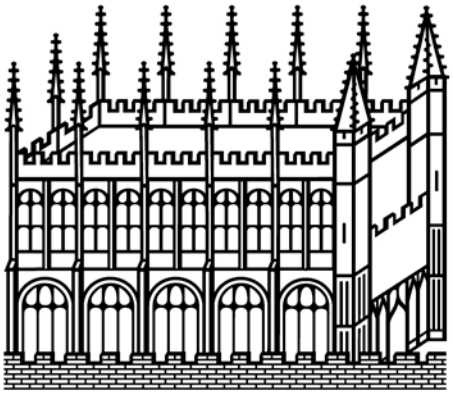

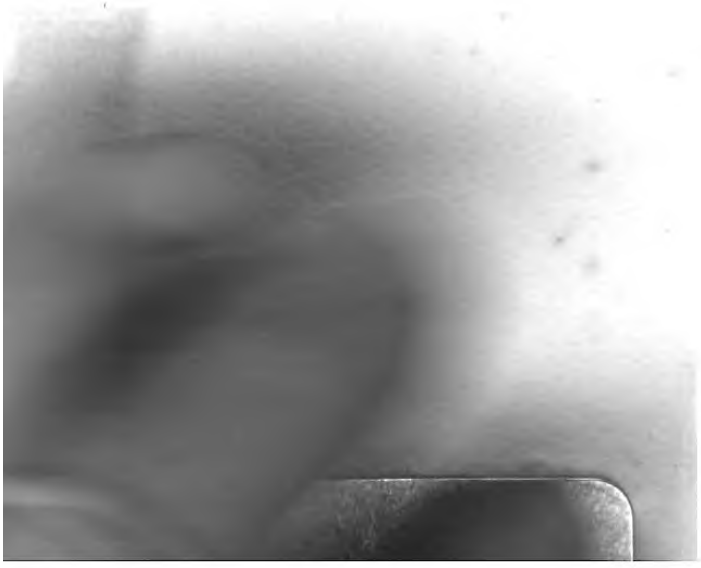

THE

ELEMENTS

OF MODERN

CONCHOLOGY;

BRIEFLY AND PLAINLY STATED,

FOR

THE USE OF STUDENTS AND TRAVELLERS.

BY WILLIAM SWAINSON, Esq.

MEMBER OF SEVERAL FOREIGN ACADEMIES.

Parva sed apta.

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TO

DR. W. HENRY, M.D., F.R.S., &c.,

OF MANCHESTER.

My Dear Sir,

I cannot dedicate this little tract with more propriety than to you, as the first idea of writing it was suggested by the wish of rendering Conchology a pleasing recreation to your daughter. With my sincere hope that it may effect this,

Believe me,

My dear Sir,

Faithfully yours,

W. SWAINSON.

Tyttenhanger Green,
London Colney, near Barnet.

PREFACE.

In this little tract I have endeavoured to condense, into as small a compass as posssible, all that it is necessary for the amateur Conchologist to know of the families and genera of shells, whether recent or fossil. I have used the most intelligible, and often homely language, and restricted the definitions to those points *only* which are essential. On this plan the reader has the substance of elementary books, five times the bulk and price of this. It has long been a general complaint that those who are best qualified to write introductions to the different branches of physical science, hold themselves aloof; as if preparing such "food for babes" would lessen their reputation. The consequence has been, that in almost every department these elementary works are written by mere compilers, who generally take upon themselves to teach others, before they have

been instructed themselves. It is quite time that this system should be checked.

"Let those teach others who themselves excel,"

is a maxim which at once shows the true dignity belonging to such an eminent man as Professor Young, who has set an example, in simplifying Algebra, which has conferred incalculable benefit on the rising generation. I shall esteem myself fortunate if a part of such success attends this attempt in one of the branches of natural history. Should it prove so, I may possibly follow the same plan in the other departments. But had no other motive existed, I should, as a parent, have written this for the use of my own children, seeing that I have not met with any Introduction to Conchology which they would not, hereafter, have to *unlearn*.

W. S.

EXPLANATION OF TERMS.

Note.—Many of the technical words used in the following pages, either precede or follow another, more generally intelligible, and are printed in *italic;* as *obsolete* or half formed, p. 9, blunt or *obtuse,* p. 14, &c., the word thus carrying its own explanation; a few others, however, require more particular notice.

Anterior side, or slope, of bivalves. That side on which the ligament is placed.

Aperture. The mouth or opening of univalves.

Bosses. The two prominent tops or summits of a bivalve shell, called by some *umbones,* and by others *beaks.*

Byssus. A bunch of thread-like fibres, by which some bivalves adhere.

Cardinal teeth. Those placed immediately under the bosses.

Canal. A projecting channel at the base of many univalve marine shells.

Confluent. Lines running into each other.

Ears. Appendages on one or both sides of the bosses.

Fusiform. Spindle-shaped, thick in the middle, the ends tapering.

Hinge. The thickened inner edge of bivalves, under the bosses.

Inflected. Bent inwards. *Reflected.* Bent outwards.

Irregular. Or of no regular, equal, or determinate form.

Imperforate. Without any hollow, or hole.

Laciniated. As if irregularly cut, or lacerated.

Lateral. Placed on one or both sides.

Lips. In univalves: the side of the mouth or aperture next the pillar, is the *inner* lip, that on the other side is called the *outer.*

Linear. Very narrow, and of equal breath.

Lobe. A notched division. *Longitudinal.* Lengthways.

Muscular impressions. Indentures on the inner surface of bivalve shells, either in the middle, or at each end.

Opaque. Not transparent. *Orbicular.* Nearly round.

Pillar. The support, or axis of a spiral shell.

Posterior side. In bivalves, that opposite the anterior.

Reticular. Resembling net-work. *Spatulate.* Spoon-shaped.

Spire. The different *turns, volutions,* or *whorls* of a spiral shell form the spire.

Sinuated. Taking a bend inwards.

Striated. Marked by raised or indented lines.

Symmetrical. Proportionate, the sides or parts equal.

Syphon. A tube or pipe.

Tumid. Swelled or bulged. *Truncate.* Ending abruptly, as if cut off.

Transverse. Cross-ways. *Tubular.* Pipe, or tube-like: hollow within.

CHAPTER I.

OF MOLLUSCOUS ANIMALS IN GENERAL, AND OF THE TESTACIA, OR SHELL FISH, IN PARTICULAR.

(1.) The Molluscous, or soft animals, constitute one of the three primary divisions of the animal kingdom; the two others being composed of VERTEBRATED animals (*Vertebrata*), having an internal bony skeleton; and ANNULOSE animals, or insects (*Annulosa*), having jointed feet, but no internal bones. Hence it follows that we include, under the general name of *Mollusca,* all those soft, or slimy, or "creeping things," which, without having distinct feet, are yet frequently able to crawl upon their belly, or to swim in the ocean. Some few, as the snail and slug, live on dry land, but nearly all the rest are aquatic.

(2.) The foregoing definition brings into the class of mollusca not only shell fish, but an infinity of other strange looking creatures, such as sea eggs (*Echini*), starfish (*Asteridæ*), *Medusa,* or sea

pulps, *Polypes*, or animal flowers; animalculi, the coral animals, &c. On looking, therefore, to this vast assemblage, we find that they arrange themselves into three secondary classes. 1. TESTACEOUS MOLLUSCA, or animals whose skin is either soft and naked, or protected by a calcareous shell; their nervous system is composed of scattered ganglions, or knot-like masses, united by nervous threads. 2. RADIATED ANIMALS, in which the body is round, and the mouth in the centre, as starfish, medusa, &c.; and 3. ACRITA, or *polypes*, &c. These latter animals are so little organised, that they generally resemble masses of naked transparent pulp; the nervous system being composed of minute granulations. There is generally a hollow or cavity in the middle, but no limbs, head, eyes, or other distinct parts or members.

(3.) It must not be supposed that all the Testacious Mollusca are provided with shells, or that all animals *with* shells belong to this class. The nervous system and construction of these creatures decide their station, for the shell is but of secondary consequence. Thus the Barnacles and Acorn-shells (*Cirripeda*) are in reality annulose animals with jointed legs, in the disguise, only, of Testacia. So, also, are the worm shells (*Serpula*), for they have red blood; while that of all the MOLLUSCA is white. Yet in spite of these facts having long been known, some modern writers, who should know

better, continue to place both the Cirripeda and the Serpula along with shell fish.

(4.) Looking, then, to the Testacious Mollusca, we find they are composed of the following tribes: 1. GASTERAPODA, having a head and eyes, and living in univalve or spiral shells. 2. ACEPHALA, having no head, and living in bivalve shells. 3. NUDIBRANCHIA, headless and naked. 4. PTEROPODA, naked, with fin-like processes. 5. CEPHALAPODA, or Cuttle fish; naked, with distinct eyes, and swimming arms. The two first orders comprise all the genuine shell-fish, and to these only will our attention be chiefly restricted.

CHAPTER II.

ON THE GASTEROPODA, OR UNIVALVE SPIRAL SHELL FISH.

(5.) In the artificial system of M. Cuvier, the true Gasteropoda having spiral shells and eyes, are confounded with the *Nudibranchia* or Tritons, which have neither a shelly covering, a distinct head, or any organs of sight, so that they agree only with the former in crawling on the flattened disk of their belly. This unnatural combination of two tribes of animals, totally different in structure, is quite inconsistent with any arrangement "founded on their organization." Detaching, therefore, the Tritons, &c. from the order *Gasteropoda*, we find it is composed of the five following tribes:—1. ZOAPHAGA, or Carnivorous Shell Fish. 2. PHYTOPHAGE, or Herbivorous Shell Fish, with the mouth of their shell entire. 3. SCUTIBRANCHIA, or the Limpets. 4. CHITONES, or the Chitons. 5. HETEROPODA, or the Firoles. The first two embrace the most perfect of all the Testacea; and they inhabit spiral univalve shells. The shells of the third tribe (or the Scutibranchia) are also univalve, but are not spiral; those of the Chitons are neither univalve nor

spiral, but the animal is a true Gastropod, while the shells of the Heteropoda cover only a part of the animal, and are univalve, fragile, and revolute, resembling the testaceous Cuttle Fish (*Cephalopoda*).

(6.) The shells which serve to protect the true Gastropods were termed by Linnæus UNIVALVES; and they are composed, like that of the garden snail, of one entire piece. This name we shall retain, extending it to the shells of all those animals which, as above explained, compose the five tribes of the GASTROPODA. As our present business, however, is with the shells, and not with the animals, we shall chiefly confine our remarks to the former. Conchology, as a science, must be founded both upon the structure of the soft parts of the animal, and upon the shell which covers it; the first is the most essential, but the latter is most useful. Both are in harmony; and it therefore follows, that whenever the characters of the empty shell are sufficient to explain the natural affinities of its inhabitant, we require no other for the purposes of popular instruction.

(7.) *Univalve Shells* have no internal divisions or chambers; for the nautilus family, in which such a structure is seen, is inhabited by a race of cuttle fish (*Cephalopoda*). Univalves are either composed of spiral turns or volutions, with a mouth or opening for the head of the animal, or they are conical,

like a pointed cap, without any turns. The Chitons, or Armadillo shells, resemble the latter more than the former; but their shelly covering is of several pieces. Lastly, come the Firolas, some of which have very thin and delicate shells, shaped like the nautilus, but perfectly hollow inside.

(8.) We begin with the SCUTIBRANCHIA, or LIMPET tribe, as being the most simple of all shells, and which gradually lead us to those which are spiral. These shells are known to every one, from being shaped like a little, pointed, conical cap. They are found with the animal adhering to rocks in all parts of the world, and although dull on their outer surface, are particularly beautiful within. Lamarck has divided them into many small groups, which are termed genera; the names and characters of which are as follow. The animals of all these are not larger than their shells.

1. *PATELLA. Shell simply conic, without any perforation or internal appendage, and with the margin undivided.
2. SIPHONARIA. *Sow.* Like the last, but with an indented groove from the centre to the side, which is there somewhat dilated.
3. *FISSURELLA. Like a Patella, but with a roundish hole at the *apex*, or top.
4. EMARGINULA. A narrow slit, at the margin.
5. PILEOPSIS. The apex lengthened and recurved; inside dull.

6. CALYPTRÆA. The inside with a funnel-shaped appendage.

7. CREPIDULA. The inside partly covered with a plate, like a half-decked boat.

8. TROCHILEA. *Sw.* Imperfectly spiral, the apex or top nearly central; a distinct mouth beneath; resembling a Trochus. Fossil: type, *Trochus pileus.* Auct.

9. ANCYLUS. Oblong, entire, small, transparent. Inhabits only fresh water.

(9.) The PHYTOPHAGA have univalve spiral shells, the mouth of which is entire, or unprovided either with a notch or channel. The genus Trochilea conducts us to this tribe, which is at once known by the shell being composed of several turns or whorls, both which characters are found revolving round an internal support, called a columella or *pillar.* As connecting these spiral shells with the Limpets, we shall first mention the following genera:—

10. HALIOTIS. Ear-shells. Flat, and pearly inside; one end slightly spiral, and one side perforated with small holes.

11. STOMATIA. Like the last, but not perforated.

12. SIGERETUS. Ear-shaped, but neither pearly, nor perforated.

(10.) The TROCHUS family next succeeds, and of which there are many genera. All these shells are strong, thick, and often heavy; in shape resembling

a pyramid; the broadest part is flattened beneath, with the top or *spire* gradually diminishing to a point. The mouth is closed by a lid, called the *operculum*, which is either horny or shelly, according to the genus; and they are all marine. The chief distinctions rest on the form and shape of the mouth, and whether the substance is plain or pearly; most of these shells have numerous spiral turns, called *whorls*, with a central support or *pillar*.

13. TROCHUS. Mouth pearly, without any teeth, operculum horny.

14. ODONTIS. *Goodall.* A tooth-like process in the aperture.

15. MARMAROSTOMA. *Sw.* The whorls few and convex; inside pearly; operculum shelly; mouth very round.

16. ROTELLA. Small; the outside smooth and polished; a thick deposition round the mouth.

17. SOLARIUM. Mouth not pearly, the margin very thin; no pillar.

18. DELPHINULA. Like marmarostoma, but without a pillar.

(11.) We next come to the TURBO family, well represented by the common periwinkle: these, also, are marine shells, but their whorls are more convex than the last, and their substance is never pearly, neither are there any folds or *plaits* upon the pillar.

19. TURBO. Mouth simple or *entire;* operculum horny.

20. PHASIANELLA. Outside smooth and polished; operculum shelly.

21. PLANAXIS. Very small; mouth with a half-formed or *obsolete* notch.

22. TURRITELLA. Shell excessively long; needle-shaped; with numerous whorls, connected by a pillar.

23. SCALARIA. Shell lengthened; but without any pillar.

(12.) The family of HELICIDÆ, or Snails, is very extensive. It comprises all those spiral shells whose animals live either in fresh water or upon land, and whose spiral tip is in the middle. The genus *Ianthina* alone is marine, and its shell combines the form of a Turbo with that of a Helix. The shells of this family are always thinner and much lighter than those of the last. And although there are no certain marks for distinguishing land and fresh water from marine shells, the student, with a little experience, will soon know the difference. We may arrange the genera of this family under two divisions—the land and the fresh water; omitting such as are so far naked (like the Slugs) as merely to possess the rudiments of a shell.

(13.) The LAND HELICES, or Snail Shells, are either of a depressed or *discoid* form, or are more or

less lengthened; as if the whorls were pulled out. The genera are as follow:—

24. *HELIX. Discoid; mouth with a thickened rim, but no teeth.

25. *HELICELLA. *Ferr.* Discoid; mouth with a thin rim and no teeth.

26. *CARACOLLA. Very flattened or discoid; mouth with a thickened rim, and generally toothed inside.

27. ANASTOMA. Discoid; mouth toothed and turned upwards.

28. HELICINA. Discoid; small; mouth semicircular, closed by an operculum.

29. *CYCLOSTOMA. More lengthened; mouth circular; margin thick; operculum shelly.

30. BULIMUS. Spiral whorls lengthened; lip thickened.

31. ACHATINA. Like Bulimus, but the lip thin, and a slight notch at the base of the pillar. Generally large.

32. ACHATINELLA. *Sw.* Like Achatina, but the lip is thickened. Small.

33. *SUCCINEA. Small, thin, transparent; spire very short, of two or three whorls.

34. AURICULA. Oval; spire short; lip thickened; mouth toothed.

35. PUPA. Oval, of equal thickness throughout; spire long; mouth toothed and thickened.

36. *CLAUSILEA. Like the last, but much more slender.

(14.) The second division contains the genera of FRESH WATER Helices, in which the mouth is never toothed, and the margin is thin.

37. AMPULLARIA. Generally large and apple-shaped; spire very short; mouth semicircular.

38. *PALUDINA. Spire lengthened, mouth operculum horny or shelly; nearly round; operculum horny.

39. *PLANORBIS. Flat and disk-shaped; no operculum; mouth semicircular.

40. VALVATA. Like the last; but has an operculum; mouth round.

41. *PHYSA. Oval, small, very thin, mouth on the left side, or reversed.

42. *LYMNÆA. Oval; inflated; spire small; pointed.

43. MELANIA. Shape of Turritella; spire very long; mouth pear-shaped; operculum horny.

44. MELANOPSIS. Like the last; but the base is slightly notched.

45. PIRENA. Like Melania; but a notch at the top and bottom of the mouth.

The fresh water genus NERITENA is placed in the family of NATICA or Nerits, the last of this tribe.

(15.) We now leave the fresh water univalves, and come to a small group which inhabit the sea,

and are known by their plaited pillar, which gives an appearance of the mouth being toothed.

46. MELAMPUS. Small, conical, spire depressed; plaits one or two; lip thickened inside.

47. *TORNATELLA. Small, oval, spire pointed and very small; pillar with one or two thick plaits; edge of the lip acute and thin.

48. PYRAMIDELLA. Long, like a Turritella, but the pillar is plaited.

(16.) The last family contains the NERITS. They are chiefly distinguished by the smallness of their spire, which seems placed on one side of the shell, as in the genus *Haliotis;* the mouth is generally semicircular, somewhat resembling that of the genus *Crepidula;* a few have the shape of *Helix* and *Ampullaria,* but being marine, are more strong, heavy, and brighter coloured upon a *white* ground.

49. *NATICA. Shape of Ampullaria; but the left side of the mouth, or inner lip, is thickened by a shelly deposition.

50. NERITA. Spire nearly hid; inner lip, flat, broad, and deeply notched; operculum shelly.

51. *NERITINA. Inner lip convex, nearly smooth. Fresh waters only.

52. NAVICELLA. Spire concealed; resembles a Limpet or *Crepidula.* Fresh waters.

Here terminates the series of entire-mouthed spiral shells, whose animals live upon plants.

(17.) The ZOOPHAGA, or third great division of univalve shells, is distinguished by having the lower part of the mouth, or *base*, either distinctly notched, or lengthened out, into a gutter, or *channel*. All these are comprised under one or other of the following families, and are inhabited by predacious or carnivorous animals. 1. VOLUTIDA, or Volutes, having the pillar plaited. 2. CYPRÆADÆ, or Cowries, where the spire is concealed. 3. STROMBIDÆ, or Wing-shells, in which the lip is notched above, and dilated. 4. CASSIDÆ, or Helmet-shells, with the channel short and turned backwards; and 5. TURBINELLIDÆ, or Pear-Volutes, having distinct plaits on the pillar, and the base channelled. Under each of these families we shall now arrange their respective genera.

(18.) The VOLUTIDÆ, or Volute-shells, are at once known by having a deep notch, instead of a channel, at their base, and by four, five, or six strong plaits, or folds upon the pillar. They are again divided into smaller groups or *sub-families*, as 1. The True Volutes. 2. The Mitres. 3. The Olives. 4. The Ivory Shells. 5. The Date Shells. The first of these divisions contains the following genera.

53. VOLUTA, or Melons. The shell is much swelled; with a very short, thick, blunt, and smooth spire, which is sometimes obsolete.

54. CYMBIOLA. *Sw.* Not swelled or ventricose; spire

sculptured, longer and more slender; plaits four or five.

55. HARPULA. *Sw.* Plaits on the pillar, generally very numerous; spire blunt, or *obtuse.*

56. VOLUTITHES. *Sw.* Plaits only one or two in number; spire acute. All fossil.

57. SCAPHELLA. *Sw.* Shell smooth and polished; spire not thickened; plaits variable.

The Mitres (MITRANÆ) are comparatively smaller shells, and are distinguished from the Volutes by having a longer and a more pointed spire: the last plait is also the smallest.

58. MITREOLA. *Sw.* Tip of the spire slightly thickened. See Zool. Illustr. 2 pl. 128.

59. TIARA. *Sw.* Mouth narrowed at the base; with an internal upper groove.

60. MITRA. Mouth wide at the base; no internal groove.

61. MITRELLA. *Sw.* Smooth and polished; plaits projecting, and close together.

62. CONOELIX. *Sw.* Spire very short; plaits more than four or five.

Among the Olives (*Olivinæ*) there are but few genera; they are all smooth, and highly polished shells, with a short spire, marked by a deep groove, and with many indistinct plaits.

63. OLIVA. Mouth narrow throughout; plaits indistinct; a groove round the whorls.

64. HIATULA. Mouth very wide towards the

base, pillar finely striated, and inclining outwards.

65. OLIVELLA. Mouth as in the last; pillar with two strong basal plaits, and inclining inwards; mouth with an operculum.

The Ivory shells are composed, at present, but of one genus.

66. ANCILLA. The shell is polished; spire short; the mouth wide, and the base of the pillar thickened and inclining outward.

The Date shells comprise, as yet, but three genera; they have a very short spire, and a thickened margin round the lip and mouth.

67. MARGINELLA. Spire short, prominent.

68. VOLUTELLA. *Sw.* Spire concealed; pillar four, five plaited; mouth smooth within.

69. PERSICULA. *Sw.* Spire concealed; pillar with many plaits; mouth striated within.

70. VALVARIA. Small; cylindrical; externally striated; aperture narrow, but suddenly widened at the base, where there are three or four plaits.

(19.) The second family contains the COWRIES; they are egg-shaped shells, having no external spire, and are remarkable for their beautiful colours and exquisite natural polish. We know but of two genera.

71. CYPRÆA. Mouth thickened and toothed on each side.

72. OVULA. Mouth without teeth; its extremities generally projecting.

(20.) The third family is composed of the STROMBIDÆ, or Wing Shells, very diversified in their general aspect, yet easily known by having the outer lip partly detached, by a wide notch, at the upper part of the mouth; this lip is also usually dilated, or wing-shaped.

73. CONUS. Perfectly conical; spire hardly projecting.

74. STROMBUS. Outer lip large and dilated, but not divided into processes; sinus double.

75. PTEROCERAS. Outer lip divided into finger-like processes; sinus double.

75.[a] *APORRHIS. *Da Costa.* Outer lip dilated and digitated; sinus simple.

76. ROSTELLARIA. Smooth; spire and channel very long; lip slightly toothed.

76.[a] HIPPOCHRENES. *Montf.* Outer lip generally dilated, always entire, spiral canal nearly as long as the spire; basal canal short or moderate. Fossil.

77. TEREBELLUM. Smooth, resembling *Oliva*; but the pillar is without plaits, and the outer lip is not dilated.

78. CERITHIUM. Very long and slender; generally knobbed; channel usually turned backwards.

79. PLEUROTOMA. Spindle-shaped; channel gene-

rally long, straight; lip with a narrow slit, or bend, at the upper part.

(21.) The fourth family includes the BUCCINIDÆ, or Whelks; the most extensive group among the univalve shells. It is chiefly distinguished by the shells having no regular plaits upon the pillar, and no enlargement or swelling of the spiral whorls. As to their other positive characters, no invariable rules can be laid down; the channel is either very long, short, or entirely wanting; in which latter case, however, there is always a deep notch. These characters form the basis of the following divisions or *sub-families;* viz. 1. CASSINÆ, the Helmets: most of these are large, inflated shells, with a very short spire; the channel is also short, turned backwards, or altogether wanting; there are sometimes nodules on the back, but never prickles or foliations as in the next family. We have no examples of these shells in the British Seas. 2. MURICINÆ, or Murexes. The spire is longer than the mouth; the back is generally rough with leaf-like foliations, grooves, or nodules; while the channel is either short or long, but is never turned back. 3. The BUCCININÆ, or Whelks, are chiefly distinguished from the two last by having a deep notch instead of the channel above mentioned. The spire is always as long as the mouth, and is sometimes of excessive length, as in the needle-shells. 4. The PURPURINÆ, or Purpuras, like the last, have a deep notch, but

a short spire; the mouth very wide, and the inner lip broad, smooth, and *flat*; this latter character, in fact, is their best distinction. Lastly, with the NASSINÆ, or Nassas, we may include all those small shells which have a simple notch, and a thickened deposition of shelly matter round the mouth; but for this latter circumstance they mostly resemble the whelks. We now proceed to the genera.

(22.) The CASSINÆ, or Helmets, have either a short, recurved channel, or a deep notch, as—

80. CASSIS. Large, heavy, mouth long, narrow; with teeth on each side.

81. CASSIDEA. *Sw.* Mouth wide at the base; otherwise like Cassis.

82. DOLIUM. Large, light, lip thin, mouth wide, toothless; a notch.

83. HARPA. Shell smooth; marked with longitudinal ribs, base notched.

84. CASSIDARIA. Like Dolium, but with a short channel only half recurved.

(23.) The MURICINÆ, having the channel straight, and the spire longer. Only three genera have as yet been clearly ascertained.

85. TRITON. Shell with varices or elevated ribs, placed alternately, on each whorl.

86. RANELLA. Varices forming a ridge on each side the whole length of the shell; channel short.

87. MUREX. Varices more than two; and longitu-

dinally connected one to the other; channel long; the great diversity of these shells, which are always marked with foliated or spiney processes, renders it necessary to arrange them in smaller groups, or sub-genera. *See Zool. Illustr.* 2 *pl.* 100.

Haustellaria. Shell tuberculated; channel very long.
Murex. Shell with smooth spines; channel very long.
Phyllonotus. Shell with foliated branched spines. Varices, 3—5.
Centronotus. Shell with simply foliated spines; varices many.
Pterynotus. Varices three, fin-like.

(24.) The BUCCININÆ, or Whelks, as before remarked, have only a notch, instead of a channel; the pillar or inner lip is neither flat, as in the next group, or it is thickened, like the Nassinæ; the genera are as follows:—

88. BUCCINUM. *Whelks.* Spire and mouth nearly equal.
89. TEREBRA. *Needle Shells.* Very long and slender, shaped like the *Turritella.*

(25.) The PURPURINÆ have the inner lip broad and flat, with a notch, instead of a canal at the base.

90. MONOCERAS. Base of the outer lip with a pointed spire.
91. PURPURA. Spire and aperture of equal length; mouth unarmed.
92. CONCHOLEPAS. Limpet-shaped; spire minute; pillar none.

(26.) With the NASSINÆ may be placed other small shells, having a general resemblance to them, either in form, or in the thickening of the parts round the mouth.

93. EBURNA. Smooth; the inner lip much thickened; the base turning in.

94. NASSA. Wrinkled; the inner lip thickened and spreading out.

95. RICINULA. Spined; mouth narrow, strongly toothed on each side.

96. ONISCIA. *Sow.* Tuberculated; the mouth narrow, crenated, and granulated.

(27.) The fifth and last family of the Zoophaga, is composed of the TURBINELLIDÆ, or Pear-shells, so named from their shape resembling that of a long pear. They have distinct plaits on the pillar, like the true Volutes, but from them they are immediately distinguished by possessing a canal, more or less lengthened. In some few, however, this canal is very short, and in the genus *Struthiolaria* (which is of very uncertain situation) the mouth is almost entire. The genus *Fusus*, again, has no plaits; but it is so closely allied to the fossil genus *Clavella* (here now first defined), that there can be no doubt of its entering within the limits of this group.

97. TURBINELLA. Pear-shaped, large, heavy; canal lengthened; spire conical; the last whorl enlarged; inner lip thickened.

98. SCOLYMUS. *Sw.* Beset with blunt spires; canal short; spire pointed; inner lip thickened.

99. PYRELLA. *Sw.* Abruptly pear-shaped; channel long; one strong plait at the base; tip of the spire enlarged. (*Turbinella spirillus.*)

100. FASCIOLARIA. Large; smooth; fuciform; two or three plaits at the base of the inner lip, near the canal, which is lengthened; spire acute.

101. CLAVELLA. *Sw.* Fuciform; channel long; no plaits, but the tip of the spire enlarged. Fossil only.

102. CANCELLARIA. Prickly or rough; channel nearly obsolete; pillar distinctly plaited.

103. COLUMBELLA. Smooth, very small; outer lip thickened, turned inwards, and swollen in the middle; base notched.

104. STRUTHIOLARIA. Resembles a Buccinum (88), but the outer lip is thickened and angulated; and the base of the mouth almost entire.

(28.) The three following have no plaits on the pillar; but, like the majority of this family, the base and channel are much lengthened, and the form is more or less pear-shaped.

104. PYRULA. Pear-shaped, strong, muricated; spire prominent, but shorter than the mouth.

105. FICULA. *Sw.* Fig-shaped, thin, light, spire

concealed; resembling a Bulla, but with a lengthened channel.

106. FUSUS. *Distaff-shell.* Long, slender, tapering at both ends; the spire and channel being equally lengthened and pointed.

Here terminates the suit of the Zoophaga, or Univalve Spiral Shells, provided with a notch or channel. The two remaining tribes of the Gasteropoda, as already indicated, (5) are the Heteropoda, and the Chitones or Chitons, and these latter bring us back to the Scutibranchia or Limpets, and complete the circle of the whole order. A few remarks on these two tribes will, therefore, conclude our arrangement of the Univalve Shells, properly so called, belonging to the Gastropod Shell-fish.

(29.) The shells of the HETEROPODA are represented by the genus Carinaria, for of all the genera belonging to this tribe there are only two yet discovered which are provided with a partial testaceous covering.

107. CARINARIA. Cap-shaped; thin; glassy; very brittle, resembling an Argonauta, but the recurved top does not enter the mouth, and there is only one keel.

108. ATLANTA. *Les.* The recurved top spirally whorled.

The naked animals of this tribe, which we have had an opportunity of studying in their native

seas, are highly interesting. It will be sufficient for the Conchologist to know that as *Carinaria* is the last of the *Gasteropoda*, so *Argonauta* is the first of the *Cephalopoda*.

(30.) The fifth and last tribe are the CHITONES, or Chitons; which deviate, as already observed (5) from all other univalve shells by being composed of more than one piece. They are boat-shaped, having the shelly pieces arranged cross-wise, or transversely; the edge of one folding over the edge of the next. Their resemblance to the Limpet family (7) is obvious, and is not only seen in the shells, but in the animals. The five great divisions of the Testacious Gasteropoda thus form a circle of affinity; and the series, commencing with Patella, again returns to the same point.

109. CHITON. Shell boat-shaped, composed of about eight transverse pieces folding over each other at their edges, and inserted into a tough ligament, the sides of which are scaly.

110. CHITONELLUS. Like the last, but the valves are very small, placed only on the upper ridge of the back, and generally disunited.

(31.) Although not connected with the order treated of in this chapter, we may here observe that the only recent examples of the Testaceous CEPHALOPODA, mentioned at (4) are the genera NAUTILUS, and SPIRILLA; the first having the spire internally hid, the latter having it exposed, and, as it

were, coiled round like a Helix; the whorls, however, do not touch each other. Both these genera have their shells divided internally into a number of little chambers, connected together by a pipe or *syphon*. The fossil *Nautili* are exceedingly numerous.

CHAPTER III.

OF THE ACEPHALA, OR BIVALVE SHELLS.

(32.) The animals of this tribe are entirely destitute of a visible head; neither have they those pedunculated eyes, (resembling the antennæ of insects,) which are observable in all the families of the Gasteropoda, or spiral shell-fish. It is not, however, to the animals, but to the construction of their shells, that we are now to direct attention. Nature, in passing from one model of construction to that of another, always proceeds with "measured steps and slow," in other words, by a gentle progression. We have seen this in the gradations between a Limpet and a Trochus. And we accordingly find that the passage between a Limpet and a bivalve is graduated on the same harmonious principle. Of the five great divisions of the Acephala, the *first* may be considered as the connecting link between this tribe and the one we have just left; while the *last* division of the Acephala, in like manner, will show us as great a deviation from the usual form of bivalve shells, as the Chiton does from the ordinary univalves.

(33.) The names and characters of the first great divisions of this tribe are as follow:—1. The APLYSIDÆ (or TECTIBRANCHIA), or internal Limpets; so named because the shells resemble Limpets, but are hid in the fleshy parts of the animal. 2. DIMIARIA. Bivalve-shells, having two muscular impressions in each valve, and which are inhabited by animals possessing locomotion. 3. MONOMIARIA. Bivalve-shells with but one impression, and which are generally attached to other substances. 4. BRACHIOPODA. Bivalve-shells, also attached, but having no connecting ligament to their valves. 5. CHELYOSOMA? Headless animals; with a shell resembling that of a tortoise. These short definitions will be sufficient to give the young conchologist a general idea of the groups under which the genera of bivalves are here arranged; and which we shall now proceed to define.

1. *On the Tectibranchia, or Internal Limpets.*

(34.) The TECTIBRANCHIA, *Cuv.* are very soft animals with internal shells, somewhat resembling Limpets; they are very few; and present us with every gradation in their substance, between a strong calcareous and an almost transparent horny shell, the first indication, in fact, of a hard covering. It is quite clear that the first three in the following list are naturally allied, while the close connection

which Cuvier and others have insisted upon, between Aplysia and Bulla, induces us, for the present, to follow their example. We are by no means satisfied, however, that this is a real affinity; for setting aside the animals of Laplisia and Bulla, which materially differ, the shells of *Bulla* and of *Cypræa*, seem to have a strong and even intimate connection. The genera may be thus concisely defined from their shells.

111. UMBRELLA. Like an oval Limpet, from which the shell can only be distinguished by its very sharp and thin margin.

112. PARMOPHORUS. Like an oblong Limpet, with one end sinuated, but the margin is thick, smooth, and polished.

113. LAPLYSIA. The shell of this genus, if such it can be called, is an oval, thin, nearly transparent plate.

114. DOLABELLA. The plate has a resemblance to the last, but is shelly.

115. BULLÆA. Shaped something like a young Cowry, but the mouth very wide.

116. BULLA. Shell external? solid, egg-shaped; no spire; mouth wide: this latter genus more probably belongs to the Gasteropod Zoophaga (see 19.)

2. *On the Dimiaria, or Bivalves with two muscles.*

(35.) The DIMIARIA, or unattached Bivalve

shells, have two muscular impressions; they are the most perfect of their tribe, whether we consider the structure of the animals, or the beauty of their shells. The primary divisions of this group, by the celebrated Lamarck, are apparently so natural, that we shall, with little variation, follow his series; but the genera will be arranged in a somewhat different manner. It may be as well to remark in this place, that although the shells of the last family, and part of this, are in effect, *univalves*, yet that the structure of the animals,—which must always be a primary consideration,—is totally different from those inhabiting the true Gastropod Testacea. Nature does not pass from one to the other suddenly and abruptly, but progressively; and hence we find, even among the more perfect bivalves, some which do not strictly show us all the typical characters of that group to which, nevertheless, they unquestionably belong. The young student, before he enters upon the study of the Bivalve shells, will do well to make himself acquainted with the nature of the teeth, the hinge, or ligament, bosses, and other parts which enter into the following definitions. The DIMIARIA, again, are separated into two great divisions. In one the shells are more or less open at one or both ends; while in the second the valves close all round. The first, or gaping division, contains the five following subordinate sections:—1. The TEREDINÆ, or tubular

bivalves; having a tube affixed to one extremity of their valves, so as to give them, at first sight, an appearance of being tubular univalves. 2. PHOLADÆ, or Borers, having small shelly pieces to unite their valves, instead of a ligament. 3. SAXICAVIDÆ. Small shells, gaping at one end, and of an intermediate shape between Pholas and Mya. 4. SOLENIDÆ, or pod shells: sometimes very long, but without the additional or *accessary* pieces seen in Pholas. 5. MYADÆ. Ligament internal, attached to a large spoon-shaped tooth. We shall now define the genera of these tubular and gaping shells.

(36.) The TEREDINÆ, or tubular bivalves, as above stated, have a very ambiguous aspect, inasmuch as the valves themselves appear but as appendages to their tubes. They are more curious, n connection with their animals, than interesting to the mere conchologist.

117. ASPERGILLUM. Resembling the spout of a watering-pot, but the tube is thicker at one end.

118. CLAVAGELLA. Funnel-shaped, the top open and much dilated; valves very small.

119. FISTULANA. The tube shaped like a chemist's retort; the valves internal, widely gaping, unattached, and united by a ligament.

120. SEPTARIA. Tube long, slender at one end, and divided internally into chambers.

121. TEREDO. Tube long, sinuated, covering the valves; with no internal divisions.

122. TEREDINA. Tube somewhat retort-shaped, united to the valves, which are external; the other extremity being closed by an operculum. Fossil only.

(37.) The PHOLIDÆ, like the Teredo, are inhabited by boring animals; but they have no tubes, and therefore present the appearance of true bivalve shells. Most of the species are milky white, very thin, and elegantly marked with rows of little prickles, they have the power of piercing stones, chalk and wood, excavating for themselves a dwelling wherein they live and die.

123. GASTROCHÆNA. A small bivalve, living in holes made by the animal in coral. The valves gape very much, and have neither teeth, shelly plates, or ligament at the hinge.

124. PHOLIDEA. *Swains.* Resembling Pholas; but the posterior extremity bearing a cup-shaped appendage.

125. PHOLAS. The bosses (or *Umbones*) are close to one end, where there are small shelly pieces to keep the valves together; but they have no ligament; posterior extremity widely gaping.

(38.) The SAXICAVIDÆ constitute a small family of boring shell fish; living like the last, in cavities, made by themselves, in rocks, stones, &c., but they have no additional pieces to their two valves;

and they also possess an external ligament; one extremity generally gapes very much.

126. PHOLADOMIA. *Sow.* Aspect of a Pholas; very thin; hinge formed by a small rather lengthened pit; with a hinge plate, supporting a short external ligament.

127. PETRICOLA. Shape variously oblong; frequently like a Pholas. Two cardinal teeth in each valve.

128. VENERIRUPES. Transverse. Three cardinal teeth, placed close together.

129. SAXICAVA. Transverse, but variable in form; teeth obsolete, or indistinct. The *Sax. rugosa* connects this group with the Solens.

(39.) The SOLENIDÆ. (Pod, or razor-shells,) are usually very long; gaping at both ends, and having an external ligament.

130. SOLEN. Excessively long; razor-shaped, both ends open.

131. PANOPÆA. Large, much broader, and shorter, one conical tooth in each valve, with a thick callosity on the side. 1 *Sp.*

132. GLYCIMERIS. Oval; no teeth but with thick projecting callosities. 1 *Sp.*

133. SOLENIMYA. Shape and aspect of the last, but with half of the ligament external, and half internal; a small compressed tooth in each valve. 2 *Sp.*

(40.) The MYADÆ, or Gapers, have the ligament

internal; an excellent character; by which, although their valves gape at one or both ends, they are easily distinguished from the foregoing.

134. GALEOMA. *Turton.* Transversely oval; small; one cardinal tooth in each valve; ligament partly external and partly internal; ventral margin widely gaping.

135. MYA. Transversely oval. A large spoon-shaped tooth in one valve.

136. ANATINA. Thin, almost transparent, a spoon-shaped tooth in both valves.

137. LUTRARIA. Oval, like Mya, but the tooth divided in the middle by a fold.

(41.) The MACTRIDÆ, or Mactras, have also an internal ligament, but their teeth are usually very complicated, and their valves are generally closed.

138. CORBULA. Shell not gaping; the valves unequal; the boss of one larger than that of the other.

139. MACTRA. Oval, with thin cardinal and lateral teeth; the former very complicated; valves equal.

140. CRASSATELLA. Two strong sulcated diverging cardinal teeth; valves entirely closed, no lateral teeth.

141. ERYCINA. Small, resembling Crassatella; but having short lateral teeth.

(42.) We may place together some other genera,

which also have their ligament internal, but whose teeth are very simple.

142. UNGULINA. Nearly round; tooth bifid; lateral teeth none; the ligament placed on one side of the bosses, and partly external.

143. AMPHIDESMA. Roundish—oblong; a little gaping on one side, which is undulated like a Tellen. Ligament both internal and external.

144. PANDORA. Valves unequal; upper valve flat, lower valve convex: hinge like the letter Λ; ligament internal.

(43.) The TELLINIDÆ, or Tellens, are the most delicate and beautiful shells of this tribe; they are generally oblong; rather more flattened than others; the outside smooth and polished, and usually tinged more or less with shades of pink and orange. The ligament is always external, and supported by a thickened and often projecting hinge plate. The valves do not gape, or so slightly, as to be hardly perceptible; they are nearly all transverse shells.

145. TELLINA. The posterior side irregularly undulated. Cardinal teeth two; lateral teeth small, two.

146. TELLINIDEA. No undulated margin. Cardinal teeth two; lateral tooth only one.

147. LUCINA. Nearly round; generally thick, strong, and convex; teeth variable.

148. CORBIS. Oval, thick, heavy; cardinal teeth two; lateral teeth two, one of which is remote.

149. DONAX. Wedge-shaped; cardinal teeth two; lateral teeth variable.

150. CAPSA. Somewhat triangular, covered with an epidermis; no lateral teeth in one valve.

(44.) The CYCLADÆ, are fresh water shells, covered with a brown skin or epidermis, but not of a pearly substance, like the Pearl Muscles (*Unionidæ*), the bosses are generally in the middle, and their form more round than transverse; with but one exception, the ligament is external.

151. CYCLAS. Small, thin, convex; the bosses never worn or *eroded*. Cardinal teeth never more than two. These are all small shells, not larger than a nut.

152. CYRENA. Shaped like the last, but larger, thicker, and stronger; inside opaque; bosses eroded. Cardinal teeth three; lateral two.

153. GNATHODON. *Gray*. Like Cyrena; but the ligament is small and internal.

154. MEGADESMA. Thick, triangular, eroded, cardinal teeth large, three, divaricating, no lateral teeth in one valve. One or two species only, found in the African rivers.

(45.) The VENERIDÆ, or Venus shells, have been so named from the beauty and variety of their delicate markings. They are all marine, and, with

one exception (Cyprina), their outer surface is always smooth, and generally polished.

155. CYPRINA. Large, covered with a thick brown skin. Three cardinal teeth, and one lateral, in each valve.

156. CYTHEREA. Solid, and generally smooth; oval. Four cardinal teeth in one valve and three in the other: lateral teeth short.

157. PULLASTRA. *Sow.* Transversely lengthened. Cardinal teeth three in each valve; ligament long; no lateral teeth.

158. VENUS. Short, oval; cardinal teeth three, lateral short.

159. VENERICARDIA. Resembling the last, but with only two cardinal teeth.

(46.) The CARDIADÆ, or Cockles, like the common edible species, are more or less heart-shaped.

160. CARDIUM. More or less heart-shaped. Two cardinal and two lateral teeth in each valve.

161. CARDISSA. *Sw.* Half-heart-shaped, the ligamental or anterior side being truncated.

162. CARDITA. Oblong. Two cardinal teeth in one valve; no lateral teeth.

163. CYPRICARDIA. Oblong; three cardinal teeth and one lengthened lateral tooth.

164. ISOCARDIA. Heart-shaped; the bosses very prominent; recurved different ways, and not touching each other.

(47.) The ARCADÆ, or Ark shells, are distinguished from all other bivalves by the great num-

ber of their teeth, which generally have the appearance of those on a very fine saw.

165. ARCA. Generally heart-shaped; ribbed; the valves closing; hinge in a straight line.

166. CUCULLÆA. Shaped like the last; but the teeth are more irregular, and there is a partly detached, elevated, shelly plate inside.

167. PECTUNCULUS. Nearly round or orbicular. Hinge plate curved, teeth larger.

168. BYSSOARCA. *Sw.* Oblong. Teeth as in *Arca*, but the valves gape on the ventral margin: bosses wide apart.

169. NUCULA. Pearly inside; ligament internal; teeth sharp.

170. TRIGONIA. Roundish, pearly inside; teeth like the letter Λ, the sides striated. The situation of this genus is doubtful.

(41.) The UNIONIDÆ, are the pearly fresh water muscles, of which some are found in England, and great numbers in America. We can only insert, in this sketch, the five principal genera, which are properly types of as many sub-families; they are all dark brown outside, and pearly within

171. UNIO. Cardinal teeth short; lateral teeth long.

172. HYRIA. Cardinal teeth lengthened.

173. IRIDINA. Teeth small, numerous; resembling those of *Arca*.

174. ANODON. No teeth, or mere rudiments thereof.

175. ALASMODON. *Say.* With one or two cardinal teeth, but no lateral teeth.

(49.) The CHAMADÆ are large, rough, and irregular shaped shells, affixed by one of their valves, which is the largest, to other substances.

176. DICERAS. Bosses very much lengthened and distorted. Fossil only.

177. CHAMA. One long thick tooth in one valve, ligament external.

178. CLEIDOTHÆRUS. *Stuchbury.* Teeth as in the last, but with a claviculate appendage, ligament internal.

179. MYOCHAMA. *Stuchbury.* Two unequal teeth in each valve.

3. *On the Monomiaria, or Bivalves, with one muscle.*

(50.) This is the second great tribe, as already mentioned (p. 26), of the true bivalves; they are readily distinguished by having but one muscular impression in each valve, and nearly the whole are more or less affixed or attached to other substances; the animals not being endowed, like the former tribe, with the power of locomotion. The genera, which are much less numerous than those of the unattached or *free* Bivalves, may be naturally arranged under the following families:—1. The TRIDACNIDÆ, or Clams. 2. The PECTINIDÆ, or Pectens. 3. The OSTREADÆ, or Oysters. 4. The MARGARITIDÆ, or Pearl-oysters. And 5. The MYTILIDÆ, or Muscles.

(51.) The TRIDACNIDÆ, or Clams, are the giants of the Acephalous Mollusca. Nearly all the species grow to a large size, and some are so immense that a single shell can with difficulty be carried by one person. They are affixed to rocks by a bunch of fibres, called a byssus, and this is sometimes so strong that it can only be cut through with a hatchet. There are but two genera as yet known.

180. TRIDACNA. Transverse; a wide opening on one side the bosses.

181. HIPPOPUS. Resembling the last; but without the opening.

(52.) The PECTINIDÆ, or *Pectens*, are *solid* shells, with a defined margin, and no internal iridescence or pearly hue. Some are only attached by a byssus when in a young state; and all are more or less fan-shaped; the bosses being in the middle at the narrowest end.

182. PLICATULA. Much resembling *Trigonia* (170) in its shape and teeth. Attached by its under valve to stones.

183. PLAGIOSTOMA. Fan-shaped; no teeth; valves closed; slightly eared. Fossil only.

184. LIMA. Obliquely fan-shaped; slightly eared; valves gaping near the bosses; two small lateral teeth.

185. PECTEN. Perfectly fan-shaped; bosses eared; ligament internal, triangular; valves closed.

186. SPONDYLUS. Shape irregular; outside rough

or spiney; two strong teeth closely uniting the valves.

117. PEDUM. Shape somewhat irregular; hinge strait, with a spoon-shaped tooth in the middle, connected to a narrow gutter dividing the bosses, which are broad, thick, and shapeless.

(53.) The OSTREADÆ, or Oysters, are *foliaceous* shells; that is, composed of thin plates, or *laminæ*, which gives to the margin an irregular appearance, and renders it very brittle. The common Oyster shews this structure very plainly. Nearly all these shells are attached, by one of the valves, to stones, rocks, or other substances, when young, and generally remain so.

188. PLACUNA. Unattached; both valves flattened, glossy, and almost transparent; teeth like a reversed Λ.

189. ANOMIA. Somewhat resembling the last, but more irregular: and attached by a shelly mass, which passes through a large hole in the under or *smallest* valve.

180. OSTREA. Flattened; substance foliaceous, margins undefined, plain.

191. DENDOSTREA. *Sw.* More convex; substance nearly solid; valves with the margins plaited, and clasping into each other. *Tree Oysters.*

192 GRYPHÆA. One valve boat-shaped, very convex, with its boss lengthened and incurved;

the other valve smaller, and nearly flat. Fossil only.

193. ETHERIA. Shape very irregular, attached by one valve, muscular impressions two; teeth none; ligament partly internal. Fluviatile.

194. MULLERIA. *Ferr.* Resembling the last, but with only one muscular impression. These last two genera have the inside pearly, and their natural affinities are involved in much uncertainty.

(54.) The MARGARITIDÆ, or Pearl Oysters, are also foliaceous, but their general substance is pearly; and their inner side is highly iridescent. Nearly all of them adhere by a byssus—thus differing materially from the last family—which in general passes through a notch, or *sinus*, in one or both of the valves near the bosses.

195. MARGARITA. *Leach.* More or less oyster-shaped; the hinge margin but slightly, or not at all winged; no teeth.

196. AVICULA. Hinge margin much lengthened and with minute teeth.

197. MALLEUS. Shell irregular, hammer-shaped; no teeth.

198. VULSELLA. Each valve with a conical cavity, obliquely arched.

199. PERNA. Like the last, but with numerous grooved teeth in transverse, parallel lines.

200. CRENATULA. Shell short, irregular; teeth numerous, crenated, or semi-circular.

201. PINNA. Shell ham-shaped, thin, fragile, gaping, no teeth.

(55.) The MYTILIDÆ, or Muscles, form the last family. They have all, more or less, the shape of the common species, some are pearly inside and are attached by a byssus; others are Borers, analogous to the *Pholidæ*, and live in rocks; they have rarely any teeth, and the ligament is external.

202. MYTILUS. Ham-shaped; bosses placed at the extreme end.

203. MODIOLA. Bosses more prominent, and slightly removed from the end.

204. LITHODOMUS. *Cuv.* Long, narrow, and completely cylindrical. Perforates rocks.

4. *On the Brachiopoda, or Soldered Bivalves.*

(56). The last tribe we shall notice of the Acephalous Bivalves differ most remarkably from all the preceding by the structure of the animal, no less than by their shell: they are fixed to other substances, generally by means of a ligament, which passes through a hole in the boss of the largest valve; and these valves—without either teeth or ligament—are yet so closely united, that although they can be partially shut and opened, they cannot be *separated* without breaking. The recent species are few, but great numbers are found in a fossil state. Strictly speaking, the Brachiopoda, in their

natural affinities, probably follow the Scutibranchia, or the Limpets; and this relation is so close, that it even still remains a question among authors to which of these tribes the singular genus Hipponyx truly belongs. As the greater part of these singular bivalves are known only as fossils, deprived of their animals, all attempts to arrange them, in a truly natural series, must be extremely difficult; we shall therefore merely throw the genera into such groups or divisions as may be determined by the nature of the shells only. The fossil Terebratulæ more particularly require a much better examination than they have yet received. The following divisions include all such genera as have been already defined. 1. ORBICULINÆ. Orbicular bivalves, adhering by one of the valves to other substances. 2. TEREBRATULINÆ. Oval or triangular bivalves, adhering either by a byssus, or a cartilaginous muscle, protruded through one of the valves. 3. LINGULINÆ. Pedunculated bivalves; attached to and elevated upon, a long fleshy peduncle. Following these, we shall then insert a few genera whose affinities among the Testacia are very doubtful.

(57.) ORBICULINÆ. Orbicular bivalves. The lower valve is generally flat, and affixed by its outer surface to stones, rocks, shells, &c., the other valve is either convex or pyramidical; sometime resembling a cap.

205. CALCEOLA. Substance somewhat porous; one valve cap-shaped, internally marked with radiated lines or *striæ*; smaller valve (the upper?) flattened, semi-orbicular, resembling an operculum; no muscular impressions. One species. Fossil.

206. HIPPONYX. *De France.* Upper valve conic, cap-shaped, like a Limpet; lower valve flattened, with the edge slightly elevated. In both valves a muscular impression, shaped like a horse-shoe. Affinities doubtful.

207. ORBICULA. *Sowerby.* Irregularly orbicular, upper valve convex, lower valve flat and thin, with a central perforation for attachment to other bodies. Four impressions in each valve.

208. CRIOPUS. *Poli.* (*Crania,* Auct.) Resembling Orbicula, but the lower valve has no fissure.

209. PRODUCTA. One valve convex, the other flat, hinge line long, produced on each side, straight, without teeth; both margins of the valves inflexed.

210. THECIDIUM. *De France.* Shaped like a Terebratula. One valve convex, with a prominent boss, and two cardinal teeth; the other nearly flat; with two short teeth, united into a semi-circular rim. No fissure or perforation.

(58.) The TEREBRATULINÆ are Bivalve shells, affixed either by a byssus, passing between the valves, or by a muscle issuing through a hole in the largest valve.

211. SPIRIFER. Triangular; the hinge line straight and very long; bosses very distant, with a central cavity, in the intermediate space, for the passage of a byssus.

212. TEREBRATULA. More or less oval; a round opening in the boss (*umbo*) of the larger valve, for the passage of the ligament.

(59.) The LINGULINÆ, or pedunculated bivalves, are only known by one genus, found in a recent state.

213. LINGULA. Shaped like the bill of a duck; both valves equal, with internal muscular impressions, but no teeth.

(60.) Having now come to the end of the Acephala or Bivalves, we shall here notice three fossil genera of Lamarck, placed among these testacea, but whose affinities are very doubtful.

214. BIROSTRITES. Shape resembling a thick, short, tongue. Described as a bivalve, one valve of which envelopes the other.

215. SPÆRULITES. Aspect of a *Chama;* nearly surrounded with irregular, broad foliations on the lower valve, which is largest; both valves with irregular tuberculous ridges and cavities; teeth unknown. Fossil only.

216. RADIOLITES. Inferior valve somewhat funnel-shaped; deeply striated; upon which reposes the other valve, shaped like a cover, or operculum; hinge unknown. Fossil only. We have never seen these three fossil genera, and are, therefore, compelled to simplify the characters from Lamarck and De Blainville. The relation, however, between *Radiolites* and *Calceola* appears very strong.

CHAPTER IV.

ON THE CEPHALOPTERA, OR CHAMBERED SHELLS.

(61.) The Cephalopoda, or Cuttle Fish, as already observed (p. 3, 24), constitute one of the primary groups of the Testacia, by which this class is united to the great circle of Vertebrated animals. In the primitive ages of our planet these extraordinary animals existed in immense numbers; an undoubted fact, attested by their fossil shells being found enclosed in rocks of the oldest formation. But successive changes and convulsions have annihilated the greatest part of these wonderful creatures; they have been expunged from the catalogue of living beings, and but for the evidence of their shells, and the preservation of almost a solitary living example, to show us what sort of animals these fossil shells belonged to, we should have been in complete ignorance that such creatures had ever existed. With the exception, therefore, of the three genera *Argonauta, Nautilus,* and *Spirula,* the whole of the testaceous cuttle fish are fossil. The discovery of the animals of the two latter genera gives us every reason to conclude that the greatest part,

if not the whole, of these extinct races had their shells enveloped, more or less, in the folds of their body, which in many instances must have been of a vast size. The recent Cephalopoda, or those now living in the ocean, like the Loligo, Sepia, &c. are naked animals, and being destitute of shells, come not within our present sketch. The shells of the testacious Cephalopoda, unlike all others, are divided into chambers or partitions, generally connected together by one or more syphons or hollow pipes. Others, as the *Orthoceridæ*, appear to have been mere internal supports to the fleshy parts of the animals they belonged to, and are often curiously jointed. To frame a *natural* classification of such objects is, therefore, clearly impossible. And with this impression we shall follow, with little variation, the genera of Lamarck, blended with that of De Montfort, recommending the complicated but ingenious system of M. d'Orbigny,* to those who make these curious fossils their particular study.

(62.) The Testacious Cephalopoda may be conveniently arranged under the following divisions or families:—

1. ARGONAUTIDÆ. Symmetrical shells, with a small whorl, entering the aperture, which has no internal divisions. 2. NAUTILIDÆ. Symmetrical and spiral, with internal transverse divisions, connected

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by one or more syphons; the last whorl much enlarged, smooth, and generally enveloping (more or less) the others. 3. NUMMULIDÆ. Disc-shaped, without an aperture, or external whorls. 4. RADIOLIDÆ. Disc-shaped, with a central spire, and a small marginal aperture. 5. SPHERULIDÆ. Globular, spherical, or oval, resembles a seed, with unequal grooves, and a round hole at one end. 6. CRISTALIDÆ. Semidiscoid; spire eccentric. 7. ORTHOCERATIDÆ. Shell straight, or nearly so, long, resembling the spine of an echinus. 8. SPIRULIDÆ. Straight at one end, curved at the other, or both ends curved inwards. 9. AMMONITIDÆ. Resembling a Nautilus, but all the whorls apparent, and the last not much enlarged.

(63.) The ARGONAUTIDÆ, or Paper Nautili, are recent shells, inhabited by a cuttle fish, by some considered a parasite, by others, and we think with more reason, as the natural inhabitant. The two dilated arms of the animal, and the thickened and polished basal margins of the aperture, which are sinuated, appear to us conclusive evidences on this point. The former are obviously made for sailing, and the latter are analogous to the rests wherein the oars of a boat are worked. There is but one genus known.

217. ARGONAUTA. Spiral; hollow; the last whorl nearly enveloping the others.

(64.) The NAUTILIDÆ are of a similar shape to

the last, but the interior is divided into transverse chambers, connected by one or more syphons. A great number of these are minute, and are only distinctly seen by the microscope. Numerous genera have been recently proposed, but our limits will only permit the enumeration of the most remarkable.

218. NAUTILUS. Shell not carinated; syphon central. This is the only recent genus known.

219. ANGULITES. Shell carinated; mouth triangular; syphon central.

220. AMALTHITES. Carinated; but all the whorls distinct. Syphon central. This genus seems to connect this family with the Ammonitidæ; many of the species are large. The following genera are all minute, and deviate considerably from the general form of the Nautilus.

221. VORTICIALIS. Shell discoid, whorls contiguous, but internal; *septa* or chambers transverse, imperforate, mouth marginal.

222. POLYSTOMELLA. *Lam.* Discoid, spiral, the whorls not apparent externally, but crossed by radiated ribs; syphons several.

223. DISCORBITES. *Lam.* Discoid, the whorls apparent; septa transverse, numerous, not perforated.

(65.) The NUMMULIDÆ. Disk-shaped; without spire or aperture.

224. NUMMULITES. *Lam.* Round, thickest in the

middle, internally spiral, with the whorls obliquely divided by septa.

(66.) The RADIOLIDÆ are flattened orbicular shells; having an aperture.

225. ROTALITES. Above convex or conic; beneath flat, rayed, and tuberculated; aperture marginal.

226. LENTICULINA. *Lam.* Minute, but nautilus-shaped; septa curved.

227. PLACENTULA. *L.* Minute, orbicular, no spire, aperture slit-shaped.

(67.) The SPHERULIDÆ, unlike the last, are nearly globular, and—with one exception, 230—have an opening.

228. MILIOLA. *L.* Like an oval seed, composed of three pieces, aperture at one end, interior chambered.

229. GYRONITES. *L.* Like the last, but hollow; aperture central.

230. MELONITES. *L.* Round; internally chambered; no aperture.

231. POLLENTES. *Mont.* Like the last, but the chambers pierced alternately at both ends, the last entirely open.

(68.) The CRISTALIDÆ with one exception (232) are semi-discoid, resembling a flattened Nautilus, but are almost encircled by a thin keel.

232. RENULITES. Kidney-shaped; the surface sulcated.

233. CRISTELLARIA. Thin, disk-shaped, spiral; septa not perforated. Recent and fossil; minute.

234. ORBICULINA. Minute, round; whorls internal; the cells very numerous; septa not perforated, mouth narrow, arched. The form of these and nearly all the minute Cephalopoda are so strange and complicated, and so unlike regular shells, that it is almost impossible to convey correct ideas of them without figures.

(69.) The ORTHOCERIDÆ are mostly like great spines, but have septa, or divisions, within.

235. BELEMNITES. One part sheathing the other, the inner sheath with transverse chambers, and a central syphon.

236. ORTHOCERA. Minute, lengthened, with external ribs, transverse septa, and a lateral or central syphon.

237. NODOSARIA. Minute, like the last, but smooth.

238. HIPPURITES. Cylindrical conic; septa transverse, with two obtuse plates on one side, the last chamber closed by an operculum. It is very doubtful if this fossil is a Cephalopoda.

239. BACULITES. Straight, cylindrical, compressed; the septa lobed, greatly sinuated, the last very long; syphon dorsal.

240. CONOLITES. Resembling a Belemnite, but is slightly curved, and the interior case is not separable from the outer.

241. HAMITES. Cylindrical; bent like a hook, septa sinuated; syphon dorsal.

242. AMPLEXITES. *Sow.* Nearly cylindrical; septa transverse; no syphon.

(70.) The SPIRULIDÆ have one end spiral, the other straight, but in Scaphites both ends are curved inwards.

243. SPIRULA. Thin, pearly; septa transverse, syphon in the middle, the last chamber straight, but this is usually broken off.

244. SPIROLINA. Minute, shaped like the last, but the straight end is thickest; the spiral whorl club-shaped. Fossil.

245. LITRIOLITES. Minute, chambered, partly turned into a discoid spire, the last whorl straight. Septa irregular, the last with three or six perforations, but no syphon.

246. SCAPHITES. Shape resembling two Nautili, with their apertures brought together; the last whorl being elongated and then turned inwards.

(71.) The AMMONITIDÆ, or Snake shells, bring us back again to the Nautilus family, which they closely resemble in their general form, excepting that the internal septa are indicated by corresponding ridges on the outside; the whorls are more numerous, exposed, and the last is not greatly enlarged; the septa are also lobed or sinuated at their margin.

247. AMMONITES. Whorls numerous, exposed, ribbed. Syphon generally marginal.

248. ORBULITES. Small, spiral, the last whorl enveloping all the others. Septa indicated externally by zic-zag lines; syphon lateral.

249. AMMONOCERATITES. *Lam.* Shell horn-shaped, arched, nearly semicircular; septa transverse, numerous; the margins lobed and laciniated. Syphon marginal, but not perforating the septa. The shell, when perfect, is in all probability discoid.

(72.) That this sketch of the Testacious Mollusca might be useful to the Geologist, we have been thus particular on the fossil Cephalopoda. With the generality of Conchologists, however, they possess but little interest, and are not usually brought into their collections. The situation of the following genus, which resembles a recent Turitella in its outer form, is very doubtful.

250. TURRILITES. *Mont.* Spiral, turrited, with internal septa pierced in their disks

CHAPTER V.

ON THE PTEROPODA, OR CRYSTAL SHELLS.

(73.) This fourth primary division of the Testacious Mollusca are composed of a small assemblage of very singular animals, first distinguished by Cuvier. They are, in general, small; having some resemblance to the naked cuttle fish, but without their long arms; and are chiefly to be distinguished by two membraneous fins, resembling wings, on the sides of the neck. Like the *Cephalopoda*, which they follow, and the *Nudibranchia*, which they precede, they can crawl upon their bellies, although their most natural movement is by swimming. Some few are naked, others are more or less protected by a cartilaginous, gelatinous, or horny covering, which is never calcareous, and always transparent; this covering is usually, but erroneously, called the shell, and from being white and clear, it frequently resembles crystal or glass. It is these coverings which we shall now describe. The *Clio Borealis*, which is naked, connects this class with the Cephalopoda.

251. CLEODORA. *Peron.* A transparent triangular cone, which envelopes the body.

252. CYMBULIA. *Peron.* Shell cartilaginous, clear-white, somewhat resembling in shape a Nautilus, but without whorls.

253. LIMACINA. *Cuv.* Shell (protecting the tail of the animal,) very small, of one whorl and a half, umbilicated on one side, and flat on the other. *Cuv.*

254. HYALIA. *Lam.* Shell horny, transparent, somewhat resembling in shape, a Terebratula, one end with three spines, the other with a narrow transverse opening; above convex; beneath flattened.

(74.) The NUDIBRANCHIA, which form the fifth and last division of the Testacia, as before observed (4), are entirely naked, and consequently are excluded from our present survey.

CHAPTER VI.

ON COLLECTING, PRESERVING, AND ARRANGING SHELLS. A PLAN OF STUDY.

(75.) Shell fish, as they usually are termed, chiefly inhabit the sea, but many are peculiar to fresh water, and not a few live on dry land. When both the animal and its shell are to be preserved, they may be put, either together or separately, into a small bottle of spirits, but when the shell alone is desired, the animal can be immediately killed with hot water and taken out by a strong pin or other sharp instrument. Bivalves gape when the animal is dead, and the latter can then be removed by a knife. The perfection of a shell consists in having been procured when the animal was alive, for then the colours are brighter, and the natural polish uninjured; it is then technically called a *live shell*; when, on the other hand, it has laid some time on the beach, empty, it soon becomes injured, and is then termed a *dead* specimen, and those of course, which are not broken or chipped are the best specimens.

(76.) Marine shells may be procured in various

ways. Dredging with a trawl, a net much used on some of our own coasts, is the best for such as live in deep water. If the collector wishes to make the most of such an excursion he should go in the boat himself; if not, he must give his instructions to the fisherman to put all such things as they usually throw away, into a bucket with sea weed. The contents should be well examined, the shells picked out, and put into clean salt water; this will give an opportunity of seeing the animals, and of drawing or describing them, an advantage that should never be slighted. Afterwards, when the animal is killed, the shell may be simply cleaned with a nail brush and soap, dried, the operculum or lid, if any, again placed on the mouth, and the specimen then wrapped in paper with a little cotton or tow; remember not to use any acid, as spirits of salt, &c. in the cleaning, neither remove the *epidermis*, or rough skin with which many are covered. Next to trawling, I recommend walking on the beach immediately after a violent gale or storm, when many of the species inhabiting deep water, are cast upon the shore with their animals. When the tide is very low, many species may be found in the little pools of sea water, under sea weed, on bits of wood, adhering to stones and rocks, &c. Limpets and Chitons are found in the latter situations, and must be procured by suddenly inserting an oyster knife between them and the rock, giving

it a little turn to detach the animal. In Catholic countries shell fish are much used for the table, and many sorts may be procured by frequenting the fish markets of marine towns. Rocks, coral reefs, &c. left dry at very low water, may be advantageously examined. Many bivalves live at some depth below the sand, and are only to be detected by little dimples upon its surface; a small spade will dig them up. The collector should always carry a small basket, or large pockets, and one or two little tin boxes for small shells. Wherever dead shells are found upon the beach, he may feel pretty sure that *live* ones are in deeper water not far off. Baskets, tin boxes, oyster knife, hammer and chisel, and a spade, with a knapsack slung over his shoulder, complete the equipment of a shore Conchologist.

(77.) Fluviatile or fresh water shells are more easily procured. The univalves mostly adhere to grass and herbage in, or half immersed within, the water, chiefly in clear ponds, lakes, or running streams. The bivalves lie at the bottom, or are buried in the mud. A hand net, with the bag made of small wire meshes, and made to fit upon a walking stick is very useful for procuring most sorts; but the large river bivalves must be got by wading, or be searched for when the season is very dry, and the water shallow. Never separate the ligament or hinge of bivalves; but when the animal is out, and the shell dried, close the valves by tying them

together with thread. Land shells are found among herbage, or are seen crawling when the dew is out, or the day gloomy; others live among moss, under the bark of trees, beneath stones, in the crevices of rocks, &c., all which situations generally produce different kinds. For packing shells for a voyage, let each be wrapped in paper, put in a box, and the crevices well filled with tow or cotton wool.

(78.) The best mode of preserving collections of shells is in cabinets, consisting of drawers (about twenty-one inches by sixteen), from one and a half to two and a half inches deep *in the clear*, and secured by folding doors. The large shells will form an ornament on the top. Very small species can be fixed by strong gum water, in little card boxes or trays, lined at the bottom with black paper or black velvet, and the name written upon a label beneath. All the others can be laid upon carded cotton, sufficiently thick to prevent the specimens from shaking about; a number may be affixed to each, referring to a catalogue of the whole. Bad specimens are always preferable to none, and should be kept as memorandums, until better are procured. I should recommend the economic student, if he lives in London, to attend the frequent sales at Mr. Stevens', King-street, Covent-garden, who is, in fact, our Zoological Auctioneer; he will there have frequent opportunities of procuring shell cabinets at little more than half their cost price, and of

adding to his collection in any department, on the most favourable terms.

(79.) I shall conclude with an example of the plan of study I would recommend to every beginner. Nothing tends so much to facilitate an acquaintance with this, or any other branch of science, as a knowledge of *first principles*. Let the young conchologist, therefore, begin by committing the first chapter to his memory. A periwinckle and an oyster show him the characters of a univalve and a bivalve shell. If he wishes to know further particulars on the characters of the first, he is not to begin bewildering himself, in the first instance, by looking over the genera, but proceed regularly in *first* ascertaining to which of the great divisions of univalves (5) his shell belongs. On looking to these he observes that the PHYTOPHAGÆ have the mouth or opening of their shell *entire*, that is, the margin is not divided or notched; this description answering to the shell before him, he at once passes to a more detailed account of the Philophaga (9); his belief in being correct is now confirmed, and he therefore proceeds to ascertain to which of the *families*, coming under this division, his shell belongs. After passing that of the Haliotis, he comes to that of Trochus, which answers tolerably well to his shell, but he finds that all of this division are either pearly inside, or, when otherwise, of a very flattened form: this latter character his shell has not, and therefore he

proceeds to the next family, not troubling himself with the genera. On comparing his periwinckle with the definition given of the Turbo family, he at once perceives its resemblance, "the whorls are more convex than the last, and their substance is never pearly." Having discovered the family, he *now* proceeds to ascertain the genus; he reads over those numbered 19, 20, 21, 22, and 23, and as his shell is neither polished outside like 20, or faintly notched like 21, or excessively long like 22, or without any pillar like 23, it must obviously belong to 19, which is the genus TURBO, having the mouth simple or entire (in contra-distinction to 20), and closed by a horny operculum or lid. Thus he ascertains the generic name of a shell, without troubling himself to read any other definitions, or learning the names and characters of all the other genera by wrote. Whenever a technical term occurs, it is explained by referring to the list. This example familiarly explains the plan by which a competent acquaintance with conchology may be gained by even juvenile students in a very short time. I recommend all young beginners to go to Mr. Stuchbury's, 47, Theobald's-road, or any other of the respectable dealers, and for a few shillings they may purchase a number of cheap shells of different genera, quite good enough to follow up the plan here recommended.

(80.) As soon as the student has made himself

acquainted with this alphabet of the science, he will be prepared to understand the Conchological volume of Dr. Lardner's *Cabinet of Natural History* shortly to be published; while, for discovering the names of the *species*, the volumes of Lamark are the best, the most comprehensive, and the cheapest he can procure. Small collections of shells, illustrating genera, can also be had from most of the commercial naturalists.