brought up by hand. It was entirely removed from all other birds, and seldom heard any sounds but those of the endearing epithets that were addressed to it by its fair protector. To the surprise and delight of the household, the first utterances of the little pet were those very expressions of endearment. When only three months old it repeated "Kissie, Kissie," and imitated the sound of kissing; and after a while it would repeat for hours together, "Dear, sweet Titchie, kiss Minnie; kiss me then, dear Minnie; sweet, pretty, little Titchie, Kissie, Kissie, Kissie, dear Titchie, Titchie, wee, gee, gee, gee, Titchie, Titchie," frequently stringing together these particular expressions, and repeated them over and over again in rapid succession. Occasionally it imitated the sound of a dog-whistle used about the house; and like a loyal subject it learned to whistle the first bar of "God save the Queen." The little creature was remarkably tame; and frequently would hop down from its cage to its owner's finger, shouting and talking the while in the most excited manner.

Whatever force there may seem to be in facts like those we have given, as tending to show that birds have no innate ideas of the notes which are supposed to be peculiar to each species, their value in the argument is greatly diminished by a consideration of the circumstance, that it is only in exceptional cases, and under what we may call unnatural conditions, that they occur at all. Moreover, it seems difficult on the theory of imitation to understand how birds should have any distinctive notes at all, and why it is that the individuals of each species exhibit such a constant general uniformity in their song. But the theory is contradicted by the fact of every-day experience. Nothing is more common than for young Thrushes, Blackbirds, and Larks, not to mention other birds, to be taken from the nest within a few days of their being hatched, and to be brought up by hand in towns far away from the green fields and the songs of their fellows, and

yet these birds eventually burst out into song, each in the peculiar notes of its race, so as not to be distinguished from those in a wild state.

But granting it to be the most reasonable supposition that song in birds is thus instinctive and untaught, it still becomes a question what may be the particular motive which incites to the performance; and on that point considerable diversity of opinion prevails. The general opinion seems to be that love, and the rivalry to which it prompts, are the two great stimulants to which we owe the concert of sweet sounds with which the air is filled in spring and early summer. "I lay it down as a maxim in ornithology," says White of Selborne, "that as long as there is incubation going on there is music." Pennant advocates the same view of the subject, and mentions, that as the principal cares of life fall to the lot of the female bird, the male is endowed with the faculty of song that he may alleviate her fatigues, and cheer her with his inspiriting lays the while she is discharging her parental duties. Montagu is another naturalist of eminence who supports the same opinion, and he particularly instances the Nightingale, which in the first place vies with its companions, both in song and fight, to win a partner, and then ever after attends her with the greatest assiduity, and constantly regales her with his song.

That rivalry amongst the males of singing birds has much to do with their outbursts of song, there can be no reasonable doubt; but whether mere joyousness and gaiety of heart be not a more probable motive than the special one of love may at least, we think, admit of a doubt. It should be borne in mind that the female bird is by no means destitute of song, although her partner always greatly excels her in that accomplishment. Neither is it true that song birds generally sing only during the seasons of pairing and rearing the young. With the hard-billed, seed-eating birds this is no doubt true, but with the soft-billed birds it is far otherwise. Most of these birds leave us in the autumn for the sunnier skies of the south; although when they are detained with us in cages or aviaries, they continue in song all the year. Moreover, those which remain with us the year through, the Robin and the Wren, for example, sing throughout the winter, not even excepting times of severe frost, as we can vouch from our own observation.

On the whole, therefore, we incline to the opinion that

> "The sound of music sweet
> From birds among the bowers,"

which greets us in the young prime of the year is called forth, not so much by love, as by a general and all-pervading gladness and gaiety of heart.

But the Robin and the Wren, those old traditional friends of our childhood, are not to be passed by with the bare mention of their names, familiar though they are, and pretty well known by everybody. Naturalists may say what they please, but Cock Robin and Jenny Wren are man and wife all the world over, married and made one ages ago, and with a bond so sacred and indissoluble that Sir Cresswell Cresswell, would find that it quite overtopped his capacity to cut it asunder. Hath it not oft been said or sung that

> "The Robin and the Wren
> Are God's Cock and Hen ;"

and in awe of the terrible malediction that guards their domicile from violence, does not the truant schoolboy keep his hands off from the nests of both the one and the other ?

Izaak Walton says that "honest Robin loves mankind, both alive and dead," and if the veracious history of the Babes in the Wood will suffice to verify the latter part of the assertion, we shall be at no loss to find proof of the former. But strangely enough White of Selborne who almost invariably writes in a genial and kindly tone, seems to have a positive antipathy to the Robin, and speaks of it most disparagingly. He notices it but once, and then very curtly ; and concludes what he has to say with the ungracious remark that, "notwithstanding the prejudices in their favour, they do much mischief in gardens to the summer fruits." "Pert and spruce Master Robin," as Graham calls him, was evidently no favourite with the recluse of Selborne ; and it must be confessed that he exhibits at times some very unamiable qualities. His pugnacious and quarrelsome disposition is well known, and we have sometimes seen one of the little fellows fearlessly attack a crowd of Sparrows that have come to share his daily allowance of crumbs, and fairly drive them off. It is not always, however, that he succeeds in these onslaughts, for occa-

sionally some of the Sparrows show fight in return, and oblige their assailant either to share the provender with them or to retire from the scene altogether and leave them in full possession. True to the life is Thomson's picture of the Robin when he first ventures inside the cottage door to pick up his allowance of crumbs :—

——— "Then hopping o'er the floor,
Eyes all the smiling family askance,
And pecks, and starts, and wonders where he is."

These familiar habits of the Robin, combined with its sprightly airs, have made it a general favourite wherever it is known, and have thus procured for it in almost every country of Europe some familiar and endearing epithet. The Robin is in truth the first and most friendly of all our feathered friends.

One of the most curious of our song-birds is the Dipper, or Water Ouzel (*Cinclus aquaticus*), which, although closely related to the Thrush and Blackbird, is almost as much an aquatic bird as any of those properly so called. It is always found in the immediate neighbourhood of water, and delights especially in the clear and rapid streams of mountainous districts, where it is commonly to be seen perched upon some block of stone rising from the centre of the current, perpetually dipping its head and jerking its tail much after the fashion of the little Wren. "I do not know," says Mr. St. John, "among our common birds so amusing and interesting a little fellow as the Water-ouzel, whether seen during the time of incubation or during the winter months, when he generally betakes himself to some burn near the sea, less likely to be frozen over than those more inland. In the burn near this place there are certain stones, each of which is always occupied by one particular Water-ousel: there he sits all day with his snow-white breast turned towards you, jerking his apology for a tail, and occasionally darting off for a hundred yards or so, with a quick, rapid, but straightforward flight; then down he plumps into the water, remains under for perhaps a minute or two; and then flies back to his usual station."

There has long been a dispute as to the precise behaviour of the Dipper during the time which it thus passes under water. On the one side it is maintained that the bird runs about at the bottom of the stream, much as it might do on dry ground; while on the other side it is contended that such a procedure is

absolutely impossible, and that the bird merely dives and swims under water like other aquatic birds.

In a question of this sort, the point at issue is to be decided not so much by the results of casual observation, in which from the very nature of the case all are liable to error, as by an appeal to the invariable laws of nature. Still, what *ought* to be, and even what *must* be, has to give way when confronted with a clear and indisputable case of what *is;* and on this question it must be admitted there is what looks like very reliable evidence of the impossible performance. Here, for example, is Mr. St. John, who affirms in the most positive manner that he has himself seen the Dipper walk deliberately off from his stone down into the water, and walk and run about on the gravel at the bottom, scratching with his feet among the small stones, and pecking aay a t all the small insects and animalculæ which it could dislodge. "On two or three occasions," he continues, "I have witnessed this act of the Water-ousel, and have most distinctly seen the bird walking and feeding in this manner under the pellucid waters of a Highland burn."

Against this testimony of Mr. St. John's there is that of Mr. Macgillivray, an equally careful observer, who also speaks from personal observation. He says distinctly that in one or two instances where he has been able to perceive the bird under water, it appeared to tumble about in a very extraordinary manner, with its head downward, as if pecking something, and at the same time making great exertion with both legs and wings. The general direction of the body was obliquely downwards, and the exertions the bird was making were evidently to counteract its natural buoyancy and to keep itself at the bottom. Mr. Macgillivray says, indeed, that the movements of the bird under water are precisely similar to those of the Divers, Cormorants, and Mergansers, which are effected by the joint action of both wings and legs, and are rather to be described as flying than as *bonâ fide* swimming; and he further states that the bird does not proceed to any great distance under water, but, alighting on some spot, sinks, and soon reappears in the immediate neighbourhood, when it either dives again, or rises on the wing to drop somewhere else in the water, or to take up its favourite position on some insulated stone in the middle of the brook.

In so far as observation is concerned, therefore, there are

authorities both for and against the subaqueous pedestrianism of the Dipper. But it is not to be forgotten, that in order to perform the alleged feat, it is necessary that the Dipper should have the power to overcome the effects of gravitation, which the moment the bird ceased its active exertions to keep below, would force it to the surface of the water; and as no such power is known to us, it is only reasonable to infer that Mr. St. John, and those who agree with him, are mistaken as to what they saw, and that the Dipper performs no such inexplicable feat as that which they have ascribed to it.

The Incessores or Perching Birds, with which we are now dealing, are also known as the Passerine or Sparrow-like Birds, the common House-sparrow (*Fringilla domestica*) being thus the model or type of the entire order. A word or two, therefore, for the House-sparrow. "A village without Sparrows," says Mr. Magillivray, "has as desolate an aspect as a house without children," though unfortunately for the world the one is much less rare than the other.

The boldness and impudence of the Sparrow is familiar to everybody; and Douglas Jerrold somewhere notices the arch and inquisitive way they have of looking down from the house-tops at people who find their way home to the street-door in the small hours of summer mornings, when they are themselves just beginning to wake up for the day. There is quite an air of banter about them at such times; and the hoarse chirp with which they greet you sounds very much as though they said, "Oh, oh! Mr. Jones; and where have you been? and what will Mrs. Jones say?" One can almost see their elevated eyebrows as they poke their fun at you; and the fluffy shuffle with which they accompany it shows that they enjoy the joke immensely themselves.

In affection for its young there are few birds which surpass the Sparrow, and many interesting cases are recorded of its devoted attentions. In one instance a pair of Sparrows continued to bring food to the nest some months after the young brood had left it; a ladder was placed against the wall to ascertain the cause of this unusual proceeding, when a full-grown bird was found in the nest, where it was kept prisoner by some thread in which it had got one of its legs entangled. And Mr. Jesse mentions a case in which a farm-servant having placed a nest of young Sparrows in

a trap cage, caught no less than forty old birds, all coming with food in their mouths to feed the helpless nestlings. But the Sparrow will even go beyond its own species in rendering its kind offices; and there is a well-known story of one which picked up an acquaintance with a Canary that was hung up in its cage amongst some trees in a garden at Chelsea. The acquaintance began one morning with the Sparrow dropping a worm into the cage for the Canary, and after a while it became so intimate that the Canary would take the dainty bits directly from the bill of his generous friend. The fame of this benevolent Sparrow soon spread abroad, and other Canaries were hung in adjoining gardens to share in his attentions; nor were they put there in vain; for he visited them all, though his first and longest visit was always paid to his old acquaintance.

But that incident of the young bird tied to the nest by its leg reminds us of another and much more serious mishap which once befel a Sparrow, the story of which is quoted by Mr. Yarrell from the "Illustrated London News." Those who know the Rotunda in Sackville Street, Dublin, will remember the richly carved frieze, representing the heads of oxen and festoons of flowers, which runs around the centre building and forms its principal external ornament. In the hollow of the eye of one of the heads a Sparrow built his nest, and amongst the materials composing it there chanced unhappily to be a woollen thread with a noose at one end of it. By some means the poor bird got his head inserted in the noose; and in his efforts to extricate himself, he fell from his nest and hung himself by the neck. He was observed for a while making desperate efforts to escape, but in vain; the mishap put a period to his career, and for some time his remains were to be seen gibbeted at his own door, and fluttering in the wind, while the straws of the nest projected from the eye-hole above his head.

No bird is more familiar than the House-sparrow, though we fear there are few persons who would be much disposed to give it a place amongst their feathered *friends*. But there is reason to hope that better days are coming, not merely for Sparrows, but for the feathered tribes generally. It is beginning to be understood that the entire race of birds have a work to do which is of vast importance even to man himself, and that his interests are best promoted, not by their wholesale destruction, but by their

being allowed, with as little interference as possible, to discharge the various offices for which they are specially designed and qualified. The petition presented some time since to the French Corps Législatif, requesting that steps might be taken to preserve the birds which subsist on insects injurious to agriculture, has excited great attention, not only in France, but throughout Europe, and there can be no doubt that the many striking facts which it contains will open the eyes of our agriculturists to the fact that in slaughtering the insectivorous birds they have really been destroying their best friends. In this instance, as in many others, it will be found that an enlightened self-interest is in perfect keeping with the most humane and careful regard for what, if we only knew them better, we should universally regard as our Feathered *Friends*.

CHAPTER X.

"LIVE LIONS," PAST, PRESENT, AND FUTURE.

"Wee have also parkes and enclosures for all sorts of beasts and birds which wee vse, not only for view or rarenesse, but likewise for dissections; that thereby wee may take light what may bee wrought upon the body of man."

THE good time coming foreshadowed by Lord Bacon in that remarkable fragment the "New Atlantis" is gradually drawing nigh. Our various scientific and philosophical societies give us an almost exact realization of the ideal "Soloman's House," with its different means and appliances for ascertaining the "causes and secret motions of things, and the enlarging of the bounds of Humane Empire, to the effecting of all things possible;" while the united gatherings of their members at the meetings of the British Association, correspond precisely with those "circuits or visits of diuerse Principall Citties of the Kingdome" when new inventions and discoveries were made public. In respect to actual achievements we have of course still to discover the "Water of Paradise," "souereigne for health and prolongation of life;" and with all our skill in horticulture we still fall short of making "diuerse plants rise by mixtures of earthes without seeds," and of making one "tree or plant turne into another." But with the exception of conceits like these, which the progress of knowledge has exploded, we have already in a thousand ways far outstripped the boldest imaginings of the great philosopher.

In respect to the study of Natural History the "preparations and instruments of Soloman's House are pretty much the same as we have ourselves. The "particular pooles, where wee make trialls upon fishes," are fairly represented, no doubt, by the Aquarium, with a little advantage perhaps on our side. And so with respect to "parkes and enclosures for all sorts of beasts and birds," excepting that in this case the end we propose stops short of the lofty purpose suggested by Lord Bacon, and relates mainly

to the gratification of curiosity and the enlargement of our knowledge of the animal creation. It so happens, however, that although none of the animals exhibited in our Zoological Gardens are obtained with a special view to "dissection," there are very few of them, after all, that escape the knife at last. No sooner do they cease to be of service for "view," than there are a dozen or more Fellows and Professors eager to have a hand in them, and sometimes the disclosures which are thus made are not a little curious. For example, there was Tom, the favourite Seal in the Regent's Park Gardens: nobody could conjecture at first what it was that had shortened his days, and deprived the Gardens of one of their greatest attractions. But when the poor fellow came to be dissected, it was found that the coats of his stomach were bristling with fish-hooks! The reader may be sure that not only Tom's successor in the Seal pond, but all the ichthyophagi of the establishment have benefited by the discovery, and that no fish are now served out which have not first been carefully freed from cold steel.

The Regent's Park Gardens have long been a favourite resort of ours, and there are few places where the student of Natural History can gratify himself with the sight of so many of the living curiosities of animal life. Holiday place as it is, therefore, we may well pay it a visit, and look for a while at some of its more curious and interesting occupants; not confining ourselves to those of the present time merely, but remembering our high distinction of "looking before and after," recalling for a time some of the "lions" of days gone by, and anticipating the probable "lions" of the future.

The Fish House, which contains more wonders than all the rest of the Gardens together, we may dismiss very summarily. Not a sentence need be spent on the Anemones, Serpulæ, Hermit Crabs, and their allies, though the cases containing them are at all times besieged by an eager crowd of visitors anxious to make acquaintance with these little dwellers in the deep.

In the fresh-water tanks no fish attracts more attention than that ruthless fellow the Pike, which rests so quietly that it looks like a painted fish in a painted Aquarium, although pining apparently for the still shady coverts in which it delights to nestle by the pool or riverside. Not that the fellow very readily succumbs to the effects of confinement; for one of them has lived

here in the Fish House for upwards of five years. The Jack are at all times a truculent race, and the specimens here in the tanks fully sustain the character—blear-eyed, and sinister-looking as any that ever seized thirsty calf by the nose, ravaged a fish-pond, or made off with an angler's tackle. Neither in spirit nor in appetite do they seem to be much affected by their captivity. It is necessary to cover the tank containing them with a net to keep them from jumping over the sides at night; and when feeding-time comes round, they are always ready, be the meal fish, or frogs, or birds, or, as is sometimes the case, a half-grown rat.

We have seen it stated somewhere that a young Pike here, in the Fish House, having been maltreated by an elder of its own species, was completely cured of its ailments by the attentions of a couple of Tench. There can be little doubt, however, that it was a made-up story. The Tench has long had the reputation of being "the physician of fishes," as good old Isaak Walton expresses it, especially of the Pike, although there is no evidence whatever to countenance the wide-spread belief in its healing virtues. Mr. Couch, who is a great authority on all matters ichthyological, is inclined to the opinion that it has originated from a passage in the "Chronicle" of Hollinshead, who, speaking of the Pike, says that, "when the fishmonger hath opened his side, and laid out his rivet unto the buier, for the better utterance of his ware, and cannot make him away at that present, he laieth the same againe into the proper place, and sowing up the wound, he restoreth him to the pond where Tenches are, who never cease to sucke and licke his greeved place, till they have restored him in healthe, and made him readie to come again to the stall when his turne shall come about." And so, argues Mr. Couch, this nibbling of the fat of a wound that would have healed as well without it, has in all probability given rise to an opinion which naturalists, content to copy from each other, have perpetuated to the present time.

Not long ago the Fish House just missed an addition to its live stock which would have proved a wonder of the first magnitude. It was a fine specimen, three feet long, of the famous Fishing Frog or Angler (*Lophius piscatorius*), which was captured near Weymouth, and at once sent off to the Gardens; but unfortunately the journey was too much for it, and it made its appearance in the Fish House, dead. But such a "lion,"

even though a dead one, was not to be thought lightly of; and so long as the olfactory nerves of the visitors were able to endure it, the monster was made to display his strange proportions. The Angler well deserves the name of Wide Gab, by which it is known to the fishermen north of the Tweed, for surely never was another such a mouth seen either in bird or beast or fish. This remarkable fish has much the appearance of a huge Tadpole; its head being of enormous size, measuring across the widest part more than the entire length of the animal, while its body tapers away to a tail of the most modest dimensions.

The most remarkable character of the creature, and the one which has suggested the name of "Angler," is the presence of two long, slender, and flexible appendages which spring from the top of the nose, and are dilated at the extremity into a glittering silvery expansion, that acts as the bait with which the monster attracts his unsuspecting prey. It goes to work in a very wary and sagacious fashion, crouching close to the ground, and then by the action of its pectoral fins stirring up the sand or mud. Hidden by the obscurity which it has produced, it elevates its fishing-rods, moves them in various directions, and twiddles about the shining baits at the extremity; the small fish in the neighbourhood, attracted by the moving objects, come close to examine or seize them, when the monster springs upwards with his cavernous mouth wide distended, and in a moment they are gone. There is no mistake about it, that if an ogre of this sort could be neatly caged in the Fish House, and induced to go through his performance in presence of the visitors, it would be the most successful "hit" the Zoological Society had ever made.

And yet not the most successful perhaps after all, for here is another, and withal a more practicable one. What would you say now to a Singing Fish? It is true we have lately had a "Talking Fish;" but that was a mere hoax, the so-called "fish" being a seal, and the "talking" a mere unintelligible and only occasional bark or grunt. What we propose is a real *bonâ fide* vocalist belonging to the finny tribes. It would take immensely. Singing Mice and Talking Canaries have had their day; but a Singing Fish!

Mr. Edward Newman has an interesting paper on the subject ofthese Musical fishes of the East in the "Zoologist" for last year;

and he brings together a variety of evidence in proof of the opinion that such piscine vocalists do really exist. Sir Emerson Tennant, Dr. Buist, and other persons who have actually heard the performance are brought forward as witnesses; and from the accounts they give it would appear that in all probability there are several species of fish that are gifted with these vocal powers. One of them is described as producing a sound like the gentle thrills of a musical chord, or the faint vibrations of a wine-glass when its rim is rubbed with a wet finger, not one sustained note, but a multitude of tiny sounds, each clear and distinct in itself, the sweetest treble mingling with the lowest bass. Another is said to make long, distinct sounds like the protracted booming of a distant bell, the dying cadence of an Æolian harp, the note of a pitch-pipe or pitch-fork, or any long drawn-out musical note. A third species produces a loud, monotonous, singing sound, which rises and falls and sometimes dies away, or assumes a low, drumming character.

There is obviously no lack of variety in the vocal accomplishments of these oriental fish; and if the Zoological Society would only set to in earnest to procure a good chorus of them, it would not only put an end to the scepticism with which some old-fashioned people still persist in regarding the story, but afford to the world a new musical entertainment of a character that no one had ever dreamt of before.

On the banks of one of the ponds devoted to the Water-fowl we come across a fine specimen of that little aquatic beauty, the Mandarin Duck (*Aix galericulata*), which, decked out in his bridal attire, is sitting placidly amongst the grass while Mr. Wolf or one of his brother-artists takes his portrait. It is well worth taking, for this bird is the very prince of ducks, and is celebrated for the elegance and conspicuous beauty of its plumage. It is the male alone, however, which is thus adorned, and in this respect it affords a capital illustration of that almost universal law of nature, that when in the matter of adornment there is any difference at all between the sexes, the gaiety and show is all on the part of the males. In respect to the Mandarin Duck this difference is very obvious, for while the lady is plain and unadorned to a fault, the gentleman comes out in flaming colours, and is the observed of all observers. But let there be no mistake about it; this resplendent livery is put on after

all solely with an eye to the lady; and the love season over, the gentleman at once begins to doff his gay attire, and soon appears in the same unassuming russets and grays as his bride.

The manners of this beautiful bird are remarkably gentle and loving. Once mated, they are mated for life; even in confinement they constantly move about together; and the death of one gives rise to the most obvious and unmistakable signs of grief in the other. Dr. Bennett in his "Wanderings" tells a story of a loving couple, in which this mutual attachment was very strikingly exhibited. The beautiful drake was stolen one night, while his less attractive partner was left behind. The following morning the poor duck was seen in a retired part of the aviary brooding and disconsolate, evidently sorrowing over her loss. Whilst in this condition a gay and prim drake whose partner had been accidentally killed not long before, made up to the disconsolate duck, and made a thousand endearing overtures. But it was all to no purpose; the duck refused all his offers, and moped and brooded still; she neglected her food; her plumage became ragged and dirty; and she was evidently fast falling a sacrifice to conjugal fidelity and affection. But after about three weeks had passed the stolen drake was recovered and brought back. He no sooner recognized the aviary in which he had previously lived, than he quacked vehemently and clapped his wings with delight. His partner received him with the greatest joy: they quacked in concert, crossed necks, bathed together, and were perfectly happy. But mark the sequel. The happy pair had not long been reunited before the recovered drake furiously attacked the too attentive widower, pecked out both his eyes, and left him so maimed that he died within a few days afterwards!

In China the Mandarin Duck is regarded as the symbol of conjugal fidelity, and as such is usually carried in their marriage processions; but whether the newly married couple invariably learn the lesson which is thus emblematically set before them may be open to question. But certain it is that the Chinese attach the highest value to the bird, and it is with the utmost difficulty that specimens can be obtained by foreigners. Not long since, indeed, a gentleman, writing to China for a pair of the birds, got as his reply, that in the present disturbed state of the country it would be much easier to procure a pair of Mandarins than a pair of Mandarin Ducks!

Not far off from the green and bowery pond in which these happiest of ducks pass their days is the Old Aviary, in which are several birds well worth the attention of the visitor to the Gardens, and deserving of at least a passing notice here. In the first place here are the beautiful Curassows from Central and South America, which are one day to grace our poultry yards and supply us with an additional and most delectable dish for the dinner-table. Here again stalks about, with his quills behind his ears, that singular compound of wader and bird of prey, the Secretary Bird, the Snake-eater of Southern Africa. But more attractive than all besides, here also is a group of those extraordinary birds, the Flamingoes, which form an unmistakable "link" between the waders on the one hand and the true web-footed birds on the other. To the ancients the Flamingo was the Phœnicopterus, the bird with "wings of flame," the name alluding to the gorgeous meteor-like appearance presented by the birds when winging their way through the air.

But the acquaintance which the ancients had with the Flamingo was by no means confined to this far-off knowledge: they were familiar with it on the table, and though the flesh of the bird seems only occasionally to have been eaten, the brains and the tongue were ranked amongst the greatest luxuries. The tongue especially was held in great esteem; and Pliny preserves the memory of one Apicius, whom he characterizes as "the most riotous glutton and belly-god of his time," as the individual who first taught the world that "the tongue of Phœnicopterus was a most sweet and delicate piece of meat."

The Reptile House has a peculiar interest from what we know of the frightful powers of destruction possessed by many of its apparently insignificant occupants; and, inside its doors, one is apt to look with some degree of concern at the glass fronts of the different cases. These slim-looking fellows, at rest upon the sand, or bathing in the troughs of water, are all very well at a safe distance, but we decidedly prefer not to have them at close quarters. One thinks of the terrible occurrence which took place here a few years since, when one of the keepers, a man in the prime of life and full health, perished within an hour from the bite of a Cobra not larger than a common eel.

But besides these smaller species of the Serpent tribe which kill their prey by means of poison-fangs, there are here also the

huge Pythons or Boas, which overcome their prey by mere mechanical pressure, first seizing the victim with wide-spread jaws, and then, with the rapidity of thought, throwing the folds of their vast bodies round and round it, crushing rib and limb within their terrible embrace, and relaxing the coil only when life is extinct.

One of these monsters is just now while we write attracting great attention from the novel spectacle it affords of an enormous serpent engaged in the interesting business of incubation. The animal in question is a splendid Rock Snake of India (*Python molurus*), twenty-two feet in length, and weighing nearly a hundred and thirty pounds. On the night of Sunday, the 12th January, she produced a string of leathery eggs, about the size of those of a goose, numbering in all upwards of a hundred. The Pythons are distinguished from all other reptiles by gathering their eggs into a group and covering them with their bodies, which is precisely what the lady Pythoness here in the Reptile House has done. She has wound herself up in a magnificent coil over her eggs, and there she has lain almost motionless and without food from the night of their extrusion. It is to be hoped that her maternal solicitude will in due time be rewarded by the appearance of a brood of young Pythons; though as some of her eggs are known to be already putrid, it is much to be feared that her trouble will be all in vain, and her hopes of a family disappointed.

The back of the Reptile House is generally occupied in part by some of the rarer and more valuable animals for which appropriate accommodation is not to be had elsewhere. Here, for example, lived the baby Chimpanzees, and the famous Ant-Eater; and here, at the present time, are specimens of the Lepidosiren, already alluded to, of those huge Bats, the Flying Foxes, and the Sieboldia, the Gigantic Newt of Japan (*Sieboldia maxima*), which properly should now be playing the part of first "lion," only that it has an unmistakable repugnance to the profession, and persistently hides itself away in a corner of its case.

With all its faults, however, as a professional character, the Sieboldia is a most interesting fellow, and deserves far more attention from the public than he is likely to get. It is the largest of all existing Batrachians, and measures upwards of three feet in length. A native of the mountain-lakes of Japan, this is the

first specimen that has ever reached Europe alive. It is a most ungainly looking beast, with a broad flattened head, a vertical fin-like tail, and a warty scrofulous skin mottled over with black and brown. The uninitiated public seem to be a little perplexed at finding it in water; and from hearing it spoken of as a Salamander, seem to have a confused notion that the proper place for it would be a good roasting fire. One lady, who was evidently mystified in this fashion, remarked to a companion, as we stood by, that she thought it was "extremely doubtful about its going through the fire," but as she was by no means clear on the point, and would not commit herself, she wisely kept to what she could see, and finished up with the safe position, "It is in water now, at any rate." The truth is, the Sieboldia is first cousin to our own little Water-Newt, being, like it, an aquatic Salamander, and having nothing to do, therefore, with the renowned little fire-eater whose marvellous history has already been given.

To the geologist the animal is one of unusual interest. It is the nearest existing representative of the famous *Homo Diluvii Testis* of Scheuchzer, who, having a kind of monomania on the subject of an universal deluge, was unwearied in collecting organic remains in support of his opinions. The discovery of this fossil Salamander was a perfect godsend to the poor enthusiast. He had no doubt whatever that it was a veritable anthropolite, the petrified remains of one of the accursed race that was swept away by the flood. It seems unaccountable now that such an opinion should have gained any currency amongst men of science, but Scheuchzer's own perfect confidence begat a like faith in others, and for many years this fossil skeleton of a Salamander was an European celebrity, and the great pillar of the popular faith in an universal deluge. It was left to Cuvier to determine the true nature of the animal whose remains had attracted so much attention. The rounded head and the large size of the orbits of the eyes satisfied him that the animal was a Batrachian; and when, in 1811, he obtained permission to work upon the stone containing the far-famed remains, for the purpose of uncovering any bones which might be still hidden, he placed before the operators the figure of the skeleton of a Salamander; and he relates with what pleasure they saw the bones corresponding to those in the figure make their appearance as the chisel chipped away piece after

piece of the stone which had previously concealed them from view.

Poor Scheuchzer's own bones had by that time well-nigh crumbled away, or one can almost fancy they would have rattled in their grave at this terrible exposure of his cherished *Homo Diluvii Testis.*

But let us turn from the Gigantic Salamander and his pre-Adamite ally to that most extraordinary case of suspended animation, the Two-toed Sloth (*Cholœpus didactylus*), which quietly munches a piece of biscuit as he hangs back downwards in the cage close by. The Sloth is the only animal in existence which passes its entire time suspended in this manner from the branches of trees. "The Monkey and the Squirrel," says Mr. Waterton, to whom we are indebted for most of our knowledge of these animals in a state of nature, "seize a branch with their fore-feet, and pull themselves up, and rest or run upon it; but the Sloth after seizing it still remains suspended, and suspended moves along under the branch till he can lay hold of another." It moves suspended from the branches, it rests suspended from the branches, and it sleeps suspended from the branches, and in fact it is upside down its whole life long. But it is only in that position that it can make itself at all comfortable, for while it is all but helpless on the ground, and is then properly a "sloth," up amongst the branches it is quite at home, and executes its various movements with great rapidity.

Never, indeed, was misnomer more complete than in the case of the Sloth, having regard, that is, to its proper place and to its natural habits. Here is a picture of the animal *in* and *out of* his element, drawn from the life by Mr. Waterton:—"One day as we were crossing the river Essequibo, I saw a large Two-toed Sloth on the ground upon the bank. How he got there nobody could tell; the Indian said he had never surprised a Sloth in such a position before: he could hardly have come there to drink, for above and below the place the branches of the trees touched the water, and afforded him an easy and a safe access to it. Be this as it may, though the trees were not twenty yards from him, he could not make his way through the sand time enough to escape before we landed. As soon as we got up to him he threw himself upon his back, and defended himself in gallant style with his fore legs. 'Come, poor fellow,' said I to him, 'if thou hast got into a

hobble to-day, thou shalt not suffer for it. I'll take no advantage of thee in misfortune. The forest is large enough both for me and thee to rove in. Go thy way up above, and enjoy thyself in these endless wilds; it is more than probable thou wilt never have another interview with man. So fare thee well.' On saying this I took a long stick which was lying there, held it for him to hook on, and then conveyed him to a high and stately mora-tree. He ascended with wonderful rapidity, and in about a minute was almost at the top of the trees. He now went off in a-side direction, and caught hold of the branches of another tree, proceeding in this manner towards the heart of the forest. I stood looking on, lost in amazement at this singular mode of progress. I followed him with my eyes till the intervening branches closed in between us, and then lost sight for ever of the Two-toed Sloth." The Indians, it seems, have a saying, that when the wind blows the Sloth begins to travel; the interlacing of the branches at such times no doubt making it much easier and safer to proceed from one tree to another.

Extraordinary as are the structure and habits of the Sloth, it has never been made much of here in the Gardens, and by the majority of the visitors is passed by as a thing of ordinary every-day experience. Not so was it, however, with his kinsman and near neighbour the Great Anteater, which was exhibited in the same building a few years since, and which, as a bygone celebrity of the Gardens, merits a passing notice here.

Being the first animal of the kind which had ever been brought to Europe alive, the Great Anteater naturally attracted much attention, and for a considerable time the anxiety to see it was something bordering on the ludicrous. It was not the easiest thing in the world, however, to get a sight of him, even when you had gone to the Gardens for the purpose. Like all strictly nocturnal animals, it spent the greater part of the day in sleep, a circumstance which the young lady visitors especially pronounced a "shame." It certainly was very provoking, and it is to be hoped that in the event of another Anteater paying us a visit he will be taught to comport himself in a more befitting manner. As it was you were pretty sure to find the animal asleep, coiled up upon its bed of straw in a corner of the cage, with a room full of excited visitors waiting its awaking. Everybody put great faith, of course, in the label on the front of the cage, and had no

manner of doubt that the shaggy mound in the corner was truly "*Myrmecophaga jubata*, the Great Anteater from South America;" but for all that any one could see, it might have been a goat or a dog, or simply a heap of hair. But at regular intervals a keeper entered the cage and roused the animal from his slumbers, and then you had an opportunity of observing its strange ungainly appearance. The two most characteristic parts of it are the head and the tail. The head is remarkably thin and long, covered with short close hair, and slightly curved. At the point of the elongated snout a narrow slit forms the diminutive mouth, from which the animal protrudes its long cylindrical tongue, which hangs down much like a huge black worm. The immense tail has an upward curve, precisely the reverse of the curve of the head; it almost equals the body in length, and is furnished with a profusion of long flowing hair, which sweeps the ground as the animal walks along, and forms an ample covering for the body when its owner is disposed to coil himself up for a nap. A glance is sufficient to discover that it is the fore limbs which are chiefly employed, whether for work or war. They are extremely thick and muscular, and are armed with large claws, which turn in upon the soles of the feet, so as to give the animal the appearance when in motion of walking on its knuckles.

In a state of nature the Great Anteater lives, so far as is known, exclusively on ants, for the procuring of which its entire organization is beautifully adapted. Standing on its broad hind feet, it breaks through the crust of the ant-hills with its powerful hooked claws, and the moment the insects appear at the breach, it darts its long flexible tongue, covered with a glutinous saliva, into the thickest of the throng, and again draws it into the mouth. By this means a considerable number of ants are speedily obtained, the tongue being protruded and again drawn in upwards of a hundred times in a minute, and each time of course covered with the insects.

Like all the Edentate animals, the Great Anteater is naturally shy and timid, and endeavours to escape from its assailants by flight. Its pace, however, is slow and awkward, so that it is easily overtaken, and it is said to be so excessively stupid that it may be driven along in whatever direction the driver chooses. f pressed too hard, however, it turns sulky, and sitting up on

its hind-quarters, defends itself with great vigour, striking with its powerful claws, and using one arm to support itself, while it strikes with the other. In extreme cases it throws itself upon its back, and endeavours to hug its assailant in a close embrace, when its immense muscular power enables it to overcome the most active of its foes. It is said that even the jaguar has been found dead, locked in its arms.

The Anteater had been no great while in occupation of its comfortable quarters before it was joined by a companion from its native forests, and for a time they throve so well that hopes were entertained of their surviving the winter, and so becoming established as stock "lions" of the establishment. But these hopes were speedily disappointed, and before long both animals fell to the knife of Professor Owen.

The Australian continent is scarcely more singular in respect to its native mammalia than in regard to its peculiar birds. It is indeed altogether a land of contrarieties, and the astonishment which years ago greeted the first intelligence of its black swans, and its trees which annually shed their bark instead of their leaves, has been renewed with almost every fresh addition to our knowledge of its natural history.

In the New Aviary—"new," that is, on the same principle that Charlie, a strapping fellow of four years old, is still "baby," because there is no newer—there are some of these Australian birds, which, although they have long since ceased to be novelties, are well worthy of attention. In the first place, here is that curious feathered architect, the Satin Bower Bird (*Ptilonorhyncus holosericeus*), which claims kindred with our common crow, and makes good its claim by a strong family likeness. The bowers which these birds construct are formed of two parallel rows of slender twigs, which curve inward, and nearly meet at the top, and which are so artfully arranged that all the projecting points and bifurcations are turned to the outside of the avenue, and a perfectly unobstructed thoroughfare left within. The walls of these curious structures rise from a broad platform of sticks and twigs, closely interwoven and compacted together, which thus forms the floor of the bower, and imparts to it a considerable degree of firmness and stability. So far as is yet known, the only purpose for which these bowers are constructed is that of a playground, in which the birds continually amuse

themselves, chasing each other through the avenue with the greatest glee and animation, and evidently enjoying the sport. The male bird more especially puts himself into a variety of attitudes, setting his feathers in the most grotesque manner, and making as many bows as an ancient cavalier in a minuet. But what is still more curious, perhaps, as exhibiting an instinct rarely, if in any other case, observable amongst the lower animals, is, that the birds take great pains to beautify and adorn their bowers, inserting amongst the twigs the gaudiest feathers of the parrot and other birds, and spreading about the platform such conspicuous objects as bleached bones and the shells of snails.

Another Australian bird of great interest in this aviary is the Wattled Talegalla (*Talegalla Lathami*), the Brush Turkey of the colonists, which hatches its eggs, not by the ordinary process of incubation, but by placing them in heaps of decaying vegetable matter, and allowing them to remain there undisturbed till brought to maturity by the heat engendered in the process of decomposition. The Talegalla is a gregarious bird, moving about in small companies, much after the manner of our common poultry; and in the construction of the heaps or mounds, which are of great size, and a pyramidal form, several birds appear to unite their labour. In collecting the materials the birds never use the bill, but grasping a quantity with one foot, throw it back towards the spot where the mound is being formed, and thus make a perfect clearance for some distance around. Some little time is allowed to elapse for the development of heat after the mound is completed, and then the eggs are deposited a few inches distant from each other, and buried between one and two feet deep in the substance of the mound. As soon as the chicken leaves the shell, it excavates a way to light by means of its strong and well-developed feet, when the mother bird, guided by unerring instinct to await this moment, receives her young, and commences the actual duties of parental care.

The first account of the habits of the Talegalla was given by Mr. Gould in his "Birds of Australia," published in 1842; but so extraordinary was the story that, notwithstanding his high authority, it was received with considerable doubt and hesitation. In 1854, however, the entire process of mound-raising, egg-deposition, and hatching was gone through in the Zoological Gardens by a pair of Brush Turkeys which had some time pre-

viously been added to the collection. On the birds being placed in a large enclosure with an abundance of vegetable material within reach, the male began at once to gather it into a heap, working with his powerful feet precisely as was stated by Mr. Gould. When the mound had risen to the height of about four feet, and had been brought to an even surface, a depression was made in the centre, and in this the eggs were deposited as they were laid, arranged in a circle about fifteen inches below the summit of the mound, with the smaller end of the egg pointing downwards. The male bird watched the temperature of the mound very carefully, and an opening was always maintained in the centre of the circle of eggs—no doubt for the purpose of ventilation. In about a month after the first egg was laid a young bird was hatched. It appears, however, that for some hours after chipping out of the egg it remains in the mound without making any effort to extricate itself; and what is still more curious, for the first day or two after it has left the mound it retires there again early in the afternoon, and is carefully covered up for the night by its assiduous father.

No less than five birds were hatched out of ten eggs which were deposited in the mound in the Gardens; so that it would appear there is no great improbability of this valuable and interesting bird being ultimately added to our poultry yards. And if it does come amongst us it will hardly come alone, for it has some three or four allies in the Australian bush distinguished by the same remarkable habits, and equally appropriate with itself to adorn the dinner-table.

One other Australian bird in this aviary remains to be noticed. It is the Gigantic Kingfisher (*Dacelo gigantea*) zoologically, but popularly it has almost as many aliases as some of its human companions in the bush. Its most usual name perhaps is the very elegant and expressive one of the Laughing Jackass, which it has earned for itself by the peculiar loud gurgling laugh with which it proclaims its whereabouts to the traveller in the bush. This rude and powerful laugh is the first sound heard in the dawn of the morning, when the woods resound with it on every side; it rings out again with the same frequency and volume at sunset; and the regularity with which the bird thus announces the dawn and the decline of day has procured it the appropriate name of the "Settler's Clock."

The Laughing Jackass is a true Kingfisher, although oddly enough it seldom or never goes near the water. It inhabits the dry-scrub, feeding like a bird of prey on insects, reptiles, and small mammalia, and differs essentially, therefore, in its habits from the lovely bird which flashes like a jewel along the brooks and rivulets of Europe. At one time it was much persecuted by the settlers, from the idea that it had too great a liking for young poultry; but the rapid increase of reptiles and vermin of all kinds in the districts where the bird had been destroyed, soon led to a proper estimate of its value; and it is now a privileged inmate of every farmyard in the Australian colonies. It is a constant attendant about the bush tent, and being of a very companionable nature, and useful withal, it is regarded with a great deal of favour.

Dr. Bennett, in his recent "Gatherings of a Naturalist in Australia," says it is no uncommon thing to see ten or a dozen of them perched on the branches of a large gum-tree, and on the traveller exciting them by trying to imitate their peculiar note, instead of flying away, one will immediately commence a gurgling laugh, then another will set up a scream, a third will follow with a loud bark, then they will all chime in with such an extraordinary compound of noises as baffles all description. There are three fine specimens of these singular birds in the New Aviary, and every morning they make the place ring again with their boisterous laughter, beginning with a low and gradually rising to a high and loud tone, as though they were highly amused at their own performances.

The Australian bush has three or four other birds almost equally famous with the Laughing Jackass for the singularity of their notes; and we may hope that one day they will all be assembled here in the Gardens together. There is first the little Bell Bird, whose tinkling note is a pleasant sound to the thirsty wanderer, always indicating the nearness of water; then there is the Razor Grinder, which perches on some lofty tree and sends out its rapid scizaring, grinding notes, as though it was driving an excellent business in sharpening up old cutlery; and lastly, there is the Coach-Whip Bird, which first of all startles the traveller with his loud whistle, and then finishes up with a sharp smack like the crack of a coach-whip. Mr. Sclater can surely contrive to engage the services of a few of these very original

geniuses, and their presence in the Aviary would be a decided attraction.

In no part of the Regent's Park Gardens are there so many interesting and imposing looking animals crowded together as in the long narrow strip which lies north of the public drive, and to which we make our way through the tunnel. Here are to be found the huge herbivorous mammalia of Africa, the Elephant, the Rhinoceros, the Hippopotamus, the Giraffe, and the rest of them, with the beautiful series of Antelopes, and the great Struthoid Birds of Africa, Asia, and America.

A few steps from the tunnel brings the visitor to the fine umbrageous walk in which on bright summer days you are pretty sure to meet Chuny the perambulating Elephant, shuffling along with his howdah filled with delighted and yet half-frightened children. The Zoological Society is under a cloud just at present in respect to elephantine wealth. It has never yet made good the loss it sustained years ago by the death of poor Jack, who was the most good tempered and amusing of elephants; hardly inferior, one would suppose, to the worthy of which Pliny tells us that, not being "so good of capacity to take out his lesson and learn that which was taught him, and being beaten and beaten again for that blockish and dull head of his, *he was found studying and conning those feats in the night which he had been learning in the daytime.*" Apropos of "dissection," when poor Jack was cut up, Professor Owen was well-nigh paying a terrible penalty for the zeal with which he prosecuted the work. In endeavouring to extract the brain whole, he wounded his left hand in two places, and though the larger wound was immediately cauterized, dangerous symptoms began to exhibit themselves, and for a while his friends were greatly concerned for his safety. The elephants hitherto exhibited in the Gardens, as indeed all that have yet been brought to this country, are from India, the African Elephant being one of the good things which the Zoological Society are hoping to receive from Dr. Livingstone.

It will appear very disrespectful no doubt to that pre-eminent "lion" of bygone times, the Hippopotamus, to pass him, or rather *them*, by without a word; but pass them by we must, for all that: so, too, with their next-door neighbours, the Giraffes, those slim, clean, "young-lady animals," as Leigh Hunt calls them, for the reader is growing tired; and here at the very ex-

tremity of the Gardens are two interesting groups of animals which well deserve all that remains of the present chapter.

The first of these groups or collections is that formed by the noble series of Struthoid Birds, the Ostrich and its allies, of which nearly all the existing species are here exhibited. The latest addition to this extraordinary race of birds is the Mooruk (*Casuarius Bennetti*), which has recently been discovered in the island of New Britain, and whose habits in a state of domestication have been very fully described in the "Gatherings of a Naturalist" by Dr. Bennett, the gentleman who sent the bird to this country, and after whom it is named. The Mooruk is most nearly allied to the Cassowary, from which, however, it may readily be distinguished by the triangular horny crest of the head and the brilliant cobalt blue of the naked skin on the upper part of the neck. The great peculiarity of the Struthoid Birds consists in the extraordinary development which is given to the legs, on which the entire business of locomotion is devolved, and the corresponding diminution in power of the wings, which in no case are adequate to raise the body into the air, and in most of the species are merely rudimentary. The wing-bones are most fully developed in the Rhea or American Ostrich, of which there are two or three distinct species here in the Gardens—and next in the Ostrich, in both of which the diminished organs of flight render aid in running: while in the Cassowary and the Emeu, and in the curious Apteryx of New Zealand, this characteristic part of the structure in birds generally is reduced to the most rudimentary form. In all the species alike the leg bones are immensely developed, and endowed with enormous strength, so that the birds are enabled to course along with a speed superior to that of the fleetest horse, and to deal out blows, which, at close quarters, render them extremely formidable antagonists.

By far the most interesting circumstance in relation to these great wingless birds is the discovery of what seems to have been the metropolis of the race. In the two principal islands of New Zealand, wherein, so far as is known, the Struthoid Birds are now represented solely by the Apteryx, the smallest of the race, there have been discovered within the last twenty years the remains of no less than twenty distinct species of birds belonging to this family, some of which were not larger than the Turkey, while others were more than double the size of the Ostrich, the largest

of existing birds. It is one of the most marvellous facts in Natural History, that within the limited area of New Zealand so many of these huge birds should have been associated together; and the fact becomes all the more remarkable when we consider how widely the existing species of the family are now separated from each other over the surface of the globe.

There is reason to believe, however, that New Zealand was not alone in the possession of these huge wingless birds, the egg of another species having been discovered in the Island of Madagascar. The size of this monster may be inferred from the fact that its egg would hold the contents of 6 eggs of the Ostrich, 16 eggs of the Cassowary, or 148 eggs of the common Fowl. It is highly probable that these huge birds have lived contemporaneously with man. In New Zealand the natives have a tradition that the bones belong to a bird of the Eagle kind, which has now become extinct, and to which they give the name of Moa: moreover the bones are decidedly recent, being by no means mineralized, and retaining a large proportion of their animal matter.

Let us pass from these huge birds now dead and gone, unless indeed, some of them should turn up alive by and by in Madagascar, which is not altogether improbable—to a huge Antelope, still alive and available to good purpose. The Eland is the prince of Antelopes, and stands almost as high as an Ox; and, what is more to the purpose, he is even better than an Ox in a gastronomic point of view.

"In shape and general aspect," says Sir Cornwallis Harris, "he resembles a Guzerat Ox, not unfrequently attaining the height of nineteen hands at the withers, and absolutely weighing from fifteen hundred to two thousand pounds! By all classes in Africa the flesh of the Eland is deservedly esteemed over that of any other animal. Both in grain and colour it resembles beef, but far better tasted and more delicate, possessing a pure game flavour, and exhibiting the most tempting looking layers of fat and lean, the surprising quantity of the former ingredient with which it is interlarded exceeding that of any other game quadruped with which I am acquainted. The venison fairly melts in the mouth; and as for the brisket, that is absolutely a cut for a monarch!"

This noble and "promising" animal was first imported into England in the year 1840 by the late Earl of Derby, by whom

a herd was bequeathed to the Zoological Society. They are perfectly capable it appears of enduring all the vicissitudes of our climate, and are now being established in the parks of many of the nobility in various parts of the country.

May the princely beast continue to prosper, and at no distant day may he lie in noble sirloins, barons, and briskets among the commonplaces of our butchers' stalls!

CHAPTER XI.

CONCERNING BATS.

"The shrieking bat
* * * * *
Would even swoop, and touch us as he flew;
And vainly still our hopes to entertain,
Would stint his route and circle us again."

The pictures of rural life and scenery which occur in such rich profusion in the simple verses of John Clare, the peasant poet of Northamptonshire, are drawn with such vivid truthfulness and force that no one can fail to be struck with their aptness and beauty. Poor Clare! The gay world that once petted and caressed him, as a sort of phenomenon that it did well to make much of, little recks that he still lingers out a lunatic life in hopeless darkness and vacuity. Not long since we went to see him in the asylum at Northampton, where for more than twenty years he has been the companion of idiots and lunatics like himself. It was a sad sight to recognize in the dull and heavy countenance of the poor unfortunate of fifty-eight years, the same features that have such a noble aspect in Hilton's portrait of the poet of twenty-seven, prefixed to his "Village Minstrel," but there was no mistaking the face notwithstanding the change.

His conversation—if conversation it can be called, was saddening too, the more saddening from the odd jumble of good sense with the most extravagant absurdities of which it consisted. The "Quarterly Review" had not long before, in an article on the county of Northampton, referred to his uncourtly behaviour when a real, unsophisticated peasant poet, fresh from the country, he was transported all-a-growing into the hot-bed of London life, under the guidance of Lord Radstock, his chief showman. On our alluding to the matter with an assumed playfulness, he said, "Yes, they wanted me to talk fine, but I wouldn't." And then in reply to a question as to whether he

had written anything lately, he said, "No, I haven't written a line for a hundred and fifty years; and I won't write any more. It has brought me into bondage, and I want my liberty.

> I can plough, and sow,
> And reap, and mow;

and I want to be a farmer's boy. I want to go into Northampton." Pitiful indeed was the tone in which the poor fellow spoke; and soon he wandered away into the wildest extravagances of his being a son of George III., and of his not being a man at all, but a spirit, that could stand fire and water; and of dragons that came and *flopped* down in the yard with their great wings about them; and into still wilder and more painful extravagances, till the surgeon stopped him by a touch on the shoulder, and, "Ah! Mr. Clare, that will do." It appears that until within the last six or seven years he was frequently allowed to leave the asylum and to go into Northampton, where, under the walls of All Saints church, he used to sit giving out verses of his own composition for beer and tobacco. These unwise indulgences, however, were at length discontinued, and he now remains constantly within the grounds of the asylum, dead to the world outside, and almost forgotten.

But all this is beside the mark; and as poor Clare has led us away from our subject, he shall also bring us back. It is evening then, good reader, and now—

> "The owl mopes out, and scouting bats
> Begin their giddy round;
> While countless swarms of dancing gnats
> Each water-pudge surround."

Gnats, Bats, and Owls! They are very properly associated together; for they are not only alike, things of the evening, but they stand to each other in the relation of food and feeders—the Gnats in the first place helping to fatten the Bats, and these in their turn falling a prey to the Owls.

There are few animals perhaps which, so familiarly known as the Bat, have at the same time been the subject of such general misconception. Possessing certain obvious characteristics in common with ordinary quadrupeds, and yet organized for flight like birds, it has alternately been ranked with both

those divisions of the animal world; while its striking dissimilarity in many respects to both has led again to the resolute denial that it belonged to either. The common English name of "flitter mouse" clearly indicates the position which in the popular estimation the Bat occupies. It is a veritable flying mouse, the descendant, perhaps, of some ancient pilferer of cheese, who, not content with cupboard life, and ambitious of moving in a higher sphere, gradually became endowed with those wonderful organs of flight by which the race are now distinguished.

The ancients very generally regarded the Bats as *aves non aves*, birds yet not birds; as though they were, what we sometimes still hear them described, "half bird and half beast." In Hebrew the Bat is *attaleph*, the bird of darkness; and in the Book of Deuteronomy it is mentioned last in the list of unclean birds prohibited as food. Pliny was evidently in doubt as to the Bat, for though he classes it with birds, he does it as it were under protest. "No flying fowle," he says, "hath teeth, save only the Bat or Winged Mouse:" and in his tenth book, at the end of his discourse on Birds proper, he gives the Bat a short chapter to itself, and tells us that the Rere-mouse or Bat, alone of all creatures that fly, bringeth forth young alive," and that "she is the only bird that suckleth her little ones with her paps and gives them milk." The oddest notion with respect to the true position of the Bat, is that of Aldrovandi, the celebrated naturalist of the sixteenth century, who boldly struck out in a new path, and classed it with the Ostrich. His idea was that as the Ostrich was a bird, which, while unable to fly, could yet run like a quadruped, and the Bat was apparently a quadruped which, unable to walk or run like other quadrupeds, could yet fly like a bird, the two might very properly take their place together as a special class of mongrels or monstrosities.

The peculiar organs of flight with which the Bats are provided exhibit one of the most singular modifications of animal structure observable in the whole range of animated nature. Unlike the wings of birds, which are formed by the feathery appendages of the fore-limbs, these curious organs consist of a thin and extremely delicate membrane, which is continued from the skin of the body, and connected with all four of the limbs, and in most cases with the tail as well. It is owing to the peculiar

conformation of the fore-limbs, however, and especially to that of the bones of the fingers, upon which the wing-membrane is stretched, that the Bat is enabled to make its way through the air by means of this singular structure. These bones are all greatly elongated; those of the fingers having much the appearance of the ribs of an umbrella, and, like them, serve to expand or fold up the covering to which they are attached. The thumb is the only part of the hand which does not partake of the general enlargement. This member remains undeveloped, and is furnished with a powerful hooked claw, by means of which the Bat is enabled to drag itself forward on flat surfaces, and climb about in the dark retreats to which it retires by day. The hind legs, although connected with the wings, and serving in part to support them, exhibit no marked peculiarity of form. The feet have five toes, armed with strong claws, by which the animal usually suspends itself in its seasons of repose, hanging with its head downwards. The entire power of the Bat seems concentrated upon the fore part of its body and the organs of flight. The principal bones of the wing are all possessed of great strength, and the sternum or breast-bone has the same keel-like projection for the attachment of the muscles which move the wing as is observable in birds.

Thus expressly organized for an aërial existence, it is not to be wondered at that the Bat is incapable of any but the most awkward and grotesque movements on the ground. In this position, indeed, with its wings folded, and shuffling or jerking itself along, it would scarcely be recognized as the same being which a few minutes before, it may be, was skimming the air with easy graceful movements, wheeling, doubling, and again darting forward with the greatest rapidity. The Bat is greatly aided in these abrupt evolutions by the tail, which acts as a sort of rudder, enabling the animal to regulate and change the direction of its flight, whatever its speed, with the utmost facility.

The membrane of which the wing is composed is usually entirely naked, both above and below, and endowed with the most exquisite sensibility. It was long since proved by Spallanzani, indeed, that it is chiefly owing to the extreme delicacy of perception in this membrane that the Bat is enabled to avoid coming into collision with obstacles in its path when

pursuing its flight in the dark eavernous retreats it frequents, or when flying abroad in the dusky air of evening. With a zeal for the advaneement of knowledge whieh apparently rendered him oblivious to the eruelty of his proeeedings, that eminent naturalist first deprived the Bats he experimented upon of their eyes, and then set them at liberty in a large apartment in whieh were plaeed lines and rods erossing eaeh other in every direetion, and from whieh eseape eould only be made by apertures barely large enough to allow the animals to pass without their striking against the sides. And yet we are assured the poor blinded creatures threaded the maze of obstruetions without onee coming in eontaet with them, and finally passed out of the apertures, without even brushing the sides with their wings. It has been questioned by many naturaiists whether this extraordinary power of ascertaining the proximity of solid bodies should be regarded merely as an extension or refinement of the sense of toueh, or as a sixth and unnamed sense peculiar to the Bat tribe.

It seems, however, that this extraordinary power of aseertaining the proximity of solid bodies is in some measure dependent on the sense of hearing, which with that of smell is also developed to an unusual degree in many of the Bat tribe, the organs of those senses being proportionately eonspieuous. In the Long-eared Bat of this country the ears are nearly equal to the body in length, and there is an inner fold of the membrane of the external ears whieh has the appearanee of a seeond pair of those organs. The nose, again, often partakes of the same singular development, being furnished with eurious leaf-like appendages, formed by a prolongation of the skin, whieh is folded and doubled in various direetions, so as frequently to present a most grotesque appearanee, as in the Horseshoe Bats. But these peculiarities of strueture are confined to that division of the tribe whieh eapture inseets on the wing, and are wholly wanting in those speeies which subsist on fruits and other vegetable food.

The Bats eome abroad almost exelusively during twilight and the darkness of night, remaining eoneealed by day in hollow trees, caverns, and holes in roeks, the dark recesses of ruins, under the eaves of houses, and other similar situations.

There are few plaees, indeed, at all eapable of affording the Bat a safe retreat during its daily rest whieh are not turned to

account, and they are sometimes found snugly stowed away in the most unlikely situations. Mr. Croueh of Polperro mentions that in a church in that neighbourhood some marks of a Bat having been found on the floor, immediately under an iron helmet fixed against the wall at a considerable elevation, a roll of flaming sulphur was held below the helmet, when no less than seventeen Bats made their way out and escaped; and that some time previously, when the roof of the same church was being repaired, as many Bats were caught as would have filled a wheelbarrow. In favourable situations these animals nestle away during the daytime in great numbers; and it is no uncommon circumstance in the dusk of a summer evening to find a cat attentively watching the entrance to one of these favourite retreats, ready to pounce upon the poor Bats the moment they emerge. Moreover, they have no sooner got clear of this enemy, and begun their giddy round, than they are exposed to another and still more dangerous foe, in the shape of the Owl, which seems to have quite as great a partiality for Bats as mice.

Within the tropics, where the Bat tribe attains its greatest development, both as to size and numbers, the spectacle they afford in the retreats to which they retire by day is often of the most singular character. A writer in the "Zoologist" for 1859, states that in the limestone caves of Jamaica the Bats are found by day in immense numbers, and that when they are disturbed by the entrance of people with lights, the noise of their wings sounds like the murmur of a distant sea. In one case the sides and roof, of a cave half a mile in extent, were crowded with a Bat of large size, which brings into its domicile incredible quantities of the kernels and fragments of large fruits on which it feeds, and which, with the droppings of the animals themselves, form deposits several feet in thickness over the entire floor of the cave. The horror of the scene is greatly enhanced by the fact that a sickly crop of young colourless plants struggle upwards in the darkness, while vast numbers of a large wingless insect, allied to the cockroach, feed on the decaying matter, and themselves form the prey of huge spiders, with formidable jaws, like the claws of the scorpion, which slowly creep along the walls.

But the most curious scenes of this kind are those afforded by the assemblages of the great fruit-eating Bats of India and the Indian Archipelago—the Flying Foxes of Europeans—which sus

pend themselves in the open air from the branches of large trees. Sir Emerson Tennant has given us an interesting account of the habits of one of these animals found in Ceylon. They take possession, he says, during the day, of particular trees, upon which they hang like so much ripe fruit. It seems, however, that every morning between the hours of nine and eleven they take it into their heads to have a little exercise, and dropping from the trees, they go wheeling about in the air, a hundred or more together, and apparently enjoying the sunshine and warmth. On their return from this morning exercise there is always a good deal of chattering and screaming amongst them before they can again get comfortably settled in their places; but once that is accomplished, they become quiet and remain so until the evening, when they move off towards their feeding-grounds.

With respect to size, the tropics seem to have both extremes of the Bat tribe; for while the great Flying Foxes reach four and five feet in the expanse of their wings, there are other Bats to be found in the same regions which are the merest pigmies. One mentioned by Sir E. Tennant is not larger than a Humble Bee. It is of a glossy black colour; and is so familiar that it will alight on the table during dinner, and seldom makes any effort to escape before a wine-glass can be inverted over it.

In cold and temperate climates the Bats are comparatively small, and the whole of them belong to the insectivorous section of the tribe. Their food consists principally of moths, gnats, and other late-flying insects; and considering the great abundance of the tribe, they must act as an important check upon that description of insect life. In thus subsisting upon the crepuscular or twilight-flying and nocturnal insects, the Bats discharge a similar office to that of the Swallows with respect to the insects which fly by day; and, like those birds, they have the gape considerably widened and enlarged, to enable them the more readily to capture their prey without pausing in their rapid flight.

As the season advances, and the heat begins to abate, our native Bats gradually disappear from their accustomed haunts, and retire to their winter quarters, where, huddled together, often in great numbers, and sometimes two or three distinct species in the same retreat, they suspend themselves by their hind feet, and remain in a dormant state until the approach of spring. The different species are by no means uniform as to the period of their

disappearance. The Noctule, or great High-flying, Bat is the earliest to retire, being seldom seen after July, while the *Pipistrelle*, or Common Bat, continues abroad to the end of autumn, and may occasionally be seen flitting about in fine weather in the depth of winter.

In retiring for their winter sleep they resort to pretty much the same kind of places as those in which they pass the hours of daylight in summer-time. Like the Jackdaws, the Bats seem to be very partial to ecclesiastical retreats, and it is no great while ago that a paragraph appeared in some of the newspapers, to the effect that the verger of Peterborough Cathedral was making a little fortune by exhibiting upwards of two hundred Bats which had quietly hung themselves up for the winter in a dark corner in one of the towers of that venerable edifice.

It sometimes happens that in its efforts to find out a snug and secure place in which to pass the winter, the Bat insinuates itself into places which seem absolutely closed against it, and thus it has occurred that stories have got abroad of these animals having been found alive in situations where they have been immured for many years. A case of this kind is recorded in the "Zoologist" for 1854. It appears that in making some repairs in the pavement of the aisle of a village church, it was found necessary to remove some bricks from the wall of an adjoining vault, and one of the workmen thrusting in his hand, was terribly alarmed at its coming in contact with a Bat suspended from the roof of the vault.

The vault was formed of solid masonry, and no aperture or even a crack could, it is said, be discovered, by which the Bat could have entered. And to make the marvel greater, there was good reason to believe that the vault had not been opened for a hundred and six years! The narrator of the discovery is fully persuaded, of course, that the animal had been walled up the whole of that period; but the fact that it was only half torpid on being taken out of the vault, and that it speedily thereafter recovered the use of its wings and made good its escape, is the best proof that it was not such an ancient as its discoverer supposed.

No less than fifteen or sixteen species of Bats are found in Britain, but the great majority of them are either rare or confined to a few localities, and thus are seldom seen. The little Pipis-

trelle (*Vespertili pipistrellus*), already alluded to, is at once the most abundant and the smallest of the number, and the one which most frequents the haunts of man. It particularly affects the neighbourhood of ponds and rivers, flying about the trees and over the surface of the water in search of gnats and other small two-winged insects, of which its food principally consists. This little Bat, however, has the reputation, in some parts of the country, of flying down the chimneys of the farmhouses, and feasting on the suspended flitches of bacon, and though the story has often been laughed at, there seems good reason to believe that it is strictly true. Certain it is, the Pipistrelle has a great partiality for cold joints, and not unfrequently finds its way to them in the pantry, and makes a hearty meal.

Equally abundant with the Pipistrelle in some parts of the country is the Long-eared Bat (*Plecotus auritus*).

In the month of October, when the ivy is in full blossom, and much frequented by moths and other insects, this elegant Bat, in company with the Pipistrelle, may constantly be seen in early dusk—

"The moth-time of night,"

passing and repassing the ivy-covered walls of its hunting-grounds, and eagerly snapping up the moths that come to settle on the blossoms; and so intent are they on their work, that any one provided with an insect-net may capture them without difficulty. It would appear, indeed, that this same season of the year is the harvest-time of the Bats, for they are then always plump and fat, well provided with that accumulation of substance which is necessary to repair the waste of the system during the long fast of their winter sleep.

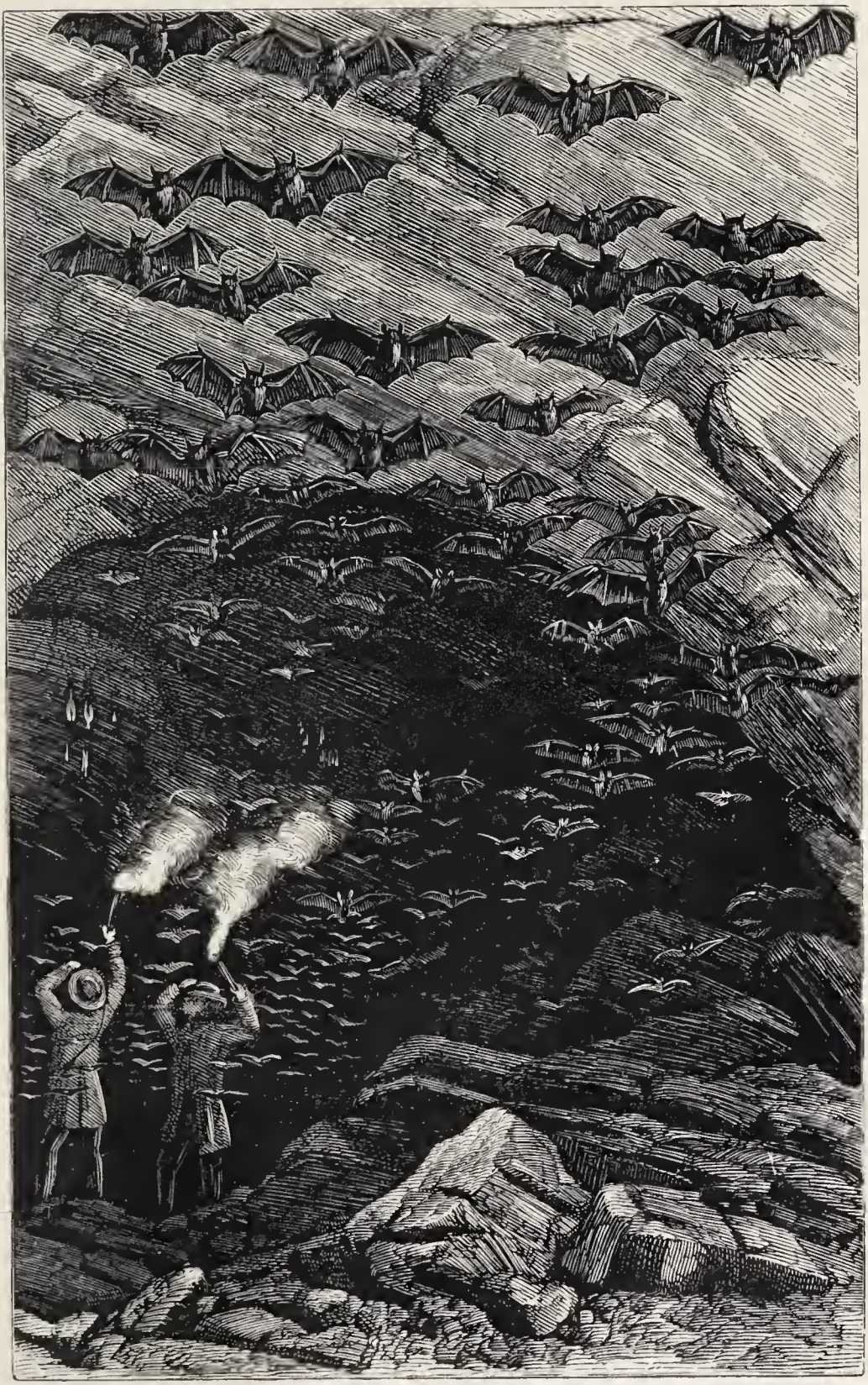
The largest of our native Bats is the Noctule (*Noctulinia altivolans*), the great High-flying Bat of White's "Selborne," in which it was first noticed and described. It is over fourteen inches in the expanse of its wings, the Pipistrelle being but eight or nine inches; and Mr. Jesse mentions the finding at Hampton Court Palace of the skeleton of a Bat which must have been as large as a pigeon. The historian of Selborne notices the fact that the Noctule ranges very high for its food, exactly as the Swifts do, and furthermore, that they both disappear much earlier than their congeners; whence he very naturally infers

that they both subsist on the same sort of high-flying insects, and that these continuing abroad but a short time limit the period of activity in bat and bird alike.

The Horse-shoe Bats are so named from certain curious leaf-like appendages which they have to the nostrils, and which, from the singularity of their shape—usually that of a horse-shoe—and the prominence of their position, give the animals a very odd and repulsive appearance. Two of our native Bats belong to this section of the tribe, the greater and the lesser Horse-shoe Bats, though from their comparative rarity and the peculiarity of their habits, haunting dark secluded caverns, they are seldom seen and but little known. In the warmer parts of the globe, however, these Bats occur in considerable abundance; and Dr. Bennett in his "Gatherings of a Naturalist," gives an interesting account of one of them which is found in Australia. It is the Great-leaved Horse-shoe Bat (*Rhinolophus megaphyllus*), and occurs in the Gudarigby Caverns, on entering which with torches, Dr. B. says he saw them in great numbers, and was much annoyed by their flapping against his face in their eagerness to escape from the lights. But the most interesting point is, that the skeletons of several of these Bats were found suspended from the roof of the cavern, no doubt in the position in which the animals had died.

In the tropical regions of South America the Bats are large in size and very numerous; and many of them subsist in part on the blood of animals, which they obtain by puncturing the skin and sucking the wound while their victim is asleep. One of these is the bloodthirsty Vampire Bat (*Vampirus spectrum*) so celebrated in fable and romance. The fearful stories which have been circulated with respect to the habits of these Bats are not without some foundation in fact, although the small modicum of fact has been amplified into a vast amount of fiction. But, as in all cases of the kind, there is no want of authorities who are ready to back up the most extravagant statements as to the frightful powers which these animals possess.

Here, for example, is Captain Stedman, who is ready to assure us that the Vampire knows by instinct when the person it intends to attack is in a sound slumber, and that alighting near the feet, it bites a piece out of the tip of the great toe, very small it is true, so that the head of a pin could scarcely be received into the wound, which is consequently not painful; but that through



The Great-leaved Horse-shoe Bat in the Gudarigby Caverns.

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this orifice the animal continues to suck the blood until it is obliged to disgorge; that it then begins again, and thus continues sucking and disgorging till it is scarcely able to fly; the sufferer meanwhile sleeps on, not unfrequently continuing to sleep from time into eternity. The captain further states that on one occasion he was attacked himself, and that on waking up from his sleep he observed several small heaps of coagulated blood around the spot where he had lain, and that from these it was estimated that during the night he had lost from twelve to fourteen ounces of blood at least. No wonder that with such circumstantial evidence before them writers on Natural History have striven to keep up the reputation of the Vampire, and have now and then embellished the story with little additional touches of their own. Thus Mr. Wood in his "Zoography" quotes the account of Captain Stedman, and then goes on: "it is said to perform the operation by inserting its aculeated tongue into the vein of a sleeping person with so much dexterity as not to be felt, at the same time fanning the air with its large wings, and thus producing a sensation so delightfully cool that the sleep is rendered still more profound, and the unfortunate person reduced almost to death before he awakes." The picture is well drawn, but unfortunately some of its most striking features are altogether imaginary.

The truth of the matter seems to be that while these Bats do occasionally attack the exposed feet of persons that they find asleep, the injury they inflict is never serious unless, as Cuvier says, the wound becomes envenomed by the climate. It is well-known, however, that they attack horses and cattle and smaller animals, although it is extremely doubtful whether any of these even are ever actually killed from the effects of their bites.

Between the two great divisions of the Bat tribe—the *Insectivorous* and the *Frugivorous*, or fruit-eating kinds—there is an obvious dissimilarity in the conformation of the teeth, in the character of the digestive organs, and in other less important points of structure. In the former division, which includes by far the greatest number of species, the molar teeth are set with pointed tubercles, adapted to crush the harder parts of their insect prey, while their canines are frequently of large size, and extremely sharp pointed. The intestinal canal, again, is unusually short, and evidently intended for the

digestion of animal food. On the other hand, in the Frugivorous Bats, the molar teeth are furnished with rounded eminences adapted for the mastication of vegetable food, while the stomach is of an exceedingly complex character, and the intestines are many times the length of the body. In these Bats too, there is no unusual development of the nose or ears, and in many cases the tail is considerably shortened, and the membrane between the hind limbs greatly reduced, or wholly absent. All these characteristics mark the Bats of this division as being little qualified for the pursuit of living prey, but rather designed to subsist chiefly, if not exclusively, on vegetable food.

The strictly Frugivorous Bats comprise but one family—the Pteropide or Rousette Bats, the Flying Foxes already alluded to. These Bats are confined for the most part to the tropical regions of the Old World, over which, however, they are widely distributed. One of the most remarkable of the number, and one which, as to its habits, may be taken as a representative of the rest, is the Kalong of Java (*Pteropus Javanicus*), an enormous creature, with a fox-like head, measuring five feet in the expanse of its wings. Our knowledge of this animal is chiefly derived from Dr. Horsfield, who states that it is very abundant in the lower parts of Java, where it lives in troops, often of several hundreds, which frequent large trees like the banyan. The greater part of the day they pass in sleep, hanging motionless, with the head downwards, and the wings wrapped about the body. They have little resemblance to living beings, and by persons not accustomed to them are readily mistaken for a part of the tree, or for fruit of uncommon size suspended from its branches. In general these societies preserve a perfect silence during the day, but if they happen to be disturbed, or a quarrel arises amongst them, they emit sharp piercing shrieks, and shuffle about in such an awkward manner as to present a very ludicrous spectacle. In consequence of the sharpness of their claws, their attachment is so strong that they cannot readily leave their hold without the assistance of the expanded membrane, and if suddenly killed in their natural attitude during the day, they continue suspended after death. It is necessary therefore to oblige them to take wing by alarming them, if it be desired to obtain them during the day. Soon after sunset they quit their hold of the tree, and set off in quest of food to the

villages and plantations, where they occasion much mischief by attacking and devouring indiscriminately almost every kind of fruit, from the cocoa-nuts which surround the villages of the peasantry, to the rare and delicate productions which are cultivated with care by princes and chiefs of distinction. In the lower parts of Java there are few situations where this night wanderer is not constantly observed, and the chase of the animal affords occasionally a very agreeable amusement to the inhabitants during the beautiful serene moonlight nights of that part of the globe.

According to Dr. Bennett there are at least two species of these Bats to be found in Australia. The commonest is *Pteropus Edwardsii*, which occurs in great abundance about Morton Bay, and the northern districts of New South Wales, where they may be seen in the daytime hanging in dense masses from the uppermost branches of the lofty gum-trees, which bend under the burden as though they would break off and come crashing to the ground. In the neighbourhood of Sydney these Bats are rarely seen, but in the year 1858 a number of them were observed suspended from the topmost branches of the lofty trees in the Sydney Botanic Gardens, where they attracted considerable attention.

In nearly all the countries where these great fruit-eating Bats occur, they are hunted by the natives as an article of food; and Leichhardt, the Australian traveller, assured Dr. Bennett that they were by no means unpalatable, notwithstanding that they have when alive a strong and by no means agreeable musky odour.

It is owing in great part, no doubt, to the peculiarity in the form of the Bats, and to the unnatural character which thus seems to be stamped upon them, that they have always been regarded with more or less of superstition and dread. The poets of almost every age have employed them as the emblems of all that is dark and terrible, and in the popular imagination they are ever ranked with those ill-omened creatures and "chimeras dire" which excite the feelings of loathing and horror. That it is especially the wings of the Bat which have procured for it a place amongst these proscribed and hated creatures may be inferred from the fact that those organs are always taken by the artist as the type and model of the wings of the ministers of evil, as those

of the dove are taken for the wings of the angels of mercy. It is evident, however, that the constant association of the tribe with gloom and darkness, with crumbling ruins and dismal caverns, and their frequent occurrence amongst the abodes of the dead, have all contributed to give strength and permanence to these feelings, and to render the entire race the objects of special aversion to the majority of mankind.

And yet, with the exception of some of the larger kinds, which were utterly unknown until long after these feelings were current, the whole tribe is not only innocent and harmless, but the means of positive good. They check and keep under the teeming abundance of insect life, and thus tend to preserve that balance of nature which the Creator has rendered indispensable to the sustentation and enjoyment of the various races of his dependent creatures.

CHAPTER XII.

A MONOGRAPH OF THE MONKEY TRIBE—BUSY APE—MEDDLING MONKEY.

Somebody has somewhere said that Monkeys were sent into the world to correct the follies of men. Exception may be taken to the notion, perhaps, but a great deal may be said in its favour. Our hairy friends are certainly great adepts at all sorts of mimicry, and caricature many of the foibles, failings, and petty villanies of the lords of creation to perfection. We have lately been observing their ways in our favourite haunt, the Gardens of the Zoological Society in the Regent's Park; and after spending some hours among the usual throng of holiday folk, we came away, musing whether, in good truth, an attentive study of Monkey life would not go far to compensate for the want of that great desideratum, the gift

"To see oursel's as ithers see us."

Assuredly

"It wad frae mony a blunder free us,
And foolish notion;"

and, we may well add,

"What airs in dress an' gait wad le'e us,
And e'en devotion?"

Then there is this further to be said, that Monkey moralists administer their reproofs with such perfect temper and so much of drollery, that the most incorrigible offenders would certainly be moved, if not mended, by their dumb-show admonitions.

We have ourselves an especial predilection for the Monkey race. It dates far back, from the time when, as "little Trotty," we were charged with the important trust of carrying the weekly halfpence to the street-door for the organ-man, who regularly came his round with a red-frocked, bespangled Monkey that

rode in state on a great white dog, and always went through his performance for the special behoof of us youngsters in front of the parlour window. Ah! what a monkey that was! there are no such monkeys now-a-days. How he danced, and waved about his plumed cap, and played on a tambourine, and fought his master with a sword, and fired off a pistol; and how we all laughed when the sly old dog would make a snap at a piece of bread pitched to him, and tumble off the Monkey from his back in the middle of the performance! But where is that Monkey now? and the organ-man? and the old dog, too? They are all gone. They have been their last round, have finished their last performance, put aside organ, tambourine, frock, and feathered cap, and quitted the scene long ago—for ever.

Italian organ-men with trained Monkeys, travelling menageries with well-stocked Monkey-cages, and zoological gardens with commodious and nicely kept Monkey-houses, are all very well; but properly to appreciate the Monkeys, one has need to see them in their own proper homes, gambolling in merry troops among the wide-spreading branches and the dense foliage of tropic woods, where the peculiarities of their structure beautifully harmonize with the conditions by which they are surrounded. We have never seen them thus ourselves yet; but of course we mean to do so—that is, when we have accomplished a few other little projects of the kind previously determined on, including a summer tour in Iceland, a trip to Lake Ngami, and a voyage with one of the sperm-whalers in the South Seas. Meanwhile, however, we have been acting the part of a stay-at-home traveller, and have made our acquaintance with the Monkey world through the pages of those who have been beforehand with us in the matter of travelling. And really it is no bad way of doing the business after all; for with the assistance of such writers as Humboldt, Darwin, Waterton, Schomburgh, Wallace, and others of that class, one can travel the world over without budging from his own door, and have this additional advantage, of everywhere seeing things as they are, with the keenest eyes and the most discriminating knowledge. One meets with none of the surprises and the excitement of actual travel, it is true, in this sort of book-wandering; but neither do you experience the pleasures of sea-sickness, get stung by mosquitoes, shiver with ague, go mad in a raging fever, or stand in dread of being roasted

alive, to make a hot supper for some of those horrible "cannibals that each other eat, the anthropophagi." There's a compensation in all things, and in this question of study-table *versus* steamship, buffalo-waggon, mule's back, Indian canoe, palanquin, &c. &c. &c., much may be said on both sides.

But to return to the Monkeys. We said that we have never seen them at home in their own woods. It will be understood that this statement is to be taken in its gross material sense only, not otherwise. Mentally, we have seen them, scores of times, and in very various circumstances. We have seen them sitting languidly in the hot sun, amongst the groves of mango-trees that grow around Buddhist temples and quiet Hindoo villages, where the Monkey is a sacred being, and no man's hand molests it; we have seen them, wrathful and vindictive, uttering harsh cries, and gnashing their teeth with foaming passion, as they have fled from well-armed hunters, pursuing them with deadly hatred among the steep rocks of their mountain fastnesses in Southern Africa; we have seen them, huge, hideous, and formidable, sweeping along, with flying leaps, amongst the dense woods and the swampy forests of Malacca and the islands of the Indian Ocean; swarming in chattering troops amidst the rank and luxuriant vegetation of the Senegal and the Gambia; and in the gloomy depths of those same forests traversing the ground in formidable gangs, ready to make war on man or beast. We have seen them, again, as we have glided down the great forest rivers of the New World, now peering at us furtively with their bright and searching eyes from behind the broad-leaved plantains on the banks, now bounding off into the thickets from the over-hanging boughs of the mangrove-trees, while toucans and aracaris still yelped and screamed overhead, and bright green and scarlet parrots swung themselves in the sunlight on the topmost branches. In short, we have tried, though maybe we have not succeeded, to get a sight of the Monkeys wherever there were Monkeys to be seen; and now, having accomplished that part of our task, we propose, with the permission of our readers, forthwith to marshal the tribe in due order before them, and pass it, company by company, in brief review.

No one needs to be told that the Monkey tribe includes other animals than those popularly known as Monkeys. Apes and Baboons belong to the tribe equally with the Monkeys properly

so called, as well also as another race of animals but little known by most people, named Lemurs. These four races, then, Apes, Monkeys, Baboons, and Lemurs, form together what we have termed the Monkey tribe, but what in the language of zoology, is the order *Quadrumana*, or animals with four hands.

Nature, however, is not to be tied down by a name, and breaks out into irregularities quite incompatible with the arbitrary distinctions of her expounders. There is no such order as that of *four-handed* animals. The hand, that marvellous instrument and ready servant of the will, is the possession of man alone. The most highly developed of the so-called "hands" of the Monkeys, those of the Orang and the Chimpanzee, fall immeasurably short, in point of mobility and variety of endowment, of the human hand, of which Sir Charles Bell has written so eloquently; while, in one large section of the Monkey tribe, the opposable thumb is entirely absent from the fore pair of limbs. The extremities of the whole tribe are rather to be regarded as more or less perfectly formed *grasping feet*, instead of hands, and, in accordance with this view, the term *Cheiropoda*, or hand-footed, has been proposed as a more appropriate designation for the order than that by which it is now distinguished. But the terminology of science once agreed upon, is like the laws of the Medes and Persians, unalterable; and, remembering that the term is used with a licence, we must still speak of the whole Monkey tribe as the *Quadrumana*.

Apes stand at the head of their order, and on the "development" principle are to be regarded of course as our own immediate zoological progenitors. And there are these weighty arguments in favour of the doctrine, that, like ourselves, the Apes have no tails; they can walk almost erect, are addicted to the use of walking-sticks; and, though amiable and docile enough in youth, are apt to become excessively crusty and perverse in old age. If this be not enough to convince the reader that his remote ancestors were indubitable Apes, he had better read Mr. Darwin's "Origin of Species," where he will find that the transformation of a Monkey into a man is a mere nothing to the wonders that can be brought about by "natural selection" in the "struggle for existence." Geographically, the Apes have their head-quarters in the extreme south of Asia the peninsula of Malacca, and the great islands of the Indian Ocean; though two of their number

and the most anthropoid or man-like of the whole, are found only on the west coast of Africa. The Monkeys proper of the Old World have long tails, which they use, when coursing along in their forest haunts, as a tight-rope-dancer does the balancing-pole; cheek-pouches, in which, as who does not know, they can stow away unlimited quantities of nuts and other forest fare; and bare patches on the posterior portions of the body—callosities, as they are termed, not elegant in appearance, and suggestive of too great devotion to sedentary occupations. The Baboons, which come next in the descending series, are the churls of the Monkey tribe. They are for the most part morose, unintelligent, ill-humoured brutes, vindictive, and ferocious to a degree. They have callosities, cheek-pouches, and short stumpy tails. They go on all-fours, live among rocks and mountains, and are confined almost exclusively to Africa. American Monkeys have neither callosities nor cheek-pouches; they are, moreover, invariably destitute of opposable thumbs on the fore-hands, though they are very generally compensated for this deficiency by the extraordinary endowments of their well-developed tails, which act as a fifth organ of prehension, and not only assist the animals in their arboreal evolutions, but are also employed in procuring food. The Lemurs are a peculiar race of animals, occurring only in Madagascar, which, though not very Monkey-like in general appearance, are associated with the Monkeys from having opposable thumbs on all four of their extremities. They are strictly arboreal in habit, and move about with noiseless sweeping motions only in the dead of night, whence it is that Linnæus bestowed upon them their alarming cognomen of Lemurs, or *ghosts*.

But generalities are apt to deceive: let us take a nearer view of the subject.

And in the first place it is worth while to note in what a strange and remarkable manner the Monkey tribe are linked on, so to speak, to the lower sections of the animal world. They are united in this way to two distinct orders—on the one hand to the Bats, which stand next below them in the scale of creation, and on the other hand to the Rodents, such as the Squirrel and the Rat.

The union between the Monkeys and the Bats is marked by that curious animal the Galeopitheeus, or Flying Lemur, an animal about the size of a Cat, and which, although now admitted

to be a member of the Monkey tribe, is yet in some respects so Bat-like in form and habits, as to have been ranked with those animals by the illustrious Cuvier himself. In general form and appearance the Galeopithecus does not differ greatly from the rest of the Lemurs; its peculiarity consists in that its limbs are all connected by a remarkable expansion of the skin between the fore and hind legs and tail, extending completely round the body and forming when expanded a sort of parachute, which enables the animal to take immense flying leaps from branch to branch in its forest haunts. The Flying Fox, Flying Cat, or Flying Lemur, as the animal is indifferently called, is, like the ghostly fraternity to which it belongs, strictly nocturnal in its habits; but, as if to demonstrate its Bat-like affinities, during the day it hangs itself up by its hind legs and with its head downwards, precisely as is done by the Pteropus, with which it is popularly confounded. There appear to be two distinct species of these singular creatures, natives of the Indian Archipelago, and they form an unmistakable connecting link between the two tribes to which they seem so closely related.

Let us look now at the link that connects the Monkeys with the Rodents.

It is an animal about the size of a Hare, found in Madagascar, which from the cry it utters has been named the Aye-Aye (*Cheiromys Madagascariensis*), and which until of late years has been known to naturalists from a specimen brought to Europe by Sonnerat towards the close of the last century. The teeth of the Aye-Aye are almost exactly like those of ordinary Rodents, as the rabbit, squirrel, rat, consisting only of molars and incisors, or front and back teeth, with a vacant space between; the incisors moreover being destitute of enamel on the inner surface, so that the natural wear of these teeth always preserves them of the regular chisel form characteristic of the animals to which in this particular it is so nearly allied. On account of this peculiarity of the dentition of the Aye-Aye, Cuvier placed the animal amongst the Rodents as its nearest allies. It is now generally conceded, however, that the shape of the animal's head, the character of its extremities—their being furnished with partially opposable thumbs, and the rotatory power of the bones of the ore-arm, alike show that, notwithstanding the aberrant character of its dentition, its proper place, zoologically as geographically, is

amongst the Lemurs, and that it is therefore really and truly a member of the Monkey tribe.

An interesting account of the habits of this hitherto little-known animal has recently been published in the "Proceedings of the Zoological Society," from the pen of Mr. H. Sandwith. It appears that the food of the Aye-Aye consists of fruits and insects, particularly of wood-eating larvæ, which it exhibits great ingenuity in discovering and withdrawing from their holes. Mr. Sandwith was led to infer that the animal fed on this latter description of food from observing the curious way in which it climbed about the chairs and tables, every now and then pausing to tap the wood with its second finger, and then listening attentively, and carefully observing the spot. On some worm-eaten branches of a tree being put into its cage, the animal climbed upon one of them and began to examine it very carefully; it then inclined its large round ears forward, and applying its nose to the bark, it struck at the wood repeatedly with its long wire-like second finger, just as the woodpecker strikes the tree, though with much less noise. Occasionally it would introduce the tip of its finger into the worm-holes as a surgeon would his probe. At length, coming to a part of the branch where some sound was evidently heard, it began tearing off the bark with its strong teeth, and then cutting away the wood, it soon exposed the hole of a worm, which it delicately extracted with its wire like-finger and conveyed to its mouth.

The Aye-Aye is a timid and inoffensive animal, concealing itself by day, and coming abroad only by night. It is covered, like most of the Lemurs, with a thick coating of fur; and it is furnished with a long bushy tail, like the Squirrel, though, unlike that animal, it seems never to carry its tail erect, but always to keep it trailing behind.

The true Lemurs need not detain us long. They differ from the Monkeys properly so called in the form and contour of the head and body, which is exceedingly fox-like; but their true position is shown by their possession of opposable thumbs on all four extremities, in this particular being, as we shall find, more Monkey-like than some of the true Monkeys.

For example, here next in order above the Lemurs stand the American Monkeys, in which the thumb of the fore-hand is never opposable to the fingers. Our comprehensive term *Quadrumana*

is wholly at fault therefore here; these American Monkeys being in so far as hands are concerned not *quad*rumanous but *bi*manous, that, however, being a designation, which, as a scientific term, is restricted exclusively to the human race. The Monkeys of America are all confined to the southern half of the continent, and even there do not extend beyond the twenty-fifth parallel of south latitude, being chiefly restricted to the countries drained by the Orinoco, the Amazon, and their tributary streams. Almost the entire area over which they are thus distributed is covered with dense and almost impenetrable forests, which, we are assured by Humboldt, are in many parts so thick and uninterrupted, that, were it not for the intervening water-courses, the Monkeys, the principal inhabitants of these regions, might pass along the tops of the trees for hundreds of miles together, without touching the ground.

In these "vast contiguities of shade" the most perfect silence reigns by day, broken only by the occasional scream of a parrot, that rings through the stillness of the forest, or the rustling overhead of some Monkey disturbed in his dreams amongst the crowded foliage. The animated tribes sink to rest, and all nature seems to pant and perspire in the fierce sun-glare, which pours down upon the impervious roof of foliage, and makes the atmosphere tremulous with vapoury exhalations. But at nightfall these same forest solitudes are vocal with a "barbarous dissonance" of sounds, in which the cries of birds, the croaking of frogs, the loud chirping of cicadas and crickets, and the scream of the jaguar, combine in wildest discord; while, high above all other noises, sound the terrific calls of the Howling Monkeys, than which, according to Mr. Waterton, nothing can sound more dreadful.

The nearest approach to the Lemurs among these American Monkeys is seen in a singular little creature discovered by Humboldt, known as the Douroucouli (*Nyctipithecus trivigratus*), and which in some respects is not a little cat-like in its behaviour. It has a large round head, and very large eyes with white eyelids, which give it a peculiar owl-like appearance. The tail of the Douroucouli is long and covered with hair, but is not prehensile. The animal is strictly nocturnal in its habits, hiding itself by day in holes and fissures, where it remains buried in profound sleep till the approach of dusk, when it shakes off all

its lethargy, and becoming restless and impetuous, roams about in quest of fruit and insects and small birds. Its nocturnal cry is loud and sonorous, and resembles that of the jaguar, whence the animal is sometimes called the *Titi tigre*. At other times it mews like a cat, and this resemblance is greatly increased, when in a state of irritation the Douroucouli puffs up its fur like a cat attacked by a dog, hisses and spits, and strikes quickly with its paws. The glossy fur of the animal is in great request amongst the natives of Guiana and Brazil, who make it into tobacco pouches and other articles for sale.

Foremost amongst the Quadrumana of this wide wilderness of the New World, stand the Spider Monkeys, so called from their being, like the long-legged spiders of our gardens, all legs and arms, to which, however, in the case of the Monkeys, we must add, and tail. From the extraordinary length of the limbs of these Monkeys, their movements on the ground are somewhat sprawling, but amongst the forest branches they are perfectly at home, and by means of their prehensile tails perform their evolutions with wonderful ease and rapidity. The tail is in constant requisition, and is coiled round branch after branch as the animals move along. Not unfrequently, indeed, these Monkeys suspend themselves exclusively by the tail, and by this means launch themselves from one branch to another with surprising velocity. They also use it as a feeler in their search after eggs and insects, inserting it into fissures and hollows of trees, and hooking out with it whatever spoil they may chance to find.

According to Dampier, when a troop of these Spider Monkeys have occasion to cross any of the larger rivers, they select the situation in which the trees are highest and project farthest across the stream; then mounting to the topmost branches, they grasp hold of one another's tails so as to form a long chain, which hanging loose at the lower end is swung backwards and forwards till it acquires a sufficient impetus to carry the free extremity to the opposite bank, when the Monkey at the bottom catches hold of the first branch that comes within reach, and mounts to the top of the tree, carrying with him the living chain, of which he forms a part, which, when he reaches the top, is detached from the other end, and the whole troop are passed over.

In captivity the Spider Monkeys are remarkably gentle and docile; and as they readily assume the erect attitude, and can

walk in this position better than any of the other long-tailed Monkeys, they are sometimes turned to account. Acosta, in his "History of the West Indies," mentions a curious case of the sort in one of these Monkeys which belonged to the Governor of Carthagena. The Monkey in question was the Quata (*Ateles paniscus*), and it had been so thoroughly domesticated that it was regularly sent to the tavern for wine, the pot being put into one hand and the money in the other; and so well up to his business was the Monkey, that the people at the tavern could never get the money out of his hand until they had given him his potful of wine. Nor was this the only piece of sagacity he displayed on these errands. The children would sometimes throw stones at him on his way home, when, says Acosta, "he would set his pot down and cast stones against the children, till he had assured his way, when he would return to carry home his pot." But what is still more to his credit, "although he was a good bibber of wine," he would never touch what he carried till leave was given him.

Next to the Spider Monkeys come the Howlers, whose contributions to the nocturnal concerts of the American woods we have noticed. These animals are distinguished by the robustness of their build, the possession of a thumb, though not opposable, on the fore-hand, and by a peculiar conformation and enlargement of the bone of the tongue, which enables them to utter those loud and discordant howlings whence they derive their popular name. These peculiar and, to the uninitiated traveller, appalling cries, are not merely uttered at daybreak and evening and throughout the night, but when a thunderstorm is approaching, or any considerable changes are taking place in the electrical condition of the atmosphere; even at midday they may be heard resounding through the woods. It is during the darkness of night, however, that these dismal howlings strike with such terror on the ear of the traveller, as they are then raised with an extraordinary volume and intonation, so that, as Mr. Waterton remarks, "one would suppose that half the wild beasts of the forest were collecting for the work of carnage." The animals themselves are gloomy and morose, and by no means active in their general movements. They are prehensile-tailed, like the preceding group, and when shot among the trees, often remain suspended long after they are dead. The Howlers being more fleshy than the

The Governor's Monkey.

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other Monkeys, are great favourites with the Indians as an article of food; but they have so much the appearance of diminutive members of the human family, that Europeans for the most part decline to touch the dainty fare.

The Howlers are the largest of the American Monkeys, and in some districts they are also the most numerous. On the borders of the Apure, Humboldt frequently counted as many as forty on one tree, and in some parts of the country he says that as many as two thousand may be found in a square mile.

We now turn to the Baboons, the most sullen, ferocious, and unloveable of all the Monkey tribe. Though belonging properly to Africa, one species extends its range eastward to Arabia, and another northward to the Rock of Gibraltar; this latter being the only member of the Monkey tribe indigenous to Europe.

All the Baboons are robust and powerful creatures, and in their form and aspect make an approach to the carniverous animals; their generic name, *Cynocephalus*, or Dog-headed, indicating their resemblance to the canine family. They are mostly found in rugged mountainous districts, where they climb about among the rocks and precipices with great facility, and procure their miscellaneous fare of berries, bulbous roots, eggs, insects, and scorpions; which latter they find in great abundance amongst the loose stones, and, first dexterously nipping off the sting, swallow alive. That modern Nimrod, Captain Gordon Cumming, relates, that, during his wanderings in South Africa, he once entered a rugged mountainous region, where he found whole colonies of Black-faced Baboons, which, astonished to behold such novel intruders upon their domain as himself and his party, leisurely descended the craggy mountain sides to have a nearer inspection of them. Having thus satisfied their curiosity, the captain says they seated themselves together upon a broad ledge, and "seemed to hold a council as to the propriety of permitting us to proceed further through their territories." What further happened we are not told. The great hunter is evidently as chary of his sentences as of his powder over such mean game; he will spend them on nothing less than elephants and hippopotami, and "man-eater" lions.

The huge Mandrill (*Cynocephalus mormon*), or ribbed-nose Baboon, the largest and most ferocious of its race, is a native of the western coast of Africa, where it associates in large troops,

which occasionally make incursions into the villages and cultivated fields, and plunder them with impunity. The male is readily distinguished by its enormously swollen and protuberant cheek-bones, which are marked obliquely with deep furrows, and bright and variegated colours. Some years ago there was a very fine specimen of this Baboon in the travelling menagerie of the late Mr. Wombwell; and on one occasion we remember to have seen it break out into a sudden and ungovernable tempest of passion, foaming and quivering with rage, for no other reason than that one of the keepers made a feint of throwing his arms around a young woman who was standing before its cage. Such exhibitions are characteristic of this animal, and more or less so of all the Baboons.

Passing by the Gibraltar Baboon, from time immemorial the "ape" of the showman, the Drill, and the Derrias, the Baboon of the ancients, we must say a word or two about the Chacma (*Cynocephalus porcarius*), the Blackfaced Baboon of the Cape. These animals are well known to the farmers of South Africa, from the depredations they commit on the cultivated districts, and are not unfrequently tracked home to their mountain retreats by the exasperated boors. When the Chacma is surprised in this manner, the cry of alarm is raised, and the whole troop betake themselves to the rocky cliffs, which, though often several hundred feet in perpendicular height, they scale with surprising agility, the young ones clinging to their mothers, and the old males bringing up the rear. The old male Chacma is an animal of enormous strength, and is not to be meddled with with impunity by either dogs or men. In captivity, it is good-tempered and frolicsome while young, but as age advances it becomes savage and dangerous. It is of one of these Baboons that Le Vaillant has given so amusing an account in his African travels. *Kees* was a young animal, and was still graced, therefore, with the juvenile amiability of his race. He was a universal favourite, but thoroughly deep and wily, and moreover shockingly addicted to pilfering. Food mysteriously disappeared when meals were being prepared, and of course Kees was either not to be found, or else stood by with elevated eyebrows, wondering with the rest where the missing provender could have gone. He had gained a perfect ascendancy over his master's dogs, and, with the exception of one of them, whose cunning was more than a match

An Inveterate Dram-Drinker Cured.

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for his own, would compel them to carry him for hours together, when he felt himself fatigued, on their frequent hunting and shooting excursions. Like many people of more rational pretensions, Kees had his taste greatly perverted by civilization, and could drink off his glass of brandy with the gusto of an accomplished toper. Of this little weakness, however, his master effectually, though unintentionally, cured him in a very amusing manner. Kees had just received his share of spirits, and was stooping down to drink it out of the plate in which it was usually given to him, when Le Vaillant, who was sealing a letter at the time, adroitly introduced a slip of lighted paper under his chin. Suddenly the whole plate burst into flame, and the terrified animal, with a yell of indescribable horror, leaped backwards at least twelve or fifteen feet at a single bound, and continued during the whole time the brandy was burning chattering and gazing intently at a phenomenon which he, no doubt, considered of preternatural occurrence. Kees could never afterwards be prevailed upon to taste spirits of any kind, and the mere sight of a bottle was at all times sufficient to frighten and alarm him.

In passing to the next section of the Monkey tribe, we are taken to the southern part of the continent of Asia, and to the impenetrable jungles and the wide-spreading woods of Hindostan. The Monkeys of this division are few in number, but of special interest in a zoological point of view, as marking a transition to the Baboons, of which, indeed, they may in part be considered the Asiatic representatives.

These Baboon-like Monkeys are large and powerful animals, with stout muscular limbs, low foreheads, heavy, elongated muzzles, and short, stumpy tails, closely resembling the true Baboons of the African continent. One of them—the Wanderoo Monkey (*Silenus veter*), a strange-looking creature, with a black face, surrounded by a flowing mane of long white hairs, and which inhabits the dense woods of Malabar and Ceylon—has actually been classed with the Baboons by some writers, while by all it is allowed to occupy a decidedly intermediate position between the two families.

According to Sir Emerson Tennant the word "wanderoo" or "ouanderoo," is a Cingalese word, signifying Monkey generally, and not any one Monkey in particular; and it is in great part owing to this ambiguity of the word that so much misconception

has arisen as to the habits of the Monkeys of Ceylon and the adjacent continent.

Father Vincent Maria gives a very quaint and amusing account of this Monkey, which he describes as quite black, with glossy hair, and a white beard round the chin. "The other Monkeys," he says, "pay to these so profound a respect that they are humbled in his presence as though they appreciated his superiority. The princes and mighty lords hold him in much estimation for his endowment of gravity, capacity, and the appearance of wisdom above every other Monkey. He is readily trained to enact a variety of ceremonies and affected courtesies, which he goes through with so grave a face, and so perfectly, that it is a most wonderful thing to see them so exactly performed by so irrational a creature." No doubt the gravity of this most grave and sapient of Monkeys is greatly enhanced by his snowy beard and whiskers.

The Bhunder (*Macacus rhesus*), another of these short-tailed Monkeys, is a native of India, and is very abundant on the banks of the Ganges, where it is greatly reverenced by the Hindoos. In the district of Cooch Bahar, a large tract of country is considered by the natives as in part the property of these Monkeys; and therefore when they cut the grain they leave a tenth part piled in heaps for these creatures, which come down from the hills, and carry off their allotted tithes. Mr. Johnson, in his "Indian Field Sports," informs us that at Bindrabun, a town near the holy city of Muttra, there are more than a hundred fruit gardens cultivated at the expense of the wealthy natives exclusively for the advantage of these Monkeys; and, as an illustration of the extreme veneration with which they are regarded, he mentions that on one occasion two young European officers, who had thoughtlessly fired at a Bhunder, were pelted with stones by the incensed natives, and, with the elephant on which they rode, were driven into the river and drowned.

The group of Baboon-like Monkeys of which we are now speaking is connected with the more typical Monkeys by a species which, while belonging to the group, exhibits but little of its more characteristic marks. This link in the chain is the Toque (*Macacus radiatus*), one of the commonest inmates of our menageries, and to be seen in every caravan of "wild beasts." Not one of our readers but knows it well, though not perhaps

by name. It is that wrinkle-browed, old-faced fellow that sits hugging and cuddling its companions with such imperturbable gravity before you, and which may often be seen plying its nimble fingers amongst its neighbour's fur, performing the kindly office of hunting down those dapper little gentlemen which, it would seem, are no less annoying to Monkeys than to men. A very "monkey" for its wickedness and inveterate propensity to mischief is the Toque, and, as a matter of course, a prime favourite with the crowd which in all zoological gardens is sure to gather around the Monkey-house. It is this same fellow, if we do not mistake, that Sir E. Landseer has taken for his admirable picture of "Cat's Paw."

The continent of Africa may be properly regarded as the head-quarters of the ordinary long-tailed Monkeys, as the south-east of Asia undoubtedly is of the Apes. In no other portion of the world do the Monkeys swarm in anything like the same abundance; and, what is more, with the exception of one small group, the Monkeys of Africa all exhibit in full development the distinctive characters of the Monkey tribe. All along the coast of western Africa these animals occupy the woods in countless numbers, each species having its particular district of the forest, and promptly uniting in strength to expel from its haunts any intrusive members of another tribe. Man himself is no privileged visitor, for, though mostly of small size, and incapable of doing any harm to the traveller, they still collect around him, and by their chattering and grimace and violent passion, endeavour to deter him from penetrating into their territory. Most of these Monkeys are capricious, petulant little fellows, vivacious and restless, and preserving this disposition even in confinement, always being amongst the most active and amusing inmates of the monkey-cage. The Mona (*Cercopithecus mona*), whose name is supposed to have been the original of our word "monkey," and the beautiful Diana Monkey (*C. Diana*), famous for its silvery "beard of formal cut," and of which it is particularly careful, both belong to this group of monkeys, together with several other less familiar species. By far the most commonly met with, however, is the Green Monkey (*C. sabœus*), to be seen in every menagerie, and a frequent companion of the organ-man. It is a native of Senegal and the Cape de Verde Islands, where they exist in countless multitudes. Our principal knowledge of this

animal in a state of nature is derived from the "Natural History of Senegal," by Adanson, the Scoto-French naturalist, who resided in the country for several years, and diligently studied its productions, both animal and vegetable. At one place, he tells us, he went on shore to divert himself with his gun. "The place was very woody, and full of Green Monkeys, which I did not perceive, but by their breaking the boughs and the tops of the trees, which they tumbled down on me; for in other respects they were so silent and nimble in their tricks, that it would have been difficult to perceive them. Here I stopped, and killed two or three of them before the others seemed to be much frightened; however, when they found themselves wounded, they began to look about for shelter, some by hiding behind the larger boughs, others by coming down upon the ground, others, and by far the greater number, by jumping from one tree to another. Nothing could be more entertaining, when several of them jumped together on the same bough, than to see it bend under them, and the hindmost drop down to the ground, whilst the rest got farther on, and others were still suspended in the air. As this game was going on, I continued to shoot at them; and though I killed no fewer than three-and-twenty in less than an hour, yet not one of them screeched the whole time, notwithstanding that they united in companies, knit their brows, gnashed their teeth, and seemed as if they intended to attack me." A vivid picture that, and of use here; but we wonder whether, while engaged in this excellent "sport," than which, he tells us, he does not think "there ever was better," the good easy naturalist ever thought of the fable of the frogs in the pond.

In the highest group of the Monkeys we find the cheek-pouches absent and the thumb only partially developed. The Monkeys of this division are all natives of India, the peninsula of Malay, and the adjacent islands, and are termed by Cuvier "Slow Monkeys," rather, it would seem, from their listless and apathetic disposition, than from any incapacity for active and vivacious movements. One of the most remarkable Monkeys of the section is the Kahan, or Proboscis Monkey (*Semnopithecus larvatus*), a native of Borneo, and, without question, the most unlovely of all Sir James Brooke's numerous zoological neighbours. Kahan is its native name, and represents the deep-toned cry with which

it swells the concerts of the Bornean woods. The name Proboscis Monkey is derived from its enormously developed nasal appendage, which, wrinkled and pendulous when the animal is unexcited, is immediately, on the slightest provocation, distended, and made to stand out in a huge facial promontory, which gives its owner an expression at once ludicrous and horrible. These animals climb and walk far more deliberately than other monkeys, and in sleeping squat on their hams, like the Dyaks, and lean the head forward on the breast. They associate in large troops, and morning and evening assemble along the borders of the wooded rivers, to gambol among the higher branches of the trees, *holding their noses*, if the natives may be believed, the while they leap from branch to branch. The Kahan has never yet been brought to Europe alive; but the time will come, no doubt, when this veritable Bardolph of the Monkey tribe will find his way to our shores, and figure for a time as first "lion" in the Regent's Park.

Not less interesting than the Kahan, and belonging to the same *un*characteristic section of the Monkey tribe, is the Hoonuman, or Sacred Monkey of India (*Semnopithecus entellus*), which, from the remotest antiquity, has been regarded with extreme veneration throughout a great part of Hindostan. The Hoonuman is one of the largest and most handsome of the Asiatic Monkeys; its general colour is a pale yellow, while its hands, feet, and face are black, the latter surrounded by a circle of long white hairs. The author of the volume on Monkeys in the "Library of Entertaining Knowledge," tells us that "Splendid and costly temples are dedicated to these animals; hospitals are built for their reception when sick or wounded; large fortunes are bequeathed for their support; and the laws of the land, which compound for the murder of a man by a trifling fine, affix the punishment of death to the slaughter of a Monkey. Thus cherished and protected, the Hoonuman abounds over every part of India, enters the houses and gardens of the natives at will, and plunders them of fruit and eatables without molestation; the visit is even considered an honour, and the Indian peasant would consider it an act of the greatest sacrilege to disturb or drive them away. They generally take up their residence in the topes or groves of trees, which the people plant round their villages to screen them from the too ardent rays of the sun; but they are permitted to

occupy the houses in common with the inhabitants, and are described by a late traveller as to be seen by dozens playing on the flat roofs, or perched with much gravity at the open verandahs, to observe the passing crowd."

The natives of India express their veneration for this Monkey in a variety of ways. There is a superstition common amongst them that any one dwelling on a spot where a Hoonuman has been killed, will be sure to die: its bones even are believed to be unlucky; and it is said that no house erected on the land where any of its bones lie concealed can prosper. Hence when a house is to be built, the greatest care is taken to ascertain whether any of these ill-omened bones are concealed in the neighbourhood. Guarded so carefully when alive, and dreaded so much when dead, it is no wonder that the Hoonuman is extremely abundant and seldom comes to harm. The rarity with which one of these animals is seen dead is expressed by a common proverb, to the effect that "He who has seen a white crow, the nest of a paddy bird, a straight cocoa-nut tree, or a dead Monkey, is certain to live for ever."

It will readily be believed that Europeans, having no very pious regard for Monkeys, find the Hoonuman a rather troublesome guest, and sometimes receive his unwelcome visits in a manner which a regard for their own safety prompts them carefully to conceal from native eyes. It would seem, however, that the Hindoos themselves are by no means averse to employing the Hoonuman as a means of working out their evil purposes upon each other. In Dhuboy, where it is said there are as many Monkeys as human inhabitants, if a man wishes to avenge himself on his neighbour for any insult or injury, he takes the opportunity, just before the periodical rains set in, of repairing to the offender's roof, and scatters over it a quantity of rice or other grain. This is soon discovered by the Monkeys, who not only devour it, but pull up all the tiles in search of what has fallen through the crevices. At this critical juncture the rains commence, and as no one can be found to re-set the tiles, the house is deluged, and the unfortunate occupier effectually punished.

Next in order to the Slow Monkeys, and constituting the lowest division of the Apes, come the Gibbons, chiefly distinguished by their slenderness of form, and by the great length of their arms, whence, indeed, they are commonly known as the

Long-armed Apes. All the details of the structure of these animals point them out as being specially designed for the wide-spreading forests of tropic regions, in which alone they are found, and where they display the most astonishing activity. They spend their time almost wholly upon trees, and sweep from branch to branch with arrow-like velocity, sometimes clearing spaces of from thirty to forty feet at a single swing. Suspending themselves by their long arms, they launch their bodies forward, aiming at some distant branch, which they seize with marvellous precision, and again sweep onwards without any pause, and with the slightest perceptible effort. The Gibbons are distributed through Java, Borneo, Sumatra, Malacca, and Siam, associating in herds or troops, occasionally of as many as a hundred or a hundred and fifty individuals; some species frequenting the mountain ranges covered by forests of fig-trees, others keeping to the forests of the plains.

There are several species of these animals, all of which are more or less timid and gentle, and easily domesticated, though they are by no means destitute of courage when at large in their own woods. One of the most characteristic of the tribe is the Agile Gibbon (*Hylobates agilis*), a native of Sumatra, where it is termed the *Wugka-puti*, from a loud and not unmusical whooping call-note which it utters in the early morning in its native forests. The activity of this Gibbon, and the velocity of its movements, are truly wonderful. It escapes from pursuit almost like a bird on the wing; rushing on the slightest alarm to the top of a tree, and then seizing some flexible branch, launching itself forward from tree to tree with a precision and rapidity that speedily carries it to a safe distance.

The largest of the Gibbons is the Siamang, *Hylobates syndactylus*, a bold and powerful animal, confined exclusively to Sumatra, in the forests of which it abounds, making their leafy solitudes resound with its loud and discordant cries. It is much less active in its habits than most of the Gibbons, but fully as gentle and affectionate in a state of captivity. It is said that the female Siamang carries its young to the water, and washes their faces with as much care and attention as a human parent; and further, that the baby-apes are as little fond of the operation, and cry and squeal under its infliction as vigorously, as baby-men.

Dr. G. Bennett has given an extremely interesting account of

one of these animals, which for some time lived in his possession on board ship. It was gentle, but lively and frolicsome, and occasionally rather apt to get out of temper. It became very intimate with a little Papuan girl on board, and would often sit with her near the capstan, its long arms round her neck, the two lovingly eating biscuit together. In his gambols with the child, he would roll on the deck with her, push her away with his feet, then entwine his long arms around her, and playfully pretend to bite. With some Monkeys on board he was equally disposed to be on good terms, but they avoided his company, and to revenge himself he took every opportunity of teasing them, and pulling their tails. One feature in the habits of this animal is peculiarly interesting. He invariably left his play when a vessel passed at sea, and taking up a position on the peak-halyards, would sit there, gazing intently across the waters at the departing ship, till it could no longer be seen.

The Orang-Outang (*Pithecus satyrus*) was long a puzzle to the early naturalists, the great Linnæus himself not excepted. It figures in all the earlier editions of the "Systema Natura" as a veritable wild *man* of the woods, and is described as coming abroad only at night, and conversing in a kind of whistling voice. The Orang is a native of Borneo and Sumatra, in the former of which islands there are two distinct species, one of comparatively small size, timid and gentle, the other a huge beast, standing nearly six feet high, and only found in the deepest parts of the forests. These monsters are much dreaded by the natives, who regard them as having a natural dominion over the secluded depths of the forest, and as being animated by the souls of their own ancestors. Intercourse with Europeans, however, is gradually undermining these superstitions; and it is now no unusual thing to meet with natives nothing loth to go in quest of the *Mias*, —as the Dyaks and Malays name the animal—braving all its terrors, natural and supernatural, "for a consideration."

Since Sir James Brooke has laid his strong hand on Sarawak, Europeans have had comparatively little difficulty in exploring the wilds of Borneo; and, as a consequence, the habits of the Orang are becoming pretty accurately known. Amongst others Mr. Wallace has been upon the track of the monster, and he has since given us a very full and complete account of the private life of this monarch of the Bornean woods. The Orang, it ap-

pears, leads a secluded life, and passes its time chiefly on trees, amidst the higher branches of which it constructs a rude platform or seat of interwoven boughs and twigs, which from below looks very like an overgrown rook's nest. On these lofty seats, the old male Orangs sit listless and apathetic for hours together, and when discovered they exhibit but little alarm, often staring down upon the intruder for several minutes, and then moving away to a short distance. The Orang is naturally sluggish and indolent, and all its movements are characterized by great deliberation. When attacked, the animal climbs rapidly to the higher branches of the loftiest tree near, breaking off quantities of the smaller boughs, and casting them down vertically, apparently for the purpose of frightening his pursuers. In one case, Mr. Wallace tells us, a female Mias on a durian-tree kept up for at least ten minutes a continuous shower of branches, and of the heavy shelled fruits as large as thirty-two pounders, which most effectually kept her pursuers clear of the tree she was on. The old lady could be seen breaking them off and throwing them down with every appearance of rage, uttering at intervals a loud pumping grunt, and evidently meaning mischief.

In making his way through the forest the Orang walks deliberately along the branches in a semi-erect attitude, and coming to a spot where the boughs of one of the adjoining trees intermingle, he seizes the smaller twigs, and pulling them towards him, grasps them together with those of the tree he is on, and thus forming a kind of bridge, swings himself onward, and seizing hold of a thick branch with his long arms, is in a moment walking along to the opposite side of the tree. He never jumps or springs, or even appears to hurry himself, and seldom proceeds much faster than a man can follow, pushing his way through the the scrub beneath. Owing to this circumstance, and to the abundance in which they occur in their native forests, there is no great difficulty in procuring specimens, when once a party is organized to hunt them down. Mr. Wallace shot no less than seventeen individuals during his recent stay in Borneo ; and in 1843 Sir James Brooke shipped, at his own cost, no less than five living specimens for the Zoological Society ; though, unfortunately, the object which he had in view in making his magnificent contribution was frustrated by the accidents of the voyage, the last of the animals dying within sight of the shores of England.

Captain Rodney Mundy, in his work on "Borneo and Celebes," has a good many things to say about the Orang, and amongst the rest, he gives us a spirited account of an Orang shooting adventure. The captain was going up the Sadong river with a party of natives, for the express purpose of seeing the Orang in his own woods. On reaching a part of the stream where the river widens out into a broad forest lake, they suddenly came in sight of one of the gentlemen, quietly seated amid the branches of a tree on the banks of the stream. Startled by the noise, the animal made off before the captain and his party could land; but, immediately they reached the bank, a hot pursuit was commenced, the Orang being seen from time to time, as he slowly passed from tree to tree in advance, while his pursuers struggled on through the jungle beneath. Presently, after crossing a slight ridge of elevated land, the sportsmen were brought up by a dark, deep, ugly-looking swamp, over which the Orang, with outstretched arms, swung himself along. Finding that his pursuers had halted, he stopped too, and from the top of a tree kept up an occasional grunting bark. Not to be daunted, the captain threw off his trousers and shoes, and followed by several of the natives, plunged into the swamp, where he soon found himself struggling up to his shoulders, with the rifle in one hand and the ammunition in the other. As they advanced, the water luckily shoaled to the waist, and they had time to look for the Orang, which was still seated in the position he had at first taken up. The captain and a native chief now fired together at a distance of about forty-five yards, and it was evident that one or both balls had taken effect, for the monster went more and more slowly from one tree to another; while the sportsmen kept loading and firing as fast as their situation allowed, and, wading here and there, enjoyed the full excitement of the sport. The woods rang with shot and the shouts of the Dyaks, who, waving their spears and brandishing their swords, rushed from one spot to another to catch a glimpse of the devoted brute. At length a fortunate shot from the captain's rifle, through the creature's head, brought him from the top of a lofty tree, crashing through the branches, with a heavy splash into the water, and finished the sport. The animal proved to be one of the smaller species, termed by the natives the *Mias rembi*, and measured four feet one inch in length. One of those victims of a somewhat too

eager science, which fell before the rifle of Mr. Wallace, was a female Orang engaged in nursing a young one, which its captor kept alive, and of which he gives the following racy account :—

"The little animal was probably not more than a month old when I obtained it by shooting its mother, with whom it fell to the ground apparently uninjured. I found out afterwards that it had then broken a leg and an arm, which, however, mended so rapidly, that I only noticed it a week or two afterwards, by observing the hard swelling on the limbs where the irregular junction of the bone had taken place. When I first obtained it it was toothless, but a few days afterwards it cut its two lower front teeth. I fed it with rice-water, given out of a bottle with a quill in the cork, which, after one or two trials, it sucked very well. When, however, a finger was placed in its mouth it would suck at it with remarkable vigour, drawing in its little cheeks with all its might, thinking, no doubt, it had hold of the right thing at last, and wondering that all its exertions could get no milk out of it. It would persevere for a long time, till at last it gave up with despair and disgust, indicated generally by a very baby-like scream." It was soon found necessary to give the little fellow a daily washing. "It winced a little, and made ridiculously wry faces when the cold water was poured over its head, but enjoyed the rubbing dry amazingly. For the first day or two it clung desperately, with its four hands, to whatever it could lay hold of, and having once unawares caught hold of my whiskers and beard, it clutched them with its little hooked fingers cruelly tight, and I had considerable difficulty in getting free. It doubtless felt quite at home, being accustomed to cling from its birth to the long hair of its mother."

"When restless, it would struggle about with its hands up to catch hold of something, and might often be seen quite contented when it had some bit of rag or stick grasped in two or three of its hands. At other times it would take hold of its own feet, and, latterly, its constant practice was to cross its arms like a little Napoleon, and with each hand seize hold of the long hair just below its opposite shoulder. I soon found that I could feed my infant Mias with a spoon, and make its food rather more solid. I gave it soaked or chewed biscuit, with a little sugar and egg, and sometimes sweet potatoes. These it liked very much, and it was a never-failing source of amusement to observe the

curious changes of countenance by which it would express its approval or dislike of what was given it. It would lick its lips, draw in its cheeks, and turn up its eyes with an expression of the most supreme satisfaction, when it had a mouthful particularly to its taste. On the other hand, when its food was not sufficiently sweet or palatable, it would turn the mouthful about with its tongue for a moment, as if trying to extract what flavour there was, and then push it all out between its lips. If the same food were continued, it would set up a scream, and kick about violently, exactly like a baby in a passion."

Mr. Wallace goes on to detail the behaviour of his little Orang with a small Hare-lipped Monkey that was given it for a companion and playmate. He also mentions his making an "artificial mother" for the little fellow, by wrapping up a piece of buffalo-skin into a bundle, with the long hair outside—a contrivance which succeeded so well that the poor little creature took it for its lost mother, and tried hard to suck. "It would pull itself up close by the strength of its arms, and try everywhere for a likely place, but only succeeded in getting mouthfuls of wool, when of course it would be greatly disgusted, scream violently, and, if not rescued, would soon let itself fall." One day it got so much wool into its throat that it was nigh being choked, and the "dummy" had to be taken away. Mr. Wallace lost his pet, at length, by intermittent fever, after having had it in his possession for nearly three months.

Next above the Orangs, and, until of late years, regarded as chief of the Apes, and topmost member of the Monkey-tribe, stands the Chimpanzee (*Troglodytes niger*), whom we herewith introduce. It differs from its allies of the Bornean and Sumatran forests most obviously in having a broader and flatter skull, in the smaller proportionate size of its incisive and canine teeth, and consequently of the jaws, and in the comparative shortness of the fore-arms and hands; in all of which particulars it has the advantage of the Orangs in the nearness of its approach to the human form. It is about four feet high, covered with coarse black hair, broad-shouldered, long-armed, somewhat pottle-bellied, and with a wrinkled, semi-human countenance, which is terribly suggestive of some remote affinity to the human family. The name by which the animal is most commonly known amongst the native tribes of Western Africa is Inchego or Engeco, which

by a slight modification has, no doubt, given us our word Jacko, so commonly applied to the whole Monkey race indiscriminately.

The habits of the Chimpanzee in a state of nature are very imperfectly known; and there is good reason to believe that it has been credited, or perhaps it would be more correct to say debited, with many of the exploits of its more terrible and recently recovered ally, to be discoursed of in our next chapter. It is a native of the heavy, dismal forests of the west coast of Africa, where it is pretty widely distributed, and in some districts it appears to be of very common occurrence.

The natives of the country regard them with great dread, and tell the most horrible tales of their ferocious depredations. It is said that their strength is so great, that they break off, with perfect ease, branches of trees that two men could hardly bend; that they build a rude kind of hut for the females and the young to lie in; and that on the death of one of their number, they cover up the body with branches and leaves of trees. They are also described as living in troops, and as giving battle to whatever wild beasts invade their territory: and it is said that even man himself is not safe, venturing into their haunts alone or unarmed. But the most terrible part of the story is that they surprise and carry off young negresses into the woods; and that cases have occurred in which the wretched women have escaped, and returned to human society, after having been detained for years in this loathsome captivity. Most of these statements, it is true, rest entirely on the testimony of the natives; but a case of female abduction came under the personal notice of De la Brosse; and Captain Paine was assured that similar instances had happened on the Gaboon. Lieutenant Sayers, who brought a young Chimpanzee to England from the Bullom country, some years since, says, that on that part of the African coast the woods are infested with them in numbers quite equal to the commonest species of Monkey. "They are exceedingly watchful," he says, "and the first one who discovers the approach of a stranger utters a protracted cry, much resembling that of a human being in great distress. The first time I heard it I was much startled; the animal was apparently not more than thirty paces distant, but had it been but five, I could not have seen it, from the tangled nature of the jungle. The native who was with me laid his hand upon my shoulder, and pointing

suspiciously to the bush, said, 'Massa, baboo live there,' and in a few minutes the woods appeared alive with them. My guide showed evident fear, and entreated me not to proceed any farther." Our brave lieutenant did proceed farther, however, and secured a young "baboo," though not without first shooting its mother.

M. du Chaillu, about whom we shall have more to say by-and-by, puts aside the accounts which the natives give of the habits of the Chimpanzee as mere idle stories, and asserts that though the young consort in companies, the adults are always found alone or in pairs; that the animal builds no sort of shelter for itself, and that it is never known to attack man. He makes known to us, however, two new Apes, which, according to Professor Owen, are to be regarded as varieties of the Chimpanzee—one the Kooloo-Kamba, so called from the peculiar cry which it utters; and the other, the Nshiego-mbouvé, a bald-headed fellow which constructs for itself an umbrella-shaped shelter, of about ten feet in diameter, high up on the lofty trees which it inhabits. Of the Kooloo-Kamba only a single specimen was seen, but the Nshiego-mbouvé afforded M. du. Chaillu better opportunities for the observation of its habits, and he gives a very interesting account of a young specimen which he captured, and which he preserved alive for five months.

The adult Chimpanzee, as may readily be supposed, is no easy matter to capture alive; but young individuals have frequently been obtained and exhibited in this country, though none of them, unfortunately, have reached maturity. We must still look to some Liverpool captain, trading to the Gold Coast, for a full-grown specimen.

CHAPTER XIII.

THE GORILLA.

"On the third day, having sailed from thence, passing the streams of fire, we came to a bay called the Horn of the South. In the recess was an island like the first, having a lake, and in this there was another island full of wild men. But much the greater part of them were women, with hairy bodies, whom the interpreters called *gorillas*. . . . But pursuing them, we were not able to take the men: they all escaped from us by their great agility, being *cremnobates* (that is to say, climbing precipitous rocks and trees), and defending themselves by throwing stones at us. We took three women, who bit and tore those who caught them, and were unwilling to follow. We were obliged, therefore, to kill them, and took their skins off, which skins were brought to Carthage, for we did not navigate farther, provisions becoming scarce."

The Gorilla is the lion of the day. It may be that long before these pages find their way into the hands of the reader, the interest in the monster will in a great degree have abated, and he may have taken his place amongst the Monkey tribe as a huge ferocious Ape and nothing more. But at the time of this present writing, he is pre-eminently *the* lion of the day, and has more than a lion's share of public attention—a subject of sharp contention amongst learned zoologists, and of wonderment to the public at large. He re-appears week by week in the pages of "Punch;" is the theme of nobody knows how many popular songs; is lectured on by Mr. Spurgeon in his huge Tabernacle; and draws crowds of eager sight-seers to inspect his stuffed skin in the British Museum.

Never before, perhaps, has the mere description of the habits of an animal created so marked a sensation. The Hippopotamus and Ant-eater fevers which prevailed some years ago were produced by the actual presence amongst us of the living animals themselves: but, in this instance, with the exception of a few skulls and stuffed skins, with which zoologists have been familiar for some years past, there is nothing to account for the

sudden enthusiasm, but the simple narrative* of one who has seen and hunted the monster in his native wilds. It is true, the same narrative opens up to us a portion of the African continent which until now has been covered with the veil of mystery; and that the region which is thus made known, is alike interesting from the unsuspected nature of its physical features, and the singular character of some of its human inhabitants, who while skilled in some of the arts of civilized life, are at the same time real unmistakeable cannibals, who make no secret of their partiality for human flesh. But these things have contributed to the prevailing interest only as the accessories of the picture. They enable us to see the "Gorilla country;" and the one thing that stands out in the fore-front, arresting and riveting the attention of all, is the figure of this huge and terrible man-like Ape, beating his breast with rage, and scowling horrible defiance at the white man, who now for the first time has penetrated to his dismal haunts.

To the student of Natural History there is a peculiar interest attaching to the Gorilla, from the circumstance that it is an animal which has been recently recovered to science, so to speak, after having been rejected as a mere creation of the fancy.

In the narratives of several of our older travellers there are frequent references to a large and powerful man-like Ape inhabiting the dense forests of Western Africa, which up to the time of Cuvier were generally regarded as indicating the existence in that region of a species distinct from the Chimpanzee, and of a much more formidable character. But the illustrious author of the *Regne Animal* almost contemptuously puts aside the notion of this second and larger species of Ape, and assumes that all the supposed references to it properly apply either to the Chimpanzee or to the Mandrill, both of which, as we have already seen, are powerful animals, and much dreaded by the African tribes. The high authority of Cuvier settled for the time the question of a second species of African Ape, and the suppositious monster was thenceforth banished from zoological science. In the year 1846, however, an American missionary at the Gaboon met with

* "Explorations and Adventures in Equatorial Africa, with Accounts of the Manners and Customs of the People, and of the Chase of the Gorilla, Crocodile, Leopard, Elephant, Hippopotamus, and other Animals. By Paul B. du Chaillu."—Murray, 1861.

a skull, and subsequently a second skull, and a part of the skeleton, of a large Ape, which, on being forwarded to Dr. Savage of Boston, were ascertained to belong to an animal specifically distinct from the Chimpanzee, and considerably larger in size. At length, therefore, all doubt as to the actual existence of such a monster was set at rest: the rejected species was authoritatively re-introduced; and it was forthwith announced to the world as the Gorilla (*Troglodytes gorilla*), and largest and most powerful of the Apes, the first and foremost member of the Monkey tribe.

The name which Dr. Savage bestowed upon the animal is explained by the passage at the head of this chapter from the "Periplus" of Hanno, one of the most curious fragments of antiquity which has come down to our own time. The original, of which only a Greek translation is extant, was written in Punic by Hanno, and is the narrative of a voyage he made, by the order of the Carthaginian Senate, along the African coast, for the purpose of establishing Lybo-Phœnician colonies. This voyage is generally supposed to have been made in the sixth century before Christ, although nothing certain is known, either as to the date of the voyage or the person of the voyager; but whoever Hanno was, and whenever he made his voyage, that he really discovered the "wild men" of which he speaks, there can be no reasonable doubt; and although up to the time when the existence of the second great Ape of Western Africa was clearly demonstrated, it had been customary to regard the Chimpanzee as the animal referred to, Dr. Savage seems to have had no doubt that his newly-recovered monster was the species really concerned; and hence he gave it the name by which it is mentioned in the narrative of the Carthaginian navigator.

In modern times the earliest and most trustworthy of the travellers who make mention of the great Apes of Western Africa is Andrew Battel, and he distinctly specifies two different kinds, the Pongo and the Engeco. Battel was a sailor who was taken prisoner by the Portuguese in 1589, and lived many years in Congo, where it would seem the animals were well known. "The Pongo," he says, "is in all proportions like a man, for he is very tall, and hath a man's face, hollow-eyed, with long haires upon his brows. His body is full of haire, but not very thicke and it is of a dunnish colour. He differeth not from man but in

his legs, for they have no calfe. He goeth alwaies upon his legs, and carrieth his hands clasped on the nape of his necke when he goeth upon the ground. They sleepe in trees and build shelter for the raine. They feed upon the fruit which they find in the woods, and upon ants, for they eat no kind of flesh. They cannot speake, and have no understanding more than a beast. The people of the countrie when they travaile in the woods, make fires when they sleepe in the night; and in the morning, when they are gone, the Pongo will come and seat about the fire till it goeth out, for they have no understanding to lay the wood together. They goe many together, and kill many negroe that travaile in the woods. Many times they fall upon elephants which come to feed where they be, and so beat them with their clubbed fists and pieces of wood, that they will runne roaring away from them. The Pongos are never taken alive, because they are so strong ten men cannot hold one of them; but they take many of their young ones with poisoned arrows. The young Pongo hangeth on his mother's belly with his hands fast clasped about her, so that, when the country people kill any of the females, they take the young which hangs fast upon the mother. When they die among themselves, they cover the dead with great heapes of boughs and wood, which is commonly found in the forests."

It seems not improbable, from some of the circumstances mentioned in this account of the Pongo, that Battel was acquainted with both the Chimpanzee and the Gorilla; but it is evident that, if this were so, he has strangely jumbled together the habits of the two animals, and made up a story which, as a whole, is true of neither the one nor the other.

The supposed references to the Gorilla in the works of travellers of later times are all of such a vague and exaggerated character, that it is impossible to say whether they are mere travellers' tales, fabricated for the purpose of exciting the astonishment and testing the credulity of the readers, or whether they are the mere reports of native tradition. In either case they are altogether unreliable, nor does there seem to have been any real and veracious account of the animal, however meagre, till the year 1819, when it is first mentioned under its native name in the "Narrative of a Mission from Cape Coast Castle to Ashantee," by T. E. Bowditch. In speaking of a visit to the Gaboon,

the author says, "The favourite and most extraordinary subject of our conversation on natural history was the *Ingena*, an animal like the Orang-outang, but much exceeding it in size, being five feet high, and four across the shoulders. Its paw was said to be even more disproportioned than its breadth, and one blow of it to be fatal." It is also described as lurking in the bush to destroy passengers, and as building a house in rude imitation of the native huts, and sleeping outside on the roof of it. It was said to feed principally on wild honey, with which the country abounds.

Although this "Narrative" appeared some years later than the *Regne Animal*, in which, as we have said, the idea of there being a second species of Ape larger than the Chimpanzee in Western Africa was set aside as groundless, it does not appear to have had the least effect in reviving the exploded notion.

The various accounts of the habits of the Gorilla, which have been published since the fact of its existence as a distinct species has been demonstrated, have all been derived indirectly from the natives themselves; and not unnaturally, therefore, they have been received with considerable hesitation and distrust.

One of the most elaborate of these accounts has been compiled by Professor Owen; and the picture which it gives of the monster is of the most appalling character. It is represented as leading a solitary life, or consorting only with its partner and young—the parents being generally seen sitting on a branch, resting the back against the tree trunk and perhaps munching their fruits, whilst the young are at play, leaping and swinging from branch to branch, hooting, and uttering harsh cries of boisterous mirth. If the old male be seen alone, he is said to be usually armed with a stout stick, with which he attacks his chief enemy, the elephant, stealing down upon him unawares from the upper parts of the trees, and striking the sensitive proboscis of the huge animal a severe blow with his club; and thus driving off the startled elephant, trumpeting shrilly with rage and pain.

In passing along the ground from one detached tree to another, he is said to walk semi-erect with the aid of his club, but with a waddling, awkward gait; when without a stick, he has been seen to walk as a biped, with his hands clasped across the back of his head, instinctively so counterpoising its forward projection. If the Gorilla be surprised and approached while walking on the

ground, he drops his stick, betakes himself to all fours, applying the back part of the bent knuckles of his fore-hands to the ground, and makes his way rapidly, with an oblique swinging kind of gallop, to the nearest tree. There he awaits his pursuer, especially if his family be near and requiring his defence.

The enmity of the Gorilla to the whole negro race is of the most determined character; and when the young men of the Gaboon make their armed excursions into the forest in quest of ivory, there is no enemy which they dread so much. If they come upon one of them unawares, he does not, like the lion, sulkily retreat, but advances rapidly to the attack, swinging down to the lower branches, and clutching at the nearest foe. The aspect of the monster at such times is described as most hideous; his green eyes flashing with rage, while the skin over the prominent roof of the orbits, is drawn rapidly backwards and forwards, and the hair erected, causing a horrible and fiendish scowl.

If fired at, and not mortally wounded, the Gorilla is said to close at once upon its assailant, and to inflict the most dangerous if not deadly wounds, with his sharp and powerful tusks. The commander of a Bristol trader informed Professor Owen that he had seen a negro at the Gaboon who was frightfully mutilated by the bite of the Gorilla; and he stated that another negro showed him a gun-barrel which was bent and partly flattened by the bite of a wounded Gorilla, in its death struggle. But the most truly terrible part of the story remains to be told. It is said that the negroes, when stealing along through the gloomy shades of the forest, are sometimes first made aware of the presence of one of these frightful creatures by the sudden disappearance of one of their companions, who is caught up into the tree, uttering perhaps a short choking cry, and in a few minutes after, dropped to the ground a strangled corpse. The Gorilla, seated on the lower branches of a tree, has been watching his opportunity—has reached down his huge hind-hand, seized the passing negro by the neck—has drawn him up in his choking grasp, and now that his struggles have ceased, drops him to the ground. A bold negro, the leader of an Elephant hunting expedition, on being offered a hundred dollars if he would bring back a Gorilla alive, replied, "If you gave me the weight of yonder hill in gold coins I would not do it."

In brief, such is the account which Professor Owen had given

of the habits of the Gorilla; and it will readily be allowed that, whether reliable or not, it was of a character greatly to stimulate the appetite for farther information on the subject.

No wonder, therefore, that a great sensation was produced when, in February last year, an American gentleman, who had actually seen and hunted the Gorilla, and who, moreover, was able to display unmistakeable proofs of his prowess in vanquishing the terrible beast, made his appearance at a meeting of the Royal Geographical Society to tell the story of his adventures. Nor is it at all strange that the appearance of the volume in which these adventures are fully narrated should have excited such a lively interest in all classes of society; for as it has truly been said, "we must go back to the voyages of La Perouse and Captain Cook, and almost to the days of wonder which followed the track of Columbus for novelties, of equal significance to the age of their discovery."

In presenting now a brief *résumé* of the discoveries of M. du Chaillu, in so far, that is, as they relate to the Gorilla, it may be as well to say at once, that notwithstanding the severe criticism to which his book has been subjected, bringing out, as it undoubtedly has, several discrepancies as to the dates of his journeys, and errors of other kinds, we have yet no reason whatever to doubt the general trustworthiness of the narrative as a whole, or those portions of it in particular which relate to the habits of the monstrous Ape with which we are here alone concerned. Backed by the authoritative approval of men like Sir Roderick Murchison and Professor Owen, M. du Chaillu may well be content to disregard the imputations which have been cast upon him, the more especially as he cannot but know that he does but share the common lot of all who have made any large and important additions to human knowledge.

It is only what might reasonably have been expected, that the account which M. du Chaillu gives of the habits of the Gorilla contradicts much that has previously been received on the authority of the natives themselves. In the first place, he dispels what he calls the "agreeable delusion," that the huge beast lurks in trees by the road side, and catches up unsuspicious passers-by and chokes them. He admits that this story is universally believed by the natives, but he regards it as one of the extravagances into which they have been led by the horror of the monster.

It is not true, M. du Chaillu thinks, that the animal lives much or at all on trees, although he believes it often climbs trees to pick the berries or nuts, on which in part it feeds, and for the purpose of breaking which, it is endowed with such enormously powerful jaws and teeth. He almost always found the animal on the ground; and on several occasions he came upon fresh traces of its bed, and could see that the animal had seated himself with his back against a tree-trunk. This, it appears, is the usual habit of the male, and on the back there is generally a bare patch in consequence.

M. du Chaillu again disputes such stories, as, that the Gorilla attacks the elephant—that it carries off women from the native villages—that it builds itself a house of leaves and twigs, and sits on the roof—all of which the natives firmly believe, with a good many other stories to boot; but of the truth of which there is no evidence whatever.

The Gorilla, as M. du Chaillu presents him to us, is a huge creature whose height, when erect, usually varies from five feet two inches to five feet eight inches—covered with iron-gray hair—living in the loneliest and darkest portions of the jungle—preferring rugged heights and wooded valleys, where the surface is strewn with immense boulders. It is a restless nomadic beast, wandering from place to place in search of food, consisting of berries, nuts, pine-apple leaves, and other vegetable matter, of which it eats an enormous quantity, as is shown by its vast paunch, which protrudes before it when it stands upright. Usually, however, the Gorilla walks on all fours; but, the arms being very long, the head and breast are considerably raised, and the animal appears, as he moves along, to be half erect. In walking thus, the back of the fingers, not the palm of the hand, is placed on the ground; and the leg and arm on the same side move together, so as to give the animal a curious waddle. The first sight M. du Chaillu had of the Gorilla was afforded by four young ones, of which he just caught a glimpse as they were running off in this fashion towards the depths of the forest. He fired without hitting either of them; but so fearfully like hairy men did they look as they ran—their heads down and their bodies inclined forward—that M. du Chaillu tells us, he "felt almost like a murderer" in merely attempting to bring them down.

It was not long after this first sight of the Gorilla that the traveller secured his first trophy as the Gorilla Slayer. They came upon the animal in a dense part of the forest, where it was tearing down the branches to get at the fruit and berries; and while they were creeping along in perfect silence, suddenly the woods were filled with a tremendous barking roar:—

"Then the underbrush swayed rapidly just ahead, and presently before us stood an immense male Gorilla. He had gone through the jungle on his all-fours; but when he saw our party, he erected himself and looked us boldly in the face. He stood about a dozen yards from us, and was a sight I think I shall never forget. Nearly six feet high (he proved four inches shorter), with immense body, huge chest, and great muscular arms, with fiercely-glaring large deep gray eyes, and a hellish expression of face, which seemed to me like some nightmare vision,—thus stood before us this king of the African forest.

"He was not afraid of us. He stood there and beat his breast with his huge fists till it resounded like an immense brass drum, which is their mode of offering defiance, meantime giving vent to roar after roar.

"The roar of the Gorilla is the most singular and awful noise heard in these African woods. It begins with a sharp bark, like an angry dog, then glides into a deep bass roll, which literally and closely resembles the roll of distant thunder along the sky, for which I have sometimes been tempted to take it where I did not see the animal. So deep is it that it seems to proceed less from the mouth and throat than from the deep chest and vast paunch.

"His eyes began to flash fiercer fire as we stood motionless on the defensive, and the crest of short hair which stands on his forehead began to twitch rapidly up and down, while his powerful fangs were shown as he again sent forth a thunderous roar. And now truly he reminded me of nothing but some hellish dream creature—a being of that hideous order, half-man half-beast, which we find pictured by old artists in some representations of the infernal regions. He advanced a few steps—then stopped to utter that hideous roar again—advanced again, and finally stopped when at a distance of about six yards from us. And here, just as he began another of his roars, beating his breast in rage, we fired, and killed him.

"With a groan, which had something terribly human in it and yet was full of brutishness, he fell forward on his face. The body shook convulsively for a few minutes, the limbs moved about in a struggling way, and then all was quiet—death had done its work, and I had leisure to examine the huge body. It proved to be five feet eight inches high, and the muscular development of the arms and breast showed what immense strength it had possessed."

It appears that the negroes, with all their horror of the Gorilla, are yet exceedingly partial to its flesh, and on this occasion, after the first expression of delight that the monster had been killed, they immediately began to quarrel about the division of the spoil. The brain is especially valued, and is carefully saved for the purpose of making charms, which, prepared in one fashion, gives the wearer a strong hand for the hunt, in another, finds him favour with the gentle sex.

On one occasion, M. du Chaillu's hunters procured him, to his great joy, a young Gorilla alive. It was a little fellow between two and three years old, about two feet six inches in length, and as fierce and stubborn a little rogue as could well be conceived. The hunters had found him in the forest, seated on the ground, eating berries which grew close to the earth, and a few feet farther off sat his mamma, similarly occupied. The mother was killed, and the youngster, taking refuge in a tree, was afterwards secured, though not until one of the men received a severe bite on the hand and another had a piece taken off his leg. "As the little brute, though so diminutive, and the merest baby for age, was astonishingly strong, and by no means good-tempered, they could not lead him. He constantly rushed at them. So they were obliged to get a forked stick, in which his neck was inserted in such a way that he could not escape, and yet could be kept at a safe distance. In this uncomfortable way he was brought into the village. Here the excitement was intense; as the animal was lifted out of the canoe in which he had come a little way down the river, he roared and bellowed, and looked around wildly with his wicked little eyes, giving fair warning that if he could only get at some of us he would take his revenge."

A bamboo cage was at once got ready for Master Joe, as the young gentleman was named, and various attempts were made to evoke a little amiability, but he continued to the end of his days

a morose, ill-tempered little beast, and utterly ferocious and intractable. Twice he escaped from confinement, and he died suddenly, at last, chained by the neck, by which means alone he could be kept secure.

In its untameable ferocity of disposition, the young Gorilla is a fair type of the full-grown animal; but in respect to courage and daring, it is just the reverse. The young always run off on all fours, shrieking with fear, as also do the full-grown females, especially if they have young; but with the adult male the case is wholly different. When once the hunter has been so fortunate as to come up with his prey, he need have no fear of its running away again. "In all my hunts and encounters with this animal," says M. du Chaillu, "I never knew a grown male to run off." Once the huge beast sees his foe, there is no sign of fear or disposition to retreat; on the contrary, he prepares at once to advance to the attack, and the only alternative of the hunter is to kill or be killed. It is idle to think of escape, and if his gun misses fire, or fails to give a mortal wound, his death is certain. One blow of that huge paw, with its nails, and the poor hunter's entrails are torn out, his breast-bone broken, or his skull smashed. And to make the matter more perilous still, if possible, the hunter dare not fire until the monster is within eight or nine yards of him, the usual shot being from fourteen to eighteen feet only.

The manner in which the Gorilla advances to the attack is very remarkable. Glaring on the hunter with malign eyes, he beats his breast, and lifting up his head, utters his frightful roar, beginning it with several sharp barks, and then rolling out a long deeply guttural roar. M. du Chaillu says, that he has reason to believe that he has heard this frightful roar at a distance of three miles. The horror of the animal's appearance at this time is beyond description—the short hair of the scalp and the skin of the forehead are quickly drawn backwards and forwards—his huge teeth are ground violently together, and his wrinkled face is contorted with ferocious excitement. In this way the animal advances a short distance, and then stops again to utter his terrible roar, and to beat his vast breast, which sends forth a hollow reverberation that may be heard at a great distance. At times he seats himself for a few moments still glaring on his assailant, and beating his breast; and thus stage by stage, in the wildest excitement of passion, scowling with fiendish rage, the

huge beast, erect and defiant, approaches the hunter, who waits in terrible suspense the moment to fire. The vast breast is a mark which, if the hunter is cool, it is not difficult to hit; and when the time comes the gun is quickly raised, and if the shot is fairly delivered, the Gorilla falls. It is a fortunate thing for the hunter that the beast dies very readily, having nothing of that extreme tenacity of life which characterises many wild animals.

It is unnecessary here to follow M. du Chaillu into the further details of his adventures with this enormous Ape, nor is it necessary to enter upon any discussion as to the proper place which the Gorilla occupies in the series of Apes, with respect to the nearness of its approach to the human race. The young reader will probably be content to know that Professor Owen, the king of animals, places the monster at the very top of the list, as the one which makes, on the whole, the nearest approach to the genus homo; but that it is still separated from it by a broad impassable gulf of organic difference. In fine, the Gorilla is a huge ferocious Ape, and nothing more, and is not for a moment to be thought of as having any ancestral connection with the human family.

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