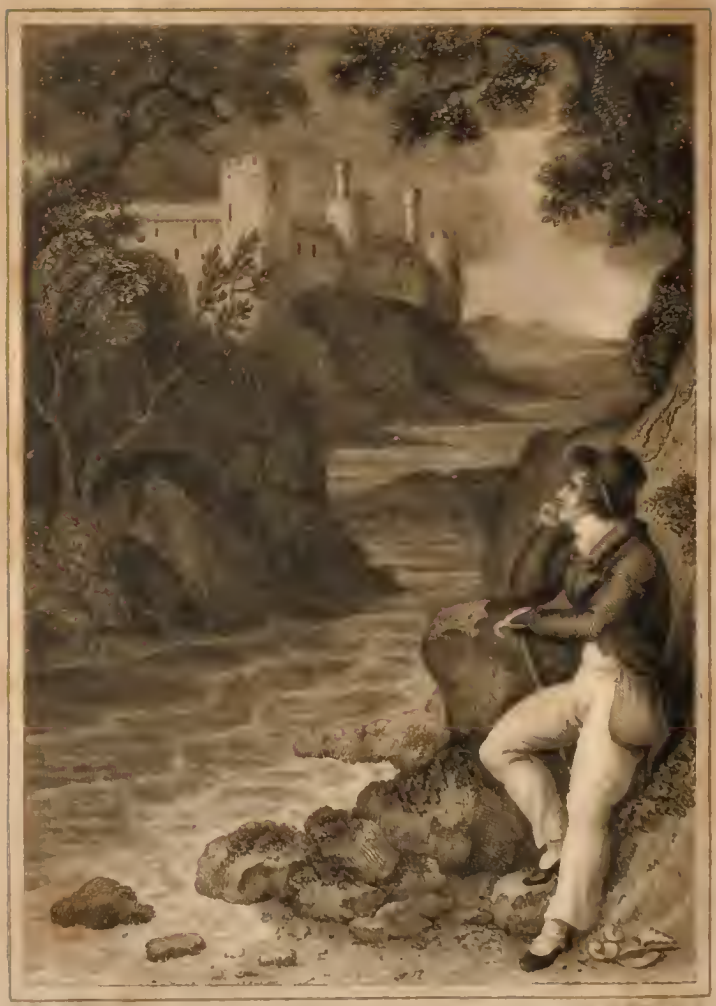
By Mary Roberts

THE

CONCHOLOGIST'S COMPANION.



His thoughts recur to the busy Multitudes who once resorted to the Conway in quest of its valuable gems but whose remembrance has passed away like the billows of the ocean over

P 185

F. H. Wollaston

THE

CONCHOLOGIST'S COMPANION;

COMPRISING THE

INSTINCTS AND CONSTRUCTIONS

OF

TESTACEOUS ANIMALS;

WITH A

GENERAL SKETCH OF THOSE EXTRAORDINARY PRODUCTIONS WHICH CONNECT THE VEGETABLE AND ANIMAL KINGDOMS.

By THE AUTHOR of

"Select Female Biography;" "Wonders of the Vegetable Kingdom;" &c. &c.

For lucre or renown let others aim,
I only wish to please the gentle mind
Whom Nature's charms delight.—*Beattie.*

LONDON:

PRINTED FOR G. AND W. B. WHITTAKER,
AVE-MARIA LANE.

1824.

LONDON:
PRINTED BY COX AND BAYLIS, GREAT QUEEN STREET.

PREFACE.

The following pages have been written amid scenes of tranquillity and beauty, calculated to inspire an ardent love for the admirable works of Nature, with the habit of observing them: or rather they have been carefully selected from different valuable and voluminous productions, in order to furnish a general sketch of the instincts of testaceous animals, and the purposes for which they are designed. They are full of borrowed images, of sentiments and feelings, excited less by my own thoughts, than suggested by those of others. "I have no pretensions to originality:" to be useful is my only aim.

LIST OF AUTHORITIES CONSULTED

IN THE COURSE OF THIS WORK.

Asiatic Researches.

Arctic Zoology, by Pennant.

Catechism of Conchology.

Conchology, Introduction to the Science of, by S. Brookes, F.L.S.

Descriptive Catalogue of Recent Shells, by L. W. Dillwyn, F.R.S., F.L.S., &c.

Dictionary of Arts and Sciences.

Essay on the Theory of the Earth, by M Cuvier.

Encyclopædia Britannica.

Elements of Conchology, by the Rev. E. 1. Burrows.

Memoirs and Tracts of the late Dr. Withering.

Mineralogical Illustrations, by Professor Jameson.

Mawe's Conchology.

Philosophical Transactions.

Polehampton's Gallery of Art and Nature.

Parkinson's Introduction to the Study of Fossil Organic Remains.

Rees' Cyclopædia.

Swinburne's Sicilies.

Travels in Lower and Upper Egypt, by M. Denon.

Wonders of Nature and Art.

ERRATA.

Page	*for*	*read*
2, 6, 7, 102, 159, 192, 228	tentacula	tentaculæ.
—	Leeuwenhoek	Leuwenhoeck
7, 8, 9, 12	Zoophytes and Zoophyte	Molluscæ and Mollusca.
12	Zoophytes	Zoophyta.
15	Gelation	Gelatin.
17	officinales	officinalis.
25, 27, 41, 53, 54	polyferous	polypiferous.
30, 31	nobiles	nobilis.
35	leaves	leave.
49	shew	show.
49	gates the	gates for the.
63	Cypræ	Cypræ
66	appeared as if inlaid	appeared inlaid
76	pholus	pholas.
79	is varied	varies.
86	Multivalve	Bivalve.
96	fishes	insects
96	are	is.
100	hey	they.
107	has	have.
125	nuclæ	nuclei.
136	gems	gem.
155, 162, 165	Multivalve	Univalve.
180	Animalcula	Animalcules.
192	grapity	gravity.
103	obicular	orbicular.
207	creature	creatures.
210	a congerie	congeries.
216	Simpets	limpets.
219	Mollusca	Molluscæ.
229	the change	the slightest change.
229	of slightest fire	the fire.

CONTENTS.

THE

CONCHOLOGIST'S COMPANION.

LETTER I.

HYDRAS AND SEA-ANEMONES.

TO ******.

April 2, 182?.

THE link which unites the vegetable kingdom to the vast world of animal existence is composed of several extraordinary productions, termed *zoophytes*, or plant animals, from their generally existing in the shape of plants. A considerable number are known by the name of Corals and Corallines, and resemble shrubs and trees, though evidently separated from them by their hard and calcareous nature; whilst in others the softness of their texture, and plant-like ramifications, caused them to

be formerly considered as creeping plants.* Among these, the genus *Hydra*, or *Polype*, is equally conspicuous for its wonderful construction and peculiar properties. This interesting genus was so named by Linnæus, from a fancied similarity to the fabulous hydra of antiquity. The principal species are the brown, the yellowish grey, and the green polypes, or the hydra *fusca*, *grisea*, and *viridis* of the Swedish naturalist. They are found in small streamlets and in stagnant water, where they adhere to the floating leaves or stems of aquatic plants, and prey on small worms and insects of various kinds. These polypes are remarkably voracious: they seize their prey with the utmost avidity, and swallow them in the same manner as a snake devours any small quadruped. Their arms, or tentacula, resemble those of the *sepia*, or cuttle fish, and are furnished with a vast number of minute organs, which apparently act as suckers, and enable them to seize and hold any floating insect which passes within their reach.†

Hydras, like many productions of the vegetable kingdom, increase by means of shoots or offsets,

* Rees' Cyclopædia.

† Polehampton's Gallery of Art and Nature.

and one or more branches frequently proceed from the parent stem; these continually throw off fresh suckers, which, in their turn, give life to others, till at length the parent polype assumes the appearance of a real geological tree. How incomprehensible are the operations of nature! The hydra of the fens of Lerna is justly considered a chimera of the imagination; but the hydra of our streamlets possesses its reproductive powers, and realizes the description of the ancient poet. For if one of these extraordinary productions is carefully divided, the upper part will produce a new tail, the lower a head and arms, and the middle both a head and tail. In short, a hydra may be divided in every possible way, and the several portions, like those of the fabulous inhabitants of the Lernian marshes, will quickly reproduce the deficient organs.*

Leeuwenhoek was the first who discovered this remarkable property; but his researches were not carried to any extent, and he remained in a great degree ignorant of the reproductive powers of the hydra. Many years, therefore, elapsed before any fresh discoveries were made; till, in the year 1730, a naturalist of the name of

* Philosophical Transactions.

Trembly, while searching in the neighbourhood of Geneva for some aquatic plants, discovered and brought to light these singular productions. Surprised at the extraordinary formation of a creature which presented the aspect of a plant, while it possessed the motions of an animal, he determined to ascertain its doubtful nature, and was equally delighted and astonished to find, that, on being divided into two parts, each, apparently, remained uninjured by the separation; and that, in the course of a few days, the severed portions reproduced the deficient organs, and eat and moved as before.

The discovery was announced, and at first considered merely as a fable; it was even contended that such a division of animal life was utterly impossible, on the principles of sound philosophy and common sense. But the fact was undeniable: and the attention of every European naturalist was consequently excited by the singularity of the circumstance. Ditches and stagnant waters were accordingly ransacked for their inhabitants, and one experiment succeeded another, till their real nature was completely ascertained. It was also found that the animals of most of the coral tribes, both hard and soft, were closely connected with polypes in their construction and repro-

ductive powers; whilst others, though endued with the same extraordinary qualities, seemed more allied to the *actiniæ* and *medusæ*.

Before we lose sight of these extraordinary productions, it will be interesting to consider the individual structure and peculiar properties of some of the most beautiful *sea anemones*.

This elegant genus is thus denominated from its close resemblance to the flower of this name. It is characterized by an oblong body, and by adhering to rocks and other marine substances. The mouth is situated in the centre of the upper part, and is surrounded by numerous feelers, or arms, spreading in the manner of rays, and disposed in a single, double, or triple series, according to the different species. These, when contracted, present the appearance of an inanimate round mass of coloured pulp; but, when fully expanded, resemble a splendid polypetalous flower. Anemones are of different kinds, and vary infinitely in colour, being either red or green, plain or spotted.

They are generally found adhering by the base to rocks and stones washed by the sea: several are common to the Tagus. Different specimens, taken from this river, were preserved in basins of water, and fed with small pieces of fish.

Their colours, in different lights and shades, were changeable as those of the cameleon, varying to green, red, striped, brown, white, pink, or orange.*

With regard to their individual formation, we observe that one consists of a row of short bead-like prominences, of a bright cerulean hue, and surrounded by a fringe of *tentacula;* of another,† that it is distinguished by a red colour and rough external surface, while the centre or middle part is of the purest white, elegantly marked near the base with numerous carmine streaks; of a third,‡ that it presents the appearance of a long white fig, delicately wrinkled and curvated at the top, like the petals of a carnation; of a fourth,§ that it grows apparently on rocks, and expands its saffron coloured petals in imitation of the stately flower from which it derives its name; of a fifth,‖ that it consists of many tubular bodies of a tender fleshy substance, surmounted by a mouth gently swelling towards the upper part, and surrounded by one or two rows

* Rees' Cyclopædia. Memoirs and Tracts by the late Dr. Withering.

† Sea anemone.

‡ Sea carnation.

§ Sunflower anemone.

‖ Cluster animal flower.

of tentacula, which on contracting assume the appearance of a circle of beads; that the lower extremity terminates like a bulbous root, and that each of the tentacula has a communication with a firm fleshy wrinkled tube, which closely adheres to the rock, and sends forth other tubes, that creep like roots in various directions; and lastly, that on dissecting the stomach of this curious animal-plant, many longitudinal fibres are discovered, lying parallel to each other, and all inserted in the tentacula which surround its mouth, evidently for the purpose of moving them at will.

And does this humble zoophyte indeed possess *a will?* Is it capable of pleasure, and susceptible of pain? Undoubtedly. Those beautiful membranaceous expansions, which resemble the petals of flowers, and are by some conjectured to be breathing organs, by others tentacula, for catching food, close up in stormy weather, and again open to the sun, as if delighting in his beams.

But such is the case with those kinds of flowers which Linnæus elegantly distinguishes by the general name of solars. The effects in both are similar; the causes widely different. In plants, the spiral wires are acted on by moisture,

light, and heat; and thus the petals close and open in accordance with the changes of the atmosphere.* In zoophytes, their beautiful expansions close together, or unfold, according to the wants or inclinations of the animal: for it has been clearly ascertained, that although these singular productions may be preserved for a considerable time in salt water, they will eagerly devour small crabs and shell-fish, when placed within their reach, or borne against them by the action of the waves; and that a sea anemone of one species will even swallow a smaller individual of another. Nor is this all: the testaceous covering of the shell-fish, and the empty armour of the crab, is returned through the mouth of the sea-anemone; but the little zoophyte re-appears in the course of a few hours, and hastens to escape from the fangs of its voracious relative.

Who shall assign a limit to the wonders of creation? Where is the spot on earth, or animal, or plant, or the creature which mysteriously partakes of both their natures, which does not lay open to us unquestionable evidence of the wisdom and benevolence of the Deity? These feeble zoophytes are seen adhering to the rocks, or bedded in the sand, where the foot of man

* Wonders of the Vegetable Kingdom.

may crush them, or the dashing of the waves may break them ; they are not furnished with the means of defence ; nor can they escape from impending danger. God has therefore wonderfully endowed them with reproductive powers ; for it is not His will that any thing which he has made should perish. The smallest portion, if accidentally divided from the parent stem, will progressively increase in size, and at length become a perfect zoophyte. Several species of anemones were recently discovered in Barbadoes, and the variety of their forms and colours having excited considerable interest, and consequent inconvenience to the individual through whose grounds the persons who came to see them were obliged to pass, he resolved to destroy the objects of their curiosity. Orders were accordingly given for this purpose: and, the more effectually to remove the slightest trace of these extraordinary animals, the holes from which they appeared were carefully bored through and drilled with an iron instrument, by means of which they were supposed to be entirely annihilated. Vain, however, were all his efforts : in the course of a few weeks they appeared again.*

* Hughes' Natural History of Barbadoes.

But of what use are these extraordinary productions? The curiosity of the human mind is insatiable. It looks abroad into the fair creation, and sees unnumbered instances of grandeur and munificence. It acknowledges the goodness of the Deity, in giving the sun to rule the day; the moon to guide the night. It confesses his parental care in visiting the earth and watering it; his power in the stormy winds and earthquakes, which fulfil his word; but why are these feeble creatures seen to mingle with so "many trophies of his divinity," who sits enthroned above the heavens surrounded by the immensity of his works?

It is reserved for revelation to solve this interesting question. "Thou art worthy, O, Lord, to receive glory, and honour, and power; for thou hast created all things, and for thy pleasure they are and were created."—*Revelation*, iv. 11.

We cannot indeed fully comprehend the purposes for which many of them are designed; yet they speak a language audible to the ear of reason; and whoever will listen to their instructions, may learn from them a lesson which the proud philosophers of Rome and Athens never taught. They will instruct him to believe that

the same Almighty Being who reigns above the glories of the firmament, "who gives vegetation to every blade of grass, and motion to every particle of blood which circulates throughout the veins of the minutest animal,"* is not forgetful or unmindful of those whom he has placed at the head of his visible creation; and that by an exercise of power, which we can neither describe nor comprehend, "He knoweth our down-sitting, and up-rising, and understandeth our thoughts afar off."—Adieu! I am, &c.

* Chalmers.

LETTER II.

SPONGES.

TO THE SAME.

April 21st, 1823.

Sponges are the habitations of a tribe of animals belonging to the class *vermes*, order *zoophytes;* each of which is characterized in the Linnæan system as a fixed animal, flexile torpid, of various forms, composed either of reticulated fibres, or masses of small spines, interwoven together, and clothed with a gelatinous flesh, full of small mouths on its surface, by which it absorbs and rejects water.

As early as the days of Aristotle these curious marine productions were supposed to possess animal life: the same opinion prevailed in the time of Pliny. Modern naturalists, losing sight of the observations of the ancients, pronounced them to be vegetables, and many extraordinary conjectures were hazarded respecting their probable origin; some assigning them to the animal, others to the vegetable, others again to the mineral kingdom; and not a few imagined that

they were produced by a concretion of sea mud. These opinions continued to embarrass the speculations of the learned till the year 1752, when Dr. Peyssonel actually discovered and described the animals that form four different kinds of sponges, each of which he pronounced to be altogether inanimate bodies, insensible to the touch, or indeed to the undulations of the sea, and formed by the juice or glutinous exudation of the worms which inhabit them.

These curious observations excited the attention of our celebrated countryman, Mr. Ellis. By him we are informed, that if a common sponge is carefully examined in a microscope it will appear to be furnished with galleries, and compartments, which rival in intricacy and number those of the celebrated labyrinths of Crete: the ramified entrances of a marine pavilion, gradually extending upwards, and sending forth branches in different directions, till they at length unite, and form a compound reticulation throughout the inside of the sponge. That the extremities of the upper shoots are furnished with small openings at the ends of their fibres; and that, as we trace these fibres downwards from the openings, a soft whitish substance may be discovered filling the internal

hollow part of the ramifications throughout the whole sponge; which ramifications resemble transparent catgut, of an amber colour, and are undoubtedly the habitations of a particular kind of *vermes*. For, although we cannot distinguish either vesicles or cells, or indeed discover any other kind of organization than that of a variety of hollow tubes inflected, and wrought together into a multitude of agreeable forms,—some branched like corals, or expanded like a fungus,—many rising like a column, others resembling a hollow inverted pyramid, with irregular cavities, entrances, or apertures,—yet from many obvious resemblances to different other kinds of marine productions, as well as from the chemical analyses of sponges in general, we are amply justified in referring them to the class of animal productions.*

In support of this conclusion the ingenious Mr. Hatchett subjected different kinds of sponges to the test of chemical experiment. Those which he particularly examined are the *S. cancellata*, *S. oculata*, *S. infundibuliformis*, *S. palmata*, and *S. officinalis*. When the sponges had been immersed in nitric acid (diluted with three measures of distilled water) during fourteen or sixteen

* Philosophical Transactions.

days, the acid became pale yellow, and was changed to an orange colour by the addition of pure ammonia. A greater or less degree of softness and transparency then succeeded, and in this state, when touched with ammonia, the part thus touched assumed a deep orange colour inclining to a brownish red; and when much softened by the acid (if afterwards immersed in ammonia), the whole fabric immediately dissolved, and formed a deep orange-coloured solution. These sponges, when digested with boiling distilled water, afforded a portion of animal jelly, or gelation, which was precipitated by infusion of oak bark, in consequence of which the sponges became less flexible, and more rigid; and the remaining part crumbled, when dry, between the fingers; or when moist, was easily torn, like wetted paper. In this state we should naturally conclude that they were entirely useless; but no: the operations of chemistry resemble the moving of a magic wand, the sponges are boiled with lixivium of caustic potash, their latent qualities are called forth, and, behold, a deposition of animal soap.

Sponges, when heated in a close vessel, give out an ammoniacal fetid smoke, and are reduced to a black charcoal, which, being burnt to ashes,

leaves a small quantity of common salt and some carbonate of lime. Thus it appears that the principal constituents, according to Mr. Hatchett's experiments, are animal gelly, albumen, a small portion of common salt, and carbonate of lime.*

Fifty different species are assigned by naturalists to this interesting genus, of which a considerable number belong to the British coasts. These curious marine productions vary both in form and colour. The *S. oculata*, or branched sponge, is delicately soft, and branched with rows of small projecting cells on the edges, through which the inhabitants derive their nourishment. It inhabits the British seas, and is from five to ten inches high. The *S. tomentosa* is common to the shores of this country, and abounds on the coasts of North America, Africa, and in the East-Indies. When newly taken out of the sea it is of a bright orange colour, and full of gelatinous flesh; but when dry it becomes white, and when broken resembles bread. If rubbed on the hand it will raise blisters; and if dried in an oven, its power of stinging is considerably increased. The *S. coronata*, or coronet-sponge, presents an elegant

* Philosophical Transactions.

appearance. It is very small, consisting of a single pale yellow tube, surmounted by a crown of little spines, with rays of a glossy ash colour. This beautiful zoophyte is found in Sussex and Hampshire. The *S. botrycides*, or grape-sponge, is composed of small hollow branches resembling grapes, of a bright yellow tint, and the openings at the tops are evidently the mouths by which the animals imbibe and discharge moisture. The surface, when highly magnified, appears covered with little groups of triple equi-distant shining spines: this species inhabit the English coasts.

The *S. lacustris* is creeping, brittle, with round, erect, and obtuse branches. It is found at the bottom of the English and Swedish lakes, and presents a beautiful appearance when seen through a transparent medium, as it is covered with scattered pores, and frequently diversified, in autumn, with small blue and shining globules.

The *S. officinales*, or common sponge, is found in the Mediterranean, where it forms an important article of commerce; and is brought from considerable depths by the inhabitants, who are early trained to the hazardous occupation of

diving. This species is irregularly formed, porous, tough, elastic, full of holes; growing into lobes of a woolly consistence, and adhering by a broad base to marine substances.

It is useful in medicine and in the fine arts; and is also efficacious in stopping the effusion of blood. For this purpose a dry and solid piece of a conical form should be pressed on the vessel, to which it will soon closely adhere, and thus the bleeding of large arteries have been frequently prevented.

You remember the beautiful *S. cristata*, or cockscomb sponge, which grows on the rocks to the eastward of Hastings; the spot where it grew, and the evening when we gathered it:

" 'Twas an evening the loveliest that summer had seen,
The sky was unclouded, the ocean serene:
The sun's setting beams so resplendidly bright,
On the billows were dancing like streamers of light.
There's a soothing enjoyment that pen cannot paint;
There are feelings which own that all language is faint;
And such on that eve to our hearts were made known,
As we mus'd by the murmuring billows alone."

Sponges, when cleaned from the earthy and saline particles which adhere to them, are generally of a brownish yellow colour, soft, light,

and porous, absorbing rapidly by capillary attraction as much as they can contain of any fluid in which they are immersed, and again yielding it when compressed.*

This property occasioned them to be frequently saturated with myrrhed wine, and held to such unfortunate persons as were suffering the dreadful punishment of crucifixion, in order to take away the sense of pain, or to subdue their intolerable thirst, and considerable sums were given by noble Roman ladies for this purpose; to which custom the sacred historian refers in the history of our Lord; but his unrelenting persecutors, instead of offering him the enlivening portion of myrrhed wine, which was rarely denied to the vilest malefactors, "filled a sponge with vinegar, and put it upon a hyssop, and put it to his mouth." The offer of vinegar was considered, among the Jews, as an intolerable outrage to their feelings. It is alluded to in the following passage, which at the same time foretold the future sufferings of the Redeemer of mankind :† "Reproach hath broken mine heart, and I am full of heaviness; and I looked for

* Rees' Cyclopædia.

† History of Jesus Christ, by W. Willan, M.D.

some to take pity; but there was none; and for comforters, but I found none.

"They gave me also gall for my meat; and in my thirst they gave me vinegar to drink." —*Psalm* lxix, 20, 21.

LETTER III.

CORALLINES.

TO *****.

May 1st, 1823.

CORALLINES are some of the most beautiful productions of the deep ; they are closely allied to corals in their construction and probable uses, and are consequently one step higher in the scale of zoophytic life than their immoveable neighbours the rock adhering *spongæ*.

They attach themselves to stones and other solid bodies, and are concretions formed by the polype insects which inhabit them ; the corallines being only the habitation of these animals. They are generally of a plant-like form : hence they were anciently mistaken for a particular tribe of vegetable productions, and noticed under the title of *marine mosses*. The branches are commonly elevated, and exhibit an elegant appearance, from the symmetry and general proportions of their respective articulations, which are subdivided, calcareous, and composed of little joints, like beads strung in a necklace,

which peculiarity easily distinguishes them from the coral family. The joints consist of a calcareous and gelatinous matter, having the surface perforated, or full of minute pores, which in many species are so very small as to be visible only with the aid of glasses. In these minute cells the polypes reside, and through the apertures they either protrude their limbs when they lie in wait for food, or draw their nourishment. When a branch of coralline is immersed in vinegar, the calcareous crust dissolves, and leaves the cartilaginous parts uninjured, by which means its internal tubular structure may be easily examined. In point of colour the corallines differ very considerably, not only in different, but also in the same species; but, without exception, they uniformly become white on exposure to the air.

Corallines are highly ornamental in collections of natural history, and one species is valuable in medicine: this is the corallina officinalis; large quantities of which are annually brought from the Levant. Fifty-seven species belong to this interesting genus; some of which are extremely beautiful, and others of rare occurrence. They vary both in size and structure, for nature is ever prodigal in the profusion of her

embellishments, though singularly frugal in the means of producing them.

" Some present
Large growth of what may seem the sparkling trees
And shrubs of fairy land; while others shine
Conspicuous, and, in bright apparel clad,
And fledg'd with snowy feathers, nod superb."

A considerable number appear like little tufts of green grass floating and trembling in the waves; others resemble bunches of hair-like tubes, varying from a greenish brown to white: a few may be compared to clusters of diminutive beads, and a large proportion to long brown filaments covered with a calcareous crust, by means of which they firmly adhere to shells, rocks and fuci. Each of these is the separate habitation of a constructing agent; and as little or no difference subsists between the formation of coral and corallines by their respective insects, I shall briefly state the accurate observations of modern naturalists with regard to the former.

M. de Peyssonel, of Marseilles, seems to have been the first who threw a proper light upon the nature and production of these marine substances, and his observations have been elucidated and confirmed by the researches of Mr. Ellis.

Those bodies which previous naturalists imagined to be flowers, are ascertained to be insects inhabiting the coral; for upon taking branches of corals or corallines out of the water, the seeming flowers which proceeded from a number of minute points answering to the holes that pierced the bark, resembling in their radiation the flower of the olive-tree, entered into the bark and disappeared; but upon being again restored to the water, they were some hours after perceptible. These flowers, when spread on white paper, lost their transparency, and became red as they dried. The holes in the bark correspond to small cavities upon the substance of the coral; and when the bark is removed, a variety of little tubes become visible, connecting the bark with the inner substance, as well as a multitude of small glands adhering to them: from these glands or tubes the milky juice of coral issues forth, the holes in the bark, as already noticed, being the openings through which the polypes come forth. These curious insects are contained in the tubes; the glandules are the extremity of their feet, and the milky juice, their blood or juice, which is always more or less abundant, in proportion to their health and vigour. This juice or liquor runs along the furrows, which are

perceptible upon the substance of the coral, and gradually becoming hard and fixed, changes into stone, and causes the coral to increase proportionably, and in every direction.

In forming coral and other marine productions of a similar description, polyferous insects labour like those of the testaceous kinds, each according to its species, while their proportions vary in accordance with their several forms, magnitudes and colours. In short, corals and corallines have the same relation to the polypes united to them, as subsists between the shell of the snail, and the snail itself.

These polypes expand in water and contract in air; they express considerable sensation when touched with the hand, or exposed to the action of acids: they have even been seen to move their claws and to expand themselves, when the water which contained them was placed near the fire. A considerable number resemble snails and lobsters; whilst others are slender, and several feet in length. The most common are formed like stars, with arms from four to six inches long, which they move about with great rapidity, in order, as it is supposed, to catch food. Some are slow in their motions, a few exceedingly active. Some of a dark colour, others blue; and others

bright yellow; those of the Mediterranean are frequently red, white, or vermilion. On the coast of Terra Australis, where their numbers are very great, Captain Flinders observed coral insects of all colours, glowing with vivid tints of every shade.*

These polypes are some of the most wonderful productions of the deep. Naturalists have accurately traced the share they take in the formation of corals and corallines; and it is extremely probable, that many marine substances, supposed to be sea plants, are in reality animal productions, formed by polypes of different shapes and sizes for their habitations. Nor is it improbable, that the more compact bodies brought from various parts of the East and West-Indies, and known by the general appellation of star, brain stones, and petrified fungi, are in fact of the same origin.

Adieu! I am, &c.

* Captain Flinders' Voyage to Terra Australis.

LETTER IV.

CORAL.

TO * * * * *.

May 29th, 1823.

THE Gorgonia or Coral is undoubtedly the most curious and interesting of the various productions of polyferous insects. It constitutes a genus of Zoophyte, the stem of which is either coriaceous, woody, horny, or resembling bone; the texture glassy, fibrous, or like stone, striated, tapering, fixed at the base, which is dilated, and covered with vascular or cellular flesh, or bark, of a spongy and friable nature in a dried state; a number of minute cells cover the surface of the stem, and contain polypes.

These marine productions were regarded by the ancients as a class of plants, and described as such by botanists; nor was this idea, however remote from truth, exploded till so late a period as the eighteenth century, when the discoveries of Peyssonel, respecting the nature of coral, and those of Trembley on the hydra, or polype, about fourteen years after, contributed to demonstrate,

in a very explicit manner, that corals, in common with other zoophytes (as these particular bodies are now denominated) do not appertain to the vegetable, but animal kingdom: or are, at least, the fabrication and genuine habitations of the sea-polypi.

Among the various observers of this curious order of animal productions, few, if any, have pursued their investigations with greater discrimination and success than Professor Pallas, our own countryman Ellis, and his friend Dr. Solander. Nor, indeed, can we hesitate to confess that our knowledge of the gorgonia tribe has been enlarged only in a very inconsiderable degree, by any of the subsequent authors on this subject. The latest observations tend principally to confirm the accuracy of those writers, who had before assured us that the gorgoniæ are the habitations of various kinds of polypiferous animals, each of which resides in a distinct cell; that they lie in general dormant or contracted during winter; and, like the blossoms of plants, push forth buds, and expand in their proper season, which is constantly in summer. The stems and branches of the gorgoniæ, which are most commonly of a somewhat horny and flexible nature, may be considered as the true ske-

letons of the nests or habitations of the sea polypi, being covered with a fleshy or pulpy substance, the exterior surface of which is porous. These pores are the mouths or openings of the cells in which the polypes are lodged; and it is the number, disposition, and varied structure of these, in addition to the general aspect of the plant-like nest of habitations, that constitute the most material difference, by which the various species are distinguished; the figure of the animal, when it can be ascertained, forming the secondary, or least important character. It may be lastly observed, that the gorgoniæ differ exceedingly in size; some of them being from one or two, or perhaps three feet in height, while other, in deep bogs, or in marine situations no less favourable to their growth and increase, attain to the gigantic height of ten or twelve feet; and from their number as well as magnitude, their remarkable ramose, and foliated or flabelliform appearance, interwoven structure, and coralline texture, form a conspicuous portion of those vast submarine "groves of coral" which are sometimes seen by navigators in the hottest regions of the globe.

Among the numerous species which naturalists assign to this interesting genus, the Antipathes,

or black coral of the shops, and the nobiles, or red, are best known.

Antipathes of certain kinds were formerly used as sceptres for princes, likewise for divining rods, and other similar purposes; as is evident from the observations of Salmasius, addressed to Solinus; wherein he says, that antipathes denotes something proper to resist incantations, and that they were adopted for that purpose by several Indian nations.

Divination, by means of rods, was one of the fifteen modes of exploring futurity, in common use among idolatrous nations. They are each of them mentioned with strong reprobation in the scriptures, and strictly forbidden as one of the abominations of the heathen.*

The structure of the gorgonia may be readily observed by exposing a branch to the action of diluted nitric acid for nearly four weeks, at the end of which it will appear to consist of strong and closely arranged fibres, forming concentric coats of a pale brown opake substance, drawn in nearly a parallel direction from one extremity of the branch to the other. The acid in which the gorgonia has been steeped then becomes of a pale yellow colour, which changes to orange when

* Ree's Cyclopædia.

ammonia is added; at the same time, so large a quantity of phosphate of lime is precipitated as to render the liquor thick and viscid.

The pieces employed in the above experiment, if boiled in a lixivium of caustic potash, form a dark coloured animal soap.*

The bone of the gorgonia nobiles, or red coral, constitutes that beautiful and much esteemed production, the red or true coral of the jewellers. This coral is a general inhabitant of the Mediterranean, Adriatic, and Red Sea, and appears to be no where more abundant than in the seas about Marseilles, Corsica, Sicily, the coasts of Africa, and in the vicinity of Barbary, the coral fisheries in those parts being carried on with great spirit, and proving highly lucrative. From the observations of Donati, an author who has devoted much attention to this curious subject of inquiry, we understand that the flesh or exterior coating of the coral is of a red colour, varying from bright to paler hues, the tint being uniformly less brilliant than that of the bone or coral itself. The most prevalent colour of the bone is red, exhibiting all the transitions from a pale rose colour to a soft scarlet, and sometimes inclining to yellowish or fine saffron. The coral

* Philosophical Transactions.

of this species is equal in hardness and durability to the most compact marble; and these material qualities, in addition to its beautiful texture and colour, have contributed to render it valuable in the estimation of the world from the earliest ages, as we learn from Pliny and other writers of remote antiquity. Thus, in the book of Job, "No mention shall be made of coral or of pearls; for the price of wisdom is above rubies."

This elegant production is common to the shores of Great Britain; but the finest specimens are brought from the Persian Gulf, Red Sea, Africa, bastions of France, islands of Majorca and Corsica, and from the coasts of Provence and Catalonia. A large fishery also subsists in the Straits of Messina, where the shell collector had lately an opportunity of not only seeing the method employed by the Sicilian fishermen in bringing up the coral; but also La Fata Morgana, that beautiful ærial phenomenon, which the credulous natives imagine to be produced by fairies or invisible beings:

> "That in the colours of the rainbow live,
> Or play i' the plighted clouds."

It was summer, early in July, the morning calm and delightful; the winds were hushed, the surface of the bay remarkably smooth—the tide at

its full height, and the waters elevated in the middle of the channel. The sun had just surmounted the hills behind Reggio, and formed an angle of forty-five degrees on the noble expanse of water which extends before the city. Suddenly the sea that washes the Sicilian shores presented the aspect of a range of dark mountains; while that on the Calabrian coast appeared like a clear polished mirror, which reflected and multiplied every object existing or moving at Reggio, with the addition of a range of more than a thousand giant pilasters, equal in altitude, distance, and degree of light and shade. In a moment they lost half their height, and bent into arcades, like those of a Roman aqueduct. A long cornice was then formed on the top, and above it rose innumerable castles, which presently divided into towers, and shortly afterwards into magnificent colonnades. To these succeeded a sweep of windows; then came pines and cypresses, and innumerable shrubs and trees; in shadier scenes

> "Pan or Sylvanus never slept, nor nymph
> Nor Faunus haunted."

This glorious vision continued in full beauty till the sun was considerably advanced in the heavens; it then vanished in the twinkling of

an eye; and instead of pilasters, groves, and colonnades, the shell collector saw nothing but the mountains of Reggio, Messina, and a beautiful expanse of water, reflecting its cultivated shores, and the cattle that were grazing on its banks.*

A new scene was now presented to his attention. It consisted of a number of boats skimming rapidly over the transparent water, each of which was tipped with vivid light; and a fleet of more than twenty small vessels, with their sails expanded to catch the breeze. They were employed in the coral fishery, which is carried on from the entrance of the Taro to the part of the Strait opposite to the church of the Grotto, or through a tract six miles in length, and to the distance of three miles from Messina. Each vessel was manned by eight men, who separately moored them above a range of submarine rocks, and then proceeded to bring up the branches of coral by means of an instrument formed of two poles of wood, crossing each other at right angles, and having a piece of net fastened on the under side; a large stone having been previously fixed at the points where the poles

* For a further description of La Fata Morgana, consult Travels in the Two Sicilies, by Henry Swinburne, Esq.

cross each other, in order to facilitate the descent of the instrument; and a cord strongly tied round the middle. Each of the fishermen held one of these instruments in his hand, and by the help of a companion, guided the net to those places where the coral was supposed to grow, which was then enclosed in the meshes of the net, broken off, and immediately drawn up.

Some of the branches were completely perforated by lithophagous worms. They had, no doubt, been rendered the habitations of these minute animalcules, either in consequence of having been accidentally broken from the rocks by some marine animal, or else by the nets of the fishermen, which often leaves behind them considerable portions of the ruptured branches. Your friend obtained several beautiful specimens of perfect, as well as perforated coral, from the different boats. He immersed the former in glass vessels filled with sea water, and amused himself with observing the polype insects coming out of their cells, as soon as the little ocean that surrounded them was perfectly at rest.

The rocks which produce the coral are situated almost in the middle of the Strait, at different depths, from 350 to 650 feet; and it is remarkable that every branch is perpendicular to the

plain on which it grows, without ever turning on one side. This curious zoophyte attains to much greater perfection in places situated to the east, than to the south; it is rarely found in such as have a western aspect, and never in a northern one. In the first situation it is larger, and of a finer colour than in the second and third; which two valuable qualities are likewise more conspicuous in such as are brought from a less depth, than in those which grow at a greater. The bay of Messina produces three kinds of coral; the red, the vermilion, and the white. The first is subdivided into the deep crimson red and the lighter red. The vermilion is extremely rare, but the white common. In the white, that of a clear and dull colour is included.

The coral fishermen divide the tract from the entrance of the Taro to the church of the Grotto into ten parts; every year they fish only in one of these divisions, and do not visit it again till ten years are elapsed. This interval is necessary in order to enable the coral to acquire its full growth in height and consistence. When this law is transgressed, the coral appears smaller, and of less consistence; the intensity of the colour being always in proportion to the number of years in which they have desisted from fishing.

The quantity of coral generally amounts in each year to three thousand pounds weight; the gain acquired is therefore adequate to the labour. Yet the fishery is considered a secondary and laborious occupation; and the fishermen only follow it when they cannot obtain a more profitable employment.

Adieu! I am, &c.

LETTER V.

CORAL ISLANDS.

To ******.

June 1st, 1823.

The objects which engage the attention of the naturalist, succeed each other like the moving pictures in La Fata Morgana of the Sicilians. My last letter related to the construction of the Gorgonia, and the method of procuring it; the present will be devoted to the extraordinary manner in which this beautiful production of the ocean is rendered subservient to the formation of reefs and habitable islands.

The coral insect is, indeed, one of the greatest wonders in the creation. Though the feeblest and most imperfect of animated beings, nature employs it in the construction of durable edifices, which she beautifies with flowers, clothes with grass and shrubs, and lofty trees, and renders comfortable habitations for innumerable tribes of animals, and even for man himself.

Of all the genera of lithophytes, the madrepore is the most abundant. It generally occurs in tropical countries, and decreases in

number and variety as we approach the poles. It encircles in prodigious rocks and vast reefs many of the basaltic and other rocky islands in the South Sea and Indian Ocean, and by its daily growth adds to their magnitude. The coasts of the islands in the West-Indies, as well as those on the east coast of Africa, are incrusted or encircled with rocks of coral. Several different species of madrepore contribute to form these extraordinary reefs; but by far the most abundant is the muricated madrepore, *madrepora muricata* of Linnæus. These lithophytic animals not only add to the magnitude of land already existing, but they form whole islands.*

On the west coast of Sumatra their production is extremely rapid. Mr. Dalrymple, in a valuable paper on the coral of Sumatra, mentions some curious facts relative to the subject. He was directed to survey the Dutch district on the coast. During the course of this survey, he had occasion to describe several shoals, consisting of branched coral, and such floating heterogeneous substances as they had arrested in their course, when impelled against them by the united efforts of the winds and waves. These shoals were of

* Cuvier's Theory of the Earth.

various depths below the surface of the water, from one foot to three or four fathoms; of a conical form, the base, in proportion to the axis, being small; resembling in this respect the poplar, or the cypress. One of the shoals was at that time covered by two feet and a half of water, and could not be easily seen, excepting on a sudden swell or agitation of the waves. In five years it had advanced nearly to the surface; and in the course of a short time, emerged considerably above it. The number, extent, and progressive increase of the islands in the Indian seas inclined Mr. Dalrymple to conjecture that they might in the course of time approximate more closely, and form extensive continents and islands; and that if the work of marine production still continued to advance, the existence of the Indian as an entire ocean, might be hereafter esteemed as fabulous as that of the ancient Atlantis.*

Reefs of considerable magnitude also extend upon the coasts of Abyssinia, in the Mediterranean, on the gold coast of Guinea, and on those of China. They are also found in almost every part of the Pacific, covering not only detached parts,

* Asiatic Researches.

but extending several thousand square leagues. The islands in the Red Sea are composed entirely of marine deposits, strongly cemented together, and forming vast and solid masses, which may not improperly be termed rock, the surface being covered in parts only, with a thin layer of soil. These deposits principally consist of corals, madrepores, echini, and a great variety of sea shells.

The work of polyferous insects in the Red Sea is particularly deserving of attention, not merely as a singular fact in natural history, but as concurring with the sands of the Lybian desert to mark the progressive stages in the unceasing march of time. These sands have advanced to a considerable distance along the western banks of the Nile, not sheltered by mountains, and completely desolated its once populous and cultivated shores. In proof of which, M. Denon informs us, in his *Travels in Lower and Upper Egypt*, that the ruins of ancient cities, buried under them, still appear externally, and that nothing can be more melancholy than to walk over villages swallowed up by the sand of the desert; to trample under foot their roofs, to strike against the summits of their minarets, and to reflect that yonder were cultivated fields, that there grew trees, that

here were the dwellings of men, and that all has vanished.

In like manner, the increase of coral reefs has produced an important change in the navigation of the Red Sea. Those parts that were anciently easy of access, are now so nearly blocked up, that vessels laden with merchandize and provisions can no longer enter them and depart, without risk of being wrecked on the shoals, which have risen since the brilliant period of Thebes and Memphis, and are still increasing in extent.

The existence, therefore, of such monuments, attest the successive progress of the encroachments of the sands; and such parts of the bank as were formerly inhabited, will for ever remain arid and waste. It is also evident that the sands of the desert were formerly remote from Egypt; that the *Oases*, or habitable spots, still appearing in the midst of the sands, are the remains of the soils formerly extending the whole way to the Nile; and moreover that this scourge of Egypt, transported hither by the western winds, has overwhelmed the ancient splendour of this extensive tract, and doomed to sterility a land which was once remarkable for its fruitfulness. Consequently, says Professor Jameson, in his *Mine-*

ralogical Illustrations of Cuvier's *Essay on the Theory of the Earth*, if our continents were as ancient as some have pretended, no traces of the habitations of men would appear on any part of the western bank of the Nile, which is exposed to the sands of the desert. Now if we fix our attention on this important fact, and reflect on the consequences which must have attended it; if thousands, or only some hundreds of centuries had elapsed since our continents first existed above the level of the sea, does it not evidently appear that all the country on the west of the Nile would have been buried under the eruptions of the sand before the erection of the cities of ancient Egypt, how remote soever that period may be supposed; and that in a country so long afflicted with sterility, no such vast and numerous edifices would ever have been constructed? When these cities, indeed, were built, another cause concurred in favouring their prosperity, the easy navigation of the Red Sea; which is now impeded by the works of the sea-polypi, as already noticed.

Thus the reefs of coral which have been raised in the Red Sea, on the east of Egypt, and the sands of the desert which invade it on the west, concur in attesting this important truth;

that our continents are not of a more remote antiquity than has been assigned to them by the sacred historian in the book of Genesis, from the great era of the Deluge. In reference to which, Professor Jameson has elegantly remarked, "that as in civil history records are consulted, medals examined, and antique inscriptions decyphered, in order to determine the epoch of human revolutions, and verify moral events; so, in natural history, we must search the archives of the world; draw from the bowels of the earth the monuments of former times; collect the fragments, and gather into one body of proofs all the indices of physical changes, which may enable us to retrace the different ages of nature."*

This attempt to condense from the elaborate works of M. Cuvier and the valuable observations of Professor Jameson, a general sketch of the important result to which their researches have naturally led, will not, perhaps, be deemed an unnecessary digression. I return from it to the various erections of the polypi insect.

The country to the north of King George's

* Voyage of Captain Flinders; Mercure de France for September 1807; Notes on Cuvier's Theory of the Earth, p. 318.

Sound appears to have recently emerged from the ocean. Branches of coral protrude from the sand, and occasionally broken columns, formed like stumps of trees.

Reefs of coral are sometimes of considerable advantage to shipping; one of which, situated at a moderate day's run from Murray's Islands, is mentioned by the late Captain Flinders as affording shelter from the south-east wind, and forming a convenient anchorage for the night to ships passing through Torres' Strait. It was termed Half-way Island, and had been evidently formed at no great distance of time by the washing up of sand and broken coral. In the rock which composed its basis, the sand, coral, and shells formerly thrown up in a more or less perfect state of cohesion, were perceptible; small pieces of wood, pumice-stone, and other extraneous bodies which chance had mixed with the calcareous substances when the cohesion began, were also inclosed in the rock; and in some instances could be easily separated from it. The upper part of the island was a mixture of the same substances, in a loose state, with a little vegetable soil; and was covered with the *casuarina* and a variety of other trees and shrubs, such as afford food for paroquets, pigeons, and

some other birds, to whose ancestors it is probable that this island was originally indebted for its scanty share of vegetation.

Innumerable reefs of a similar description are scattered in the vicinity of Torres Strait, all of them in different stages of progress; some above high-water mark, but destitute of vegetation; others overflowed by every returning tide; some again mantled with salt plants, though not yet habitable; and a few, already become considerable islands, covered with coarse grass, shrubs, and solitary trees, the haunt of innumerable water fowl, and land turtle of various kinds; while occasionally noble groups of cocoa trees, growing on some isolated banks, rear their heads above the water, and mark the rapid progress of vegetation; for trees of this description are generally the first of any magnitude that grow upon the reefs, as they are capable of resisting the light sprays of the sea. Clusters of these majestic and useful palms form invaluable beacons to warn mariners of their danger; and if rendered unavailing by the darkness of the night, their fruit, at least, affords a salutary provision for shipwrecked seamen. The navigator who would distribute ten thousand cocoa-trees among the numerous coral reefs of the great Indian Ocean and Pacific Sea,

would be entitled to the gratitude of all maritime nations, and of every friend to humanity.

In the Pacific Ocean, the construction of many of the coral reefs are extremely beautiful, and the voyager is astonished with the curious and fantastic forms of the various marine productions of which they are composed. Wheat-sheaves, mushrooms, cabbage leaves, with innumerable plants and flowers, are accurately represented by different kinds of corals, and glow beneath the water in vivid tints of purple, brown, green, and white, each with a peculiar form and shade of colouring, equalling in richness and variety the most beautiful productions of the vegetable world. Corals and *fungusses* start from between the fissures of the rocks; while large portions of the former, in a dead state, connected into a solid mass of a dull white colour, compose the stone-work of the reef. Solid masses, of different dusky hues, generally dry and blackened by exposure to the weather, are also occasionally conspicuous; they are termed negro heads. Even these are not destitute of ornament, for nature delights in the variety of her decorations. They are studded with small shells, and beautifully marked with outlines expressive of their origin. The edges of the reefs, particularly

those exposed to the waves, partake of a considerable degree of lightness, and form small coves and caverns, the habitations of live corals, sponges, sea-eggs and trepangs, or sea traces (valued in China for their invigorating quality), and enormous cockles, which are scarcely to be distinguished from the rock, excepting when they suddenly close their shells, and form living fountains which rise to the height of four or five feet.

These beautiful marine retreats surpass in richness and variety the watery halls of aged Nereus, "encompassed with his sea-green daughters round;" or the fabled abodes of Naiads and of Tritons. The constructors of them, like the conics, are "but feeble folks;"

> "Yet still they work, as if to mock at Art,
> And, in defiance of her rival powers,
> Perform such vast, inimitable feats,
> As she, with all her rules, can never reach.
> Silently, as a dream, their fabrics rise;
> No sound of hammer or of saw is there.
>
> ..... No forests fall
> When they would build; no quarry sends its stores
> T' enrich the wall; but they can stem the floods,
> And make their marble in the glassy wave.
> 'Mid such retreats young Aristæus found
> Cyrene, when he bore the plaintive tale
> Of his lost bees to her maternal ear."

At the commencement of their labours, and in situations where a strong easterly wind generally prevails, they always work perpendicularly, till the wall of coral, being arrived within a few yards of the surface of the water, affords a shelter to the leeward of which their infant colonies may be sent forth in quest of new settlements; for the windward side of a reef exposed to the open sea, is generally, if not always, the highest part; and rises precipitously, sometimes from the depth of two hundred, and, perhaps, even many more fathoms. Indeed, the lee-side of such a coral reef in the Pacific Ocean, which is governed by constant monsoons, frequently does not shew itself above the water, when the windward side from time immemorial has attained perfection in the atmospheric region. Nay, it often happens that the former is interrupted in many places by intervals of considerable breadth, and of the same depth as the inner sea, which have been left by nature, like open gates, the ready admittance of the exploring mariner into the internal calm and secure harbour.*

With regard to the formation of coral reefs, Captain Flinders and Mr. Chamisso, who accom-

* Notes to Cuvier's Theory of the Earth, p. 330.

panied Kotzebue in his voyage, have ingeniously conjectured, from the appearance of the low islands of the South Sea, and Indian Ocean, which form occasionally rows, or groups, while they are totally absent in other parts of the same seas, that the coral insects rear their habitations on marine shoals, or, to speak more correctly, on the top of sub-marine mountains: that these adhere together by virtue either of the glutinous nature of the insect, or some property in salt water, and continue to increase by the labours of successive generations on one side, as their structures approach the surface of the sea; whilst, on the other, they progressively extend their borders: and that various heterogeneous and floating substances, as noticed in the formation of Half-Way Island, are caught by their stony tree-like fabrics, till at length a solid mass of rock is formed, which progressively advances to the surface of the water.* When arrived at this point they are open to inspection: the deposits of the ocean no longer tenaciously adhere, but remain in a loose state, and form, what is termed by mariners, a key upon the summit of the reef; while the sea, by throwing up

* Notes to Cuvier's Theory; Flinders' Voyage.

sand and mud on the top of these rocky shelves, progressively raises them above its own proper level. The new island, for such it may now be designated, is soon visited by sea birds; salt plants successively appear, and mantle the sterile soil with a luxuriant covering: as these decay, vegetable mould is gradually deposited; cocoa-nuts, or some floating seeds, hurried on shore by the impetuosity of the waves, take root, and soon begin to grow; land birds, attracted by the verdant appearance of the bank, fly thither in quest of provisions, and deposit the seeds of shrubs and trees: every high tide and every gale add some new treasure, the appearance of an island is gradually assumed, and at length man comes to take possession.*

Such, my friend, has been the origin of some of the most beautiful islands in the Pacific and Indian Oceans. They bring to mind, in their formation, and gradual advances to perfection, one of the noblest Institutions† of this or any other age. Like them, it has commenced from a small beginning, and the waves and currents of opposition have rolled above its head; but though almost imperceptible at first, it has ap-

* Flinders' Voyage.

† The British and Foreign Bible Society.

peared high above the waters; a sun "whose goings forth have been from everlasting,"* is risen gloriously upon its pleasant fields, and the leaves of its trees are for the healing of the nations.

Adieu! I am, &c.

* Mich. v. 2.

LETTER VI.

CONSTRUCTION OF SHELLS.

TO *******.

July 4, 1823.

A PECULIAR kind of coral, resembling, in some respects, the fabrication of a testaceous, in others that of a polyferous insect, forms a connecting link between these beautiful productions of the deep.* The elegant Tubuli Concamerati, a genus of the Tubuli marinus, is one of the most interesting of this extraordinary division, and is easily distinguished by its exterior configuration and internal structure.† The former is long and shelly, usually either of a conic or cylindric form, or else resembling the Dentales in shape, with occasionally the smaller end bent and twisted round. The latter consists of a number of hollow compartments, each of which communicates with the next by means of a syphon, in the same manner as those of the Nautilus, only with this difference, that in the

* Cuvier's Theory of the Earth. † Rees' Cyclopædia.

Tubuli Concamerati, the syphon was capable of being dilated to a considerable extent, according to the inclination or necessity of the inhabitant.*

This interesting genus is at present unknown in a recent state; but is frequently brought from Sweden in the stones that are used for pavements.

Many beautiful instances of evident design might be adduced from different species in the genus Tubulus marinus, that especially of the sea-pencil, the head of which is pierced with a multitude of holes in the manner of a watering pot; but they are foreign to the subject of this letter. The Tubuli Concamerati is merely noticed as being one of the most extraordinary of those remarkable productions that form a kind of connecting link between shells and corals; and could not therefore be omitted in our progress from the works of polyferous insects to those of testaceous animals.†

These are included in the interesting science of Conchology, which embraces the knowledge, arrangement, and description of testaceous bodies. A science, according to the system of Linnæus, which has for its basis the external

* Parkinson's Introduction to the Knowledge of Fossil Organic Remains.

† Cuvier's Theory.

form and character of the shell, and is totally independent of the animal inclosed within the calcareous covering, though undoubtedly its habits and instincts are comprised in the researches of the Conchologist.

Each individual is composed of two parts, one of which, the animal itself, is soft, molluscous, without bones, and furnished with lungs, heart, mouth, and organs peculiarly adapted to its nature ; the other is its shell or habitation, which is generally hard, stony, or calcarious, and either partially or entirely covers the inhabitant, which is attached to it by means of a ligament or muscle.

Animals of this description are very numerous ; some inhabit the sea, others fresh water, others again the land : their instincts in general appear superior to those of their relatives, the undefended mollusca, and many of their testaceous coatings are extremely beautiful.*

Linnæus divides the order Testacea into Multivalves, Bivalves, and Univalves, according as the shell comprizes many parts, two parts, or a single part. Multivalves consist of many plates or shells connected ; in some species, like

* Brookes' Introduction to the Study of Conchology.

different parts of a coat of mail, as in the Pholas, Lepas, and Chiton.

Bivalves consist of two shells, united by a hinge, as the Muscle, Oyster, &c.

Univalves comprehend those that have, or have not a regular spiral; this division is very numerous; it includes the Snail, Perriwinkle, &c.*

The shells of testaceous animals appear to be of two descriptions, with regard to the substance of which they are composed.

I. Shells with a procelaneous aspect, and enamelled texture, such as the Voluta and Cypræa. These, when submitted to the test of experiment, evidently consist of carbonate of lime, cemented by a very small portion of animal jelly.

II. Shells, furnished generally, if not always, with a strong epidermis, principally, or entirely composed of the substance called nacre, or mother-of-pearl. Of these the oyster and river muscle, furnish familiar examples. Shells of this kind differ in their composition from the preceding only by possessing a smaller proportion of carbonate of lime; which, instead of being simply cemented by animal glutin, or jelly, is intermixed with, and serves to harden a membranaceous or cartilaginous substance; and this substance, even when deprived of the carbonate

* Brookes.

of lime by infusion in diluted nitric acid, still retains the figure of the shell.

The animals which inhabit these stratified shells, increase them every year by a stratum of carbonate of lime, secured by a new membrane; thus the age and growth of the animal may be readily ascertained.*

The two substances of which shells are composed, may be separated from each other by an easy chemical analysis, in the gentle operation of which they become exhibited distinctly to the view, without any material alteration from the nature of the solvent employed for that purpose. Thus, if a sufficient quantity of nitric acid, considerably diluted, either with water or spirits of wine, is poured upon a shell or fragment of one, contained in a glass vessel, it will soon exhibit a soft floating substance, constituting the animal part of the shell, and consisting of innumerable membranes of a retiform appearance. These membranes retain the exact figure of the shell, and afford a beautiful and popular object for the microscope. They exhibit satisfactory proofs of a vascular and organical structure; and evince that this membranaceous substance is, in

* Philosophical Transactions.

fact, an appendage to the body of the animal, or rather a continuation of the tendinous fibres that compose the ligaments, by means of which it is fixed to the shell. They also prove that the shell itself owes its hardness to the earthy particles perspired through the vessels of the animal, which gradually encrust the meshes formed by the reticular filaments of which this membranaceous substance is composed. In analysing shells of a finer texture than such as are generally submitted to the test of experiment, the greatest circumspection becomes essential. So much so, that M. Herissant, whose attention was particularly devoted to the subject, after placing a porcelain shell in spirits of wine, added from day to day, for the space of two months, a single drop of spirits of nitre, lest the air, generated or let loose by the action of the nitric acid on the earthy substance, should tear the compages of the fine membranaceous structure, which would necessarily have occurred, had a more hasty and less gentle dissolution been adopted. This gradual operation was attended with complete success, and a delicate and beautifully reticulated film, resembling a spider's web in texture, rewarded the patience of the operator; the organization of which, from its extreme tenuity,

he was not, however, able to delineate. In shells of peculiar delicacy, even five or six months are sometimes necessary for their complete developement; but, in others of a coarser texture, the process is soon completed.

Many beautiful configurations and appearances are afforded by the membranaceous part of different shells; that especially which is disclosed in the laminæ of the Oyster, River Muscle, and Sea-Ear, after exposure to the action of diluted nitric acid.

These elegant marine productions are well known to present a constant succession of rich and changeable colours, that —

> "Flying several from each surface, form
> A trembling variance of revolving hues,
> As the site varies in the gazer's hand."*

Nature, always magnificent in her designs, but singularly frugal in the execution of them, produces these brilliant decorations at a small expense. The membranaceous substance is plaited and rumpled in such a manner, that its interior laminæ, incrusted with earthy and semi-transparent matter, form an infinite number of little prisms, which refract the rays of light, and pro-

* Thomson.

duce all the changes of colour observable in these brilliant shells.*

> " Oh! who that has an eye to see,—
> A heart to feel,—a tongue to bless,
> Can ever undelighted be
> By Nature's magic loveliness!"

The most beautiful shells are generally brought from the Red Sea and East-Indies. Those of the West are less brilliantly tinted; and as we advance towards the temperate and arctic regions, they gradually diminish in lustre and variety, till at length a few solitary specimens of the genera Trochus, Buccinum, and Limpet, are occasionally found on the barren shores of the Frozen sea; and these, though extremely elegant in their construction, are plain with respect to colour.†

This remarkable difference is owing, undoubtedly, to different degrees of solar heat, and probably the vast seas of the equatorial regions, which are not liable to be weakened by the pouring in of such a " liquid weight" of fresh water, as the Oronoque, Orellana, and " sea-like Plata," continually bear into the Atlantic Ocean; may afford a greater quantity of nourishment to such molluscous animals as inhabit them, and thus

* Memoirs of the Academy of Sciences.

† Pennant's Arctic Zoology.

augment the size and brilliancy of their testaceous coverings.*

It appears from the accurate investigations of Leuwenhoeck and Reaumur, that an infant shell-fish is uniformly furnished with a testaceous coating, which gradually increases by means of a viscous exudation from the aperture, or hinge round the circumference of each valve,† and forms a coat of mail, shed, or marine pavilion, adapted to the exigences, and proportioned to the shape of the wearer. These, as the animals increase in size, increase also in thickness though not in length ; while the elevations, depressions, striæ, tubercles, and spines, which distinguish individual subjects, may be attributed to corresponding projections, tentacula, and other irregularities in the fleshy form of the constructing agent.‡ The same admirable economy, which gave rise to the arrangement of little prisms in the membranaceous part of different shells, is also apparent in their configuration, notwithstanding the various decorations with which they are frequently embellished. This curious fact is strikingly exemplified in the spiral form of many of these elegant receptacles. Round or oblong

* Rees. † Mawe. ‡ Burrows.

cases would effectually defend the animal inhabitants from external injury; but these require in their construction a considerable quantity of the viscous exudation already noticed; whereas, a thin coating, fitted to the shape of each individual, answers the purpose equally as well, and moreover enables it to feel the vibrations of the aqueous element in which it frequently resides.

Thus, in subserviency to this general system of economy, as well as in accordance with the instincts of the animals themselves, we find that different species of shell-fish are enclosed in various kinds of testaceous coverings. Those which defend the active family of Donax, enable them to dart away on the approach of danger; while the shells of their less active relatives, the perambulating Razor-sheaths, are admirably adapted to assist their movements through the yielding sand. The warlike Chitons walk abroad in coats of mail closely fitted to their shapes, and surrounded with narrow belts or margins, covered with scales. The shields of the Pholades bristle with points resembling a file, by means of which they are defended from external injury, when occupied in slowly excavating the hardest substances; and the hospitable mansions of the peaceful Pinnæ, are sufficiently large for the

admission of their unassuming guests. The conical shaped shells of the Patellæ (lympets) remind the traveller of Anchorites dwelling by the sea-side in solitary tents: the Helices, or Snails, slowly perambulate the garden walks, with coverings that resemble the awnings of broad-wheeled waggons; the Cardia, or Cockles, are provided with thick coatings, which enable them to endure the rough beating of a boisterous sea; and the shells of such species as are fragile, diaphanous, and scarcely able to resist the slightest pressure, are found in still ponds and muddy ditches.* A considerable number of bivalves resemble little boats, and float upon the billows with their shells expanded to catch the breeze; others may be compared to vessels of a larger size, and are provided with sails, pumps, cordages, and all the requisites for navigation. Such are those of the Pectens, Nautili, and Argonautæ of the English, Mediterranean, and Indian Seas. Others again, as the Mytilus, or pearl muscle, are enclosed in diving bells of an oblong or compressed form, with which they emerge from the deep recesses of the ocean, or visit "the bottom of the monstrous world," as instinct or inclination lead them. The Cypræ are said to throw aside

* Burrows.

their vestments when continual accumulations render them cumbrous to the wearers;* while their brethren of the Voluta,† Strombus,‡ Buccinum,‖ and Nerita¶ tribes, carry about their houses with them, and are moreover furnished with materials for repairing any accidental dilapidations in the moving walls.**

Paley has justly observed, "that the works of the Deity are known by expedients. Where we should look for absolute destitution, where we can reckon up nothing but wants, some admirable contrivance always comes in, to supply the privation."

The truth of this remark is no less confirmed by the singular adaptation of the shells which envelop molluscous animals to the sites of ocean or of land which they are designed to occupy, than in the colours with which their Maker has invested them. The testaceous coverings of such species as move readily from one situation to another, and are consequently able to choose their places of retreat, are generally varied with brilliant tints. This is particularly obvious in

* Catechism of Conchology. † Volute, or Wreath.
‡ Winged or Claw Shell. ‖ Whelk.
¶ Nerite, or Hoof-Shell.
** Brookes; Mawe; Rees.

different individuals of the numerous family of Turbo, of Voluta, of Conus, and of Cypræa, some of which either exhibit the glowing colours of the aurora, or the tints of the finest tulips, or else resemble little marine lamps, suspended in the crevices of dark rocks; while a considerable number appear invested with silver armour, as they walk under the spreading shades of the madrepore.

Such, on the contrary, as seldom move from their places of abode, or are particularly obnoxious to observation, are uniformly of the same colour as the sites which they occupy, or the party-coloured stones, or sea-weeds to which they cling. We may adduce as a familiar example the common snail, which is scarcely to be distinguished from the ground over which it creeps; or the still more helpless lympet, that adheres to the surface of the rocks by means of a vacuum, which it produces at pleasure, like the inhabitants of the little cones noticed by the authors of Entomology on the broad leaves of the pear-tree.

The same extraordinary compensation with respect to colour is also obvious in the Oysters of the Red Sea, which hide themselves in the fissures of the rocks; in the Muscles, that ride

at anchor in shallows of the sea-shore; in the Fin-shells, which moor their fragile barks to the pebbles by means of silken cords; in the silver-tinted Anomiæ, or Antique Lamps, which attach themselves to floating tufts of sea-weed, and appear like foam upon the billows, and lastly in the Nautili of the Sicilian seas, which often resemble vessels on the stocks, when calmly reposing in the little coves that are formed by the stony, tree-like fabrics of the lythophites.

The Shell Collector has frequently observed this striking similarity on the coasts of the Mediterranean. In walking over the island of Cyprus, he was particularly struck with the number of brilliant lympets for which that classic spot is so much celebrated. A considerable number had fixed themselves to branches of white coral, where they resembled the delicate blossoms of the peach; others, which appeared as if inlaid with mother of pearl, opal and amethyst, clung to the sheltering rocks, as if fearful of being separated from them by the agitated waves of the surrounding element. The rocks were also gorgeously attired, and some of the most conspicuous, streaked with lichens, and dotted over with marine plants, appeared nearly as beautiful as the adhering shell-fish.

St. Pierre notices the same striking effect on the rocks of the Straits of Magellan. He observed, at the base of such as sweep along the sea-coast of the district of Caux, a variety of black Perriwinkles, azure-coloured Lobsters, legions of Muscles of a deep cerulean blue, Oysters mottled with red and brown, and Limpets of a sober grey. Each of these beautifully harmonized with a multitude of marine plants, that fringed the black and white rocks with tints of purple, grey, rust-coloured, brown and green, and presented, in the variety of their forms, long tufts of different shades, garlands, festoons, and cordages, agitated by the waves in every possible manner.

Different kinds of shell-fish, such especially as seldom move from their customary stations, are either clothed with a brown and shaggy garment, black pedicle, mud-coloured tartar, or thin epidermis, in accordance with the colours of their respective places of retreat. This extraordinary provision is particularly observable in different species of Solon, Tellina, Lympet, Venus, and in several individuals of the numerous division of univalve; while they conceal beneath their gloomy upper coats, pearly tints and appearances, which not unfrequently exceed the brilliant hue of the most gaudy shell-

fish. Thus the Magellan Lympet, when disrobed of its unsightly garment by the application of nitric acid, presents a polished surface resembling the finest tortoise-shell, blended with burnished gold. The Iris Trochus conceals in like manner a splendid metallic lustre; and numerous species of the genus Mya, which are covered with a thick brown or green epidermis, present a brilliant and polished surface, glowing with the colours of the rainbow.*

St. Pierre, with his accustomed elegance of thought, conjectures that Nature has veiled the beauty of these singular productions, in order to preserve it for the admiration of her sons: that she has placed them among the shallows of the sea-shore, where the agitated element purifies them by the continued motion of its waves, in order to throw them within their reach; and that, as if to excite the astonishment of the most untutored of men, she places shells of unrivalled lustre in regions exposed to the fury of the elements, while at the same time she presents the poor Patagonians with spoons and cups, the lustre of which surpasses the richest plate of polished nations.

* Mawe.

But why, illustrious naturalist, did your observations extend no further? Saw you nothing in these darkly-coated and brilliantly-tinted shells, but an arrangement of bright colours to please the eye of taste, or cups and spoons for the rude inhabitants of savage districts? Saw you not that the Almighty Creator of the universe, without whose permission a single hair does not fall from our heads, nor a sparrow from heaven to the ground, nor a shell, nor a pebble, is rolled by the billows upon the shore, by investing them in these simple colours, and causing the waves to cast them on the most uncultivated and sterile regions, provides against their utter extinction, by the depredations of sea-birds and rapacious fishes, while at the same time he spreads abroad for these a constant supply of food, in the desolate sites of earth or ocean which they are appointed to occupy?

The Roman naturalist noticed with admiration the transformation of several species of caterpillars from an intermediate state to that splendid investiture in the Spring, when still preserving their identity, and having passed from the baseness of a worm, they burst the silken shroud which envelopes them, and traverse the air in a form that is dazzling to the eyes. The Egyptians

apparently referred to this intermediate state, and to the change which follows it, in the configuration of their mummies, for the most ancient are swathed and filleted, so exactly after the fashion of the Eruca, or Chrysalis, that the resemblance could not be accidental.* The sages of that country, who expressed all their notions by symbols, also signified the suppositious transmigration of the soul by the transformation of the insect; and the Grecian poets, improving on this idea, made use of the same symbol to designate its immortality. In like manner the botanist confesses, in the unfolding of the calyx which covers the gaudy head of the oriental poppy, an attractive emblem of the expanding of the human mind, as it emerges from a state of ignorance, or in the gradual development of a plant, the progressive advancement of every moral excellence.

And shall no tender, or appropriate emblem rise on the mind of the Conchologist, when he observes the tints of the aurora, or the colour of gold, or purple amethyst emerging from under a rough tartar, or shaggy epidermis? The Christian philosopher confesses in the humble shell-fish, a striking emblem of human nature in a savage or unconverted state; without beauty, without

* Jones's Disquisitions.

comeliness, destitute of all those graees whieh exalt the man, or adorn the Christian. But, behold, the hand of the refiner is upon him: he emerges from the veil of obseurity whieh had previously invested his moral faculties; or rather, to borrow the emphatic language of inspiration, "He is quickened,"* when dead in trespasses and sins; he stands forth in all the perfection of his nature, and remembering that he is no longer his own, that he is bought with a price, he seeks to glorify his Maker with his body and his spirit, which are his.

To return from this digression to the immediate subjeet of my letter. We admit that shells are beautiful, and that they are admirably adapted to the exigencies of the wearers: but how shall we aceount for the endless diversity of shades and eolours, varying from the sober coating of the garden snail, to the delicate and glowing tints whieh are diffused over some of the finer species, in the infinite profusion of undulations, clouds, spots, bands, and retieulated figures, with which these admirable arehitects enrich the walls of their beautiful reeeptacles? The means of produeing them must be sought

* Eph. ii. 1.

for in the animals themselves. Their necks are furnished with pores replete with colouring fluid, which blends insensibly with the calcarious exudation already noticed, and thus occasions that exquisite variety in their testaceous coverings, which art attempts to emulate, but can never fully equal.*

Thus far is the result of observation and experiment. It now remains to account for the extraordinary fact, that the stony exudations of testaceous animals condense only on those parts where they are essential to their welfare. But here investigation ends—the microscope has done its office. It seems as if maternal nature delighted to baffle the wisdom of her sons; and to say to the proud assertors of the sufficiency of human reason for comprehending the mysteries of creation, and of Providence, "Thus far can you go, and no further;" and even in the formation of a shell, or its insignificant inhabitant, your arrogant pretensions are completely humbled.

"Proud, scornful man! thy soaring wing
Would hurry towards Infinity:
And yet the vilest, meanest thing
Is too sublime, too deep for thee;

* Burrows.

And all thy vain imagining
Lost in the smallest speck we see.
It must be so:—for He, even He
Who worlds created, form'd the worm:
He pours the dew, who fill'd the sea;
Breathes from the flower, who rules the storm:
Him we may worship,—not conceive;
See not and hear not,—but adore;
Bow in the dust, obey, believe;
Utter his name, and know no more."*

Adieu! I am, &c.

* Bowring's Matins and Vespers.

LETTER VII.

MULTIVALVES.

To ******.

July 14th, 1823.

You have frequently observed on the shores of Abergelli, in Denbighshire, a number of loose stones, left uncovered by the reflux of the tide; but you did not, perhaps, imagine that they contained inhabitants of curious forms and instincts; capable of illustrating the important truth, that there are no obstacles commensurate with the abilities of mankind, and their means of obviating them, which may not be overcome by industry and perseverance. Yet such is actually the case. The Pholades which they contain are some of the most extraordinary inhabitants of the deep. For these indefatigable creatures open an entrance into stones and wood, by the help of a soft and pliant proboscis, having previously softened the former, as the famous Carthaginian General Hannibal is fabled to have done, not indeed with vinegar, but by means of a peculiar secretion with which maternal nature has bountifully provided them.

Here you will, perhaps, inquire how it is possible to ascertain these curious facts. By placing a Pholas on soft clay, and observing its method of proceeding. No sooner does the little miner find itself at liberty, than it commences its operations by perforating the clay with the boring instrument already mentioned; and thus excavates an opening in the course of a few hours, which would probably require the labour of as many months to form in a harder substance; for the motions of the Pholas are remarkably slow; and when buried in the stone, it has no discoverable movement, excepting a very slight one towards the centre, which is only in proportion to its size. The dwelling of this solitary shell-fish is generally oblique to the horizon, resembling a truncated cone, terminated with a roundish cavity, which receives the body of the animal, whilst the furthest end is filled up with a proboscis or pipe of a fleshy substance, and conical form, truncated at the end. This pipe the animal usually protrudes to the surface of the stone, for the evident purpose of drawing in the sea-water, on which it subsists, and again rejecting it for a fresh supply.

A small green vessel has also been observed in the body of the Pholas; but its use is not

certain. This pipe, when plunged into spirits of wine, assumes a purple colour.*

The shell of this curious animal, in most species, is ovate or oblong, formed of two large valves opposite to each other, with several less and differently shaped accessory ones, that act as substitutes for a hinge, which in bivalves generally determines the generic character.†

The exterior is commonly destitute of colour, or rather of a pure or dusky white, though it sometimes partakes of a brownish cast; this deficiency is, however, amply compensated by the beautiful fret-work with which the shells of this elegant genus are usually adorned.

In some species the reticulations are so delicate in their texture, as to resemble the finest lace; in others, they may be compared to small basket work; and in the *P. costata*, or ribbed Pholus, the shell is covered with regular, elevated, jagged or scolloped ribs, gracefully disposed.‡

The generic appellation of the Pholas is derived from a Greek word, signifying something which lies hid.

The American, Indian, and European seas supply all the species that are known of this

* Rees. † Catechism of Conchology.
‡ Dillwyn.

extraordinary multivalve. It is also common in lime and sand-stone on the English coast.

The animal inhabitant which Linnæus calls an Ascidia, is scarcely any thing more than a fleshy membranaceous bag, nearly of the length of the shell, apparently open at each end, furnished at the upper with a cylindrical muscular tube, divided by a partition into two; at the lower, with a short obtusely conical foot.*

These curious shell-fish possess the property of emitting a phosphorescent liquor, which shines with brilliancy, and illuminates whatever it touches.† Ancient naturalists noticed this remarkable fact. Pliny, in particular, observes, that the Pholas shines in the mouth of the person who eats it, and renders the hands and clothes luminous when brought into contact with them.

This peculiarity has furnished a subject for various observations and experiments to different learned men, especially to the Bolognian academicians, M. Reaumur, and Beccarius, who particularly devoted their attention to the subject of phosphoric light.

The luminous quality of the Pholas is in proportion to its freshness, and even when in a

* Brooke. † Mawe.

dry state, this quality may be revived by the application of fresh or salt water; but brandy immediately extinguishes it.

A solution of sea-water increases the light of the luminous fluid; sal ammoniac diminishes it a little; oil of tartar nearly extinguishes it, and the acids entirely. The luminous water, when poured upon fresh calcined gypsum, rock crystal, or sugar, becomes more vivid. Milk rendered luminous by the Pholas, loses its shining quality when mixed with oil of vitriol; but again revives it on the addition of oil of tartar.

Differently coloured substances are powerfully affected by this kind of light: white appears to imbibe and emit the greatest quantity; yellow and green in less proportions. Such is also the case with painted boards and glasses, when filled with different colours and submitted to the same experiment. In both, the red will emit hardly any light—the yellow the most—the violet least of all.

A single Pholas renders seven ounces of milk so beautifully luminous, that surrounding objects are rendered visible by its light. This luminous quality entirely disappears when the milk which contains it is excluded from the air; but again revives on exposure to the atmosphere. In the

exhausted receiver of an air-pump, the Pholas loses its light.

Various attempts have been made to render the light of the Pholas permanent: for this purpose, the juices of the fish were kneeded with flour into a kind of paste. This compound afforded a considerable degree of light when immersed in warm water; but the preservation of the fish itself in honey, answered much better; as, by this method, the Pholas was preserved for more than twelve months, and its luminous quality could at any time be revived by the application of warm water.*

The Lepas, or Sea-Acorn, which derives its name from adhering to rocks and other projections in the sea, presents, in its construction, a striking instance of evident design. The exterior of the shell is varied in its colouring and shape; but the usual outline is conical or hemispherical, which form is acquired by a number of immoveable valves being placed perpendicularly on a base, broad at the lower margin, and gradually tapering towards the summit, where they are closed by a moveable lid or covering formed of smaller valves.†

* Philosophical Transactions.

† Brooke.

These extraordinary shell-fish are never found detached from other substances. They adhere by the base or stalk, not only to rocks and stones, but even to marine animals, such as the whale and turtle. They are also found on the bottom of vessels, and increase so rapidly in magnitude and number, as sometimes to impede their progress in sailing.

Although these curious multivalves are generally fixed to other bodies by the base or lower part of the shell, yet the *L. scalpellum*, *L. anserifera*, *L. anatifera*, or Knife-like, Striated, and Duck Barnacles, with several varieties emanating from them, are all attached by a peduncle or stem, proceeding from the base of the shell to the substance which supports it. These appendages differ exceedingly, both in character and in substance: as some resemble a smooth film-like tube of a fine texture, not unfrequently tinged with bright red or orange; whilst others are of a coarser texture, darkly coloured, and wrinkled or granulated with little warts.*

The peculiar structure of these elegant varieties has caused them to be compared to the crocus, to which, indeed, they bear a considerable

* Mawe.

resemblance when peeping from the mossy rocks to which they frequently attach themselves.*

The inhabitant of the Lepas is a triton. It is often a considerable traveller, without however moving from its shell; and is consequently exposed in many situations to the rough beating of a boisterous sea. To remedy this inconvenience, nature has affixed to the entrance of the shell an operculum, or little door, formed of four triangular valves, which the inhabitant opens and shuts at pleasure. This door is safely closed in stormy weather, but thrown aside when the sea is calm.† A feathery tube, of a brown colour, and elegantly curled, is then projected through the opening, by means of which the triton readily procures its food.†

"God," says an ancient proverb, "tempers the wind to the shorn lamb." When I behold His gracious hand thus ministering to the wants, and providing for the exigencies of such a feeble creature, I can readily believe that He beholds and blesses every thing which He has made, even as the natural sun "beholds and blesses the fruits of the teeming earth."

The peculiar structure of the genus *Chiton*, or

* Mawe. † Brooke.

Coat of Mail, readily distinguishes it from the preceding multivalves. The shell is generally composed of eight pieces, called valves, and surrounded by a narrow belt or margin, which is sometimes covered with scales. These valves are united by a cartilage, which enables the *Chiton* to roll together into a ball, like the hedge-hog and porcupine, on the approach of danger. As the back is alone defended by the shell, this ingenious expedient effectually protects the sagacious animal against the attacks of its marine enemies; and perhaps enables it to elude their vigilance, from its resemblance to a pebble when perforated by the waves.

A considerable similarity subsists between the inhabitant of the *Chiton* and *Patella*, excepting that the former is unable to protrude itself beyond the shell, and that the head is arrow-shaped, without any appearance of either eyes or horns.* These curious shell-fish resemble, in their natural state, a well-known insect often met with in decayed timber, commonly called a wood-louse; and when extracted, the form of the shell is not unlike a boat.†

Chitons, like the *Patellæ*, are generally found creeping on the rocks, or closely attached to

* Brookes. † Mawe.

stones, shells, sea-weeds, and not unfrequently to oysters, on the coast of South Devon, by means of a gelatinous fluid, which exudes from the papillary under surface of the body.* They are met with in France, Spain, and the Mediterranean, where they seldom exceed an inch; whereas in the tropical rivers they are occasionally found at least three or four inches long.†

The name of the genus *Chiton* is derived from a Greek word, signifying a coat of mail; and aptly expresses the coricated appearance of the shell, arising from the position of the valves.

To extract sentiments of piety from the works and appearances of nature, is equally the duty and the prerogative of a Christian; it is enforced in the Scriptures, and hallowed by the example of our Lord. "Behold the lilies of the field: they toil not, neither do they spin; yet your Heavenly Father careth for them." He expatiates on the wonderful construction of a single flower, and draws from it the delightful inference of confidence in God. "He teaches that taste may be combined with piety;"‡ and that the heart which glows with admiration amid the loveliness of

* Brookes. † Mawe.
‡ Chalmers.

nature, may be occupied with all that is serious and important in religion.

But here the observation naturally arises, that though the flowers of the field instruct us, for some of them are beautiful, and others admirable in their construction; and poets and moralists refer to them as striking emblems of the mutability of man: yet, what knowledge, or what instruction can we derive from the *Pholas*, the *Lepas*, or the *Chiton*. Undoubtedly, that we should despise no one, however humble his appearance, however abject his condition among men. These feeble shell-fish have few attractions to recommend them, yet they are wonderfully made; and many of the humblest in the estimation of their fellow creatures are endowed with qualities deserving of our warmest approbation and regard.

Let us also, my friend, remember, that the same Almighty Being, who furnishes the defenceless *Pholas* with the means of forming a secure abode in the hardest substances; who provides the dwelling of the *Triton* with a door, by the aid of which it excludes the rough beating of a boisterous sea; who enables the feeble *Chiton* to fold itself in a coat of mail, resembling a perforated pebble, and thus elude the vigilance of its marine

foes—has determined the bounds of our different habitations.* That it is not for us to set at nought the meanest of those who share with us the glorious hopes of immortality, for we must all hereafter stand before the judgment seat of Christ; who will not reward his finite creatures in proportion to what they had of riches, intellect, or power, but as they have served and honoured Him, "by whom all things consist."†

Adieu! I am, &c.

* Acts xvii. 26. † Col i. 17.

LETTER VIII.

BIVALVES.

TO * * * * *.

July 27th, 1823.

EIGHTY species are assigned by naturalists to the genus *Ostrea;* a well-known branch of the numerous family of Multivalve, whose habitats and instincts are designed to form the subject of this letter.

They present considerable variety in form and beauty, and are divided into seven classes, or divisions, which are again subdivided. The first and second comprize the numerous varieties of escallop, or scallop shells; and are distinguished from each other by the proportions of their ears. The surfaces are usually adorned with divergent ribs, variously diversified with beautiful colours and delicate chequer-work, and are usually covered with undulated and transverse striæ, not unfrequently assuming the appearance of elevated scales, as in the *O. imbricata*, or Imbricated

Oyster, and *O. dubia.** The animal inhabitants possess the faculty of leaping to a considerable distance, by suddenly opening and closing their valves; and though inclosed in floating citadels of considerable weight and thickness, can swim upon the water or move on land. They are elegantly termed butterflies of the ocean: as, when, darting through the sparkling waves, and flitting rapidly from place to place, they rival the glowing colours of the papilionaceous tribes. In fine weather they congregate together and mount the billows, forming little fleets, with half their shells erected, to catch the breeze; the other, which contains the animal, remaining emerged below. When any foe appears, or a sudden squall begins to ruffle the surface of the deep, the shells are instantaneously shut, and the pigmy vessels disappear.

The curious instincts of these interesting shell-fish most probably suggested the poetic chariots of the sea gods, who were fabled to ride triumphantly in shells drawn by tritons. Such was the car of Neptune, as we find in Virgil; and on a medal of Claudius:

> "High on the waves his azure car he guides;
> Its axles thunder, and the sea subsides.

* Mawe.

The monster whales before their master play,
And choirs of tritons crowd the watery way:
The martial powers in equal troops divide
To right and left; the gods his better side
Enclose; and, on the worst, the nymphs and nereids ride."

Shell-fish are occasionally represented on modern coins; an idea probably suggested by that of Claudius.

Among other curious medals, there is one of Sebastian, King of Portugal, famous for his unfortunate expedition in Africa, 1578, with his bust, full face and three-quarters length; reverse, a shell-fish in the sea, the moon and seven stars. *

Scallops sometimes travel to a considerable distance from their native element, and are occasionally deserted by the tide. When this occurs to any individual, it immediately opens its valves as wide as possible, and then closes them with a sudden jerk; an impulse is thus given to the shell, which enables it to move to the distance of four or five inches; and by a continual repetition of this simple operation, the scallop gradually tumbles forward till it regains the water. This species of shell-fish are endowed with the faculty of spinning threads, by means of which they can sud-

* Pinkerton on Medals.

denly lay hold of stones, or pieces of timber, and are often found securely fixed to some projecting rock, on which they have been hurried, like shipwrecked mariners, by the fury of a tempest.*

The shell of the *O. jacobæa* was formerly worn by pilgrims,

"Who fix'd the scallop in their hat before,"

as an emblem that they had crossed the sea in their way to the Holy Land, or some distant object of devotion: hence they are still preserved in the armorial bearings of several families of distinction. †

Large numbers of Oyster-shells, in a dead state, are found in Hudson's Bay. From the quantity which is continually dug up, for the space of ten miles along its muddy, flat and desolate shore, may be inferred the gradual receding of the waters, though the period cannot be ascertained, from the total absence of local information.‡

The remaining divisions of the genus *Ostrea* consist of those which, in substance, form, and colouring, are more nearly allied to the common, or eatable Oyster. The individuals of this family are generally of an irregular form; rough, and

* Rees. † Dillwyn. ‡ Arctic Zoology.

plated on the exterior, while the inside of their habitations are smooth and glossy, and sometimes richly varied with a steel-blue or metallic lustre. The most remarkable species in the third division is the *O. malleus*, or Hammer Oyster, which resembles a pick-axe; others that are parasitical, present the appearance of a dried leaf, and thus elude the vigilance of birds of prey. Such is the *O. folium*, or Foliated Oyster; and the *O. arborea*, or Tree Oyster, of the Atlantic and Indian seas;* where the latter is generally found attached to the roots and branches of the mangrove tree. This curious fact has been doubted by some naturalists, but admits of an easy solution. In hot countries, a great variety of shrubs and lofty trees grow on the margin of the rivers, and even among loose stones and sand, to the very edge of the sea; particularly in such places as are screened from the agitation of the waves. The sheltered recesses of bays and harbours are therefore often filled with abundance of lofty mangroves, which grow up from the shallow bottom, and present the beautiful appearance of marine forests, consequently many of the branches either dip into the waves, or grow beneath them;

* Mawe.

and to these the parasitic Oysters frequently attach themselves in such numbers, that a branch, when cut off, is too heavy for one individual to carry. The loaded branch is then washed, and brought to table; where it constitutes a favourite appendage at the banquets of the rich, for the glowing tints, which nature so liberally scatters over the birds and flowers of the tropical regions, extend even to the unassuming oyster. Many of the species are beautifully shaded, and the shells of such as inhabit the Red Sea are tinted with the vivid colours of the rainbow. *

The last division contains the *O. edulis*, or common Oyster, which is too well known for its nutritive and palatable qualities to render any description necessary. The old shells are often covered with various adhesions, such as *Anomiæ*, or Antique Lamps; *Serpulæ*, *Lepades*, or Sea-Acorns; *Sertulariæ*, and other marine productions. The interior has generally a pearly appearance, and some specimens have been found containing pearls.†

Varieties of *Ostreæ* are met with on the shores, and in the depths of almost every ocean; occasionally in clusters, or affixed to rocks and other sub-

* Rees. † Mawe.

stances. In some places they constitute a considerable article of commerce, and are frequently formed into large beds, or layers, many miles in extent; where, by proper attention to their growth and increase, they multiply beyond the powers of calculation.

Roman historians assert, that the luxurious tables of the great were supplied with this delicacy from the shores of Britain.*

The animal inhabitants of the *Ostreæ*, are apparently some of the most insignificant of created beings; yet these feeble creatures, though formerly supposed incapable of voluntary motion, and little superior to vegetables, are conscious of their existence, and conscious also that something exists exterior to themselves. They choose, reject, and vary their operations with judgment; defend themselves by adequate and complicated means; repair their losses, and occasionally assume new habits.† They possess, when young, the faculty of swimming rapidly, by means of an undulatory motion of the banchiæ, but when arrived at full growth this faculty or inclination ceases; and while their active relatives are darting round them, they remain contentedly fixed in

* Mawe. † Rees.

their places of abode, surrounded by a numerous and continually increasing progeny. For the motions of this clumsy animal, if such they may be termed, merely consist in turning from one side to the other; which they accomplish more by sagacity, than by any natural agility or inherent strength. They contrive to bolster up one side, by a gradual deposition of soft mud, till they stand nearly upright; then, availing themselves of the flowing or ebbing of the tide, they open their shells, and are tumbled over by the pressure of the water.* In this respect they differ materially from shell-fish in general. But

> "Nature, all her children viewing,
> Equal, bounteous, cares for all."

To one she gives the faculty of locomotion; to another the means of safely remaining in its allotted station: and while the Solen Donex and Mytilus frequently migrate to considerable distances from their usual places of abode, the stationary Oyster firmly moors himself to rocks and stones, by means of a bundle of small cords, denominated a byssus.

These sagacious animals, when taken from places continually covered by the sea, and

* Burrows.

placed in beds or reservoirs,* subject to the ebbing of the tide, by opening their shells frequently lose the water which they contain, and thus languish and die in a few days, unless revived by a fresh supply of moisture. When this occurs, the sufferers apparently profit by past experience, as it is uniformly observed, that neither cold nor heat, nor any external injury, will ever induce them to expand their shells again, unless overflowed by the tide.†

They possess, like many other bivalves, the faculty of squirting water from their shells. This property may be readily observed by placing one of them in a flat dish filled with salt water. The animal, finding itself at liberty, in a situation capable of affording a fresh supply of moisture, immediately squirts out the portion which it had previously stored up, with so much violence, as not only to repel the approach of ordinary enemies, but also to give the shell a considerable impetus forwards.‡

Such are the instincts which nature has assigned to the feeblest of her offspring, for its preservation and defence; but these are not the

* Those near Colchester have long been famous.

† Rees. ‡ English Encyclopædia.

only proofs which she has given of her maternal care.

What think you of a little lamp, which lights the darkness of its solitary dwelling? An attentive observer * recently remarked, on opening an Oyster, a shining matter, or blueish light, resembling a star, about the centre of the shell, which appeared to proceed from a small quantity of *real phosphorus*. On being taken from the animal, it extended nearly to half an inch in length; and when immersed in water, seemed in every respect the same as the phosphorus obtained from bones, &c. The Oyster itself was perfectly alive and fresh: consequently the light could not proceed from any decomposition of the shell or animal, but must have resulted from some other source.

The microscope has been elegantly termed "a portal to things invisible," as it opens to the naturalist a knowledge of such phenomena in nature as are too minute to be inspected by the unassisted eye. On submitting this apparent phosphorus to a high magnifier, it was found to consist of three different sorts of animalcules; one of which had no less than forty-eight legs, attached to a slender body; a black spot on the

* M. de Lavoye.

head, which was evidently its only eye; and the back exactly resembled that of an eel when deprived of its outer coating. The second insect Polypheme, had also a solitary eye, and numerous feet; a nose resembling that of a dog, and a body made up of several rings. The third was very different, having a speckled body, a head resembling a foal's, with a tuft of hair on both sides. Each of these extraordinary insects was beautifully luminous, and altogether resembled a blueish star.*

Who shall assign a limit to the wonders of creation! A living lamp diffuses its benignant ray in the solitary apartment of the Oyster; shines in the midst of a humid atmosphere; nay, even in the midst of water itself, and cheers the solitude and silence of perpetual night. Perhaps, like the enchanted lamp of Armida, it lures the wanderer to destruction; or, in other words, as fishes of every description are powerfully attracted by light, it may compensate to the Oyster for the deficiency of its moving powers.

Thirty-five species compose the genus *Solen*, Razor-Sheath or Knife-Handle. In the first division, the breadth of many of the shells are nearly

* Rees.

seven times their length, resembling the handle of a knife or razor-sheath; and some are curved and bent like the scabbard of a scimitar, with their ends invariably open. A few in the second department are of a fine pink colour; and the *S. castrensis* is singularly marked with short broken zig-zag purple lines, resembling Chinese characters, which appear, though more faintly, on the inner as well as outer surface; but in general, excepting the *S. squamosus*, or Scaly Solen, they have little to recommend them.*

This extraordinary shell is flat, pellucid, and of the purest white; of a sub-orbicular shape, minutely and elegantly punctured all over, in such a manner as to present the appearance under a common pocket lens, of the finest sha-green. It is also varied with obscure concentric wrinkles; the inside smooth, glossy, white, with obscure striæ radiating from the hinge.†

The Shell Collector lately discovered this extraordinary specimen in sand, brought from Salcomb Bay; it was perfectly clear and pellucid, and being very flat, resembled the scale of a fish.

The animal inhabitant of the *Solen*, though incapable of moving forwards horizontally, digs

* Mawe. † Dillwyn.

a hole nearly two feet deep in the soft sand, into which it can descend at pleasure. A fleshy and cylindrical leg, which is capable of being drawn out to a considerable length, and made to assume the shape of a hook or spade, is used for this purpose. Thus, when the *Solen* is preparing to form a dwelling in the sand, this singular appendage takes the form of a shovel, sharp on one side, and terminating in a point, by the aid of which a hole is dug; it then alternately assumes the shape of a hook, and the spade already mentioned; one serving the purpose of shovelling out the sand, the other to assist the wary animal in its precipitous descent. When the *Solen* wishes to change its place of abode, the leg is again put in requisition; it then takes the shape of a ball, and is stretched as wide as possible. This ball prevents the creature from slipping back, while the reaction of the muscles throws it forwards.

The inhabitant of the *Solen* has a mantle in front, and protrudes through the sand, in which it is generally concealed, two united tubes, about three or four inches in length from the upper end of the shell, for the evident purpose of maintaining a communication with the water.*

* Brooke.

The generic appellation is derived from a Greek word, signifying a tube. A considerable proportion of the shells of this genus are found in the European and Northern seas.*

They abound on the coast of Normandy, where they bury themselves in the sand. A gigantic variety, furnished, according to the legends of Scandinavia, a handle for the dagger of the Gaulish Cupid, who was armed, not with a bow and quiver, but with an enchanted cutlass. Hence, it is related, that when the Queen of Beauty descended on the Gallic coast in quest of pearls for her own dress, and a knife-handle for her son, a Triton, instigated by the envious Thetis, stole her apple from the rock, and bore it to the goddess of the sea. Thetis immediately broke asunder the golden prize, and scattered its seeds along the shore; whence arose the apple trees of Normandy, whose brilliant fruit perpetuates the memory of her triumph and revenge.†

Of the genus *Mytilus*, Muscle, forty-six specie are enumerated; constituting eight divisions. They differ considerably in external appearance; and while some are smooth, beautifully marbled and variegated with delicate colours, others are

* Mawe. † St. Pierre.

elegantly radiated with white and purple; others again consist only of one colour—as black, blue, green, yellow or brown, coarsely ribbed and grained with minute tubercles.

Many exhibit internally a pearly appearance; and some, when uncoated of a shaggy or bearded epidermis, and finely polished, display considerable brilliancy. The *M. margaritiferus* is celebrated for its irridescent colours; and is, moreover, the Pearl-Muscle of the Indian seas; though beautiful and costly pearls are occasionally found in the *Mya margaritifera*, or Pearl-Gaper, as well as in Colchester Oysters, and even under the shell of the sea-hare *aplysia*.* The animal inhabitant of the *M. lithophagus* shines like phosphorus in the dark. It inhabits a silvery tinted shell, crossed with delicate oblique striæ, and is common to the Indian, European, and Mediterranean seas, where it burrows in rocks and coral. The fishermen of the Bay of Naples frequently place the animal in the sun, and afterward rub their faces and hands with the moisture that exudes from it, by which means hey render them extremely luminous.†

Another species, the rare and beautiful *M.*

* Rees. † Dillwyn.

hirundo, or Swallow Muscle, which inhabits the Asiatic, West-Indian, and Mediterranean seas, varies in form, in colour, and in thickness. One of the most elegant of its varieties is green, with white rays; a second is of a dusky citron colour, rayed with brown; a third is white, beautifully dotted with green.*

The *Mytilus demissus*, or Silvery Muscle, is a favourite decoration among the North American Indians. They call it the white conch; and the breastplate of their High Priest is formed entirely of this kind of shell. This breastplate is worn on the great annual festival of the Indians, when, clothed in a white raiment of finely dressed doe-skins, which resembles the ephod of the Jews, this "great beloved man," as he is termed by his brethren, enters the holiest division in their place of worship, and offers the sacred fire as a yearly atonement for the sins of his people.†

The valves of the *Mytili* close and open according to the inclination or necessity of the inhabitant; and this movement is effected by means of a fleshy protuberance of a reddish colour. It is

* Dillwyn.

† *Star in the West;* an interesting American publication, designed to establish the opinion that the North-American Indians are descended from the ten tribes.

divided into two lobes, which answer the purpose of feet. Thus, when a river Muscle is inclined to leave its station, the shell is gradually opened by the help of this protuberance, which assuming a new form, pushes forward, and makes a furrow in the sand, into which the shell is drawn in a vertical position. From this position it almost immediately changes into its former horizontal one; the tentacula shovelling back the sand and lengthening the furrow, while the animal journies on its way, with a motion resembling a continual topsy-turvy. These tracks, most probably formed by the Muscle in quest of food, may be readily discerned in shallow clear streams, and resemble small furrows upon the sandy bottom; they are seldom strait, but deviate into traverses and triangles, like the course of a vessel when contending with adverse winds.*

Muscles found in the salt springs of Nubia emigrate during the rainy season to a considerable distance from their places of abode, and sometimes wander so far, that when the rains abate they have neither strength nor sufficient moisture left to enable them to return to their companions,

Marine Muscles are also furnished with the

* Rees.

means of progressive motion ; they can open and shut their shells at pleasure—remove to a considerable distance—fasten themselves to the rocks with threads similar to those of the silk-worm—respire water like their finny neighbours, and even sport upon the surface of the billows.

The construction of the inhabitant is extremely curious. It is fastened to the upper and lower shells by two white flat cords of muscular substance, which extend about two inches from the thick part of the body, growing gradually thinner. The extremity of each ear lies loose from the body of the animal; they are surrounded by a double brown fringed line, and are capable of being moved at pleasure. Next to these, above and below, are situated two other double fringed moveable substances, like the bronchiæ of a fish. These ears and fringes are joined to a cylindrical piece of hard and muscular flesh, which is capable of being contracted by the animal for the purpose of closing the doors of his impregnable citadel ; when, on the contrary, he wishes to throw them open, he relaxes the muscle, and expands the fringes, which act as wedges and separate the shells. Every part of this floating pavilion is inlaid with a membrane or epidermis, which, after having been saturated with water, unites so

closely as not to admit the passage of a single drop.

Between the hinge (*cardo*) and cylinder which serves to open or to shut the shells, lies the body of the animal, shaped like a bag. The mouth is near the hinge of the shell; it is enveloped in a veil, and has a double flap or lip on each side, whence the throat descends like a thread to the stomach. Close to the throat a curved and brownish coloured tongue is situated, half an inch in length, with an obtuse point; on the concave side of this appears a furrow, which the animal enlarges or shuts up, and probably uses to convey food to its mouth. The tongue is supposed to assist the motions of the fish as it alters its abode in search of food, or when disturbed by an enemy. Near the middle of the tongue are two blueish spots, which seem to be the eyes. In a deep hollow near the base of the tongue lies the byssus, or beard, fastened by two fleshy roots, and consisting of one hundred undivided parallel and flattened fibres, an inch long, of a dark green colour, with a metallic lustre. The top of each of these threads terminates in a circular gland or head, resembling the stigma of many plants. By means of this singular appendage, the Pearl Muscle fastens itself to rocks, corals, and other

solid bodies; adheres, when young, to the parental shell; and procures its food, which generally consists of small shell-fish, by extending or contracting its byssus at pleasure.

These curious shell-fish are frequently found buried in the sand, whence they project long breathing tubes, and thus maintain a constant communication with the water.*

"Go to the ant, thou sluggard," said Solomon; "consider her ways, and be wise." Let the unbeliever in the superintending providence of his Creator, examine the structure of this insignificant creature, and he will be constrained to acknowledge—unless blinded by prejudice, the moral cataract of the human mind, that the hand of Deity is conspicuous even here.

Muscles generally deposit their eggs in small cavities on the outside of their shells, to which they attach them by means of a gluey substance. Two or three thousand have been discovered, adhering to the shell of the common Muscle; but it is not certain that they were all deposited by the inhabitant, as this species of shell-fish, like the cuckoo, frequently appropriates a neigh-

* Rees.

bour's shell, for the temporary reception of her offspring.

A particular class of Muscles, the *M. lithophagus* and *M. rugosus*, Burrowing and Rugged Muscles, possess the extraordinary faculty of penetrating coral and calcarious rocks, and thus elude the vigilance of their marine enemies; nay, they are so firmly fixed in their holds, that it is impossible to extract them without breaking the enclosing substance. Others congregate together in immense beds or layers, and invariably attach themselves to extraneous bodies by means of a coarse silky byssus.*

These extraordinary instincts are necessary to prevent the total extirpation of the species, as they furnish a supply of food to different kinds of fish, marine birds, and animals.

But are not the *Mytili* defended with a firm testaceous coating? How, then, is it possible for a bird to open and devour them? These instinctive creatures pounce upon their prey, when left uncovered by the efflux of the tide, and mount with it to a considerable height; they then let go their hold—the shell is broken by the vio-

* Mawe.

lence of the fall, and the inhabitant easily extracted.*

Moneys also devour the Muscles, as well as other shell-fish, in considerable numbers. They watch the ebbing of the sea, and whenever an unfortunate Muscle opens his shell for the purpose of imbibing or rejecting water, a stone is immediately slipped in, which prevents the valves from closing, and renders him an easy prey to his sagacious adversary.

This kind of shell-fish is common to the Indian, Atlantic, American, and Northern oceans; they are also met with in New Zealand; in the Red, Mediterranean, and Russian seas; and a few occasionally diversify the inhospitable shores of Hudson's Bay.

Large beds of minute Muscles have also been discovered on the eminences of the Jouratzkaine coast, which borders the Frozen ocean. They are evidently a species unknown in the subjacent sea, and were most probably brought thither by such marine birds as resort to the Arctic flats for the purpose of eating them at leisure.†

The testaceous coverings of the genus *Anomia*, or Antique Lamp, has generally a small perforation,

* Mawe. † Arctic Zoology.

through which a strong ligament is protruded, whereby the animal affixes itself to different marine substances, as fuci, crabs, spines of echini, and especially to the stars of the madrepora prolifera. This singular provision is essential to the safety of the animal, as the shells are generally thin, delicate, and usually semi-transparent; peculiarities rarely discoverable in such as inhabit the ocean. Indeed, the shell of the *A. placenta*, or Cake Anomia, when in a young state, is capable of being rendered so transparent, that it is frequently used by the ingenious Chinese as a substitute for window glass. Many species, particularly the *A. caput-serpentis*, or Snake's head, when seen in profile, resemble the form of an antique lamp; and a few, as the *A. psittacea*, are very similar in their construction to the hooked or curved beak of a parrot.*

The European, Indian, American, and African oceans; as well as the Mediterranean and Northern seas, supply many species of this interesting shell-fish.

The excessive weight and thickness of the *Mya ponderosa* (Ponderous Gaper) or *M. crassa* of some authors, indicate that they are found in

* Mawe.

rapid rivers and in cataracts; indeed the shells of this peculiar genus are generally of a considerable thickness; and their inhabitants, which hide themselves in sand and mud, constitute a large proportion of the food of animals, and birds, in some inhospitable regions of the globe.

The shell of the *Donax* resembles a wedge. It is broad and thick at one end, and gradually tapers towards the other: a construction which considerably assists the animal in excavating its subterraneous dormitory. The hinge is furnished with two small teeth, consequently the anterior slope is generally gaping. Now, to remedy this apparent inconvenience, a ligament is placed near the fissure, which effectually prevents the valves from separating when the inhabitant of the *Donax* has occasion to expand them. "The meanest creature is in itself a collection of wonders." The peculiar construction of the Wedge-Shell; the slight adhesion of the hinges; the gaping of the valves; the ligament which prevents them from separating; and the power arising from all these of readily procuring its food, or changing its position, afford, when compared with the dissimilar construction of other shell-fish, convincing proofs of new and appropriate mechanism. The generic appellation of the Do-

nax is derived from its shape, which resembles the barbed head of a javelin or dart. It delights to burrow in the sand, or among loose pebbles on the sea-shore, and is found in almost every part of the known world.*

The *Chama*, Camp or Gaper, which occasionally produces large and costly pearls, is thus named from the gaping observable in two of its species. The *C. gigas*, or Giant Clam, is the largest shell in the order of testacea. We are informed by Linnæus, that one of this genus weighed four hundred and ninety-eight English pounds; that the inhabitant furnished one hundred and twenty men with provision for a whole day, and that, moreover, the sudden closing of its valves was sufficient to snap a cable asunder. A manuscript, in the library of the late Sir Joseph Banks, also notices the dimensions of a specimen brought from Sumatra, and preserved at Arno's Vale, in Ireland. The total weight of its gigantic valves amounted to five hundred and seven pounds. The largest measured four feet six inches in length, two feet five inches and a half in breadth, and one foot in depth. A shell of the same species forms the baptismal font at the church of St. Sulpice, at Paris; it was

* Mawe.

presented by the Venetians to Francis the First.*

Large pearls are occasionally found in the *Chama gigas*. One, exhibited at Sir Joseph Banks's, in June, 1804, was valued at two or three hundred pounds. The colour of this extraordinary shell is of a dirty white, or yellowish or reddish brown.† The hinge is furnished with a cartilage of a dull brown colour; but when cut and polished, is as beautifully irridescent as the opal.‡

Nature apparently delights in the variety and richness of her decorations. The shells of the genus *Cardium*, or Cockle, are sometimes of a dark brown colour, varied with white hollow elevated ribs. Those of the *Tellina*, or Tellin, are remarkable for their beautiful radiations; and many species of the *Venus* are unrivalled in the brilliant tinting and lustre of their shells.§ The rich purple *Venus mercenaria*, or Money Venus, is used by the Indians of North-America to form the purple and white beads with which their vampum, or treaty belts, are made.**

This elegant genus surpasses in beauty every other description of sea shells. It contains no less

* Dillwyn. † Dillwyn.
‡ Mawe. § Mawe. ** Brooke.

than one hundred and fifteen species, most of which are remarkable for the smoothness and brilliancy, as well as the rich and high colouring of their surfaces. One of the most beautiful is fabled to have constituted the car of Venus, which bore her in triumph to the shores of Paphros; thus elegantly noticed by a modern poet, when describing the heroine of his tale:

"Thou mean'st the daughter of the holy Callias;
I once beheld her when the thronging people
Prest round, yet parted still to give her way,—
E'en as the blue enamoured waves, when first
The sea-born goddess in her rosy shell
Sail'd the calm ocean."*

Different species are used for purposes of decoration.

"And oft a scattered ornament bestow
The tinctur'd rivals of the showery bow."

The females of the North-American Indians, especially, cover with them the shoes which they use in dancing, and thus produce a sound somewhat resembling the tinkling of the little bells that were worn, on similar occasions, by the Jewish ladies: a mode of decoration noticed and reprehended by Isaiah, in his energetic ad-

* Martyr of Antioch.

monition to the unthinking daughters of Zion, that the Lord would take away "the bravery of their *tinkling ornaments about their feet*, and their cauls and round tires like the moon," because of their haughtiness, and their forgetfulness of him. Isaiah, iii. 16, 18.*

Little is known with certainty respecting the peculiar instincts of the animal inhabitants of the Cardium, Tellina, and Venus, excepting that they are admirably adapted to the various stations which they are designed to occupy. The two former inhabit the American, Indian, and Atlantic oceans; the Mediterranean, Caspian, and Indian, seas. The latter are found in every part of the known world, and furnish a constant supply of food to marine animals and birds of various descriptions.†

The *Pinna*, Fin-shell, or Sea-wing, is a beautiful and well-known genus. The number of species which it includes is twenty-one.

The usual form of the Pinna resembles that of the larger species of Muscles, being long and tapering, narrow at the beaks, and gradually expanding towards the opposite extremity. The shells admit of some slight variations in colour;

* Star in the West. † Mawe.

they are generally brittle, and present a horn-like appearance, occasionally enriched with a steel-blue or copper-coloured gloss.*

These curious shell-fish are found in smooth water and in bays. The Mediterranean produces a considerable number; they are also discovered in the Indian, American, Atlantic, and European oceans, as well as in the Adriatic and Red seas.

The rocks under Cape St. Vito, once celebrated for an abbey of Basilican monks, and in most parts of the Mare Grande, are completely studded with the Pinnæ,

> "Thousands of spinning worms
> That in their green shops weave the smooth-hair'd silk
> To deck her sons."

They are elegantly termed the silk-worms of the ocean, in allusion to the fine silky beard, or byssus, by means of which they moor themselves firmly to the rocks, or allure small fish by the floating or trembling of the filaments in the water.† This singular appendage is readily produced by the animal on any sudden emergency. It darts out an extensile member, and discharges from its tip a drop of glutin, which, by the draw-

* Mawe. † Swinburne.

ing back of the same organ, immediately forms a silky thread; till by a repetition of this simple operation, a thick tuft is at length completed.*

Considerable numbers of the Pinnæ are annually fished up in the Mediterranean, from the depth of twenty or thirty feet. An instrument called a cramp is used for the purpose; it is a kind of iron fork, with perpendicular prongs, eight feet in length, each of them about six inches apart, the length of the handle being in proportion to the depth of the water; for notwithstanding the extreme delicacy of the individual threads, they form such a compact tuft, that considerable strength is necessary in separating the shells from the rocks to which they adhere.†

This tuft of silk, termed by the Sicilians, lana-penna, is then broken off, and sold, in its rude state, for about fifteen carlini a pound, to the countrywomen, who wash it throughly in soap and water. They then dry it in the shade, straiten the threads with a large comb, cut off the useless root by which it adhered to the animal, and card the remainder; by which means they reduce a pound of coarse filaments to about three ounces of fine thread. This they

* Dillwyn; M. De Reaumur. † Swinburne.

fabricate into various articles of wearing apparel, such as stockings, caps, gloves, and waistcoats. The web is of a beautiful yellow brown, resembling the burnished gold on the backs of some splendid flies and beetles: an effect which is produced by steeping it in lemon-juice, and afterwards pressing it with a warm iron.*

A considerable manufactory of stuffs is established at Palermo; they are extremely elegant, and vie in appearance with such as are fabricated from the finest silk.

In the year 1754, a pair of stockings were presented to Pope Benedict XV., which, in consequence of their extreme fineness, were enclosed in a small box not larger than one of an ordinary size, such as is used for holding snuff. A robe, of the same singular materials, is mentioned by Procopius as the gift of a Roman emperor to the satrap of Armenia.

It is even conjectured, by some writers, that the fine byssus, or byssum, produced in India, Egypt, and about Elis, in Arabia, was no other than the threads of this interesting shell-fish, from which the richest apparel was anciently made, and afterwards died purple, for the sacer-

* Swinburne.

dotal vestments of the Jewish and Egyptian priests. Some interpreters of the Scriptures render the Greek word, denoting byssus, by fine linen; but other versions, such as Calvin's, and the Spanish printed at Venice in 1556, explain it by silk; though undeniably of a different kind than the produce of the silk-worm, as appears from the testimonies of several ancient writers, particularly Jul. Pollux. Commentators usually distinguish two sorts of byssus, one of Elis, the other of Judea; from the latter the sacerdotal vestments were uniformly made; the former being assigned to the wearing of the Levites.*

Thus elegantly has the Earl of Shaftesbury referred to the productions of these industrious insects:—"How shining, strong, and lasting are "the subtile threads spun from their artful "mouths! Who beside the All-wise has taught "them to compose the beautiful soft shells, in "which, recluse and buried, yet still alive, "they form those beautiful threads, when not "destroyed by men, who clothe and adorn themselves with the labour of these sweet creatures, "and are proud of wearing such inglorious "spoils?"

* English Encyclopædia.

The animal inhabitant of the Pinna is a blind slug, to which the Sepia, or Cuttle-fish, is a deadly foe.

"Ambush'd in weeds, or sepulchred in sand,"

he watches all his motions; and no sooner does he open his bivalve shell, which occasionally exceeds two feet in length,* than he rushes upon him like a lion. It will naturally be asked, how such a blind, defenceless creature can either procure food, or protect itself from the attack of its implacable enemies. Nature uniformly redoubles her exertions in favour of the weak. A kind of crab-fish, naked like the Hermit, and very quick-sighted, is the constant companion of the *Pinna marina*. They live and lodge together in the same shell, which belongs to the latter. When the Pinna has occasion to eat, he opens his valves, and sends out his faithful purveyor to procure food. If any foe approaches, the watchful Crab returns with the utmost speed and anxiety to his blind protector, who being thus warned of danger, shuts his valves, and escapes the rage of the enemy; when, on the contrary, the Crab loads himself with booty, he makes a gentle noise at the opening of the

* Brookes; Mawe.

shell, which is closed during his absence, and when admitted, the two friends feast together on the fruits of his industry.* This curious fact, although well known to the ancients, escaped till lately the observation of the moderns. Aristotle tells us that the Pinna kept a guard to watch for him; that there grew to the mouth of the Pinna a small animal, having claws, and serving as a caterer, resembling a crab, and termed the *Pinnophylax*. In like manner, Pliny mentions a small animal called *Pinnotheres*, which, he says, is liable to injury, and therefore prudently hides itself in the shell of Oysters. He also speaks of the Pinna as belonging to a genus of shell-fish, produced in muddy water, and constantly attended by a companion, termed by some *Pinnotheres*, by others *Pinnophylax*.†

" One room contains them, and the partners dwell
Beneath the convex of one sloping shell
Deep in the wat'ry vast the comrades rove,
And mutual interest binds their constant love :
That wiser friend the lucky juncture tells
When in the circuit of his gaping shells
Fish wand'ring enter; then the bearded guide
Warns the dull mate, and pricks his tender side ;

* Hasselquist. † Encyclopædia Britannica.

He knows the hint, nor at the treatment grieves,
But hugs th'advantage, and the pain forgives:
His closing shell the Pinna sudden joins,
And 'twixt the pressing sides his prey confines;
Thus fed by mutual aid, the friendly pair
Divide their gains, and all the plunder share."

OPPIAN.

It is impossible to contemplate this curious fact without mingled emotions of surprise and pleasure. The naturalist may view it merely with a reference to his favourite pursuit; but the Christian philosopher regards it as a striking proof that the tender mercies of the Creator are over all his works. Wonderful and consolatory thought! He, who has kindled the suns of other systems, takes care of the helpless Pinna, and assigns him a companion which, himself houseless and defenceless, amply compensates, by activity and quicksightedness, for the deficiencies of his blind protector.

Adieu! I am, &c.

LETTER IX.

PEARLS.

TO * * * * *.

August 1*st*, 1823.

THE pearl is elegantly termed by oriental writers, "Margion, or a globe of light;" from which, and the Persian name "Mervarid," that is, the offspring of light, was derived "Marguerite," the appellation in southern Europe.*

To account for the formation of this valuable gem, has embarrassed the speculations of both ancient and modern naturalists. Pliny, and after him Solinus, struck with its similarity to a drop of dew, imagined that the pearl fish rose every morning to the surface of the water, and expanded its shell to imbibe the dew of heaven; which, silently descending like a liquid pearl, entered the body of the Oyster, and assumed the texture, shape, and colour of a real pearl. This elegant

* Rees.

hypothesis was probably suggested by the various transformations observable in nature ; such as the conversion of the nectareous juice of flowers into wax and honey.

A similar opinion is still entertained by the natives of Ceylon, and recorded in the Sanscrit books of the Brahmans. The Persians hold the same idea, of which the following ingenious fable is an interesting proof. Addison introduces it at the conclusion of one of his fine moral essays, in which he shows the presumption of ascribing our successes to our own good management, instead of considering them as the bounty of heaven.

" A drop of water fell out of a cloud into the " sea, and finding itself lost in such an immen- " sity of fluid matter, broke out into the follow- " ing reflection :—Alas ! what an insignificant " creature am I in this prodigious ocean of " waters ; my existence is of no concern to the " universe ! I am reduced to a kind of nothing, " and am less than the least of the works of " Omnipotence. It so happened that an Oyster " which lay in the neighbourhood, chanced to " gape and swallow it in the midst of its humble " soliloquy." The drop, says the fable, lay a great while hardening in the shell, till by degrees it was ripened into a pearl ; which falling

into the hands of a diver, after a long series of adventures, is at present that famous pearl which is fixed on the top of the Persian diadem.

Many equally wild and extravagant opinions were advanced to account for the formation of the pearl by different European naturalists, and succeeded by others of a similar description, till the year 1717, when M. Reaumur, in a curious paper which appeared in the Memoirs of the French Academy, on the structure of both shells and pearls, conjectured with great probability (and his conjectures are now generally admitted), that pearls are formed of a juice extravasated out of some ruptured vessels, and detained, and fixed, among the membranes of the Oyster.

To evince the probability of this ingenious supposition, he shows that oceanic and river shells are formed wholly of a glutinous and stony matter, which oozes from the body of the animal; and that, consequently, an animal furnished with vessels fraught with a sufficient quantity of stony juice to build, thicken, and extend a shell, is fully capable of forming pearl, if the juices designed for the increase of its habitation should chance to overflow, among the membranes, or to

fill up any accidental cavity in the body of the animal itself.

In proof of which, he has further shown, that when pearls of two colours are found in the Pearl Muscle of Provence, the tints of each are precisely the same with those of the shell; and that each kind of coloured pearl is found in the corresponding coloured part of the shell itself; thus clearly evincing that where the transpiration of a certain juice had formed, and would have continued to form a coat or layer of a peculiar tint, the vessel that conveyed the juice had ruptered and occasioned a small deposit, which gradually becoming hard, retained the colour of the shell. Of this the structure of the pearl, and the shell itself is a convincing proof; for the silver or pearl-coloured part of the Pearl Muscle is formed of strata lying one upon another like the coats of an onion; and also of the reddish part of a multitude of small, short, close, cylindrical fibres; which peculiarity of texture is also discoverable in the different coloured pearls of the Muscles of Provence. These are both composed of concentric couches; but those of the reddish pearl are much less sensible, and are moreover furnished, like the shells, with fibres

diverging from the centre to the circumference.

The intrusion of some heterogeneous substances, such as particles of sand, into the stomach of the animal, frequently produces these curious extravasations. M. Reaumur elegantly terms them the nuclæ, or primary causes of the formation of these valuable gems; as the sagacious animals cover them from time to time with exudations of pearly matter, in order to obviate the disagreeable friction which they necessarily occasion; and these exudations form several regular lamellæ, resembling the coats of an onion, or different strata of bezoars, though considerably thinner, and more delicate in their construction. Loose pearls are often found within the shelly covering of the Mytilus; when this is the case, they have been undoubtedly rejected from the stomach of the animal, and have fallen into the cavity of the shell; whilst such as are fixed, most probably owe their origin to some interior roughness.*

The exterior of the *Mytilus margaritiferus* generally indicates the value of the gem which it contains. Such as are varied and incrusted with

* Rees.

thick calcarious substances, and with zoophytes of various kinds, enclose the finest pearls; those, on the contrary, which present a smooth surface, have only begun to form these valuable secretions, and are sometimes entirely without them.*

The observation of this curious fact probably suggested the first idea of forcing the Mytilus to produce pearls. It was known in the first centuries of the Christian era, and acted on by the ancient people who inhabited the coasts of the Red Sea, as we are informed by the philosopher Apollonius. "The Indians," said he, "dived into the sea after they had rendered it calm, and perhaps clearer, by the pouring in of oil; they then induced the Muscles, by means of some attractive baits, to expand their shells, and having pricked them with a sharp-pointed instrument, received into a perforated iron vessel the liquor which exuded from the wound, where it hardened gradually, and formed pearls of the finest water."

Modern naturalists are undecided with regard to the accuracy of this narration; yet there are various reasons to conclude, that the people who lived on the shores of the Red Sea were acquainted with an artificial mode of producing

* Rees.

pearls; and this opinion is additionally confirmed by the method now in use among the modern Chinese, who retain, with few alterations, the arts and customs of their ancestors. Pearl Oysters, at certain seasons of the year, congregate in considerable numbers on the surface of the water, where they open their shells, and enjoy the influence of the sun. At this period the Chinese fishermen throw into each of them a small string of beads, formed of mother-of-pearl, which becoming incrusted in the course of a few months, present the appearance of real pearls. As soon as this curious process is supposed to be completed, the Muscles are drawn up, and robbed of the treasures which they contain. The truth of this extraordinary statement may be implicitly relied on; it is confirmed by the testimony of respectable travellers, and the result of various experiments; to which Professor Fabricius adds the testimony of having seen, in the possession of Sir Joseph Banks, several Chinese Chamæ, in the shells of which were contained bits of iron wire, covered with a substance of a pearly nature.* These wires had

* Dillwyn.

evidently once been sharp, and it seemed as if the sagacious Muscles, anxious to secure themselves against the intrusion of such unwelcome visitors, had incrusted, and thus rendered blunt, the points with which they came in contact. May not, therefore, the process employed by the ancients be still practised? And are we not authorized in conjecturing that these bits of iron, which probably had slipped from the hands of the Chinese workmen, and remained in the animals, resembled the spikes noticed by Philostratus as being used by the ancient people who inhabited the banks of the Red Sea, for the purpose of pricking Muscles.

The invention of Linnæus cannot therefore be considered altogether new; though he was undoubtedly, in Europe, the reviver of this ancient art. It was announced to the Swedish King and Council in the year 1761, with an offer of disclosure for the benefit of the kingdom. Various circumstances prevented the acceptance of his liberal offer, and the secret was purchased by a Gottenburg merchant of the name of Bagge, for the sum of five hundred ducats. The sealed manuscript containing the receipt was afterwards disposed of, by the heirs of this gentleman,

to the highest bidder; and is said by Dr. Stover to have passed into the hands of our distinguished countryman, Sir J. E. Smith.

The emblematic coat of arms, which typified the feelings of an admiring country, while it ennobled the celebrated Swedish naturalist, is stated to have been given in consequence of this important invention: but it appears from the historian of Linnæus, that the patent of nobility was granted previous to the year 1756; and that the pearl which superficial observers have assigned to his arms was in fact an egg, designed by the blazoner, M. Tilas, as an emblem of maternal nature, after the manner of the ancient Egyptians. The arms of Linnæus are, indeed, equally elegant and appropriate. They are divided into three fields, each of which designates the three kingdoms of nature; the red signifying the animal, the green the vegetable; the whole is surmounted by an helmet, and the beautiful linnæa forms the crest. The phalaena linncella, shining with its silvery colours, is displayed around the border in preference to festoons, and below the motto, "*Famam extendere factis*," immortalizes the active genius of Linnæus.*

* Life of Linnæus.

The appellation of Margion, or globe of light, with which the Orientalists designate their favourite gem, is elegantly expressive of its peculiar form and lustre; as the true shape of the pearl is that of a perfect round. When its contour resembles a pear it is less valuable; it is then generally used for ear-rings, and ornaments of a similar description. The natives of the East, like the ancient Romans, prefer it to any other kind of precious stone. The finest are used for personal decoration, while those of an inferior description are seen to sparkle on the trappings of their horses. We are even told that, in the magnificent hunting equipage of the Sultan Mahmoud, consisting of four hundred greyhounds and bloodhounds, each was decorated with a collar set with jewels, and a covering edged with gold and pearls.

These beautiful productions are frequently alluded to by Oriental writers.

Hafiz has thus admirably illustrated from them a maxim of the ancient Arabs, which says to the virtuous man, "confer benefits on him who has injured thee."

"Learn from yon orient shell to love thy foe,
And store with pearls the wrist that brings the woe;

Free, like yon rock, from base vindictive pride,
Emblaze with gems the hand that rends thy side;
All nature cries aloud—can man do less,
Than heal the smiter and the railer bless?" *

It is customary among the Turks to send letters to their distant friends entirely composed of various little articles, to which some appropriate meaning is attached: in these the Margion always holds a conspicuous station, and signifies "fairest of the young;" as a rose, "may you be pleased, and your sorrows mine." There is, indeed, no kind of colour, flower, weed, or fruit, herb, pebble, gem, or feather, which has not some meaning assigned to it by the natives of the East.†

The Persian poet Meskin Aldaramy, in allusion to these fanciful associations, has thus elegantly compared his friends to a string of pearls; himself to the cord on which they are suspended.

"With conscious pride I view the band
Of faithful friends that round me stand,
With joy exult that I alone
Can join these faithful friends in one:
For they're a string of pearls, and I,
The silken chord on which they lie.

* Asiatic Researches.

† Letters by Lady Mary Wortley Montague.

With joy their inmost souls I see
Unlock'd in every heart to me;
To me they cling, on me they rest,
And I've a place in every breast;
For they're a string of pearls, and I,
The silken chord on which they lie." *

The following allusion to this beautiful production of the Indian seas is certainly not inferior to the preceding:

" Farewell—farewell to thee, Araby's daughter,
(Thus warbled a Peri beneath the dark sea);
No pearl ever lay under Oman's green water,
More pure in its shell than thy spirit in thee.

" Oh, long upon Araby's green sunny highlands
Shall maids and their lovers remember the doom
Of her, who lies sleeping among the Pearl Islands,
With nought but the sea-star † to light up her tomb.

" Farewell—be it ours to embellish thy pillow,
With every thing beauteous that grows in the deep;
Each flow'r of the rock, and each gem of the billow,
Shall sweeten thy bed, and illumine thy sleep.

* Carlisle's Translation from the Arabic.

† Star-fish: one of the greatest curiosities found in the Persian Gulf. It is circular, and at night very luminous, resembling the full moon surrounded by rays.

" Around thee shall glisten the lovliest amber
That ever the sorrowing sea-bird has wept ;
With many a shell, in whose hollow-wreath'd chamber,
We, Peris of Ocean, by moonlight have slept."

Adieu, I am, &c.

LETTER X.

PEARLS.

TO *****.

August 9th, 1823.

As early as the days of Solomon, a considerable trade was carried on by the Phenicians of Sidon and Tyre, who, both in their manners and policy, resembled the great commercial states of modern Europe. Among the various branches of their commerce, that with India for pearls may be considered as one of the most lucrative and most considerable. Having wrested from the Idumæans some commodious harbours towards the bottom of the Arabian Gulf, they rendered them the great emporiums of Oriental commerce, whence they diffused these costly productions, in common with many others, along the Eastern and Southern coasts of Africa. The distance, however, from the Arabian Gulf was a considerable one, and the conveyance of goods by land carriage attended with so much inconvenience, that these enterprizing people at length took possession of Rhinoculura, the nearest port

in the Mediterranean to the Arabian Gulf. Thither all the commodities from India were readily conveyed, re-shipped, and transported by an easy navigation to Tyre, and by "her merchants who were as princes, and her traffickers the honourable of the earth," distributed throughout the world. But at length the declining glory of the merchant city bore ample testimony to the validity of the prophetic declaration, "That the Lord had given a commandment against it," to "destroy the strong holds thereof;"* whilst it afforded a melancholy earnest that the period was rapidly approaching, when the site of imperial Tyrus was destined to become as the top of a "barren rock, even a place for the fishermen to spread their nets upon."† Alexandria was erected by the enterprizing genius of the monarch whose name it perpetuates, and at length monopolized the advantage of supplying Europe with the productions of the East.

Upon the conquest of Egypt by the Romans, pearls, in common with other Oriental productions, continued to be brought into Europe by the same channel; and, amid all the various articles of luxurious decoration in which the

* Isaiah xxiii. 8—11. † Ezekiel xxvii. 14.

Romans so much delighted, it is recorded that a decided preference was given to pearls. They were eagerly purchased by persons of every rank, and worn in every part of the dress ;* the most expensive were considered as necessary appendages to rank and fortune; while smaller ones, of inferior quality, displayed the taste, and gratificd the vanity of persons in a humbler sphere.† Indeed, so ardent was the general admiration of this kind of gems, and so enormous the prices given for them, that we are informed by Pliny that Julius Cæsar presented Servilia, the mother of Brutus, with a pearl, for which he paid forty-eight thousand four hundred and fifty-seven pounds. The famous ear-rings which the profligate Cleopatra dissolved in vinegar, and drank to the health of Mark Antony, were valued at one hundred and sixty-one thousand four hundred and fifty-eight pounds. In emulation of which, the dissipated Clodius presented each of his guests with a glass of vinegar in which a valuable pearl had been dissolved. ‡

Nor was the wearing of pearls confined to Oriental ones: the rivers of Germany and

* Robertson's Historical Disquisition concerning ancient India.

† Annals of Tacitus. ‡ Rees.

Saxony were ransacked for this favourite gem; and it is recorded by Suetonius, that the reports which had reached Rome concerning the British pearls, were the actuating motives which induced Cæsar to attempt the conquest of the island.

His expectations were not entirely realized; but a buckler formed of English pearls was carried by the conqueror to Rome, where it was dedicated to Venus, and hung up in her magnificent temple as an offering worthy of the sea-born goddess.

As such was the general predilection, it will not appear extraordinary that, while the imperial city was filled with patricians, who had scarcely any other occupation than to enjoy and dissipate the wealth acquired by their ancestors, the demand for their favourite gem, as well as for every thing elegant, rare, or costly which exotic climes afforded, should continually increase, in order to support their pomp, or to heighten their pleasure.

Hence extraordinary efforts were continually made, and as the commerce with India increased, new channels of communication were successively opened. From the earliest ages some intercourse had subsisted between Mesopotamia and other provinces on the banks of the Euphrates,

and those parts of Syria and Palestine which lay near the Mediterranean, of which the migration of Abram from Ur of the Chaldees to Sichem, in the land of Canaan, is a convincing proof. As the intercourse increased, the possession of this station became an object of such importance, that Solomon, when he turned his attention towards the extension of commerce among his subjects, built a fenced city there. Its Syrian name of Tadmor in the Wilderness, and its Greek one of Palmyra, are both descriptive of its situation in a spot adorned with palm trees. This was not only plentifully supplied with water, but surrounded with a portion of fertile land, which, though of no great extent, rendered it a delightful residence, in the midst of barren sands and an inhospitable desert.* Its present state "pleads haughtily for its past glories." It rises like an island out of a vast plain of sand, covered with the magnificent ruins of temples, porticoes, aqueducts, and other public works, which in splendour and extent, and some of them in elegance, were not unworthy of Athens or of Rome in their most prosperous state. The Arabs of the desert now pitch their tents amid the ruins; and at Pal-

* Robertson.

myra, as well as at Balbec, thousands of little lizards crawl over the ground, the walls, and stones of the ruined buildings.*

Such is the present state of Palmyra In ancient times it was the emporium of Eastern commerce, and traded with the Romans, and their rivals for empire, the Parthians. Indeed so great was its power, that Zenobia contended for the dominion of the East with Rome, under one of its most warlike Emperors: a power which evidently resulted from the opulence acquired by extensive commerce. Of this the Indian trade was undoubtedly the most considerable and most lucrative branch.

But while the merchants of Egypt and Syria exerted their activity to gratify the increasing demands of Rome, the eagerness of gain (as Pliny observes) brought India itself nearer to the rest of the world. Navigation began to occupy the attention and exercise the ingenuity of experienced seamen. Hippalus, the commander of a ship engaged in the Indian trade, ventured, about fourscore years after Egypt was annexed to the Roman Empire, to relinquish the slow and gradual course through which the commodities of India had found their way into Egypt, and

* Wood's Ruins of Palmyra.

stretching boldly from the mouth of the Arabian Gulph across the ocean, was carried by the western monsoon to Musiris, a harbour in that part of India now known by the name of the Malabar coast.

The discovery of this route to India was considered of great importance, and Musiris and Barace, another harbour not far distant, were continually resorted to by the Indian and Egyptian merchants. Hence the splendid productions of the East, its elegant manufactures, spices, aromatics, precious stones and pearls, were more readily diffused among nations possessed of wealth sufficient to purchase them; and Rome, the ancient capital of the empire, and Constantinople, the new seat of government, were supplied with the precious commodities of that country by the merchants of Alexandria.

Under the Emperor Justinian, Persia became a rival to the Romans, in the Indian seas. About fourscore years after his decease, the conquests of Mahomet occasioned a considerable revolution in Oriental commerce; and at length the same commercial spirit which prompted the Mahomedans of Persia to visit the remotest regions of the East, animated the Christians of that country.

But while the Christians and Mahomedans

continued to extend their knowledge of the East, the inhabitants of Europe found themselves almost entirely excluded from any intercourse with their Oriental neighbours. Egypt had passed from under the Roman yoke; Alexandria shut her port against them; and the new lords of the Persian Gulf, satisfied with supplying the demand for Indian commodities in their own extensive dominions, neglected to convey them, by any of the usual channels, to the trading towns of the Mediterranean. The opulent inhabitants of Constantinople and other great cities of Europe bore this privation of luxuries to which they had been accustomed, with extreme impatience; and the surprising efforts which were then made to open fresh channels of communication with the East, strikingly evince the high estimation in which its commodities were held. The endeavours of the European merchants were ultimately crowned with success: Constantinople became a considerable mart of Indian and Chinese commodities, and thus the pearls of India were again circulated throughout Europe.*

It is foreign to our purpose to notice the va-

* Robertson.

rious commercial revolutions which the long wars between the Christians and Mahomedans occasioned.

Amalphi, Venice, with the capitals of Genoa and Portugal, successively diffused throughout Europe the costly productions of the East. Other nations also gradually arose upon the commercial platform; and at the present period the pearls of India, with its spicery and rich perfumes, gold, frankincense and myrrh, muslins, shawls, and chintzes, are widely circulated, through the medium of innumerable channels.

Having thus completed a general survey of the various sources of communication through which the pearls of India were introduced into Europe, it now remains to show the different places from which they are derived, as well as to point out the pearl fisheries of ancient times.

These to a considerable extent formerly subsisted in the Red Sea, the pearls of which are supposed by Mr. Bruce to have been produced in the shell of a species of Pinna. He conjectures that this kind of pearl was the penim or peninim of Scripture, and that the name is derived from its redness, peninim being literally translated by the Greeks, pina or pinna, and the shell pinnicus. This shell abounds in many

places mentioned by Strabo, Theophrastus, and Ptolemy. The same species is noticed by Solomon, as the most precious of all productions.

Job also refers to them in the following memorable passage: "No mention shall be made of coral or of pearls, for the price of wisdom is above rubies."—xxiii., 18.

The peninim is said to have been the most valued or the best known in India; and though Pliny acknowledges that the excellency of pearls consists in their whiteness, yet this opinion was, to a certain degree, a local one, for those of a yellow cast are as much esteemed in India, as the peninim, or reddish pearl, was in Judea, during the reign of Solomon.

Considerable pearl fisheries formerly subsisted on several of our rivers, particularly the Conway and Esk. Sir Richard Wynn of Gwydir, chamberlain to Catherine, Queen of Charles II., presented her Majesty with a valuable gem taken from the former of these rivers; which was placed, and still continues, in the royal diadem, as a beautiful specimen of the English pearl.*

The habit of wearing Oriental and foreign pearls has superseded those of Welch and

* Pennant's British Zoology.

English growth; but the *Mya margaritefera*, or Pearl Gaper, is still common to many of our native rivers.* The Shell Collector remembers to have met with a remarkably fine specimen on the banks of the Conway, within sight of its ancient castle; a most majestic ruin, rising proudly from the shelving sides of the rock, and washed by the high tides of the river. It was a fine evening in the month of June. The sun was setting in mild majesty, his tempered beams shed a soft radiance on the aged ruin, and tipped with silver the dark drapery of ivy and festoons of wild honeysuckles which streamed down the broken walls. All was silent, except the fitful rustling of the stream, or the gentle sighing of the wind, as it murmured through the ruined chambers, and shook the long fantastic tufts of withered grass, "wherewith the mower filleth not his hand, nor he that bindeth sheaves his bosom." This scene of desolation brought to his remembrance the days of ancient times, when the sun rose as gloriously, and set as mildly over the proud battlements of Conway Castle, as then on its deserted ruin. He thought too of the joy and grief with which, for more than ten centuries, those must be fami-

* Mawe.

liar, who were once its glory and its boast, but are now forgotten; and his thoughts recurred to the busy multitudes who once resorted to the Conway in quest of its valuable gems, but whose remembrance has passed away like the billows of its mountain stream.

Chateaubriand preserved as memorials of his travels the waters of the different rivers that he visited. With the same view the Shell Collector has added to the *Mya* of the Conway, those of the rapid Teith, and Ythan, rivers of Scotland, with a specimen from the tranquil Elster, that waters the plains of Saxony. Each of these rivers produces Pearl Muscles in abundance; and their gems, though certainly inferior to those of oriental growth, are used in necklaces, the price of which is sometimes estimated at a thousand crowns.* As late as the beginning of the last century, Ireland also boasted her pearl fisheries, and several beautiful specimens were brought from the rivers of Tyrone and Donegal; one of which came into the possession of Lady Glenlearly, who wore it in a necklace, and refused eighty pounds which was offered for it by the Duchess of Ormond.*

* Pennant's British Zoology.

Modern history furnishes several instances of the value attached to this kind of gem. One in the possession of Philip II. of Spain was estimated at fourteen thousand eight hundred ducats; another belonging to the Emperor Rudolph, called peregrina, or the incomparable, of the shape of a pear, weighed thirty carats; and a third, mentioned by Tavernier, in the hands of the Emperor of Persia, was bought in the year 1633, of an Arab, for thirty-two thousand tomans; which, at three pounds nine shillings the toman, amounts to one hundred and ten thousand, four hundred pounds sterling.*

A considerable number of pearls are annually brought from the great Gulf of Mexico, along the coast of Terra Firma, where five extensive fisheries are already established.

The city of Nipehoa, situated on a lake of the same name in Chinese Tartary, produces pearls in abundance, though of inferior quality. This fishery occasioned a dreadful war between the Chinese and Muscovites, which was at length amicably settled, towards the end of the seventeenth century, by the intervention of two individuals, who benevolently suggested a division

* Rees.

of the lake between the contending nations, each of which had pretended to the whole.*

The fisheries of the Bornean islands were formerly much frequented, but are now of little consequence; such is also the case with those of the South Sea.

From the earliest periods of authentic history the Indian seas and rivers were celebrated for the production of the pearl. They are rich, says an Oriental writer, with pearls and ambergris; their mountains are stored with gold and precious stones; their gulfs inhabited by creatures yielding ivory; and among the plants and trees with which their shores are shaded and adorned are ebony, red-wood, and the wood of Hairzan, aloes, cloves, sandal, and all other spices and aromatics; parrots and peacocks are the birds of the forests; musk and civet the productions of the land. To these exotic regions we must therefore look for the finest pearls. They are brought from the island of Bahrein, or Baharem, in the Persian Gulf, from the fishery of Catisa, on the coast of Arabia Felix, and from Ceylon and Japan.

The pearl fishery established at Manaar, a seaport in the island of Ceylon, is one of the

* Rees.

most considerable. It commences in February, and ends about the beginning of April. During this period Candatchy, about ten miles from Manaar, presents an interesting and novel spectacle. The bay is thronged with vessels; the coast with an incredible multitude from all parts of India, consisting of persons of different complexions, countries, castes, and occupations. Here are to be seen boat-owners running to the shore with anxious faces, and looks of joy, in hopes of a rich cargo, stepping on the rocks that project into the sea, and wading as far as they can venture. There groups of jewellers, brokers, merchants, foreigners and natives, variously employed; some bargaining for pearls, others separating and sorting them; others with scales in their hands, weighing and ascertaining the value of each; others hawking them about; while a considerable number occupy themselves in drilling and preparing the pearls for future use.

Occasionally a few fantastic figures are seen to mingle with the motley groups. These are conjurers, known in the Malabar language by the appellation of Pillal Karras, or binders of sharks. They are held in great veneration by the credulous natives, who firmly believe in their miraculous pretensions. Each boat is accordingly

accompanied by one or two of these impostors, who frequently carry off the finest pearls; whilst others take their stations on the shore, where they spend the day in muttering prayers, distorting their bodies, and performing a variety of unmeaning ceremonies.

In the mean time the bay is thronged with vessels of various descriptions. The boats employed in the fishery assemble at the same period, and wait the signal for setting sail. This signal is the firing of a gun at Arippo, which is answered by a loud huzza; each boatman then plies his oar, the vessels sail out together, and reach the pearl bank, twenty miles distant, before day-break. Here they continue busily occupied, till warned to retire by the sea breeze, which rises about noon. Again a signal gun is fired, and the respective owners hail the arrival of their boats.

A number of people are now seen busily occupied in depositing the Oysters in holes or pits, dug in the ground to the depth of two or three feet; or on small square places covered with mats and fenced round, where they are suffered to remain till the inhabitant of each is completely dried away: the pearls are then taken out and prepared for the market.

Each boat is manned with twenty men, and a tindal, or chief boatman, who acts as pilot, Of these, ten are employed in rowing, or in assisting the divers: the others go down alternately, five at a time, and thus enable their companions to recruit their strength, which is frequently exhausted by the excessive fatigue of diving.

The business of a diver appears extraordinary and full of danger to a European; but to the Asiatic it affords a lucrative and familiar occupation. His chief risk and terror arises from the ground shark; a common and terrible inhabitant of the Eastern seas, and a source of perpetual uneasiness to the adventurous Indian. It, however, rarely happens that any lives are lost, for the real or imaginary appearance of a shark immediately spreads dismay throughout the whole fleet; each diver then rapidly ascends, and the boats return to Condatchy, whence they seldom venture out during the day to recommence the business of fishing.

In order to facilitate the descent of the divers, the boats are separately furnished with five large pyramidical shaped, and perforated stones, round at the top and bottom. These are fixed to different ropes, and each diver, when about to plunge, seizes one of them with the toes of his

right foot; while with the other he suspends a bag of net work; for these people are so extremely dexterous in the use of their feet, that they employ them, as well as their hands, for the most common purposes, and sometimes pick up the smallest stones or straws from off the ground. The diver then takes hold of another rope in his right hand; while with the other he endeavours to prevent the water from entering his nostrils, plunges into the sea, and speedily reaches the bottom; where he is eagerly occupied in tearing up the shells, cramming them into his bag, which he suspends around his neck, and running from side to side, in order to render the water turbid and elude the vigilance of his marine foes.

As soon as the bag is full, or the appearance of any danger warns the diver to retreat, he resumes his former position, makes a signal to those above by pulling the rope in his right hand, and immediately ascends.

The fatigue attendant on the act of diving is very great, and the men employed in the pearl fishery frequently discharge not only water, but even blood from their ears and nostrils, on being drawn into the boat. But this does not prevent them from making forty or fifty plunges during the course of the day: for persons accustomed

to the water from their infancy acquire a sort of amphibious nature, and appear to retain the same self-possession, while in this deceitful element, as when on land. Savage nations, as well as the adventurous Indians, are remarkable for this peculiarity; and according to the accounts of several voyagers, the inhabitants of the South-Sea islands are such expert divers, that when a nail, or any piece of iron, is thrown overboard, they will instantly plunge into the sea, and never fail to recover it, notwithstanding the quick descent of the metal.*

Each of the pearl divers generally remains under water about two minutes at a time, though instances have occurred in which four, or even five minutes, have been devoted to this dangerous employment; and a diver from Anjanga, in the year 1797, absolutely remained under water during the space of six minutes.

Such is the general method of obtaining pearls; such are the dangers connected with this adventurous trade. Yet these costly gems have no pretensions to any actual use, as their value arises merely from their rarity and beauty, united to a general predilection for ornamental decorations:

* Rees' Cyclopædia; Cook's Voyages.

a predilection which appears natural to mankind, both in a savage and civilized state; for uncultivated people adorn themselves with feathers and with shells; and among luxurious nations pearls and jewels are generally the insignia of riches or of rank. The former are undoubtedly the most perfect and beautiful of precious stones. Every other description owe something to the hand of man, but the "Margion" emerges in full beauty from its ocean bed; where maternal Nature silently and secretly performs her work, and gives to it a lustre and perfection, which her sister Art has frequently sought to emulate, but can never fully equal.

There is yet another and far more interesting point of view, in which this "offspring of the light" may be regarded. "For the kingdom of heaven," said our Saviour, "is like a merchantman seeking goodly pearls; who, when he had found one pearl of great price, went and sold all that he had, and bought it."—Matt. xiii. 45. Thus admirably illustrating this important truth, that the utmost energy and devotedness ought to prompt the exertions of a Christian for the attainment of that heavenly treasure, which can never fade away nor be diminished. The gift of Him, whom to know is life eternal, and the

fruits of whose Holy Spirit are love, joy, and peace.

" And truly are they, in the inmost heart
As the deep waters of a hidden well;
Whose living freshness have a pow'r to impart,
Far more than e'en the poet's page can tell
Of pure enjoyments inexhaustible,
Valued beyond old Ocean's rarest gem;
For they have power to bid the bosom swell,"
With feelings of delight that flow from them,
E'en as the morning's rays from the sun's diadem.*

Adieu! I am, &c.

* Bernard Barton.

LETTER XI.

UNIVALVES.

TO *****

August 16, 1823.

We now pass on to the numerous family of Multivalve; but of these little comparatively is known, excepting in the solitary instances of the *Nautilus*, *Argonauta*, *Patella*, *Helix* and *Serpula*. The shells of this division are in general extremely beautiful, and their names indicative of their origin or shape. Thus the generic appellation of the *Donax* signifies a cone, the shells of which are remarkably elegant, and singularly varied, and some of the rarer species valued at twenty guineas.* The genus *Cypræa* was early dedicated to the fabulous divinity of Cyprus. It admits of six divisions, of which the *C. Monita* is collected by the negro women of the Indian islands, three days before and after full moon, and thence transported into Bengal, Siam, and Africa, where it is used by the natives as

* Mawe.

a substitute for money. Vast quantities are imported into this country, for the purposes of traffic; and at least one hundred tons of them are annually sent to Guinea.*

The genus *Bulla* is aptly named, from its general similarity to a bubble. The form of the

* The following observations are extracted from the Catechism of Conchology. They refer to a custom which, although foreign to the subject of this letter, the author is anxious to notice with decided reprobation.

" One thing, my young friend, I would forcibly impress upon your mind: let nothing induce you to adopt the savage, the barbarous custom of putting live shell-fish into cold water, and allowing them to boil over the fire, as the means of killing, and then extracting them. Throwing the shells into boiling hot water answers the purpose equally as well, and it appears that the life of the animal is immediately extinguished, whereas a different mode inflicts a slow, excruciating death upon these innocent unoffending creatures. I would also urge you to recommend the same mode to the shell-collectors, pointing out to them the excessive and wanton barbarity of the method in general use. I would even go further, and refuse to purchase any shells, the inhabitants of which had been subjected to similar torture. I once knew a lady, whose benevolent exertions entirely did away the barbarous custom of pegging live lobsters which formerly subsisted on the western coast. If ladies and gentlemen would act with similar firmness, they would often have it in their power to do much good, and not a little

shells composing the elegant genus *Voluta* naturally suggested its appellation, which signifies rolled up cylindrically. Of these the *V. pyrum*, or Pear-shaped Voluta, an oval, ponderous, smooth shell, about half an inch long, and nearly half as broad, of a dusky white colour, is held sacred in China. Shells of this species are valued at considerable sums, and kept in pagodas by the priests, who occasionally use them in administering medicines to the sick, and at the coronation of the Emperor, when they hold the sacred oil. They are sometimes elegantly carved, and used by the Indians for drinking cups.*

Many valuable shells are included in the genus *Buccinum*, which signifies a trumpet. The rare

little to diminish the aggregate of national cruelty, and consequently of national crime."

" For many a crime deem'd innocent on earth,
Is register'd in heaven, and these no doubt
Have each their record with a curse annexed.
Man may dismiss compassion from his heart,
But God will never. When he charg'd the Jew
To assist his foes' down-fallen beast to rise,
And when the bush exploring boy that seiz'd
The young, to let the parent bird go free:
Prov'd he not clearly that His meaner works
Are yet his care, and have an int'rest all,
All in the Universal Father's Love?"—COWPER.

* Dillwyn.

and beautiful *Bifasciatum*, or, as it is elegantly denominated by Petiver, the Grass-girdled Indian Unicon, belongs to this division. The shell is white, shining like alabaster, and twice encircled with a dark violet band, shaped like a tongue or wheat leaf, terminating in a white point; the whirls are continuous, and the sutures obsolete.*

Buccini, of extraordinary size and beauty, abound on the shores of the Red Sea. According to Strabo, the natives of the country wore large collars composed of them, both for ornaments and as amulets. The same kind of shell is also mentioned in the ancient books of the Hindoos, who call it Sancha.†

The *Strombus* is thus named from the resemblance which some of its species bear to a whipping top. The *Murex* owes its designation to a number of its shells, which are rough and rock-like. Several of its species inhabit the English coasts. The Shell-Collector has occasionally found the beautiful *M. subulatus*, or Awl-shaped *Murex*, among sea-sand at Scalasdale, in the Sound of Mull. It is a rare shell, long, slender, and white, with about fifteen slightly elevated whirls, defined by a purplish brown spiral line,

* Dillwyn. † Asiatic Researches.

and elegantly decorated with two rows of beards, divided by a depressed line, and marked with minute elevated longitudinal striæ.*

Ancient Syrian coins sometimes bear the *Murex* and *Buccinum*, in commemoration of the Tyrian Purple.†

Trochus signifies a top, of which the *T. conchyliophorus*, or Carrier, is invariably covered with extraneous substances closely adhering to the whirls of the shell. This singular species admits of two distinct varieties, one of which is familiarly called the *Conchologist*, from its being loaded with perfect shells or fragments; as well as *Zoologist*, or Coral-Carrier, when merely the bearer of poliferous insects; the second, the *Mineralogist*, as its adhesions consist of stones and ores.‡ The beautiful *T. vernalis*, or Green Trochus, belongs to this division of Testaceæ: it inhabits the East-Indies and the Bay of Naples. A transverse row of nodulous belts gracefully diversifies the surface of a shell, to the delicacy of whose tinting the beautiful description of the poet of "The Seasons" is applicable, with a slight alteration:

* Dillwyn, 759. † Pinkerton.

‡ Mawe.

> " Nor" *softer* " verdure dies the robe of Spring,
> When first she gives it to the southern gale,"
> Than the Vernalis shows.

Between the nodulous belts the sutures are marked by an elevation resembling a pearl necklace.*

The solid, ponderous, and irridescent coloured shells of the genus *Turbo*, which has the same signification with the Greek derivative of the preceding genus, are many of them extremely beautiful; especially the *T. chrysostomus*, *T. vitreus*, *T. scalaris*, or Golden-mouthed, Glassy, and Wentle-trap Turbines. The first inhabits the Asiatic Ocean, Red Sea, Coasts of Amboyna, Moluccas, and Friendly Islands. The shell is about two inches and a quarter long, of a yellowish white colour, tinged with green and marbled with chestnut brown; the inside of a rich gold colour. The second is white, smooth, and so beautifully pellucid, as to render the columella visible through the shell. The Shell Collector has frequently met with them on the Cornish coast. The third is a rare and elegant species, of a snowy white, or pale flesh colour. Large and perfect specimens formerly sold at very high prices; one which now belongs to Mr. Bul-

* Dillwyn.

lock has been valued at two hundred guineas. This kind of shell inhabits the coasts of Tranquebar, Batavia, Ceylon, Amboyna, Philippine Islands, and Japan.*

The brilliant *Nerita* anciently derived its generic appellation from a supposititious power of swimming in the ocean. *Haliotis*, a beautiful and well-known species of sea-shell, takes its name from a Greek word signifying sea-ears, in reference to its habitat and form. *Patella* signifies a little dish or basin. *Dentalium* from dens, a tooth; which aptly expresses its miniature resemblance to an elephant's tooth. *Serpula* from Serpo, to creep, in reference to the vermiform character of some of the shells.†

Different species of this interesting genus attach themselves to shells, stones, wood and algæ; others are found on the Corallina officinalis; and a rare and elegant species, the *Cornu-copiæ*, inhabits the Mauritius, where it burrows into stone and coral.‡

Sabella is derived from Sabellum, fine gravel, of which the habitations of many of the species are composed; whilst others are constructed with the fragments of different vegetable productions, adhering to a tubular membrane. The

* Dillwyn. † Mawe. ‡ Dillwyn.

S. ammoniata, or Ammonitis, is covered with fragments of the Cornu-Ammonis; the *S. Indica*, or Indian, with particles of quartz; and the *S. clavata*, or Club-shaped, with various small stones. The *S. alveolata* consists of numerous parallel tubes, communicating by an aperture, and presenting the appearance of a honey-comb, whence its name; the tubes are nearly strait, from two to three inches long: it adheres to rocks in extensive clusters. The *S. rectangular* is one of the largest of the genus, and often measures nine inches in length.

The *S. vegetabilis* and *S. arundinacea*, or Vegetable and Reed-sand shells, are covered with fragments of twigs, the bark of stems, and broken pieces of the Tellina Cornea.

The greater number of the species inhabit the rivers and fresh waters of Thuringea and Belgium; the remainder, the Indian, American, Northern, and European seas.*

Such are a few of the most conspicuous among the elegant assemblage of multivalves, which occasionally diversify the shores of our own and foreign countries.

Many others are equally deserving of attention, but it is impossible to particularize them here;

* Mawe.

and the foregoing are merely noticed in reference to your observation, " That the science of Conchology led, in your opinion, to no beneficial result."

" Drink deep, or taste not the Pierian spring."

To know little of a science is frequently to disesteem it; to know much is to yield it a just tribute of admiration. " The cultivation of a fine taste for the beautiful works of nature," as Dugald Stewart justly observes, in reference to a taste for general literature, " not only enables us to enjoy more fully those primary pleasures which are afforded by an appropriate object; but superadds to these a secondary pleasure, peculiar to itself and of no inconsiderable value." The secondary pleasures connected with the study of natural history, in even its minuter divisions, may be readily explained. They tend to excite a predilection for intellectual pursuits, in preference to such as are frivolous and unsatisfactory; and to quicken that general admiration of the wonders of creation, which the Deity has wisely implanted in the mind of man. The primary are of a higher character. They are derived from a due consideration of the works of nature in connexion with their Divine Arti-

ficer, and the feelings associated with them are those of adoration and delight. They are such as were felt by the royal prophet, when he exclaimed with devout admiration, "All thy works praise thee, O Thou who madest the heavens and the earth, the sea and the fountains of water." The Conchologist is naturally led to these and similar reflections, by the many exquisite specimens of beauty and contrivance which crowd upon him at every step of his enquiry. His further researches also tend materially to convince him, that even in this department of natural history, the manifestations of that beneficence are eminently conspicuous, which constrains every part of the creation to act in subserviency to the general benefit.

The preceding divisions of Testaceæ are extremely numerous, and abound in the most dissimilar situations. Some inhabit ditches and stagnant waters, where they afford a constant supply of food to such birds as frequent their banks; others, no doubt with the same benevolent design, incrust marine plants in sandy barren places, near the sea; a large proportion remain concealed in the deep recesses of the ocean, where they furnish food to the finny tribes; others adhere to floating sea-weeds, and

abundantly supply the wants of marine birds; and, lastly, exotic snails abound in many uncultivated regions of the globe, where they frequently afford a welcome repast to the fainting traveller.

In some species of multivalve the forms of the constructing agents are extremely curious. The inhabitant of the *Buccinum purpura* has two horns, like those of the common snail: but the eyes, instead of being placed at the extremities, are situated in the centre of each.* It is by nature a rover, and one of the most voracious inhabitants of the deep; while its relative, the stationary *Murex*, generally adheres to rocks and stones. These dissimilar shell-fish furnished the gorgeous purple of Imperial Tyre. It is recorded, that the ancients were originally indebted for this discovery to the accidental circumstance of a shepherd's dog having stained his mouth of such a colour by the breaking of one of these shells on the sea-shore, as to excite the admiration of all who saw it, and to occasion the application of this chance discovery to the colouring of stuffs.

Some historians assign this event to the reign of Phœnix, second king of Tyre, who flourished

* Swinburne's Sicilies.

rather more than five hundred years before the Christian era; others, to the time when Minos first reigned in Crete, about 1439 years before the advent of our Lord. But the greatest number agree in giving the honour of the invention to the Tyrian Hercules. This renowned hero is said to have presented the first efforts of his ingenuity to the king of Phœnicia, who was so much delighted with the splendid effect produced by this new colour, that he forbade the use of it to any of his subjects.

Others again relate the story differently. By them it is recorded that a favourite dog of Hercules having stained his mouth with a shell, which he had broken on the shore, Tyras, a nymph to whom Hercules was attached, was so charmed with the beauty of the colour, that she vowed never to see her lover again, unless he procured her a purple suit; and that Hercules, anxious to gratify her wishes, immediately gathered a considerable quantity of the shells, and having extracted the colouring matter, presented her with the robe she so ardently desired.* Such are the different traditions respecting the origin of the purple dye, though involved in that obscurity which pervades the discovery of all the

* Rees.

arts connected with the ordinary wants and necessities of man; which have originated in times beyond the reach of authentic history or tradition, and are the offspring of his natural faculties, directed by the great primitive wants of food, shelter and raiment.

But though neither history nor tradition has preserved any authentic information with regard to the origin of this interesting art, yet, from analogy, as well as observation on the practice of barbarous nations at the present day, we can readily credit the fables of the latter with regard to the rude beginnings whence the art has sprung: as it well known that the rich and gaudy plumage of birds, the finely-spotted skins of animals, coloured shells, stones, and such other substances as nature herself supplies, afford the first materials for savage finery, and indeed suggest the idea of imitating them.

Such was the case in Otaheite, before the light of Christianity arose on that benighted country; and Pomare, in abjuring his idols, renounced also the savage customs of his ancestors. The caps and mantles of the chiefs were almost wholly composed of feathers, richly coloured, and decorated with the most beautiful shells. Of these a considerable number were

the native productions of the country; others derived their lustre from the juices of herbs and flowers.*

The high antiquity of the Tyrian purple is confirmed by Homer, who ascribes the wearing of purple ornaments and robes to the heroes of Greece and Rome, and assigns the preparing of them to queens and princesses. In reference to which custom, this great poet and accurate observer has thus described the occupation of the worthless Helen, at the court of Polypus:

"(Whose sovereign sway
The wealthy tribes of Pharian Thebes obey.)
Alcandra, consort of his high command,
A golden distaff gave to Helen's hand,
And that rich vase, with living sculpture wrought,
Which heap'd with wool the beauteous Philo brought;
The silken fleece impurpled for the loom,
Rivall'd the hyacinth in vernal bloom."

Odyssey, Book iv. 175.

This beautiful colour was held in such esteem by the ancients, that it was, at one period especially, consecrated to the service of the Deity. Moses used purple stuffs for the works of the tabernacle, and the habits of the high priest. The Babylonians arrayed their idols in robes of the same colour. Such was also the case with

* Cooke's Voyages.

the ancients in general. The pagans were even persuaded that the purple dye had a particular virtue, and was capable of appeasing the wrath of the gods.

Purple was also a distinguishing characteristic of dignity: the King of Phenicia, to whom tradition says that the first attempts of the Tyrian Hercules were presented, exclusively confined this colour, as already mentioned, to the imperial vestments. Among the presents which the Israelites made to Gideon, the Scriptures notice purple habits as some of the spoils of the Kings of Midian. Homer also clearly informs us, that it alone belonged to princes to wear the purple; and this custom was observed by all the nations of antiquity.

It is not easy to give a clear and concise idea of the process followed by the antients in the production of this highly valued colour. The works of Aristotle and of Pliny contain some details, but they are not sufficiently circumstantial; according to the latter, the purple dye was procured from different shell-fish. The most valuable for this purpose were found near the island, where New Tyre was erected; fishermen were also employed to obtain them in various parts of the Mediterranean. The coasts of Africa

were famous for the purple of Getulia; those of Europe supplied the purple of Laconia, which was held in great esteem.

Pliny, in the 36th chapter of his second book, ranges in two classes the shell-fish which produced the purple. The first comprehended the smaller species, under the denomination of Buccinum, from their resemblance to a hunting horn; the second included those denominated Purpura. These Fabius Columna conceives to have been also distinguished by the generic name of Murex, though others suppose that the term included several different species: all of which, according to Pliny, afforded dyes of different shades; and from their compounds, other varieties of colour were produced.

A few drops of this precious dye were obtained from each fish, by extracting a white vein placed in the throat of the animal; but with the smaller species this troublesome process was avoided, by pounding the whole fish in a mortar; a practice, according to Vitruvius, often adopted with the larger. The liquor, when extracted, was mixed with a considerable portion of salt, and suffered to remain three days; after which it was diluted with five or six times its quantity of water, and digested, in a moderate warmth, during ten days,

in a lead or tin vessel, being frequently skimmed for the purpose of removing all impurities. The wool having been previously well washed, cleansed, and prepared, was then immersed in the fluid; after soaking five hours, it was taken out, carded, and again returned to the boiling dye, till all the colour was completely absorbed. To produce particular shades of colour, nitre, and a marine plant, called fucus, brought from the rocks of Crete, were occasionally added.*

The Tyrians, by the confessions of all antiquity, succeeded best in dyeing purple stuffs. Their process slightly differed from the one narrated by Pliny, as they merely used such purple shells as abounded on the shores of the Mediterranean, and made a bath of the liquor extracted from the fishes. In this they steeped the wool for a certain time, then took it out, and threw it into another boiler, which alone contained an extract from the Buccinum or Trumpit-fish. Wool which had been submitted to this double process, was so highly estimated, that in the reign of Augustus each pound sold for one thousand Roman denarii, about thirty-six pounds sterling. We need not indeed wonder at this

* Rees. Swinburne.

enormous price, when the tedious nature of the process is considered, and also the small quantity of dye; not more, on an average, than a single drop being afforded by each shell fish. For fifty pounds of wool, the ancients used no less than two hundred pounds of the liquor of the Buccinum, and one hundred pounds of that of the Purpura, or six pounds of liquor to one pound of wool: consequently, the real Tyrian purple vied in value even with gold itself. Ancient writers mention several different shades of purple; one of which appears to have been a kind of dark violet, inclining towards a reddish hue; another, less esteemed, resembled crimson; the most valued of all, was a deep red purple, of the colour of coagulated blood; in this the Tyrians particularly excelled. Homer and Virgil give to blood the epithet of purple, in allusion to this colour.

"The purple death comes floating o'er his eye."
ILIAD.

A fourth kind, of a whitish tint, was also known in later times.*

The wearing of purple robes was, in Italy, originally confined to the first officers of Rome;

* Rees.

but luxury, which was carried to great excess in the capital of the world, rendered the use of them at length common among the opulent, till the emperors, by an imperial edict, constituted them an attribute of imperial dignity, and a symbol of inauguration; hence, "to assume the purple," was a phrase synonimous with that of ascending the throne. Officers were appointed to superintend the manufactories of this imperial dye. It was principally prepared in Phenicia, and the punishment of death was decreed against any who should have the audacity to appropriate it to their own use, though concealed by garments of another colour. The penalty, so tyrannically denounced against this whimsical kind of treason, doubtless occasioned the loss of the art of dyeing purple; first in the west, afterwards in the east, where it flourished till the eleventh century.

The finest kind of purple preserved its brilliancy for a considerable time; hence Plutarch relates, in his life of Alexander, that the Greeks found in the treasury of the king of Persia a great quantity of purple, which had not lost its beauty, though nearly one hundred and ninety years old.

The ancients obtained from the coccus, now known by the name of kermes, a colour nearly equal to the Tyrian dye, with which, according

to Pliny, it was indeed occasionally blended, under the name of scarlet. The use of the coccus in dying is very antient, since it appears from commentators, to be alluded to in Exodus:—

"And of the blue, and purple, and scarlet, they made cloths of service, to do service in the holy place, and made the holy garments for Aaron.

"And a girdle of fine twined linen, and blue, and purple, and scarlet, of needle work; as the Lord commanded Moses."—xxxix. 1. and 29.

Adieu! I am, &c.

LETTER XII.

UNIVALVES.

TO *****.

August 24, 1823.

A SERIES of experiments by Mr. Cole and M. du Hamel, have furnished some curious particulars relative to the modern mode of extracting the Tyrian die, and also serve to elucidate the brief descriptions of Pliny and Aristotle.

It appear that when the shell is broken, and the mutilated fragments carefully removed so as not to injure the inhabitant, the white vein, already noticed, appears lying transversely in a little furrow or cleft near the head of the fish.

In this vein the purple matter is lodged; some of which, being laid on linen, appears at first of a light green colour, and, if exposed to the sun, soon changes into a deep green, then into a sea-green, and, in a few minutes, into a blue; it then becomes of a purplish red; and in an hour more, of a deep purple.

Here the action of the sun terminates; but by washing the linen in scalding water and soap,

and afterwards drying it, the colour ripens to a bright and brilliant crimson.

The juice from which this beautiful colour originates, is perfectly white during the time that it remains in the body of the animal, and while the creature is in health, but no sooner is it exposed to the sun, than it begins to change colour, and in less than five minutes, passes through several gradations of pale, yellowish, and vivid emerald green; after which it becomes of a duskier hue, then blue, red, and finally, of a deep and very beautiful purple. Sometimes, when the animal appears to be in a diseased state, the juice assumes a greenish tint. It, however, immediately becomes red, and afterwards purple, on being exposed to the sun; the several preceding changes seeming to have been made already in the body of the animal.

If a piece of linen be rubbed over with this juice, and partially exposed to the action of the sunbeams, that part of it only will turn red, which is so exposed; the other retaining the natural tint without any alteration. If a needle or any other opake body, be laid upon the linen while it is yet green, the spot on which it is laid will remain unaltered while a rapid change has taken place in every other part.

A plate of grass, though it be three inches thick, will not prevent the colour from changing purple by being laid over it, but the thinnest metal effectually precludes any alteration; the one being opake, and the other pellucid, are evidently the occasion of this difference.

If the coloured linen be successively covered by three pieces of paper, the one blackened with ink, the other in its natural state, and the third rubbed over with oil, it will change colour on being exposed to the sun in different degrees, and that exactly in proportion to the degree of transparency in each of the papers.

These experiments were made in the months of January and February, by M. du Hamel, in Provence.

The vivacity of this beautiful purple renders it particularly valuable, especially as the pieces of stained cloth retain their colour, in spite of several boilings in different liquors; and the colour on examination is found not to be a superficial one, but to have thoroughly penetrated the cloth.

The *Buccinum* as well as *Murex*, was used by the ancients for purposes of dyeing. They are both fished up in great plenty in the gulf of Tarentum, as well as in various parts of the Mediterranean. *Buccini* of a prodigious size are

also frequently surprised by Sicilian fishermen, asleep and floating on the smooth bays of the Mare Grande.*

The seas of the Spanish West Indies about Nicoya, furnish a shell-fish, which perfectly resembles the ancient *purpura*, and, in all probability is the same. This fish we are informed by Gage, usually lives about seven years: it conceals itself in the sand a little before the dog days, and continues to disappear for three hundred days running. These curious shell-fish are gathered plentifully in the spring; and by rubbing them one against another, they yield a kind of saliva or thick glaire, resembling soft wax; but the purple dye is situated in the throat; and that of the finest hue in a small white vein. The chief riches of Nicoya consist in these shell-fish. They are used in dyeing the cloth of Segovia, which is often sold for twenty crowns the ell; as the wearing is entirely confined to nobles of the highest rank.†

The coasts of the South-Sea, near the equator, in the neighbourhood of point St. Helena, in the province of Guayaquil, also furnish some shell-fish of a similar description, which are termed by

* Swinburne. † Rees.

Don Antonio de Ulloa, sea snails. They adhere to such rocks and stones as are covered by the sea at high water, and are about the size of small nuts, containing a liquor or juice, which has the true colour of purple. This colour is very bright, and so durable, that washing rather increases than diminishes its lustre; nor does it fade or change by use or wearing. As soon as a sufficient quantity of the liquor is squeezed from the fish, cotton threads are immersed in it, which readily imbibe and retain the tincture without any farther trouble; but the purple tint does not become apparent till the threads are dry; the juice being of a milky colour at first, but it soon changes into green, and at length settles to a purple.* In reference to which M. Reaumur observes, "The modern purple fish is a kind of *Buccinum*, a name given by the ancients to shells of every description which bore any resemblance to a hunting horn; and, as it appears from Pliny, that part of the ancient purple was derived from this kind of shell-fish; what has been esteemed a modern discovery, is, in fact, only a revival of an ancient one which was supposed to be lost."

* History of Carthagena.

The Caribbee islands have likewise their purple fish, which resemble our periwinkles. The shell is of a brownish azure—the flesh white, and the intestines of a bright red, the colour of which appears through the body. On being taken from the water the creatures exude a considerable quantity of froth, which is received on a linen cloth, and becomes purple in proportion as it dries.*

The *Purpura* lives on other fish. It usually hides itself at a small depth in the sand, sometimes even in fresh water rivers; and as it lies hid, it thrusts up a pointed tongue, which wounds and kills such diminutive fish and animalcula as heedlessly approach too near. Sea shells are frequently found perforated with round holes, as regularly as if made with a boring instrument: these are generally supposed to be formed by the tongue of the Purpura, in order to its feeding on the fish within.†

Shell-fish yielding the Tyrian dye have also been discovered on the Somersetshire coast, and in South Wales, where they are commonly used by the country people for staining their linen. Indeed, the Murex and Buccinum are among

* M. Reaumur. † Rees.

some of the most common deposits of the ocean, on the shores of the Principality, beautiful specimens of each are frequently brought from among the magnificent arcades, which the incessant toiling of the waves have excavated in the rocks of Gower; a romantic little peninsula in Glamorganshire, as much distinguished for the primitive simplicity, politeness, and intelligence of its singular inhabitants, as for the grandeur of the sea views, ancient castles, and beautiful home scenes, with which it is surrounded and diversified.

The generic appellation of the *Murex* has been already noticed. That of the *Buccinum* signifies a horn or trumpet, and was applied by Pliny to a certain class of shells, with a round emarginate mouth.*

This kind of shell, undoubtedly suggested the first idea of a trumpet, as by breaking off or making a hole near the apex, an instrument is formed from which a variety of sonorous sounds may be produced. This kind of trumpet is still employed by Italian herdsmen for directing the motions of their cattle. Similar ones are also

* Brooke.

common in North Wales, where they are used by the farmers in calling to their workmen, and their deep and hollow sounds produce a striking effect as they break upon the silence of those Alpine districts. Triton, the trumpeter of Neptune, is generally pictured with a shell of this description in his hand, with which the ancient poets feigned that he convened the river deities around their monarch. It is wreathed like those called sicankos or sea-horn, common to India, Africa, and the Mediterranean, and still used as trumpets for blowing alarms, or giving signals.

Such is the case in Lithuania and Muscovy, where they are also applied to pastoral purposes; for no sooner is a herdsman risen in the morning, than he winds his horn, and the horses, mules, oxen, asses, goats, and sheep, immediately leave their respective places of retreat, and assemble round their conductor. He then advances at their head, and leads them into such pasturage as he thinks proper for the day; a second signal conducts them to the waters, a third commands them home, when every one repairs to his shelter for the night.

Thus beautifully has Isaiah referred to this ancient custom, which is still common in the east:

"The ox knoweth his owner, the ass his master's crib; but Israel doth not know, my people do not consider."

In Palestine, bee masters were also accustomed to summon their bees by blowing a small whistle, formed of a bone or shell. They sometimes collected the humming population of a village, "which followed them as orderly as sheep obey the voice of their shepherd," and lead them from one meadow to another till an impending shower, or the approach of evening, cautioned them to return. This singular custom is noticed by St. Cyril, who flourished in the fourth and fifth centuries, as a thing which he had frequently seen. He also mentions, that Isaiah refers to it, in the following memorable passage, in which the future conquests of the Assyrian monarch are foretold.*

"And it shall come to pass in that day, the Lord shall hiss (or whistle) for the bee that is in the land of Assyria.

"And they shall come, and shall rest all of them in the desolate vallies, and in the holes of the rock, and upon all thorns, and upon all bushes."—vii. 18, 19.

* Spectacle de la Nature.

In reference to which, St. Cyril notices that the Prophet evidently derived this form of speech from the ancient method of managing bees, "as those who have the care of these sagacious insects, accustom them to know the sound of a whistle, by means of which they entice them from their hives into the meadows, and by the same signal warn them back again."*

Adieu! I am, &c.

* Spectacle de la Nature.

LETTER XIII.

UNIVALVES.

TO * * * * *.

August 29th, 1823.

THE cliffs of Tenby first rose upon the view of the Shell-Collector, on one of those delightful mornings in July, when a fresh cool breeze gently ripples the surface of the deep; and the distant mountains, beautifully varied with light and shade, are occasionally obscured with floating mists, which sometimes envelop their majestic heads, and again as rapidly disclose them. The scene was beautiful and animating. Light skiffs glanced merrily over the transparent waters, and sea-birds darted from their coverts in the rocks, now rising in the air, now diving into the sea, and again appearing like foam upon the billows. In the distance stupendous masses of black granite stood forth in all their native majesty, and on the nearest cliffs the glittering windows of a range

of houses, met the view. Suddenly the mellow tones of the church clock, as if inspired by the spirit of Memnon, began to strike the hour at the moment when the beams of the now rising sun burst in full glory on the surrounding scene, and a long line of radiance streamed upon the face of the waters, occasionally lost or broken by the huge shadows of distant rocks. Meantime the vessel advanced to the shore, and the Shell-Collector sprung on land,

> " Seeking whate'er of beautiful or new,
> Sublime or dreadful in earth, sea, or sky,
> By chance, or search, was offered to his view,
> To scan with curious and romantic eye."

A variety of sea-shells, including several fine specimens of the *Turbo interruptus*, or Streaked Turbo, and the *Mya declivis*, or Sloping Gaper, had been recently thrown on shore; the former half buried in the sand; the latter attached to a group of sea-weed, with an elegant little *Rotatus*, or Wheel Nautilus, a species of shell-fish commonly found on the British coasts, though one of the least valuable of the numerous family of *Nautilus*. Among which the superb *N. scrobiculatus*, or Sunken Spire Nautilus, and the *N. Pompilius*, or Great Chambered Nautilus, are two of

the most conspicuous for beauty, and evident design.

The generic appellation of the *Nautilus* signifies both a ship and sailor; an appellation evidently suggested by its similarity to a vessel with a high poop; in reference to which both ancient and modern authors have given it the name of pompilius, nautilus, polypus testaceous, and Le Voilier.

The *Nautili* differ considerably in size; some are so exquisitely minute that they can only be defined by a high magnifier; others are nearly a foot in diameter.*

The animal inhabitant of the shell, as the generic character of the *Nautilus* implies, is either a sepia or a clio;† most probably the former: and its appearance and manners of life are so singular and interesting, that they did not escape the notice of some of the earliest writers on Natural History.

The *N. siphunculus*, or Piped Nautilus, especially, which is often brought from the coral reefs on the Sicilian shores; and the *N. scrobiculatus*, already mentioned as the rarest species of the genus, are conjectured to have originally

* Mawe. † Brooke.

taught mankind the use of sails, from the skill which they evince in directing their fragile barks.

> "For thus to man the voice of nature spake,
> Go from the creatures thy instructions take;
> Learn of the little Nautilus to sail,
> Spread the thin oar, and catch the driving gale."

The American and Indian oceans, as well as the Mediterranean, Adriatic, and Red Seas, afford several different species of Nautili; but their most favourite resorts are the European and British coasts.* They are also occasionally seen spreading the wonderful mechanism of their sails and oars in the smooth bays of the Mare Grande.†

The testaceous covering of this interesting shell-fish is univalve; the partitions arched and perforated: it is divided into forty or more cells, which open one into another, by means of a perforation in the middle of each partition, and decrease in size as they approach the centre of the cell. The animal resides in the largest apartment, and keeps up a communication with the others by means of a slender syphon running spirally through the perforations of the shell. The

* Mawe. † Swinburne.

office of this tube is ingeniously conjectured to be analogous to that of the swimming bladder in fishes. It is, consequently, essential to the movements of the animal, for the gravity of the shell is so admirably counterbalanced by its empty apartments, that the weight of the whole apparatus is capable of being increased or diminished according as the syphon is dilated with gaseous or aqueous fluids. Thus, if the animal is stationary at the bottom of the sea, saturated with food, and the syphon filled with water, we may conjecture from analogy, that in proportion as the food becomes digested and decomposed, detached gass will pass into the syphon, gradually exclude the water, and so considerably diminish the specific gravity of the shell as to enable it to ascend readily to the surface. When, on the contrary, the Nautilus is inclined to descend, he lowers a small membrane which answers the purpose of a sail, contracts himself within his boat, and filling the remaining cavity with water, immediately disappears.*

This ingenious little sailor is frequently seen in fine weather calmly riding on the billows, with

* Mawe. Rees. Brookes. Parkinson's Introduction to the Study of Fossil Organic Remains.

his sails expanded to the wind; and extending two oar-shaped tentaculæ for the purpose of rowing his fragile bark; thus steering his course without chart or compass, self-taught in the art of navigation; at once both vessel and pilot.

> "No star has he to guide his way
> Or Tyrian synosure."

Yet still he sails along, regardless of adverse winds, and undeterred by the perils of the deep; apparently conscious that he contains within his shell, all the necessary requisites for navigation, rudders, sails, oars, and cordage. In short, a vessel which no human hand has formed, and guided by no human skill; a striking proof amidst the terrors and the wonders of the deep, that whilst nothing is too great for the controuling power of Omnipotence, nothing is too humble for his protecting care.

The shell of the *N. pompilius* is often converted by the inhabitants of the East into a drinking cup, on the surface of which various ornaments and devices are engraven: they also frequently remove the outer coatings, and thus render visible the beautiful pearly appearance of the shell.* An exquisite specimen was lately exhi-

* Mawe.

bited among the curiosities at Fonthill; the decorations were executed in the first stile by Hillican; the subject, the triumph of Neptune and Amphitrite; it was mounted in the most elegant manner in silver gilt embossed, with minutely engraved shells, and decorated with finely mounted and chased ornaments of masks, cupids, and figures, with a coat of arms and helmet, beautifully pierced and engraved in gold.

The shells of the genus *Argonauta* or Paper-Sailor, are nearly as extraordinary in their appearance and formation as those of their relative the Chambered Nautilus. They are remarkable for excessive thinness and brittleness, and are perhaps surpassed by none in the delicacy and elegance of their construction. The form resembles that of a scroll with a very large aperture; the surface is ornamented with numerous channelled grooves, proceeding from the summit to the outer margin which is generally bicarinated; the colour of the shells is commonly a bluish or dingy white, relieved by the delicate brown tinting of the keel. The Argonautæ differ considerably in size and value. A few of the most curious are the production of the Cape of Good Hope, Mediterranean, and Indian

Ocean; whilst others are commonly found in the Atlantic, Northern, and Greenland Seas.*

This interesting genus, the Nautilus of Pliny, has been separated from the chambered genus, bearing that name in the Linnæan System, and is denominated *Argonauta*, from a favourite companion of Jason, in the celebrated voyage of the ship Argo. The art of navigation is supposed to have owed its origin to the expert management of this instinctive sailor, as well as to that of the *Nautilus*. For like the latter he frequently rises to the surface of the sea, by ejecting a quantity of water, and thus diminishing the specific grapity of his shell; nay, more, he guides his mimic vessel by means of several oar-shaped tentaculæ, and also expands a little membrane, which answers the purpose of a sail. These on the approach of danger are immediately drawn in, and hauled down, and by a rapid absorption of the water, the *Argonauta* betakes himself to his native dwelling in the fathomless abyss.† In

* This delicate and brittle shell, composed as it were of two parts, or of two sides connected with a keel, approximates more nearly to the bivalves than any other univalve; for which reason it is generally placed first in the last division of Testaceæ.—Brookes.

† Burrows.

consequence of these extraordinary instincts, the sagacious little mariner is seldom taken in the act of sailing, but is usually drawn up from marine rocks, or intangled in the nets of the fishermen.

Cicero refers to the ocean and its inhabitants as affording irrefragable proofs, in connexion with the general wonders of creation, of the existence of some presiding deity. "How beautiful," says this enlightened heathen, "is the majestic ocean! How delightful to contemplate the vast expanse of waters, varied with islands and continents! How innumerable and diversified the multitudes of living creatures which it contains; some dwelling in its deep recesses, others sporting on the waves, others again adhering to the rocks—!" "Who can observe the beauty of the universe, the order of the celestial bodies, the rising of the sun and moon, and the motion of the stars, without being convinced that the world was not formed by chance—that God alone, is able to be the creator and director of so many wonders?" If the mind of an heathen was thus enabled to rise from the works of nature to a faint apprehension of their Divine Artificer, what ought to be the feelings of a Christian, when he considers that the matchless beauties of

the universe are the workmanship of One, whom greatness cannot overpower, nor minuteness perplex?

> " That they are His by a peculiar right,
> And by an emphasis of interest his,
> Whose eye they fill with tears of holy joy,
> Whose heart with praise, and whose exalted mind
> With worthy thoughts of that unwearied love
> That plann'd, and built, and still upholds, a world,
> So cloth'd with beauty for rebellious man."
> ——————— " His to enjoy
> With a propriety that none can feel,
> But who, with filial confidence inspired,
> Can lift to heaven an unpresumptuous eye,
> And smiling say,—' My Father made them all.' "

It is delightful, as we walk along the rough and twilight paths of life, to contemplate the wonders of creation; to consider that the smallest shell or leaf is the production of an almighty hand, and that, amidst the strange vicissitudes of time, the laws of nature remain unaltered and her Great Author never changes. Let us then, my friend, endeavour to render the acquisition of human knowledge conducive to the attainment of that which is divine. And while we are occupied in admiring the beauty, variety, and extraordinary instincts discoverable in the tes-

taceous tribes, let us gratefully acknowledge that even in these insignificant creatures the Most High has not left us without convincing proofs of his wisdom and benevolence. "Oh my God!" said the admirable Fenelon, "he who does not see Thee in thy works has seen nothing. He who does not confess thy hand in the beautiful productions of this well-ordered world, is a stranger to the best affections of the heart. He exists as though he existed not, and his life is no more than a dream."

Adieu, I am, &c.

LETTER XIV.

UNIVALVES.

TO *****

Sept. 6, 1823.

PALEY justly observes that a snail-shell is a wonderful, a mechanical, and, if we may so express ourselves concerning the works of nature, an original contrivance. "Other animals have their proper retreats, their hybernacula also, or winter quarters, but the snail carries these about with him. He travels with his tent; and this tent, though, as was necessary, both light and thin, is completely impervious either to moisture or to air." The young *Helix*, like his numerous brethren of the family of Univalve, emerges into life with a covering adapted to his exigencies, which enlarges with his growth by means of a certain viscous exudation from innumerable pores. Now the aptness of this secretion to the purpose for which it is designed, its property of congealing into a firm and hard cretaceous substance, independent of any effort on the part of the inhabitant, cannot be referred, as the

same admirable writer has justly observed, to any other cause than express design; and that not on the part of the unconscious architect, who, although he might build the house, could not supply the materials. Moreover, the form of the building with its pillar and convolution is not only a very artificial one, but admirably adapted to the exigencies of the inhabitant; which is confessedly one of the most feeble and unprovided of all artificers. Nay more, the testaceous coverings of such as live on land, or inhabit still ponds and ditches, are scarcely able to resist the slightest pressure; while in others their defensive strength suits well with the lives of those that have to sustain the dangers of a stormy element, and a rocky bottom, as well as the attacks of voracious fish.* The sealing up of the mouth, which serves in several species as an effectual protection against the cold of winter, is also admirably adapted for warmth, and for security. But the serate is not of the same substance as the shell; evidently because the animal would be then unable to break down the enclosing barrier, when the return of spring invites him from his winter quarters. In the midst of

* Paley.

an almost endless variety, a striking regularity is nevertheless discoverable. However different individuals may vary in form and colour, according to the sites which they are designed to occupy, in one point they almost universally agree. The number of turns in the same species is generally, if not always, the same; and these, with a few exceptions, are uniformly in one direction, that is, from right to left, like the motion of the globe, when the mouth of the shell is turned northward, with the base towards the ground.*

These admirable receptacles, when deserted by their artificers, serve as temporary habitations to insects of various kinds. The *Caracol Soldato*, or Soldier Snail of Carthagena, takes up his abode in the hollow apartment of a marine *Helix*. This singular creature, which resembles a snail in his general construction, while the head and claws differ little from those of a crab, is destitute of any kind of covering, and from the tenderness and flexibility of his body is peculiarly liable to injury. He, accordingly, no sooner becomes sensible of his helpless situation, than he hastens to secure a safe retreat in some empty shell.

* St. Pierre.

This borrowed citadel, or armour, is borne about by the Caracol, who occasionally deserts it in quest of food, but on the slightest appearance of danger hastens to resume it with the utmost alacrity. Being too bulky to turn round in his dwelling, he obviates the inconvenience by walking backwards into it, and filling up the entrance with his formidable claws; where he sits looking out, and inflicting deadly gripes upon all who approach too near; the symptoms attendant on which are as dangerous as those produced by the bite of a scorpion. When grown too large for the comfortable occupation of his mansion, the Soldier Snail retires to the sea side, where he wounds some defenceless Whelk, or *Buccinum*, the shell of which is more commodious, turns out the owner, and occupies his dwelling*

The Caracol Soldato of Carthagena resembles in its habits the *Cancer Barnhardus*, Diogenes, Soldier, or Hermit Crab; an industrious little animal which commonly inhabits the coasts of Europe, and occupies himself in clearing the sea-shore of such fragments of small fish and marine insects as the waves have from time to

* History of Carthagena by Don Ulloa.

time deposited. That Beneficent Being who denies to this particular species the coat of mail, in which he has invested every other of the same genus, compensates for the deficiency by instructing it to take refuge in the empty cavity of a turbinated shell.* This species is parasitic. It affords a striking instance of the powerful effect of instinct; of that propensity which is prior to experience, and independent of instruction. No sooner does the young Hermit emerge from under the protection of his parent, than he hastens to the deserted shell of some simple *Nerite*, which he continues to occupy for a considerable time; but as his desires increase in proportion to his growth, he removes from one residence to another, till at length, like the Soldato mentioned by Don Ulloa, he takes up his abode in the spacious mansion of a marine *Helix* or *Buccinum*. With either of these he can travel rapidly over the soft sand, retire at night into its "hollow wreathed chamber," or render it an impregnable citadel, by withdrawing to the farthest end; thrusting out his longest claw, and inflicting severe pinches upon such as venture to attack him. Now mark the extra-

* Pennant's British Zoology.

ordinary manner in which the Hermit, or Soldier Crab, is enabled to carry his tent from one place to another; for as it is sometimes considerably larger than the inmate, it must, without some peculiar expedient for obviating the inconvenience, be continually left behind. The Creator of the Hermit Crab, who consigned it to a borrowed habitation, foresaw the difficulty, and admirably provided for it. The tail is furnished with a bent claw exactly in the form of a hook, by which the Hermit attaches himself to any accidental projection, crevice, chink, or roughness in his moveable habitation.* Without this admirable appendage the parasitic Crab, would be one of the most helpless of all animals, obnoxious to every kind of injury, and unable to ward off the insults of his enemies. The want of armour is thus completely made up to him, and while he hooks himself by the claw to the walls of his apartment, he travels with a thin commodious tent, impervious to air and moisture; which he is moreover able to throw aside, whenever it becomes too small for his convenient reception.

Nothing can be more amusing than to observe the movements of this little animal when about

* Stewart's Elements of Natural History.

to change his habitation. He is seen busily parading along that line of pebbles and of shells which is formed by the extremest wave, still dragging after him his incommodious dwelling, as if wisely resolving not to part with one, however inconvenient, till certain of obtaining another more congenial to his wishes. Then stopping at a shell, turning it, and passing on to another, which he contemplates for a short time, slips out of his old mansion and tries on the new. If this does not appear to suit him in every respect, he quickly re-enters the one which he had left, and trots away in quest of a more commodious. The Shell Collector has often amused himself on the coast of Cornwall, with observing one of these active little crabs, examining and rejecting different kinds of shells, till he has at length provided himself with a light, roomy, and convenient habitation. Yet it is not till after many trials and many combats also, that the Soldier is completely equipped; for it sometimes happens that a warm combat ensues with a Crab of a similar description, for the occupation of a well-looking and favourite shell. Both endeavour by fraud or violence to obtain an entrance. They strike with their claws, and bite each other; till the weakest is obliged to

yield by giving up the object in dispute. The victor then triumphantly takes possession and parades backwards and forwards on the strand, as if in defiance of his envious antagonist, who travels off to seek an habitation among the fresh deposits of the ocean.

Nor is the construction of the common *Helix* less deserving of attention, than that of the adventitious resident in its deserted mansion. This feeble animal is soft, spungy, and diaphanous; furnished with horns, or antennæ, at the extremity of which the eyes are situated, appearing like small dark spots, black, sparkling, obicular. These, on the approach of danger, are rapidly drawn down, together with the horns, into the head, which immediately disappears beneath the shell. In the course of a few seconds the horns reappear; the eyes run up the narrow transparent channel down which they had descended, and the *Helix* journies on its way.

Now the reason for such a peculiar construction is obvious. The snail is thus enabled to command a more extensive sphere of vision than if the eyes were situated in the head. Moreover, the pliability of the antennæ enables them to turn in different directions, while the ease with which they are capable of being drawn out, or

shut together like a pocket telescope, admits the ready drawing of the head into the shell; an arrangement which beautifully harmonizes with the extreme weakness of the animal.

Shakespeare notices this striking peculiarity. "I can tell," said the faithful adviser of King Lear, "why a snail has a house." "Why?" replied his unfortunate master. "Why to put his head in, not to give it away to his daughters, and to leave his horns without a case."

The movements of the common *Helix* are remarkably slow. But how shall we account for this extraordinary fact, since the snail is light, and small, and apparently by no means incapable of comparatively rapid motion? Doubtless by the viscous nature of its juices, which are extremely tardy in their circulation, and consequently produce a considerable degree of sluggishness in the movements of the animal. This ingenious idea was first suggested by Mr. Braidley. He observed their circulation in a Snail just hatched, the body and shell of which being quite transparent, enabled him to discover that the pulsations of the heart succeeded each other at the distance of three seconds. Conjecturing, however, that the juices in so young a subject would circulate more quickly than in an older

one, he had recourse to some, the shells of which appeared to be damaged by previous accident. In these the beats were five seconds distant from each other, the circulation having probably been accelerated by the injury they had sustained; as in the course of three hours afterwards, seven seconds elapsed between each, at which period some of the largest had begun to renew their shells, by throwing out a considerable quantity of viscous juice through the pores of the undefended part. A casual observer would be inclined to pity the poor animal for the deficiency of its moving powers. But let it not be forgotten that the defect of the *Helix* in this respect, is amply compensated. The peculiar nature of its juices seem to have a reference to its mode of life; for no degree of natural or artificial cold, has ever been known sufficiently powerful to congeal them. Thus, while the common worm, which incautiously has left its shelter in the garden mould, is frequently discovered in a frozen state; and even birds and small animals fall victims to the severity of the weather, the Snail is rendered insensible to cold, and either burrows in the earth, or seeks the shelter of some hollow tree till invited from his subterraneous dormitory.*

* Wonders of Nature and Art.

Helices belong to a very numerous and comprehensive tribe of terrestrial animals which are entirely destitute of feet. But the want of these is wonderfully compensated by such a disposition of the muscles and fibres of the trunk, as to produce a progressive and undulatory movement of the body, in any direction to which the will of the animal determines it.* This undulatory motion occasions the exudation already noticed, which not only materially assists the common *Helix* in adhering to extraneous substances and climbing walls and trees in quest of food, but is also essential to its safety, as it has frequently occasion to travel along ceilings with the shell reversed. Snails, however, generally remain in a quiescent state, and seldom move abroad excepting when in search of food.

But why such an extraordinary combination to provide for the security, and promote the comfort of an obscure animal? Let this great truth be solemnly impressed on our minds: God has made nothing in vain. It is a clue that will safely conduct us through many of the intricate mazes of the great labyrinth of nature, as far, at least, as it is permitted for finite beings to explore them. In many instances we are unable

* Paley.

to comprehend the intentions of the Deity with regard to the construction of his creature: in others, their uses are so obvious that they cannot be mistaken. The common Chickweed, and the different species which constitute the genus *Helix* are apparently of little worth; yet the former, during winter, is nearly the sole support of innumerable flocks of birds; and, without the latter, a considerable proportion of the animal creation would be entirely destitute of food. Hence in both the Creator has deviated from his usual course to provide for their security, and to compensate for all their various and necessary defects.

The numerous species which compose the genus *Helix*, Snail or Spiral, are principally land or fresh-water shells. A considerable number inhabit aquatic plants; others are found on trees or shrubs; and others in decayed wood. They also abound in the most unfavourable and arid situations. The few solitary vegetables which occasionally diversify the extensive sands on the south side of the Tagus, are incrusted with a species of small snail. Such is also stated to be the case in the deserts of Zara, by African travellers.*

* Notes relative to the Natural History of Portugal, by

Two hundred and fifty-three species are assigned by naturalists to this extensive genus; some of which are beautifully marked; and some of rare occurrence. Of these the *H. sultana*, and *H. hæmastoma*, Variegated and Rose-lipped Helices, are two of the most celebrated; the latter, in particular, for its elegant bandings and rose-coloured lip.*

The *Helix pomatia* or Exotic Snail, differs little in appearance from the common. This species was introduced into England by the celebrated Sir Kenelm Digby, as food or medicine for his lady, who died of a consumption. Various attempts have been made to naturalize them in Northamptonshire, but without success, as they uniformly refuse to emigrate from the southern woods of England. They are tenacious of life, and equally susceptible of cold; towards winter they cover their sub-lunate apertures with a calcarious lid, resembling an operculum, and remain in a torpid state until the spring.†

Exotic Snails are used as food during Lent in several parts of Europe. They are fattened for the purpose in large reservoirs, the floors of which

the Editor of the Memoirs of the Life, Character, and Writings of the late William Withering, M.D. F.R.S., &c. &c.

* Pennant. † Mawe.

are covered with herbs and flowers. This species formed a favourite dish with the luxurious Romans who fed them on bran and wine till they grew to such a size, that, if we may credit the testimony of Varro, the shells would contain ten quarts. Admitting the truth of this account, the temperance of the younger Pliny will no longer be a subject of admiration, whose suppers consisted of a lettuce for each guest, three snails, two eggs, barley cake, sweet wine, and snow. Fulvius Hirpinus is said to have introduced this luxury, a short time before the wars of Cæsar and of Pompey.*

Several extraordinary instances of evident design; of design studiously directed to produce important consequences in the animal economy, are discoverable in such species as either inhabit aquatic plants, or are decidedly oceanic.

The *H. vivipara*, and *H. tentaculata*, Viviparous and Dusky *Helices*, are furnished with horny opercula, or small pieces of shell, answering the purpose of doors or shutters, by means of which they close the apertures of their shells, and thus completely exclude the water.†

The animal inhabitant of the *H. ianthina*, or

* English Encyclopædia. † Brooks.

Violet *Helix* swims at liberty in the sea. It is furnished with four horns, or horn-shaped tentaculæ, and a membranaceous bag, consisting of a congerie of small bladders, which it inflates at pleasure, and is thus enabled to float on the surface of the water.* It is also endowed with the property of emitting a phosphorescent light, and stains the hand of a rich purple colour, which is not easily removed.† The congerie of small bladders mark the character of the animal. A creature floating in the ocean, or attached to marine substances.

It is highly interesting to observe the movements of these little *Helices*, when changing their places of abode; they then inflate their marine balloons and skim the surface of the billows; or seek, in the cavity of their moving vallies, a shelter from the wind: To watch them as they slowly retire into those sea-covered regions, dotted with plants of innumerable shades and colours, which like the animals that inhabit them, never receive the rays of light but through the medium of water. Where the vallies are clothed with elastic plants, such as the sea peacock, the leaves of which are perforated like a sieve for the evident purpose of admitting the currents that gush

* Brookes. † Mawe.

through them with the rapidity of sluices.* Where the hills stand thick with bristly beds of madrepore, festooned with floating garlands of fuci, algæ, and innumerable sea-weeds, the colours of which are nearly as splendid as those of the showery bow of Iris.

Such are the objects which attract the leisure hours, and occupy the thoughts of those who delight to trace the footsteps of unerring wisdom, as they appear impressed on the oozy bottom of the ocean. Nor let him who is confined to inland scenes, lament that these researches transcend his fortune or exertions. The mossy lanes which surround his quiet dwelling, or the river that waters his native town, will afford subjects for investigation and improvement. In the shady recesses of the one, or on the margin of the other, he may learn to acknowledge that the life of an individual would be scarcely sufficient to compose the history of a few shell fish.

For my own part, I confess that when I see a poor little Muscle, which seems by her helplessness to lie at the mercy of every passing wave, mooring her fragile bark under the shelter of some projecting stone, by means of strong ten-

* St. Pierre.

dinous threads, which she has the faculty of spinning on every emergency; or watch the common Snail, slowly ascending the cavernous trunk of some aged oak, or climbing up a garden wall without the aid of wings, feet, or thread, solely by means of the viscid humour discharged from her skin, and consider the secret spark of life which is in each of them; "that where we look for absolute destitution and can reckon upon nothing but wants," some admirable contrivance amply compensates for every apparent deprivation and preserves them, and their still more feeble offspring; my mind is carried up to the praise and adoration of that Gracious Being whose wisdom, beneficence, and power, are thus conspicuous in the humblest of his works.

Helices abound in almost every part of the known world. They furnish an important article of food on the shores of the Mediterranean, where they are boiled in their shells, and served up with rice.* They possess much of the quality of oysters, and are extremely nutricious. The use of them not unfrequently retards the fatal termination of that less active form of consumption called a decline; and so long as a sufficient

* Voyager's Companion.

quantity could be procured, many patients have appeared convalescent from the rapid recovery of their strength by the use of this nutricious food.

Various conjectures have been hazarded respecting the means by which the Israelites were supported during their rapid flight from Egypt as we are informed in the sacred volume, "That the people took their dough before it was leavened, their kneading troughs being bound up in their clothes upon their shoulders," and "That they were thrust forth out of Egypt, and would not tarry, neither had they prepared for themselves any victuals."

Père Sicard conjectures, with great probability, that the Exotic Snail furnished a considerable portion of their food. This gentleman, in company with Mr. Fronton, took the very same journey as that pursued by the children of Israel, in their departure from Egypt. It lay through a valley between Mount Diouchi and Mount Torah, and leads to the shore of the Red Sea, opposite Mount Sinai. The following is an extract from his interesting narrative.

"Although the children of Israel must have consisted of above two millions of souls, with baggage, and innumerable flocks and herds, they

were not likely to experience any inconvenience in their march. Several thousand persons might walk abreast with the greatest ease, in the very narrowest part of the valley, in which they first began to file off. It soon afterwards expands to above three leagues in width. With respect to forage, they would be at no loss: the ground is covered with tamarisk, broom, clover, and saintfoin, of which latter, especially, camels are passionately fond, besides almost every variety of odoriferous plant and herb proper for pasturage.

"The whole of the sides of the valley, through which the children of Israel marched, are tufted with brushwood, and are equally proper to afford food to their beasts, together with many drier sorts for lighting fire, on which the Israelites could, with the greatest ease, bake the dough they brought with them, on small iron plates, which form a constant appendage to the baggage of an Oriental traveller. Lastly, the herbage underneath these trees and shrubs is completely covered with snails of a prodigious size, and of the best sort; and, however uninviting such a repast might appear to us, they are here esteemed a great delicacy. They are so plentiful in this valley, that it may be literally said, that it

is difficult to take one step without treading upon them. The Israelites, indeed, could only meet with water at their halting places; but at each of them it was plentiful."*

Adieu! I am, &c.

* Mrs. Skimmelpennick's Biblical Fragments.

LETTER XV.

UNIVALVES.

TO * * * * *

Sept. 14, 1823.

One of the most imposing spectacles in nature is afforded by the ocean, as seen from overhanging cliffs or out at sea, when the foaming waves lash the rocks, broken into chasms, hollowed into caverns, or bending in frowning majesty as on the Pembrokeshire coast: one of the most delightful, when, on a fine summer morning, the bright emerald waters sparkle and murmur in their retreats, and gently break upon the shore. What beauty is then beheld on earth! what loveliness in ocean! what majesty in those immense strata of rocks several hundred feet in length, which seem to have been laid one upon another in an oblique direction, or start in bold projecting masses from the bosom of the ocean! Rocks which appear, as high as the tide rises, to be covered with the most beautiful grey moss or lichens, but in fact incrusted with innumerable families of little simpets, which are silently taught

by him whose tender care is over all, to fix themselves on the maternal bosoms of the surrounding rocks, which like foster parents shelter and protect them between the efflux of the ocean, when they would otherwise expose their defenceless sides to be devoured by birds of prey. But these are not the only objects deserving the attention of the naturalist. The excavations which are formed by the toiling of the waves apparently encircle diminutive groves and gardens, formed of crimson, green, brown, and pink coloured sea-weeds, occasionally diversified with strings of beads, which fancy pictures as the work of invisible fingers for the decoration of sea-nymphs of fairy size; some in the perfect form of minute trees; others trailing like little ribands floating and trembling in the waves, or simply expanded by the water which remains at low tide in the hollows of the rocks. Of these a considerable number are either incrusted with minute shells that shine like silver; or else afford shelter to innumerable little fishes, and marine insects of various descriptions, "their coats bedropt with gold," and varied with vivid tints of azure, green, and purple. For the Supreme Creator of the universe, as if wishing to communicate some scattered rays of his glory and

his blessedness to this extended world of matter, has replenished every leaf, every drop of water, "and every possibility of space with myriads of inhabitants."

Such were the reflexions that arose in the mind of your friend, the Shell Collector; and such the beautiful variety of marine objects which attracted his attention, during a solitary walk on the beach at Weymouth.

The sun had just risen, his broad beams shed a dazzling radiance on the vast expanse of waters:

"Whose intervening billows snowy foam
Rising successively, seem'd steps of light,
Such as on Bethel's plain the angel's clomb
When to the slumbering patriarch's ravish'd sight
Heaven's glories were reveal'd in visions of the night."*

The scene was indescribably pleasing. The earth, the air, the water, teemed with delighted existence. Myriads of "insect youth were on the wing," trying their pinions in the air, and sporting in wanton mazes with inconceivable rapidity. Shoals of little fishes darted through the sparkling waves, or bounded from the shal-

* Bernard Barton.

low margin of the water, as if rejoicing in their newly-discovered faculties ; while on the nearest rocks, a few Mollusca in the shape of sea-anemones expanded their imitative petals to the sun.

In the fore-ground a group of dark weather-beaten stones were covered with Limpets *(patellæ)*, the conical summits of which, as the waves occasionally dashed them with their spray, presented a beautiful variety of forms and colours. They stood, like Ossian's " lonely dwellers of the rock," solitary in the midst of numbers, and apparently incapable of sharing in the general joy.—But softly, has not Providence assigned to every class of being its peculiar sources of enjoyment? and is not the solitary Limpet, exempt from dangers which continually surround the finny natives of the deep? Gradually the beams of the sun illumined the summit of the rocks. One of the shells began to open. A kind of leg, or foot, apparently embracing part of the interior, was carefully projected from beneath the shell which gently erected itself on one edge as if to diminish friction, and by a sudden spring the creature actually advanced to a considerable distance.

" This," said a fisherman, to whom the Shell

Collector pointed out the movement of the Limpet, "is their common method of proceeding. The form of the leg which you observed, is capable of being altered at pleasure: it answers the purpose of a foot, or hand, by help of which they are able to sink into the mud, rise from it again, and even spring, as you have just observed, from the rocks to which they generally adhere so closely, that it is impossible to remove them without considerable force; unless, for it seems that their sense of hearing is very exquisite, you come upon them unexpectedly."

We boast of our inventions in the arts and sciences, forgetting that we are frequently anticipated by the feeblest of created beings. The Torpedo defended himself from his enemies by means of an electric shock, long before academicians thought of making experiments in electricity. The Limpet acted as if he understood the pressure of the atmosphere, and attached himself to the rock by forming a vacuum in his pyramidical shell, more than five thousand years before the air-pump came into existence.*

Seven divisions are assigned by naturalists to this extensive genus, the distinctions of which

* St. Pierre.

are strongly marked. The first comprizes such species as are furnished with an entire margin, not pointed at the summit; those of the second own a compressed form; the shells of the third are singularly varied with a perforated hole at the summit, whence they are termed Key-hole Limpets; the fourth includes those species which are pointed and recurved; of these the most remarkable, *P. ungarica*, is a beautiful and valuable shell, called the Fool's-cap, from its similarity of shape: the interior is usually of a pale fawn colour, the outer margin bordered with a fringed epidermis, and the interior of a bright pink. The shells of the fifth division have a marginated fissure, which is most conspicuous in the *P. fissura*. Those of the sixth are characterized by a curious internal appendage, whence has originated the common appellation of Cup-and-saucer Limpets. The interior of the last division is furnished with a transverse partition, giving to the shell the appearance of a slipper.*

Limpets are generally found adhering by their base to rocks, stones, fuci, and other marine substances, from which they are not easily de-

* Mawe.

tached. They inhabit the Indian, Southern, European, Northern, and Mediterranean seas; the American and Indian Islands, the Atlantic, and the shores of China, Greenland, and Iceland. The island of Cyprus is particularly celebrated for the beauty and variety of its specimens.*

Shells of this interesting genus are frequently discovered in a fossil state. The *Patella Mitrata* of Linnæus, and the *P. cornucopia* and *dilatata* of Le Chev. de Lamarch, are each of them attached with a small ligament or muscle to an operculum or undervalve. By the aid of this singular appendage they not only fixed themselves to rocks and marine pebbles, but also rose occasionally above them, like sentry boxes on an elevated station.†

Little is known with certainty respecting the peculiar habits of the *Patellæ*, or the purposes for which they are designed. They are placed on the boundary line between those shells which are furnished or unfurnished with a regular spire, and such is the general harmony of nature, that the shells of the third division, with a recurved apex form a natural link between the

* Rees. † Parkinson.

Haliotis, or *Sea-Ear*, and the genus *Patella*, of which they constitute such an interesting portion.* Consequently they could not be removed from the station that is assigned them, without producing a chasm in the creation, which, however imperceptible to us, would materially affect the general order of things. A conclusion which naturally arises from the harmony that is every where discoverable in moulding and fashioning such parts of material nature, as come immediately before our view; nor will this appear extraordinary when we consider, that He who is the God of order, has formed the beautiful world which we inhabit, and replenished it with such a variety of curious and exquisite productions. It also seems as if he designed to instruct us by the admirable arrangement of his creatures; that different gradations in society, are equally designed by His providence, and appointed for our good. What Cicero has happily denominated the insatiable variety of nature, continually opens to the reflecting mind a source of instruction and delight: it is wonderful to observe the infinite variety of shapes and species through which the world of life progressively

* Burrows.

advances, before a creature is formed that is complete in all its parts. Thus, in the instance of the solitary Limpet, some kinds adhere to the surface of the rocks; others, as the *Haliotis* or Sea-Ear, are apparently but one remove from these; a third description possess no other senses than those of feeling and of taste; a fourth are furnished with an additional one of hearing; a fifth of smell.* The whole chasm of nature is thus filled up with different kinds of creatures, rising in regular gradation with such a gentle and easy ascent, that the little transitions and deviations are almost imperceptible. Class is linked to class with a just and admirable precision, by means of an order trespassing on both; order to order by an intermediate genus; genera to genera by a doubtful species; one species to another by continual varieties. The mineral and vegetable kingdoms are united in like manner, by the Amianthes and Lytophites; Zoophytes form a connecting link between animals and vegetables. Tube-worms unite insects to shells and reptiles; the latter are joined to fishes by sea-eels and and water serpents. Flying fish connect the finny natives of the deep with those

* Addison.

that skim the air; and bats and flying fowls, associate birds and quadrupeds together.*

"Thus the wide chain of being, though widely extended,
Unites all its parts in one beautiful whole:
In which grandeur and grace are enchantingly blended,
Of which God is the centre, the light, and the soul."†

Adieu! I am, &c.

* Burke. † Barton.

LETTER XVI.

TEREDO NAVALIS.

TO * * * * *.

Oct. 10th, 1823.

THE perforations in the timbers of the gallant vessel which you lately saw at Deptford, were occasioned by the *Teredo Navalis*, or common Ship-Worm. This singular animal is a Terebella, furnished with two hemispherical calcareous valves, truncated in front, angulated beneath. The shell is tapering, flexuous, penetrating wood.* The generic appellation is derived from a Greek word signifying to bore.

The *Teredo* readily enters the stoutest timber, and ascends the sides of lofty vessels, which it insidiously destroys, like the evil genius so admirably portrayed by Captain Morris, whose visitations no earthly bulwarks could impede.

"Care mounts Rideaux, with four-and-twenty pounders,
Nor heeds our light troops, nor our Indian warriors,
Swifter than morse deer, or the fleeter east wind,
Pushing the crowds on.—".

Imitation of Horace, Monthly Magazine.

* Mawe.

The head of this indefatigable insect is well prepared by nature for the difficulties which it has to encounter, being surmounted with a helmet, and provided with a tooth adapted for perforating the hardest substances; the neck is also furnished with strong muscles, which materially assist the operations of the head; and the body covered with a thin transparent horn, through which its internal operations may be easily discovered. Mr. Hatchet ascertained by analysis, that the shell is composed of carbonate of lime, and an animal gelatinous substance; greater in proportion than that of the *Chama gigas*, but considerably less than that of the common Oyster. The heart is situated on the back, between the mouth and the lower part of the stomach; and admits of only a single circulation, as in animals which respire in an aqueous element: an organization which clearly demonstrates the care of a benevolent Creator. In like manner, the extraordinary fact that the breathing organs of the Ship-Worm, in common with such animals as are unprovided with a cavity for the reception of salt-water, are placed externally, evinces that their construction is in exact accordance with their mode of life. This wonderful provision is particularly obvious in the *Actiniæ* or Animal

Plants of the West-Indies. Their beautiful membranaceous expansions which resemble the petals of flowers, and glow beneath the water in vivid tints of yellow, green or purple, are in fact breathing organs, not tentacula for catching food.

The *Teredo Navalis*, or Ship-Worm, when arrived at its full growth, closes up the end of the shell; hence it has been inferred that the animal, by this act, formed its own tomb, since it could no longer destroy the wood in which it was contained. But Sir Everard Home has ascertained that in the *Teredo gigantea*, or Gigantic Teredo, death is not the consequence of this seclusion. He adduces a variety of curious facts to prove that the Ship-Worm when arrived at its full growth, or when prevented from increasing in length, closes up the end of its shell, and lives a long time afterwards; being furnished with food from the sea-water, which it receives, like the Actinæ through the medium of several small tentacula.

Teredines turn readily in their respective shells. They merely adhere to them by means of a slight connexion at one particular part; an arrangement evidently designed to prevent the tubes from being disturbed by the motion of the inmates, which resembles that of boring. As the

Teredo gigantea burrows in the mud, on which it cannot be supposed to subsist, a question has arisen whether the *T. navalis* receives any support from the wood which it destroys; or is solely supplied with food from the sea. The latter opinion is now generally adopted. It appears, on the closest investigation, that the saw-dust received by the animal does not experience the change; as when exposed to the action of slightest fire, it emits the odour of wood, and forms a charcoal, which readily consumes into white ashes, in every respect resembling those produced by vegetable charcoal.

When the body of a vessel continues for any length of time in water, the *Teredines* appropriate it to their use. They commence their operations by perforating the softest parts of the wood, and as they have seldom at this period attained their full growth, the perforations are frequently so small as to be scarcely discoverable. As soon as they have entered, and completed their habitations, their next care is to beautify, and render them commodious. This they effect by means of a white glutinous fluid exuding from their bodies, like the viscous juices of the Common Snail, which hardens into a sort of crust; and forms a thin smooth lining to their

respective cells. This lining, by filling up the cavities, and smoothing every inequality, protects their tender bodies from being injured by the roughness of the wood; it also enables them to move in various directions without inconvenience or danger.

A social compact apparently subsists between these shelly anchorites, as the greatest care is evidently taken to avoid injuring each other's habitations. Each case, or shell, is preserved entire, and even where a piece of wood has been so completely perforated as to resemble a honey-comb, the slightest passage or communication has never been discovered between the different compartments, though the divisions have frequently not exceeded the thickness of fine writing paper.*

Thus far are we indebted to the elaborate observations of Sir Everard Home. There is something humbling in the conclusion to which they naturally lead. Those floating castles which open communications between different countries,

"Armaments which thunder strike the walls
Of rock built cities, bidding nations quake."

* Philosophical Transactions, Feb. 13, 1806.

are liable to be destroyed by the bite of an insignificant reptile, as if designed to teach mankind the weakness of their boasted strength. But mark the protecting care of Providence. The destructive operations of these insidious animals are in a great degree obviated by the singular fact of their generally perforating the wood in the direction of the grain.*

The fossil cases of the *Teredines* are termed Tubuli Fossiles. They are found buried in the earth, and vary considerably in appearance. Some are discovered, in a more or less perfect state, in strata of earth or stone; others which are immersed in masses of the Ludus Helmontii, or septariæ, constitute one kind of pipe stone, or lapis syringoides; but the most beautiful of this description are broken fragments of vessels, or marine posts, which have been originally pierced by *Teredines,* and afterwards petrified, with the cases, or tubuli, of the worms remaining in them.

Elegant specimens of these are brought from the shores of Sheppey, and the London and Richmond clay-pits.†

Teredines abound in the richest provinces of Holland, where the inhabitants have the frightful

* Mawe. † Rees.

spectacle of their great rivers held up by dikes at the height of twenty or even thirty feet above the level of the land.* Here they frequently work their way into the piles of timber, which sustain these important barriers, and threaten their total demolition; when the precaution of sheathing their lofty sides with copper, or a composition of tar and glass has been neglected. In the year 1731, considerable apprehensions having been excited on the subject, persons were appointed by the government to examine the piles of timber that sustain the dikes. On drawing up one of them, which had been driven into the sea rather more than twenty years before, it was found, though apparently sound on the outside, completely perforated by innumerable *Teredines*, some of which exceeded a foot in length.*

One question may possibly have dwelt upon your mind during the perusal of these observations. Why so much care and evident design in the construction of a pernicious reptile; the instincts of which are fraught with destruction to the noblest works of art, and even to man himself?

Patience, my friend. Is not man, endowed

* Notes to Cuvier's Theory of the Earth.

† Wonders of Nature and Art.

with faculties to reason and apprehend; ardent to investigate, and skilful to obviate inconveniencies; fully adequate to cope with, and counteract the depredations of an obscure insect?

All the various parts of nature are beautifully designed to act in concert. We see the hand of God employed in forming the lowest, and frequently, in our opinion, the most despicable creatures; assigning to each its station, and so admirably adjusting the mighty whole, that every particle of matter, and every living thing that creeps or moves upon the surface of the earth, is formed in subserviency to the general good. Indeed, in many instances, the lower we descend in the scale of creation, the more obvious are the uses, and the more extraordinary the instincts of many of the creatures which compose it. Providence has mercifully provided that such should be the case; and the reason is obvious: for if the destructive and congregating propensities of the Whale and Shark were similar to those of the *Teredo Navalis*, the skill and ingenuity of man himself would be almost inadequate to counteract the machinations of such sagacious and persevering foes.

Sea-Worms, though apparently so pernicious to our shipping, have the same office assigned

them in the water as *Termites* have on land. You are perhaps aware that these extraordinary insects, which to a casual observer appear solely occupied in spreading terror and destruction wherever they advance, are nevertheless of infinite importance to the well-being of mankind in the exotic regions of the globe. They consume decaying vegetable substances of various kinds. They also resemble common flies in their general operations; those indefatigable little labourers, the pioneers of cleanliness and order, which continually employ themselves in perforating animal substances, and enabling the elements speedily to decompose and dissipate them.

Changes conducive to the general benefit are perpetually going on in the animal and vegetable kingdoms. Their various productions successively experience a gradual or rapid deterioration in accordance with the character of each, and recede from the sites they occupy, in order to make room for others. Thus when aged trees, or even forests, especially in tropical climates, are overthrown by a tornado, or partially consumed by fire, innumerable agents hasten to complete their demolition. The *Termites*, especially, are so expeditious and effectual in their operations, that companies of them have been known to destroy

and carry away in the course of a week, the bodies of the largest trees. They clear the ground, and afford room for vegetable productions of various kinds, which rapidly assert their right, and occupy the places which nature has assigned them. Ruined houses also frequently become a prey to these indefatigable insects; nay, even the sites of populous villages, when abandoned by their inhabitants, as is frequently the case in Arabia and in Senegal, have by their agency, in the course of two or three years, been covered with grass or trees, and not the vestige of a single post has been left remaining.

To such scenes of desolation and subsequent fertility the following stanzas most probably refer. They afford a fine specimen of oriental poetry, and were translated by Sir William Jones from the Moalaket, one of the seven Arabian poems, which are suspended in the Temple of Mecca.

I. Desolate are the mansions of the fair, the stations in Minia, where they rested, and those where they fixed their abodes! Wild are the hills of Goul, and deserted are the summits of Rijaam.

II. The canals of Rayaan are destroyed; the remains of them are laid bare, like characters engraved on the solid rock.

III. Dear spot! many a year has been closed, many a month holy and unhallowed, has elapsed, since I exchanged vows with thy fair inhabitants.

IV. The rainy constellations of spring have made their hills green and luxuriant; the drops from the thunder clouds have drenched them with profuse as well as with gentle showers.

V. Here the wild eringo-plants raise their heads; here the antelopes bring forth their young by the sides of the valley; and here the ostriches drop their eggs."*

I have entered more particularly into the natural history of the *Termites*, because their operations tend to elucidate those of the *Teredines*, with which it is impossible to become so accurately acquainted from the nature of the element in which they subsist. We are, however, fully warranted in concluding from well-known facts, and recent observations, that were it not for their incessant labours, those mighty rivers,

> " To whose dread expanse
> Continuous depth, and wondrous length of course
> Our floods are rills,"

would in time become impeded by the vegetable masses and innumerable trunks and branches of large forest trees, which are continually carried

* Guthrie's Geography.

into them by adventitious causes; a considerable proportion of these, from the preservative nature of salt-water, would probably last for ages, form a basis for fresh accumulations, and eventually become productive of evils, of which in the present harmonious and admirably balanced state of things, it is impossible to form an adequate conception.*

Nor is this all. The feeble *Teredines* open a source of considerable riches to the inhabitants of Sweden, and those who reside on the borders of the White Sea, by employing the vigilance of the Dutch. The necessity which they impose upon these active people of continually tarring and repairing their dikes and vessels, forms a bond of union between the two commercial nations, by occasioning a perpetual demand for oak, pitch, and fir. And as these apparently pernicious insects are continually at work at Amsterdam for the advantage of Stockholm and Archangel, so the labours of others in the north are equally profitable to the Hollanders, by promoting the consumption of their salt, spices, and grocery, which are annually exported in large quantities, either for the purpose of seasoning

* Encyclopædia Britannica.

and preserving the provisions of their northern neighbours, or to cure the fish which they use instead of bread.*

Cease then, my friend, to regard those creatures as decidedly obnoxious, the use of which you do not readily perceive. The *Teredo* is apparently an insignificant reptile, nay, more than insignificant; it appears on a slight acquaintance to be perfectly injurious: yet the Creator has assigned it an important station among his works. The evil which it produces is readily obviated by a little care and contrivance; but the good which it is appointed to effect is incalculably great in the mighty scale of universal nature.

Adieu! I am, &c.

* Spectacle de la Nature.

LETTER XVII.

FOSSIL SHELLS.

TO * * * * *.

August 24, 1823.

From the natural history of testaceous animals, the transition is obvious to those fossil shells which diversify the strata of the earth.

The lowest and most level parts of the great globe which we inhabit, when penetrated to a considerable depth, exhibit horizontal strata, composed of various substances, generally containing innumerable marine productions. Such is also the case in more elevated regions, where occasionally fossil shells so far preponderate, as to constitute the entire body of the stratum. These are generally in such a perfect state of preservation, that even the smallest retain their most delicate parts, their sharpest ridges, and their finest and tenderest processes. They are found in situations far above the level of the sea; and in places to which the sea could not be conveyed by any existing cause. They are not only enclosed in loose sand, but also incrusted by the hardest

stones. In short, every part of the known world. both hemispheres, every continent, and every island of any size, exhibit the same phenomenon.

The traees of revolutions beeome still more apparent and deeisive, when we aseend a little higher and approach nearer to the foot of the great chain of mountains. These eontain many beds of shells, some of which are even larger and more solid, and as well preserved, though not of the same speeies with those of less elevated regions. And, whereas, in the plains, low hills, and vallies it is necessary to dig deep in order to detect the suceession of the strata; here we pereeive them by means of the rents and exeavations which time or violenee has oeeasioned, and which disclose their edges to the view of the observer. At the bottom of these deelivities, hugh masses of their wreeks are frequently collected, and form round hills, the height of which is eontinually augmented by the operation of every thaw, and every storm.*

In Chili some of the highest mountains are formed entirely of shells; and on the Deseaheyado, whose towering summits aspire nearly to those of the magnifieent Chimborazo, Oysters

* Cuvier.

and periwinkles are discovered in a calcined and petrified state. That magnificent range of the vast Andes which passes through the narrow isthmus of Darien into the kingdom of Mexico, as well as the lofty sweep of the Apalachian hills, offer similar indications. The low grounds which extend from the base of the latter, are varied with small risings composed entirely of shells; incredible numbers are also found, at the depth of fifty or eighty feet, in the vast plains of Virginia and Carolina.*

Bivalve shells are frequently discovered on Mount St. Julian, in Valencia, bedded in gypsum, and surrounded by detached pieces of slate; while large masses of sea-shells start forth amid the sultry plains of Asia.

The famous rock of Gibraltar is principally composed of lime-stone, traversed by fissures, or hollowed into caves, in which the osseous breccia is contained. Cuvier notices that the shells which it exhibits, are uniformly water or land species. The high hills of Spain are frequently composed of river and oceanic shells, blended with other marine substances, and layers of dark earth. Even the *Ammonites*, inhabitants of deep and tempes-

* Pennant's Arctic Zoology.

tuous oceans, have been discovered in Alpine regions. Large beds of Oysters diversify the calcareous strata of Bezières in France. An assemblage of marine petrefactions have recently been found in the depth of a marble quarry near Aix, fifteen miles from the Mediterranean, and six hundred and fifty-eight feet above its level,* principally consisting of nondescript *Patellæ* and *Tellinæ*. A vast mass of diluvian marine shells are deposited near the summit of Haldon Hill, to the north of the town of Teignmouth, at an elevation of eight hundred feet above the level of the sea. On the same level is another distinct accumulation of shells, mostly composed of various species of *Cardium*, *Mactra*, and *Arca*, mineralized into a mass of blood-red chalcedony or cornelian.†

In the exotic regions of South America, and on the frozen mountains of the north are several organic remains, indicating the former dominion of the ocean. Asia and Africa bear also ample testimony to the validity of this wonderful event. Sea-shells are witnessed on Perdu, at an elevation of ten thousand feet above the waters of the

* Parkinson. † Teignmouth Guide.

ocean. On the lofty mountains of Arsagar the bivalve shells of the Caspian are spread abroad in all directions; and rings for cables are still observed on the rocks near Sevastopole in Tartary. "Thus, while fossil shells have been discovered in the quarries of Flanders, and among the Alps behind Genoa; the Pyrenees, Caucasus, Athos, Lebanon, Ararat, the Riphaean ridge, the steep mountains of New Ireland: the Andes, and the Cordilleras, present strata, either of shells, sea-weeds, or skeletons of fishes, amphibia, and other animals, not only at their feet, but in their girdles and near their very summits."*

Sea-shells of various descriptions are discovered in the large fragments of loose stones, which lie scattered round the base and extend far up the rocky side of Glyder-war, or the eminence of Tempests, a terrific mountain on the banks of Llyn Peris, near Capel Carig, in North Wales.

Snowdon, the monarch of the British Alps, whose lofty summit rises three thousand five hundred and seventy-one feet above the level of the Irish Sea, also exhibits similar indications. Marine shells, or medals commemorating the

* Bucke's Harmonies and Sublimities of Nature.

deluge, as Cuvier elegantly denominates them, are found bedded in the slate of which the mountain is composed.

The long ranges of sand-hills which skirt both slopes of the Appennines through almost the entire length of Italy, contain every where perfectly well preserved shells; these are often found retaining their colours and even their natural pearl like polish, and several resemble those still found in our own seas. Leaves of trees and the trunks of bituminous wood, mixed with the bones of fish and other marine animals, are also brought from the same range of mountains; while on the sides of Mount Sarchio, between Rome and Naples, shells are discovered mixed with blue marl.* Similar remains are visible on Lebanon. At the foot of the Ligurian Mountains a considerable tract of breccia contains shells of various descriptions, both bivalve and multivalve, with a profusion of madrepores bedded in pieces of quartz, and agglutinated scales of mica.† Among the lofty range of mountains which divide the Zand and the Orange River, north-west of the Cape in Africa, numerous petrifactions of shells are discovered, many of them

* Cuvier. † Bucke.

in situations at least one hundred and fifty feet above the level of the ocean.*

Enormous beds of shells have been also found in Touraine, situated thirty-six leagues distant from the sea. Oceanic shells have been recently brought from the fissure of a lead mine at Pontpian, near Rennes; they were found with the remains of a beech tree; the centre of which had been converted into coal, the bark into pyrites, and the sap wood into jet.† The lake Garda furnishes similar organic remains. The borders of Mount Baldo exhibit large pieces of grey marble beautifully diversified with sea-shells: innumerable cockles are found imbedded in the stones which form the walls of Megara: Oysters incrust the fossil remains of enormous marine animals found near Valdarno Superiore, and Placentia; while the ruins of Agrigentum rise upon the partial ruins of the ancient world; an eminence composed of a concretion of sea-shells, hard as marble.

The well waters of Modena spring from beds composed of gravel and marine shells; the latter, though more than sixty feet in depth, occupy a

* Parkinson. † Polehampton.

line of country one hundred and thirty feet above the level of the Mediterranean.*

Descending from these elevated regions, we trace the same alluvial deposits in the plains and vallies of our own and other countries.

France offers a rich mine to the geologist. Its metropolis is situated in the midst of an extensive plain, which for horizontal or secondary stratification, is one of the most remarkable with which we are acquainted. Great masses of rock, containing thousands of marine exuviæ, alternate regularly with others, in which the shells of fresh-water fish are similarly imbedded. The bones of land animals, of which not only the species, but even the genera are entirely unknown, occupy extensive districts; while other bones, belonging to large animals, to which we find nothing analogous excepting in remote and exotic regions, are scattered near the surface: characters of a mighty torrent are also discoverable from the south-east, impressed on the forms of the hills, and in the directions of the principal ridges.†

The fossil remains which diversify the south of England very nearly resemble those of the

* Parkinson. † Cuvier.

lower marine formation in the basin of Paris; a similarity of no small importance, as it leads to the probable inference that the lower marine formation of our own country belongs to the same deposit; an inference which derives additional strength from the well-known similarity in the minerals of each.*

Beds of Oyster-shells are found at Reading nearly two feet in thickness. In the neighbourhood of Broughton, in Lincolnshire, fresh-water shells, consisting of *Pectinidæ* and *Echinites*, with pieces of coral and the *Mya Margaritifera*, are frequently found in quarries of blue stone. Kent has also its beds of Shells, and twenty-eight different fossil species diversify the sands at Harwich; of these ten species of the genus *Buccinum*, one *Nerita*, one *Turbo*, one *Pecten*, one *Auricula*, seven *Pentuncula*, are among the most conspicuous.†

The digging of a moorish pasture in Northamptonshire, produced abundance of snail and river shells of various kinds. This place had no doubt been formerly overflowed with water, and its deposits had accumulated in the course of years to a bed of considerable thickness. Re-

* Professor Jameson.

† Polehampton's Gallery of Art and Nature.

culver, in Kent, is celebrated for its alluvial deposition of white *Conchites:* these are at least twelve feet in thickness, imbedded in green sand, and occasionally varied with a few scattered pieces of wood. *Trochi*, or St. Cuthbert's Beads, as they are termed by the country people, occur in the fissures of the rocks at Broughton and Stock, small villages of Craven. They are also found in Holy Island, the theme of legend and of song, and are eagerly sought for by the sailors, who endow them with supernatural qualities.*

Many important conclusions result from a serious consideration of these extraordinary depositions of testaceæ. Cuvier, the Newton of geologic science, has clearly proved, from the observation of them in common with other organic remains, that the crust of our globe has been subjected to a great and sudden revolution, which buried all the countries before inhabited by men and animals; as it is evident that the sea has not only covered our plains, but also rolled above the highest mountains, where it must have remained for a long time in a state of considerable tranquillity; which circumstance was

* Pennant. Parkinson.

necessary to account for the formation of such solid, thick, and widely-extended deposits, containing exuviæ so perfectly preserved; and that previous to the formation of the horizontal strata, others had been deposited, which by some means have been broken, lifted up, and overturned in a thousand different ways. A result not less clearly demonstrated than the first to every one who will take the trouble of carefully examining the remains by which it is illustrated and proved. He has also clearly shown that these repeated irruptions of the great waters have been neither slow nor gradual, especially in the instance of the last; an event confirmed by the history of all nations, and recorded on the surface of the globe; the epoch of which, the same distinguished Geologist has proved, by a careful investigation of the different changes that have taken place since the receding of the waters for the last time, cannot be referred to any very ancient period: a fact undoubtedly the best established, though perhaps the least attended to of any in rational geology, notwithstanding its importance, as connecting natural and civil history together in an uninterrupted series. Hence it is evident that at the period of the deluge, when every thing of human origin was swallowed up in the

great waters; cities and palaces, majestic pyramids, and perhaps triumphal arches embellished with the trophies of ancient kings! when there remained on the earth no traces of the glory or felicity of the antediluvian race, but all was swept away, and not only these, but the still more splendid monuments of nature's greatness involved in one common ruin; innumerable mementoes of this event were impressed on the clay, and still subsist as memorials of that devastation: relics of a primeval world, which proclaim with a loud voice the instability of earthly affairs, and impress upon the minds of those who seriously consider them, sentiments of piety and feelings of devotion. In reference to which Professor Jameson has elegantly observed, "If the antiquary digs from among the ruins of Herculaneum a piece of ancient money, a vase, or a statue, we rejoice with him, in finding the mode of life, the manners and arts of an ancient people placed before our eyes: if he finds an old record, illustrative of the history of his country, however limited in extent that country may be, we are grateful to him for the particle of knowledge which he has added to our store;—but if, among the ruins of the common country of the human race," or rather in the traces of those

mighty revolutions with which Omnipotence was pleased to prepare our present habitation, " we linger at the great sepulchre of animated beings, who can look upon it without sentiments of piety? It is not here the statues of Polycletus that we admire, but the admirable monuments of the workmanship of nature, taken from the ruins of the great Herculaneum overwhelmed by the ocean, that we look upon with feelings of the deepest wonder and devotion !"*

Adieu, I am, &c.

* Observations by Professor Jameson, affixed to his translation of Cuvier's Essay on the History of the Earth.

THE END.

LONDON:
PRINTED BY COX AND BAYLIS, GREAT QUEEN STREET.

WORKS

PUBLISHED BY

WHITTAKER, TREACHER, AND CO.,

Ave Maria Lane, London.

I.

In Quarterly Parts, each containing from 16 to 20 Engravings, price, in demy 8vo. 12s.; in royal 8vo. 18s.; in royal 8vo., with the Plates accurately coloured, 24s.; and in demy 4to., with Proofs on India paper, 24s.
Or, in Monthly Numbers, with 6 or 8 Plates, demy 8vo. 4s.; royal 8vo. 6s.,

THE ANIMAL KINGDOM

DESCRIBED AND ARRANGED IN CONFORMITY WITH ITS ORGANIZATION.

By the Baron Cuvier:

Translated, with large additional Descriptions of all the Species hitherto named, and of many not before noticed, and with other Original Matter,

By E. Griffith, F.L.S., C. Hamilton Smith, F.L.S., and E. Pidgeon.

The CLASS MAMMALIA, complete in Twelve Parts, with upwards of 200 Engravings, forming 5 vols., price, in extra cloth boards, demy 8vo., 7l. 4s.; royal 8vo. 10l. 16s.; ditto coloured, 14l. 8s.; demy 4to. India proofs, 14l. 8s.

A Supplementary Volume, just published, contains an Account of the

FOSSIL REMAINS,

Demy, 8vo. 1l. 16s.; royal 8vo. 2l. 14s.; demy 4to. 3l. 12s.

The CLASS OF BIRDS, complete in Nine Parts, forming 3 vols., price, in extra cloth boards, demy 8vo. 5l. 8s.; royal 8vo. 8l. 2s.; ditto coloured, 10l. 16s.; demy 4to., India proofs, 10l. 16s.

The REPTILES will form Three Parts, (25, 26, and 27,) and the INSECTS will form about Six Parts; the whole comprising about Forty Parts. It will be so arranged, for the convenience of those who may confine their Zoological studies to either of the Classes, that each Class will make a distinct work, as well as one of the Series of the "Animal Kingdom." The conclusion will contain a Tabular View of the System, a Copious Index, and a general Terminology of the Science.

The engraved Illustrations of this Work are in a superior style of execution, by different Artists of distinguished eminence; and among the rest, many are by Mr. Landseer. Most of them are from original Drawings made from Nature, and several represent Species altogether new, or never figured before.

[Manning & Co., Printers, London-House Yard, St. Paul's.]

II.

In 2 large vols. medium 8vo., containing above 2000 pages of close print, price 36s. in handsome cloth boards,

A GENERAL BIOGRAPHICAL DICTIONARY:

By John Gorton.

"*It is small praise to say this Dictionary supersedes all the prior compilations of the kind; but we have consulted a multitude of articles, and have been surprised at the accuracy, versatility, and intelligence which they exhibit. We must not omit to remark an important recommendation in a bulky book of reference—its cheapness. Though far more copious, and carried down to a much later period, we believe the work does not exceed the price of the imperfect repertories of Biographies.*"—Atlas.

"*Among the many cheap and useful publications now issuing from the press, we have scarcely seen one which unites so many excellences as this Biographical Dictionary. It exhibits a fine specimen of typography, and has a merit which belongs to very few low priced works. The Editor, who is evidently a person of learning and talent, has taken many articles from books not in general circulation, translated or abridged others from foreign dictionaries or journals; and, what is still better, he has infused into the whole a degree of taste and spirit which we should look for in vain in some biographical compilations of much greater costs and pretensions.*"—Scotsman.

"*Mr. Gorton's publication is altogether one of great excellence, calculated to be useful to a large number of students, and deserving extensive popularity. We may also mention, that it is sufficiently large to contain everything necessary, but not too extensive for the ordinary purposes of study, filling, in this respect, an open space in the fields of biographical literature.*"—Athenæum.

"*This Dictionary is peculiarly valuable as a work of reference, for the general reader, on account of information respecting prominent characters that have figured on the stage of life being more its object than an alphabetical list of individuals of various note and merit; and upon this ground particularly it has a claim to distinguished notice. Impartiality is another recommendation, and as far as we have observed, this spirit is very creditably maintained throughout.*"—New Monthly Mag.

III.

In Two large Volumes, Octavo, price 30s.

THE HISTORY OF ITALY:

From the Fall of the Western Empire to the Commencement of the Wars of the French Revolution.

By George Perceval, Esq.

"*For the elegance of its style, the generous tone of its sentiments, and, above all, for its faithful reference to original authorities, this work is certainly a valuable acquisition to our historical literature.*"—Monthly Review.

"*The History of Italy fills up a blank long felt in our literature, in a way highly creditable to its author.*"—Literary Gazette.

IV.

In Two Volumes, 8vo., the Third Edition, with an Appendix containing the Acts of Parliament and other Documents relating to the Settlements, embellished with Maps, &c. Price 24s.

A STATISTICAL ACCOUNT OF THE BRITISH SETTLEMENTS IN AUSTRALASIA;

Including the Colonies of New South Wales and Van Diemen's Land; with an enumeration of the Advantages which they offer to Emigrants, as well as with reference to each other, as to the United States of America, and the Canadas; and Directions and Advice to Emigrants.

By W. C. Wentworth. A Native of New South Wales.

V.

In 4 vols., post 8vo., price 35s. 6d.,

OUR VILLAGE:

SKETCHES OF RURAL CHARACTER AND SCENERY.

BY MARY RUSSELL MITFORD.

"*The sketches of country scenery, in which this volume abounds, have such a convincing air of locality, the human figures interspersed among them are touched in such a laughter-laving good-humoured spirit of caricature, innocent, yet pungent withal, that we scarcely know a more agreeable portfolio of trifles for the amusement of an idle hour.*"—Quarterly Review, *No.* 61—*on Vol.* 1.

"*It is with a feeling of gratification equal to that with which we have just perused this pleasing addition to 'Our Village' annals, we are here enabled to repeat our favourable opinion of their style and character, of their simplicity, taste, and originality. With equal pretensions in other points, they indisputably boast more variety, and more discrimination of character, than the Sketches in the preceding volume, while they aspire to a higher class. They open wider and more general views of rural life, and peculiarities of temper and disposition, in the more elevated rustics around the village, in particular towards the close of its history,—even more than we were entitled to look for, from the simple plan and promise given in the outset, and in the whole of the former volume.*"—New Monthly Mag. *on Vol.* 2.

"*Miss Mitford's Series of Sketches are too well known to need an analysis. We can only say that the present volume is as entertaining as its predecessors, and shews no diminution of the power and genius which has before been so acceptably received by the reading world. For treating simple themes, we should find it difficult to discover a writer equal to the authoress of 'Our Village.'*"—New Monthly Mag. *on Vol.* 4.

BY THE SAME AUTHORESS,

In Post Octavo, price 10s. 6d.

DRAMATIC SCENES.

SONNETS, AND OTHER POEMS.

And in post Octavo, price 8s.

FOSCARI; AND JULIAN.

TRAGEDIES.

VI.

In post 8vo., with a new Map, price 10s. 6d.

THE PICTURE OF AUSTRALIA;

Exhibiting a faithful representation of the Geographical Position, Surface, and Appearance of the Country; of the Seas around its Shores; of its Climate and Meteorology; of its Native Productions and Native Inhabitants; of the several Colonies in New South Wales, Van Diemen's Land, the Swan River, Melville Island, and other places; of the Agricultural and Commercial Resources of the Country, and the prospects which it holds out of advantage, whether to the intending Settler, to the Merchant, or to the Country at large.

"*We cordially recommend this book to the attention of our readers. No work has yet appeared which will afford the inquirer a juster idea of this interesting and wonderful country.*"—Athenæum, *Sept.* 23. *See also* Times, *Sept.* 24.

"*The book before us contains the fullest and most satisfactory information concerning the natural history, meteorology, products, statistics, and every other desirable point of knowledge. It seems to be very impartial in its accounts, and contains such a multiplicity of curious, instructive, and interesting matters, that we know no geographical work of superior character.*"—Gent. Mag.

VII.

In post 8vo., with Engravings, price 7s. 6d.

A DISCOURSE ON THE REVOLUTIONS OF THE SURFACE OF THE GLOBE,

AND THE CHANGES
THEREBY INTRODUCED INTO THE ANIMAL KINGDOM.

BY THE BARON CUVIER.

Translated from the French, with Illustrations, and a Glossary.

VIII.

In 8vo. with Plates, price 12s. boards,

THE ANTIQUITIES OF FREEMASONRY;

Comprising Illustrations of the Five Grand Periods of Masonry, from the Creation of the World, to the Dedication of King Solomon's Temple.

BY THE REV. G. OLIVER.

IX.

The Fourteenth Edition, in 12mo., with important Additions, Alterations, and Improvements, by the Rev. G. OLIVER, price 8s.

ILLUSTRATIONS OF MASONRY;

By the late WILLIAM PRESTON, Esq., Past-Master of the Lodge of Antiquity.

X.

In octavo, with 20 Coloured Engravings of Manners, Customs, and Religious Ceremonies, price 16s. boards,

SKETCHES OF PORTUGUESE LIFE, MANNERS, COSTUME AND CHARACTER.

"The whole volume is one of extraordinary entertainment, and a very curious picture of national manners."—Lit. Gaz.

XI.

In 8vo., with a coloured Frontispiece, the Second Edition, price 14s. boards,

THE GREEN-HOUSE COMPANION;

Comprising a general course of Green-house and Conservatory Practice throughout the Year; a natural arrangement of all the Green-house Plants in cultivation; with a descriptive Catalogue of the most desirable to form a collection, their proper soils, modes of propagation, management, and references to Botanical Works in which they are figured. Also, the proper treatment of Flowers in Rooms, and Bulbs in Water Glasses.