II. The Animal Sub-Kingdom.

Division I. Invertebrata.—Invertebral Animals.

Essential Characters.—Animals destitute of a *vertebral column* and an *internal skeleton*. *Skin* sometimes ossified, and thereby forming an *external skeleton*. *Nervous system* not always evident.

Subdivision I.—ACRITA, *Macleay*.

Nervous system indistinct, diffused, or molecular (Owen). (*Cyclop. of Anat.* art. *Acrita*.)

Class I.—*PORIPHERA*, Grant.—*PORIPHEROUS ANIMALS*.

Essential Characters.—Simple, soft, aquatic *animals*, with a fibrous *axis*, without perceptible *nerves* or *muscular filaments*, or *organs of sense*, or any *circulating* or *glandular organs*. Their body is composed of a soft gelatinous *flesh*, traversed internally with numerous, ramose, anastomosing canals, which commence from superficial minute *pores*, and terminate in larger, open *vents*. (Grant, *Brit. Annual*, for 1838, p. 267.)

SPON'GIA OFFICINA'LIS, *Linn. E. D.*—THE OFFICINAL SPONGE.

(Sponge, *E.*)

(Spongia, U. S.)

History.—Aristotle (*Hist. de Anim.* lib. i. cap. ix. p. 16, Tolosæ, 1619) was acquainted with the sponges, and notices the popular but erroneous opinion of their shrinking when attempted to be plucked.

Zoology. **Gen. Char.**—Body soft, very elastic, multiform, more or less irregular, very porous, traversed by numerous tortuous canals which open externally by very distinct vents (*oscula*), and composed of a kind of subcartilaginous *skeleton*, anastomosed in every direction, and entirely without spicules (De Blainville). (*Man. d'Actinol.* p. 529, 1834.)

My friend, Mr. J. S. Bowerbank, (*The Microscopic Journal*, vol. i. p. 8,) has recently shown that spicula do exist in the keratose or horny sponges of commerce. They are imbedded, to a greater or less extent, in the substance of the fibre, and are mostly to be observed in the larger flattened portions of the fibre, and not in the finer anastomosing threads.

Mr. Bowerbank has also shown that the fibre of the true sponges is solid, and not tubular, as commonly supposed.[1]

Sp. Char.—*Masses* very large, flattened and slightly convex above, soft, tenacious, coarsely porous, cracked and lacunose, especially beneath. *Vents* round, and for the most part large (Lamouroux). (*Hist. des Polyp. Corall.* p. 20, 1816.)

These characters are insufficient to distinguish the officinal sponge from numerous other allied species; and it is tolerably clear, from Mr. Bowerbank's discoveries, above alluded to, that the naked eye is incompetent to distinguish species of this curious genus, and that the microscope must be principally, if not wholly, relied on for ascertaining specific characters. Mr. Bowerbank has recognised three distinct species in the sponges of commerce.

The animality of sponge is by no means universally admitted; indeed a considerable number of the naturalists of the present day regard it as of vegetable origin; and its position, in a natural classification of plants, it is said, should be between Algæ and Fungi.[2] But the recent observations of Mr. Bowerbank appear to me to be conclusive as to its animality. In one species of sponge he detected a branched vascular system, with globules in the vessels analogous to the circular blood disks of the higher animals. Now, nothing analogous to this has hitherto been detected in plants.

The sponge derives its food from the fluid in which it lives. The water (containing the matters necessary for the existence of the animal) enters by the superficial pores, circulates through the anastomosing canals, and is expelled by the fæcal orifices or vents, carrying along

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[1] The only tubular sponge known to Mr. Bowerbank is *Spongia fistularis*. This, however, he proposes to separate from the genus Spongia, and to give it the generic name of *Fistularia*.

[2] See Hogg, in the *Linn. Trans.* vol. xviii. pp. 363 and 368; also, Johnson's *History of British Zoophytes*, Ed. 1838.

with it particles which separate from the sides of the canals. (Grant, *Outlines of Comparative Anatomy*, p. 310, Lond. 1836.)

Sponge adheres to rocks by a very broad base. When first taken out of the sea it has a strong fishy odour. Its colour varies from pale to deep brownish yellow. It often contains stony or earthy concretions (*lapides spongiarum*), which Bley (*Pharm. Central-Blatt für* 1834, S. 273) found to consist principally of the carbonates of lime and magnesia. Shells also are found in sponges. Various marine animals pierce and gnaw it into irregular holes.

Hab.—In the Red and Mediterranean Seas. Chiefly collected about the islands of the Grecian Archipelago.

Collection.—The inhabitants of the Greek islands collect sponge by diving for it. In their submarine operations they carry with them a knife. Practice enables them to remain a considerable time under water. (Savary, *Letters on Greece*, p. 109, Lond. 1788.) As soon as the sponge is brought on shore, it is squeezed and washed to get rid of the gelatinous matters, otherwise putrefaction speedily ensues.

Description.—Commercial sponge (*spongia*) is the dry skeleton of the animal, from which the gelatinous flesh has been removed, as just mentioned. When deprived of stony concretions, &c. found in the interior of the mass, it is soft, light, flexible, and compressible. When burnt it evolves an animal odour. It absorbs water, and thereby swells up. Nitric acid colours it yellow. Liquor potassæ dissolves it: the solution forms a precipitate on the addition of an acid. The finer sponges, which have the greatest firmness and tenacity, were formerly called male sponge; while the coarser portions were denominated female sponge.

In 1841 duty (6d. per lb. with an additional 5 per cent. on the duty) was paid on 58,931 lbs. of sponge.

In English commerce[1] two kinds of sponge are met with, which are respectively known as Turkey and West Indian.

α. Turkey Sponge.—This is imported from Smyrna, and constitutes the best sponge of the shops. It occurs in cup-shaped masses of various sizes. Its texture is much finer than the West Indian kind. Mr. Bowerbank, by the aid of the microscope, has discovered that it consists of two species of Spongia, not distinguishable from each other by the naked eye. One of these is characterized by the presence of a beautiful, branched, vascular tissue, which surrounds, in great abundance, nearly every fibre of its structure, and is inclosed in an external membrane or sheath. In the other, and most common, kind of Turkey sponge, no vascular tissue has yet been discovered.

β. West Indian Sponge.—The principal source of this is the Bahama Islands; whence it is commonly known as *Bahama Sponge*. Its forms are more or less convex, with projecting lobes. Its fibre is coarser. Its tissue has but little cohesion, and hence this kind of sponge is commonly regarded as rotten. Mr. Bowerbank states that it consists of one species only of Spongia.

Composition.—Well-washed sponge, freed as much as possible from earths and salts by dilute acids, was analysed, in 1828, by Hornemann, (*Berl. Jahrb.* Bd. xxx. Abt. ii.) who found it to consist of *a substance similar to osmazome, animal mucus, fat oil, a substance soluble in water, a substance only soluble in potash, and traces of chloride of sodium, iodine, sulphur, phosphate of lime* (?), *silica, alumina, and magnesia*. Mr. Hatchett (*Phil. Trans.* for 1800, p. 327,) found sponge to consist of *gelatine* (which it gradually gave out to water), and a thin, brittle, membranous substance, which possessed the properties of *coagulated albumen*.

Uses.—The extensive economical uses of sponge are familiar to every one. To the surgeon it is of great value on account of its softness, porosity, elasticity,

1. On the continent a considerable variety of sponges are known. See Baudrimont, in the *Dict. de l'Industrie*, t. iv. art. *Eponge*; and Dr. T. W. C. Martius's *Lehrbuch der pharmaceutischen Zoologie*. Stuttgart, 1838.

and the facility with which it imbibes fluids. Its use at surgical operations and for checking hemorrhage is well known.[1] It has also been applied to wounds and ulcers for imbibing acrid discharges.[2] The *sponge-tent* is usually made of compressed sponge impregnated with wax (*spongia cerata*), and which is called *prepared sponge* (*spongia præparata*). It is prepared by dipping sponge into melted wax, and compressing it between two iron plates till the wax hardens. It was formerly much used for dilating sinuses and small openings, but it is seldom resorted to now.

SPONGIA USTA. *Pulvis spongiæ ustæ*, D. *Calcined* or *burnt sponge*. (Having cut sponge into pieces, beat it to free it from little stones; burn it in a closed iron vessel until it becomes black and friable, and reduce it to powder, *D.*)—Preuss (*Pharm. Central-Blatt für* 1837, 169,) calcined 1000 parts of sponge: of these, 343·848 parts were destroyed by heat. The residue consisted of *carbon* and *siliceous insoluble matters*, 327·0; *chloride of sodium*, 112·08; *sulphate of lime*, 16·430; *iodide of sodium*, 21·422; *bromide of magnesium*, 7·570; *carbonate of lime*, 103·2; *magnesia*, 4·73; *protoxide of iron*, 28·720; and *phosphate of lime*, 35·0.—Burnt sponge, if good, should evolve violet fumes (*vapour of iodine*) when heated with sulphuric acid in a flask. It has been employed as a resolvent in bronchocele, scrofulous enlargement of the lymphatic glands, &c. Its efficacy is referrible to iodine and bromine. Iodine is now almost invariably substituted for it.—Dose, 3j. to 3iij. It is given in the form of electuary or lozenges (*burnt sponge lozenges; trochisci spongiæ ustæ*).

Class II.—*POLYPIPHERA*, Grant.—*POLYPIPHEROUS ANIMALS.*

The polypiferous animals have received their name from the circumstance of their bearing tubes called *polypes*. They consist of two parts, a skeleton and a fleshy portion. The *skeletons* vary in their consistence, and also in their position relative to the soft parts. They are soft and flexible, or hard and calcareous. They are external and tubular, or internal and solid. The *fleshy portion* may be, with respect to the skeleton, either external or internal. It gives origin to fleshy tubes (*polypes*), each of which, at its external orifice, is surrounded by *tentaculæ*.

The calcareous internal skeleton of Corallium rubrum, Lamarck (*Isis nobilis*, Pallas; *Gorgonia pretiosa* Ellis), is the *Red Coral* of the shops. It consists of carbonate of lime principally coloured with oxide of iron. *Prepared Red Coral* (*Corallium rubrum præparatum*) was formerly used in medicine, but it presents no advantage over chalk. Its powder, obtained by levigation, or an imitation of it, is still kept in the shops, and is occasionally employed as a dentifrice.

Fig. 254.

Corallium rubrum.

Subdivision II.—RADIATA, *Lamarck.*—RADIATE ANIMALS.

Essential Character.—*Nervous system* distinct, composed of filaments and rudimentary ganglia; the filaments arranged circularly around the buccal orifice (*Cyclo-neura*).

No officinal substance is obtained from the Radiata.

Subdivision III.—MOLLUSCA, *Latreille.*—MOLLUSKS OR SOFT ANIMALS.

Malacozoa, *Blainville.*—Cylo-ganglia, *Grant.*

Essential Characters.—Inarticulated animals with a soft not annulated *skin*. *Cerebral ganglia* arranged circularly around the œsophagus.

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[1] C. White, *An Account of the topical Application of the Sponge in the Stoppage of Hemorrhage*. Lond. 1762.

[2] *On the Use of Sponge after Amputations*, by Mr. T. Kirkland, in the *Med. Observ. and Inq.* vol. ii. p. 278. Lond. 1764.

Class III.—*CONCHIFERA*, Lamarck.—*CONCHIFEROUS MOLLUSKS.*

Essential Characters.—Acephalous, aquatic mollusks, with a bivalve or a multivalve *shell*. *Organs of respiration* four pectinated laminæ. *Heart* simple. *Impregnation* effected without the assistance of a second individual.

OS'TREA ED'ULIS, *Linn. L.*—COMMON EDIBLE OYSTER.

(Testæ, *L.*)

(Testa, U. S.)

History.—Oysters were greatly admired by the Romans as a most delicious article of food. (Pliny, *Hist. Nat.* lib. xxxii. cap. 6, ed. Valp.) Those of Britain were much esteemed; though they were said to be inferior to those of Cyzicena (Pliny), (Juvenal, *Sat.* iv.)

Zoology. **Gen. Char.**—*Body* compressed, more or less orbicular. Edges of the *mantle* thick, non-adherent or retractile, and provided with a double row of short and tentacular filaments. The two pair of *labial appendices* triangular and elongated. A subcentral, bipartite *muscle*. *Shell* irregular, inequivalved, inequilateral, coarsely laminated. *Left* or *inferior valve* adherent, largest, and deepest; its summit prolonged, by age, into a kind of keel. *Right* or *upper valve* smallest, more or less opiculiform. *Hinge* oral, toothless. *Ligament* somewhat internal, short, inserted in a cardinal pit, growing with the summit. The *muscular impression* unique and subcentral (Blainville).

Sp. Char.—*Valves* ovate-roundish or obovate; the upper one flat. *Lamellæ* of both valves, imbricated and undulated (Brandt) (*Med. Zool.*)

Brandt (*Ibid.* Bd. ii.) has given an elaborate account of the anatomy of the oyster, to which I must refer the student interested in these details.

Hab.—European and Indian seas. Our own coasts furnish some of the finest kinds. Those found at Purfleet are said to be the best.

Oyster Fisheries.—Oysters are caught by dredging. In order to improve their flavour and size they are laid on beds in creeks along shore, where they rapidly improve. Colchester and other places of Essex are the nurseries or feeding grounds for the metropolis. (For details respecting the treatment of oysters in beds, see Spratt's *History of the Royal Society*, p. 307.)

Description.—The officinal parts of oysters are the *shells* (*testæ ostreæ*). The hollow valves are preferred, as they contain carbonate of lime. When calcined, oyster shell yields a quicklime formerly much esteemed as a lithontriptic.

Composition.—*Oyster shells* have been analysed by Bucholz and Brandes, (Gmelin, *Hand d. Chem.* ii. 1477), and by Rogers. (*Silliman's Journal*, vol. xxvi. p. 361.)—The *flesh of the oyster* has been analysed by Pasquier. (Gmelin, *op. supra cit.*)

Bucholz and Brandes's Analysis.

Carbonate of lime	98·6
Phosphate of lime	1·2
Alumina	0·2
Albuminous matter	0·5
Oyster shells	100·5

Pasquier's Analysis.

Ozmazome, Gelatine, Mucus, Albumen, Fibrine	12·6
Water	87·4
Flesh of the Oyster	100·0

The dietetical properties of oysters have been before noticed (see vol. i. p. 89.)

TESTÆ PRÆPARATÆ, L.; *Testæ Ostreorum Præparatæ* (*Testa Præparata*, U. S.); *Prepared Oyster Shells*. (Wash the Shells, first freed from impurities, with boiling water; then prepare in the same manner as directed for chalk, *L.* [U. S.])

—The mode of preparing chalk by elutriation has been already described (see vol. i. p. 501). After oyster shells have been washed, boiled, and crushed, they are dried and ground to an impalpable powder previous to elutriation. In the shops the substance sold as prepared oyster shells is in small conical masses. The principal constituent of prepared oyster shells is carbonate of lime, and they therefore possess the same medicinal properties as chalk, already described (vol. i. p. 502), and which is usually substituted for them.

Class IV.—*CEPHALOPODA*, Cuvier.—*CEPHALOPODS.*

Essential Characters.—*Body* inclosed in a bag (*mantle*). *Head* protruding from the bag, crowned with inarticulated arms, furnished with cups or suckers, and surrounding the mouth. *Eyes* two, sessile. *Mouth* with two horny mandibles. *Hearts* three. *Sexes* separate.

SEPIA OFFICINA'LIS, *Linn.*—COMMON CUTTLE FISH.

The substance called *os sepiæ* or *cuttle-fish bone* is an oval or oblong calcareous bone (sometimes termed a *shell*) deposited in the mantle of the animal. The common species of sepia is *S. officinalis*, Linn.; but *S. elegans*, Blainville, also yields part of the cuttle-fish bone of the shops. (Brandt and Ratzeburg, *Med. Zoolog.* ii. 299.)

Os sepiæ has a cellular texture, and is so light as to float on water. It is cast in considerable quantities on the shore, and is collected for commercial purposes. It was analyzed by John, who found the constituents to be as follows:—

	Hard, Upper or Outer Portion.	*Porous Part.*
Carbonate (with a trace of phosphate) of lime	80	85
Non-gelatinous animal matter, soluble in water with some common salt	7	7
Gelatinous membrane, not soluble in water	9	4
Water, with a trace of magnesia	4	4
	100	100

Reduced to powder it is used as a dentifrice. It is employed for several purposes in the arts, as for polishing, for forming moulds for small silver castings, and as a pounce.

Subdivision IV.—ARTICULATA, *Cuvier.*—ARTICULATED ANIMALS.

Essential Characters.—*Skin* annulated. *Muscles* attached to the inner surface of the skin. *Nervous system* of two cords extended along the ventral surface of the body, with ganglionic enlargements at intervals (*diplo-neura*;) the anterior ganglion (brain) placed over the œsophagus.

Class V.—*ANNULOSA*, Macleay.—*ANNULOSE ANIMALS.*

Annelides seu Annelida.

Essential Characters.—*Body* more or less elongated. *Skin* soft, segmented and annulated. *Articulated members* and *wings* absent. *Blood* red.

SANGUISU'GA, *Savigny.*—THE BLOOD-SUCKING LEECHES.

Iatrobdella, *Blainville.*

History.—We have no accurate knowledge of the exact period when leeches either became known to, or were employed by, man; but this deficiency of information is not necessarily referrible to their discovery preceding the date of our historical documents. It is true that in the common version of our most ancient record, the Bible, (*Prov.* xxx. 15,) this passage occurs, "The horse-leech hath two daughters, crying, give, give;" but critics are not agreed as to

the correctness of this translation. The word "*Olukeh*," or "*Aluka*," here interpreted "*horse-leech*," means, according to Bochart, destiny or fate, either of which terms should, according to this writer, be substituted for that of horse-leech; the daughters alluded to being Eden and Hell. But the Vulgate, Greek, and Lutheran translations, are all against his opinion. Brandt (*Med. Zool.* ii. 231) has entered into a very elaborate discussion of this subject, from which it appears that, in Arabic, the term *Aluka* indicates a leech, while *Aluk* signifies fate; the latter being derived from *Alaka*, to attach or hang to, because every man's fate is supposed to be appended to him, just as a leech affixes itself to the body; so that from this it appears probable the word "*Olukeh*" of the Old Testament really refers to the leeches. Nay, I think there is some reason for suspecting that the *Sanguisuga ægyptiaca* is the species referred to. The leeches referred to by Herodotus (*Euterpe*, lxviii.) are *Bdella nilotica* (Savigny.)

But admitting that these animals were known at this early period, it does not appear that they were employed in medicine: for Hippocrates makes no mention of them, though he notices other modes of drawing blood. Aristotle also is silent with regard to them. In the extracts which Cælius Aurelianus has made from the writings of Diocles, Praxagoras, Herophilus, Heraclides, Asclepiades, and other ancient physicians, who lived between the time of Hippocrates and Themison, no mention is made of the employment of leeches; a remarkable fact in favour of the opinion that they were not at this period in use. In fact, the founder of the Methodic sect, Themison, is the first person in whose works we find mention of leeches being employed therapeutically. (Le Clerc, *Hist. de la Médec.* p. 442, Nouv. éd. 1729.) However, it does not follow that he was the first who prescribed them, though our documentary evidence fails in tracing back their use beyond his time.

In the Latin and Greek languages, the animal has received its name from its sucking or drawing qualities. Thus the Greeks called it βδέλλα, from βδέλλω, to suck; the Romans *hirudo*, probably from *haurio*, to draw out; or *sanguisuga*, literally signifying "blood-sucker," from *sanguis* and *sugo*. It would appear, however, that the latter of these two Latin terms is the more modern; for Pliny, (*Hist. Nat.* viii. 10, ed. Valp.) in speaking of elephants, says, "Cruciatum in potu maximum sentiunt, hausta hirudine, quam sanguisugam vulgo cœpisse appellari adverto."

Zoology. **Gen. Char.**—*Jaws* with two rows of pointed, numerous *teeth*, which are mutually inclined at an acute angle (Brandt). (*Med Zool.* ii. 231.) *Body* elongated. *Back* convex. *Belly* flat. *Extremities* somewhat narrowed, furnished with disks or suckers; the anterior extremities somewhat narrower than the posterior one. *Rings* from ninety to a hundred. *Eyes* represented by ten blackish points. *Mouth* tri-radiate. *Jaws* cartilaginous, armed with numerous cutting teeth. *Anus* small, placed on the dorsum of the last ring.

Cuvier (*Règne Animal*, t. iii. p. 212, Nouv. éd. 1830) includes all leeches in the genus *Hirudo;* but later naturalists have found it necessary to arrange them in several genera. The leeches employed in medicine have been formed into a distinct genus, called by Blainville (*Dict. des Scien. Nat.* t. 47, art. *Sangsue*) *Iatrobdella*, (from ἰατρὸς and βδέλλα, *a leech*,) by Savigny, (*Desc. de l'Egypte, Hist. Nat.* t. 1er, part. 3e, p. 114,) *Sanguisuga*. The latter classical term, so expressive of the blood-sucking properties of the genus, I have adopted. All leeches, it appears, are not provided with an apparatus for perforating the skin of vertebrate animals. In consequence of the numerous complaints addressed to the Préfet de Police, in 1825, that of the leeches sold in Paris some would not bite, while others caused painful and obstinate wounds, he consulted the Council de Salubrité, who deputed MM. Pelletier and Huzard fils, to inquire into the accuracy of the statements. One of the results of the investigation was, that the animal called in France *horse-leech*, and which had been particularly charged with causing painful wounds, could not perforate the human skin, the teeth of the animal being quite blunt. (*Journ. de Pharm.* t. xi.) The horse-leech referred to, the reporters declared to be *Hæmopis sanguisorba*, Savigny; but Blainville says it was *Hæmopis nigra*.

Species.—1. Sanguisuga officinalis, Savigny. *Hirudo provincialis*, Carena, Mém. della Reale Accad. di Torino. xxv. 282; *Sanguisuga meridionalis*,

Risso, Hist. Nat. de l'Europe merid. iv. 428; *the Green Leech.*—*Back* greenish or blackish-green, with six rusty-red bandlike [longitudinal] stripes. *Belly* olive-green, unspotted (Brandt).—South of Europe. Those brought to England come from Bourdeaux, Lisbon, and Hamburgh.

Moquin-Tandon (*Monogr. de la fam. les Hirud.* p. 112) admits three varieties:
α. Dorsal bands interrupted at intervals.
β. Dorsal bands reduced to blackish spots.
γ. Dorsal bands united by transverse ones.

2. SANGUISUGA MEDICINALIS, Savigny. *Hirudo medicinalis*, Linn. L. D. *True English* or *Speckled Leech.*—*Back* greenish or olive-green, with six rusty red longitudinal stripes, which are mostly spotted with black. *Belly* greenish yellow, spotted with black (Brandt).—*Spots* very variable in size and number; in some cases they are but few; in others are so numerous as to form the the almost prevailing tint of the belly, the intervening spaces appearing like greenish yellow spots.—Europe, especially the northern parts. A native of England, but rare. Imported from Hamburgh.

Several varieties of this leech have been described and figured. One of the most remarkable of these is the *flesh-coloured medicinal leech* (*Sanguisuga medicinalis carnea*) described by Guillez of Paris. The anterior half of its body is flesh-coloured; while the posterior half is of the usual colour. The *spotted* or *piebald leech* is flesh-coloured with olive-green spots. (See Brandt and Ratzeburg, *Med. Zool.*)

These are the only species employed in medicine in this country. Others have been described and figured by Brandt. (*Med. Zool.* ii.) The following is a short sketch of the *anatomy* of the medicinal leech:—

The CUTANEOUS SYSTEM of the animal consists of a transparent *epidermis* (which is thrown off from the body every four or five days) and the *corium*. The latter consists of condensed cellular tissue, composed, according to Brandt, of globules. Like the epidermis, it shows the partitions into rings. It contains a number of *globules* impregnated with a pigment, varying in colour in different places, and which is the source of the colours presented by the surface of the animal.

It is asserted that the predominant or base colour is, in part at least, owing to the colour of the soil in which the animals are found. Dr. J. R. Johnson (*Treat. on the Med. Leech*, p. 42, 1816,) says, "Mr. Baker, a man of some intelligence, residing in Glastonbury, and who for the last twenty years has been in the habit of collecting large quantities of leeches for sale, informs me that at the Black River, near Glastonbury, they are black, from the peat being of that colour; at Cook's Corner, they are of a reddish cast, from the red peat; while at Auler Moor, where, from a deficiency of peat, they penetrate the clay, they are yellow."

The MUSCULAR SYSTEM has been elaborately described by Brandt, but can scarcely be comprehended without the aid of drawings. The muscles of the trunk are arranged circularly, longitudinally, and obliquely: of these, the circular fibres are the most external, and the longitudinal ones the most internal.

The DIGESTIVE SYSTEM consists of a mouth, alimentary tube, anus, salivary glands, and liver. The *mouth* is placed in the middle of the oval or buccal disk; its shape is triradiate,—that is, of three equidistant lines or rays meeting in a centre. Within it are three white sublenticular *jaws* (*dentiferous tubercules* or *piercers*), which in appearance are cartilaginous; but Brandt says they consist of a strong firm skin, inclosing a muscular mass. On the free curved sharp margin of each jaw are about sixty small, finely-pointed *teeth*. The *œsophagus* is a muscular tube, and dilates as it approaches the stomach; but at its termination it contracts into a small circular aperture, its whole length not exceeding a

FIG. 255.

Alimentary Canal of the Leech.

a, Œsophagus.
b, *c*, *d*, *e*, *f*, *g*, *h*, *i*, *k*, *l*, *m*, Cells of the stomach.
n, Cæcal sacs.
o, Funnel-shaped pylorus.
p, Irregularly expanded commencement of (*q*) the small intestine.
r, Cæcal sac of the last cell of the stomach.
s, Large intestine.
t, Rectum.

quarter of an inch. The *stomach* occupies two-thirds of the length of the animal, and is divided into about eleven compartments or cells, each of which, from the second to the eleventh, gives off on each side a *cæcal sac*, those of the last cell being far the largest, and extending down by the side of the intestine as far as the commencement of the rectum. The stomach consists of three coats,—a cellular, a muscular, and a mucous one. Its eleventh cell terminates by a funnel-shaped projection in the intestine. The *intestine* is about an inch in length; at its upper orifice is a valve, and at its lower end a sphincter: on either side of it, for the greater part of its length, is one of the sacs for the last compartment of the stomach; on its inner surface are several folds. It is divided into *small* and *large intestine*, the lower part of the latter being called a *rectum*. The *anus* is not, as we might anticipate, in the posterior disk, but on the dorsal surface of the last ring. *Salivary organs* have been described: they consist of whitish granular masses placed around the œsophagus, into which tube the common salivary duct opens. De Blainville, Carus, and Brandt, speak of a *liver*. It is a brownish mass placed on the alimentary canal, the ducts opening into the stomach and intestine. The best mode of displaying the cells of the stomach is to immerse a leech, fully gorged with blood, for a week in a saturated solution of corrosive sublimate.

The Vascular System consists of four great pulsating *vessels*, giving off numerous ramifying branches; but without any heart, commonly so called. Two of these are placed laterally, a third in the median line of the dorsal surface, and a fourth on the abdominal surface. All these vessels pulsate (Johnson). We know very little about the manner in which the blood circulates. Brandt thinks that the lateral vessels must be arteries, on account of their very distinct transverse and longitudinal fibres: the dorsal and venous vessels he terms veins. (*Med. Zool.* t. ii. 249.) Does not the dorsal vessel correspond to the vena cava, and the abdominal vessel to the vena porta of higher animals? Grant, (*Outl. of Comp. Anat.* 440,) however, terms the dorsal vessel of the annelides an artery. (Some interesting observations on the vascular system of leeches are contained in Knolz's *Nat. Abhandl. ü. d. Blutegel.* Wien, 1820).

The Respiratory System consists of small apertures (called *stigmata* or *spiraculæ*) arranged in two rows on the abdominal surface, and occurring at every fifth ring. They lead into little cavities lined by mucous membrane, and which have been called *airs sacs*, *pulmonary vesicles*, *mucous bags*, *cryptæ*, or *lateral vesicles*, containing usually a whitish fluid. They are placed on each side of the alimentary canal, in the spaces between the cæcal sacs of the stomach, and are usually regarded as organs of respiration. Brandt, however, asserts that the respiratory function is effected solely by the skin, and that these vesicles are, in fact, receptacles for mucus secreted by a neighbouring *glandular apparatus*, which has a whitish appearance, and in form represents a folded intestine. This notion, however is not new, but was held by De Blainville and Johnson.

The Nervous System consists of two parts: *one* (which we may compare to the *cerebro-spinal axis* of the vertebrata) consists of a chain of ganglia (usually about twenty-three in number) occupying the mesial line of the abdomen, and connected by a double nervous cord; the first ganglion (*brain*) is placed on the œsophagus, and supplies the eyes and neighbouring muscles. The *second* part of the nervous system is that lately discovered by Brandt, and may be regarded as a kind of *sympathetic system*. It consists of three ganglia (connected to the brain by filaments, and supplying the jaws), and a single nerve connected to them, and running along the abdominal surface of the stomach in the mesial line.

Of the External Senses three only have been recognised: *feeling*, which resides in the external surface of the body; *taste*, apparently indicated by the fondness of leeches for certain fluids (as blood, milk, &c.); and *vision*, effected by ten eyes (in the form of black spots) arranged in a crescent form at the anterior or cephalic extremity of the animal.

The Sexual System is double,—that is, each animal is androgynous, or possesses both male and female organs. There is, however, no power of self-impregnation (the contact of two individuals being requisite, each acting to the other in a double capacity of male and female). The male organs consists of several pairs of *testicles*, *two vasa deferentia*, *two vesiculæ seminales*, *two ejaculatory ducts*, and a *penis* surrounded at its base by what some have termed a *prostate gland*. The penis projects from the abdominal surface at about one-third distant from the anterior extremity. The female organs consist of *two ovaries*, *two oviducts* (which subsequently unite into one) a hollow organ (*uterus*) which opens by a contracted aperture (*vagina*) externally, at about the twenty-ninth ring, or five rings below the penis.

That leeches are essentially oviparous admits of no doubt; and we have now an admirable account of their developement by Professor Weber. (*Meckel's Archiv.* for 1828, p. 366.) It appears that soon after copulation an unusual activity pervades the ovaries, in consequence of which some *ova* (termed by Weber *germs*, by Carus *yelks*) are separated, and pass along the oviduct to the uterus, where they stop, in order to obtain the matters necessary for their developement, and their proper coats. They here become invested with a serous-like membrane, on the inner side of which is produced (either by secretion from the uterine cavity or from the membrane itself) an albuminous whitish mucus, serving in part for the nourishment of the ova, and which is regarded as a kind of *liquor amnii*. Subsequently a glutinous fluid is deposited on the outside of the serous coat. When the ova are expelled from the uterus, part of this fluid gives a coating to them, while part is expelled before and after them. But this coat

seems now distended with air vesicles, and has the frothy appearance of well-beaten white of egg, produced by the violent contraction of the uterus.

The animals usually deposit their ova (in their own native waters) in holes or moist places on the shore, from May to the end of September. When first expelled, they are somewhat cylindrical in form, and have a brownish appearance. The frothy layer adheres very slightly; but after lying in the water for a quarter of an hour, the outer surface becomes somewhat hardened, forming a kind of pellicle or fine skin. After some days a portion of this frothy covering is converted into spongy tissue (*spongy coat of the cocoon*), covering the capsule of the ova (*cocoon*) wholly or partially. In this state the cocoon has a brownish, fibrous appearance, similar to fine sponge, and varies somewhat in its size and weight; its longest diameter being from six to twelve lines, its shortest from five to eight, and its weight from twenty-four to twenty-eight grains. (See figures of the cocoon, in Dr. J. R. Johnson's *Furth. Observ. on the Med. Leech*, 1825.)

The ova or germs, which have a lenticular form, evince vital movements; and very soon we perceive on each a funnel-shaped tube, extending from their surface inwards, and which appears to absorb the albumen of the cocoon. The ovum goes on enlarging, and becomes somewhat elongated, and subsequently the young leech begins to be developed on the exterior part of the ovum, the aperture of the funnel being the spot where the mouth of the young animal is observed. The abdominal surface is the first, the dorsal the last, to be developed. When the young leeches have attained a considerable size they pierce their cocoon.

FIG. 256.

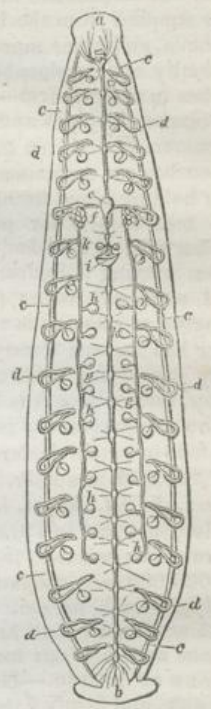

Diagram illustrative of the internal anatomy of the leech.

a, Brain.
b, Last ganglion. Between these will be observed the chain of ganglia of which they form portions.
c, Lateral or branchial vessels.
d, Folded mucous glands; each is connected by a duct to an air vesicle.
e, Penis, the rounded enlarged base of which is supposed to contain the prostate gland.
f, Vesiculæ seminales.
g, Vasa deferentia.
h, Testicles.
i, Uterus.
k, Ovaries.

DISEASES OF LEECHES.—The natural duration of the life of leeches is not easily determined; but judging from the slowness of their growth, and the length of time full-grown leeches have been preserved, we may necessarily infer that they are long-lived animals. Dr. Johnson thinks that in their native waters, if they can always meet with an abundant supply of food, they may live at least twenty years. But they are subject to several diseases, some of which are epidemic, and of a very destructive kind. Although the study of the pathology of this animal is of considerable interest in a commercial and even scientific point of view, yet no practically useful results have hitherto been arrived at, in regard to the prevention and treatment of the diseases of leeches. Dr. J. R. Johnson mentions three diseases as common to this animal:—1st. An ulcer, seated in various parts of the body, but more generally affecting the side. It destroys life in a few days. 2dly. A rigidity and narrowing of one part, whilst another portion is studded with tumours of putrid coagulated blood. 3dly. A flaccid appearance of the whole body, except the lips, which are hard, swollen, purple, and frequently bloody. These diseases are particularly prevalent during the summer months. Brostat (Brandes's *Archiv*. Bd. v.) describes three epidemic disorders.

COLLECTION AND COMMERCE OF LEECHES.—Leeches may be caught with the hand, or by a kind of net (described by Derheims), or by the gatherers going into the ponds with naked feet, to which the leeches adhere; or by baits, especially the liver of animals. The two latter methods are objectionable,—one because it is not free from danger to the gatherers, and the other because it is apt to injure the health of the animal. An interesting and graphic account of

the leech fishery at La Brenne, and of the miserable appearance of the fisherman who collects the leeches, by allowing them to attach themselves to his legs and feet, has been published in the *Gazette des Hôpitaux*. A translation of this paper is given in M'Culloch's *Dictionary of Commerce*.

All our leeches are imported from Hamburgh. The Hamburgh dealers draw their supplies from the Ukraine. "Having exhausted all the lakes of Siberia, Bohemia, and other more frequented parts of Europe, the buyers are now rolling gradually and implacably eastward, carrying death and desolation among the leeches in their course—sweeping all before them, till now they have got as far as Pultava, the pools and swamps about which are yielding them great captures." (Bremner, *Excurs. in the Interior of Russia*, vol. ii. p. 408, 1839.)

Leeches are sometimes imported in bags, but more usually in small barrels, each holding about 2000, the head being made of stout canvass to admit the air. The best vessels for preserving these animals are unglazed brown pans or wooden tubs. The dealers have a notion (and possibly a correct one) that the leaden glazing is injurious. These pans should be very little more than half filled with soft water (pond, river, or rain water). This does not require changing so often as is commonly supposed. In very hot weather, or when the water has become bloody, or otherwise much discoloured, it should be changed every day or so; otherwise, in summer every four or five days or a week; in winter, once a month is believed, by large dealers to be sufficient.

The *consumption of leeches* must be enormous. Some years ago it was stated that four principal dealers in London imported, on the average, 600,000 monthly, or 7,200,000 annually. (Price, *Treat. on Sanguisuct.* p. 129, 1822.) Feé (*Cours. d'Hist. Nat.* t. i. p. 21) says, "it is estimated that 3,000,000 are annually consumed in Paris; and as the population of Paris is to that of the whole of France as one is to thirty-three, it follows that, independently of exportation, 100,000,000 are consumed annually, which is equivalent to three leeches annually for each person. Now, if we estimate the average price at fifty francs per thousand, we shall have the enormous sum of five millions of francs paid for this one article of our materia medica."

Mode of biting.—Having fixed on a suitable spot, the animal applies his oval disk, and firmly fixes it (at first, perhaps, by atmospheric pressure; then by intimate contact), so that the anterior end forms an angle with the other portions of the body. The three cartilaginous jaws bearing the sharp teeth are now stiffened and protruded through the tri-radiate mouth against the skin, which they perforate, not at once, but gradually, by a saw-like motion. Dr. Johnson (*Treat.* p. 112) says, "The jaws are carried from side to side in an oblique direction;" and adds, "their action may be seen by presenting to the leech a coagulum of blood, and when the leech is in the act of suction, cautiously removing it. For a few seconds it appears unconscious of its removal, which presents a fair opportunity of observing the oscillatory movement of each piercer." The wound is not produced instantaneously, for the gnawing pain continues for two or three minutes after the animal has commenced operations. Thus, then, it appears that the leech saws the skin; hence the irritation and inflammation frequently produced around the orifices. The flow of blood is promoted by the suction of the animal, who swallows the fluid as fast as it is evolved. During the whole of the operation the jaws remain lodged in the skin. In proportion as the anterior cells of the stomach become filled, the blood passes into the posterior ones; and when the whole of this viscus is distended, the animal falls off. On examination it will be found that not a particle of blood has passed into the intestine.

Physiological Effects.—There are two classes of phenomena observed in all modes of drawing blood; one of which has been termed *local*, the other *general*. In phlebotomy and arteriotomy, the first is trifling, and of no therapeutic value; and we resort to these operations only as means of affecting the

general system. On the other hand, we obtain topical effects, both powerful and useful, from cupping and leeching; hence these are termed *local*, while the former are denominated *general* blood-lettings. It must, however, be remembered, that constitutional or general effects are also frequently obtained from both cupping and leeching.

1. *Constitutional or general effects of leeching* are the same in kind as those caused by the loss of blood from other means. A moderate quantity of blood may be abstracted without any obvious effects on any of the functions; but, if the amount taken be increased, syncope results. The quantity necessary to produce this varies, however, considerably, and will depend on the mode of drawing it (whether rapidly, or otherwise); the position, constitution, and age of the patient; the nature of the disease; and many other circumstances not necessary to enumerate. It is well known that a small quantity will, if taken rapidly, and the patient be in the erect posture, cause this effect; whereas a considerably larger amount may be abstracted, if taken gradually, and the patient in the recumbent position, without giving rise to it. The usual explanation of this is, that when blood is drawn faster than the vessels can contract, the circulation is temporarily stopped, and fainting ensues. Several reasons, however, lead me to doubt the sufficiency of this explanation. Leeching, then, as being a slower mode of abstracting blood, is less likely to cause syncope than venesection, or even cupping. As the patient recovers from the fainting state, hysterical symptoms sometimes manifest themselves. Throbbing headache, and sleeplessness, are by no means uncommon consequences of loss of blood. In some cases I have seen febrile excitement, of several hours' duration, brought on by blood-letting.[1]

Dr. Marshall Hall (*On the Morb. and Curative Effects of Loss of Blood*, 1830) has directed attention to the disorder of the cerebral functions (marked by convulsions, delirium, or coma) caused by blood-letting. I may observe, that convulsive movements are by no means uncommon in syncope from general blood-letting, and I think are not always to be considered as denoting that the remedy has been used beyond the safe degree. I have on several occasions been told by patients about to lose blood, that they are apt to faint and struggle when bled; and I have, in consequence, been requested to prevent them from injuring themselves. Delirium and coma are less frequently met with. Great depression of the vascular system, followed by sudden dissolution, is another occasional effect of loss of blood. (See an illustrative case in the *Lancet*, vol. xi. p. 94.)

As might be expected, an operation so powerfully affecting the vital functions cannot be passive in its influence over morbid action; but the phenomena vary so much in different diseases, and even in the same disease under different circumstances, that it becomes exceedingly difficult to offer any general results. That loss of blood is sometimes beneficial, at other times hurtful, is well known. Its immediate beneficial effects are best seen in pneumonia and ophthalmia. In the first of these diseases the respiration sometimes becomes easier, and the pain removed, while the blood is flowing; and from this time the amendment progresses. In ophthalmia, the redness of the conjunctiva disappears during the syncope from blood-letting, and sometimes never returns with equal intensity. A tendency to hemorrhage has been thought by some experienced practitioners to be engendered or increased by the application of leeches. Thus the return of the menses, the aggravation of menorrhagia, hæmoptysis, and apoplexy, have been found to follow, and apparently to result from, the employment of leeches.[2]

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[1] For further details respecting the effects of loss of blood, see Dr. Clutterbuck *On the proper Administ. of Blood-letting*, 1840.

[2] See the observations of Laennec and Sir James Clark, in Forbes's translation of Laennec's *Treat. on Dis. of the Chest*, p. 193, 1827.

The effects of blood-letting are considerably influenced by disease. Every practitioner is acquainted with the fact, that in certain morbid conditions patients bear the loss of larger quantities of blood than in others. I need only mention apoplexy, inflammation of the serous membranes, peripneumony, and phrenitis, as examples of increased tolerance; while chlorosis and cholera may be cited as instances of diminished tolerance. On this point there cannot be, I think, two opinions.

I confess I am not prepared to assent to the inferences Dr. Hall has drawn from these facts, nor to the rules he has laid down in the diagnosis and treatment of disease founded on the circumstances just mentioned. The susceptibility to syncope is so great in some persons, that we should, I suspect, be often led into error, if we were to infer the absence of inflammation merely from the occurrence of fainting after the loss of a few ounces of blood. Besides, it not unfrequently happens, that a patient faints on the first, but not on the second or third bleeding. I have more than once seen this. Neither do I think it would always be safe to bleed *ad deliquium*, even if we were satisfied that inflammation be present; for in some it is difficult to occasion syncope, although the quantity of blood lost be so great as to endanger the safety of the patient. The practice of Dr. Hall, however, is much to be preferred in this respect to that of Mr. Wardrop (*On Blood-letting*); for, although both recommend bleeding to syncope in inflammation, the former places his patient in the erect, the latter in the recumbent posture. And here I cannot help remarking, that the practice of ordering patients to be bled to syncope in the recumbent posture appears to me a highly dangerous one. That fainting will sometimes occur in the erect position, before a sufficient quantity of blood has been drawn, we all know; and, to prevent this occurrence, it is frequently proper to bleed in the recumbent posture: but I must protest against bleeding patients to *syncope* in this position.

I have yet to notice another class of the general effects of the loss of blood, which may be denominated secondary or remote, and which are in no way useful in the treatment of disease. In some cases excessive reaction occurs, attended with throbbing of the vessels of the brain, pain and disorder of the cerebral functions. Examples of this are seen in women who have suffered severely from uterine hemorrhage. Exhaustion, with insufficient reaction, is another remote effect of loss of blood. In two cases of infants, I have seen this effect consequent on hemorrhage after a leech bite, terminate fatally. Other secondary or remote effects of blood-letting are mentioned: they consist principally in disorder of the sensorial functions, marked by delirium, coma, or even amaurosis. (Dr. M. Hall, *op. supra cit.*)

Having hitherto described the consequences of bleeding generally, I must now refer more particularly to leeching. The constitutional or general effects caused by the application of leeches are best observed in children and delicate females—more especially the former. I have, on several occasions, seen infants completely blanched by the application of one or two leeches. Pelletan mentions the case of a child, six years old, who died from the hemorrhage occasioned by six leeches applied to the chest. Leeching, then, is here, to all intents and purposes, a mode of general blood-letting, arising in part from the powerful influence which a small quantity of blood produces in infants; and secondly, because one leech will cause the loss of more blood in them than in adults, owing to the greater vascularity of the cutaneous system. It is apparent, therefore, that in the diseases of infants, leeching may, in most cases, be substituted for venesection. But in disorders which are rapidly fatal, as croup, opening the jugular vein is undoubtedly to be preferred, since it is necessary to produce an immediate and powerful effect. As children advance in years they become capable of bearing larger evacuations of blood; and, therefore, leeching excites a less influential effect. It is quite impossible to say at what age venesection ought to be substituted, or, in infancy, what number of leeches should be applied; since

they take away such unequal quantities of blood. These are points which must be decided by the practitioner in each case. Here is a tabular statement of the amount of blood which Dr. James Blundell (*Lancet*, Sep. 20, 1828, p. 773) has taken from children at different ages:

Ages.	Quantities.
2 months	1 oz. to 1½ oz.
4 months	1½ oz. to 2 oz.
8 months	2 oz. to 3 oz.
12 months	3 oz. to 4 oz.
18 months	4 oz. to 5 oz.
3 years	8 oz. to 10 oz.
6 years	10 oz. to 12 oz.

But the quantities are exceedingly large, and in most instances greater than it will be found prudent to abstract. Guersent says, that in infants up to two years of age, we ought never to draw more than three or four ounces of blood in twenty-four hours. (On the sensible effects of leeches on man, see Vitet, *Traité de la Sangs. Méd.* 1809.)

2. *The local effects of leeching* must now be noticed. The jaws of the leech may be compared to three saws, each armed with sixty teeth. It is, therefore, not surprising that pain and afflux of blood to the wounded part should be occasioned by the laceration of the skin by a single leech. I have sometimes seen one of these animals produce intense redness to the extent of an inch around the bite. This is best observed when the skin is delicate, as that covering the mammæ of the female. Now when a number of these animals are applied, their united local effects must have some influence over a neighbouring disease. There are also certain topical effects which occur subsequently, such as ecchymosis; the irritation and inflammation of the mouths of the punctures; the diffused redness and the soreness in the parts intervening between the bites, which cannot be without influence over morbid action. They act on the principle of counter-irritation. In taking into consideration the beneficial influence of leeches, we must, therefore, not forget these, nor the fomentations and poultices subsequently employed.

When leeches are applied to the temples, especially if they fix close to the external canthus, a diffused swelling frequently arises, similar to that caused by erysipelas. This is not referrible to any noxious qualities of the animal, for it happens when the finest and most healthy are employed; nor to the teeth of the animal being left within the wound, since I have often seen it when the leech has fallen off spontaneously.

In concluding these remarks on the local effects of leeches, I have only to add, that independently of the local irritation caused by the puncture, I believe the evacuation of blood from an inflamed part may be more beneficial than the same quantity taken by the usual operation of venesection. In other words, I am disposed to admit what were formerly termed the *derivative* effects of local bleeding. The amount of benefit obtained by the application of leeches to parts that have been injured by falls, &c., as in fractures and dislocations, has frequently appeared to me much greater than could be referred to the combined influence of the quantity of blood lost, and the local irritation of the punctures; so, also, with respect to the good effects of leeching hemorrhoidal tumours. Mr. Wardrop thinks more benefit is in some cases obtained by the application of leeches at a distance from the affected organ, constituting what has been termed a *revulsive* operation.

I trust the remarks now offered will be sufficient to prove, that in estimating the therapeutic influence of leeches, the quantity of blood drawn is not the only element in the calculation; and I think, in practice, constant proof will be found that leeching is more beneficial than can be accounted for by the mere quantity of blood drawn.

Uses.—The following are some of the uses of leeches:

1. *In children and delicate adults* (*as females and aged persons*) *leeches often form an excellent substitute for general blood-letting*, where the object is not to occasion any immediate or sudden effect on the disease. In children it is necessary to avoid applying them to the neck, or other parts where compression cannot be conveniently made.

2. *In local determination of blood*, unattended with febrile symptoms, local blood-letting, when it can be resorted to, is generally, though not invariably, preferred to phlebotomy. The advantages of leeching over cupping are, the less pain, and the ease with which blood may be procured; for it is evident that in swelled testicle, in inflammation attending fractured limbs, and in acute inflammation of the mammary gland, patients could not, in most cases, bear the necessary pressure of the cupping-glass; and in some parts of the body, as the abdomen, blood can only be procured from cupping by a very dexterous manipulation.

3. In internal and other inflammatory affections, accompanied with constitutional disorder, the rule is to employ general in preference to local blood-letting. But circumstances occasionally render the reverse practice justifiable and proper, as where the disease is not active, and the patient delicate and weak. In many instances it will be found most advantageous to combine both modes of drawing blood: for example, in *abdominal inflammations*, the application of leeches, preceded by venesection, will sometimes do more good than the same quantity taken by the lancet alone. During the progress of *fever* with determination of blood to the brain, the application of leeches to the temples, after the use of blood-letting, is often attended with the best effects.

4. There are some diseases in which no substitute of equal efficacy can be found for leeches. Such, I conceive, are *hemorrhoidal tumours*, and *prolapsus of the rectum*. In these cases general is not equal to local blood-letting, and cupping is out of the question.

5. *In various organic diseases* leeches will often be found an exceedingly useful palliative means. I would particularly mention as examples, affections of the heart and lungs.

6. Dr. Crampton (*Dublin Hospital Reports*, vol. iii. 1822) recommends the application of leeches to the internal surfaces; as to the conjunctiva in ophthalmia, to the tonsils in cynanche tonsillaris, and to the internal surface of the nostrils in epistaxis. The mode of applying a leech to the tonsils is as follows: pass a single thread of silk through the body of the leech, and make fast the ligature to the finger of the operator: then apply the leech to the part.

There are few diseases in which loss of blood is required, where leeching is positively objectionable; indeed, erysipelas is the only one that can be named. Here it has been supposed that the local irritation caused by leeches would add to the severity of the malady; but I believe that even in this case the objections are more imaginary than real. There are, however, numerous instances in which leeching is negatively objectionable: in some the quantity of blood drawn by these animals is insufficient to make much impression on the disease, as in visceral inflammation of robust persons; in others, where the disease is very rapid and fatal, the effects of leeches are too slow, as in croup. Venesection is the remedy in all these instances.[1]

Mode of applying Leeches.—Let the part be well cleansed (sometimes it may be necessary to shave it): then dry the leeches, by rolling them in a clean linen cloth: place them in the lid of a pill-box, and apply to the affected part. This is a preferable method to applying them by the fingers, or in a wine-glass. A narrow tube (called a *leech-glass*) will be found useful when we wish to affix one of these animals to the inside of the mouth, or any particular spot.

[1] For a more extended account of the uses of leeching, see Dr. R. Price, *Treat. on the Utility of Sanguisuction*, 1822.

Several circumstances influence the fixing of leeches; as the condition of the animal, whether healthy or otherwise; the nature and condition of the part to which it is applied: thus, leeches will not readily attach themselves to the soles of the feet, or the palms of the hands, or to the hairy parts—the presence of grease, vinegar, salt, and some other substances, will prevent them from biting; whereas milk, sugared water, and blood, are said to have the contrary effect. Scarifying the part has been advised to promote their attachment. The condition of the patient also affects the fixing of the animal. Derheims (*Hist. Nat. et Méd. des Sangs.* p. 134, 1825) says that leeches will not bite those under the influence of sulphur, on account of the evolution of sulphuretted hydrogen by the skin. The effluvia, or vapours of the room, as the fumes of tobacco, sulphur, vinegar, &c., will prevent them biting, or even cause them suddenly to fall off.

The quantity of blood a leech is capable of drawing varies considerably. I believe four drachms to be the maximum. On an average I do not think we ought to estimate it at more than one drachm and a half. Of course this has no reference to that lost after the animal has fallen off, and which varies according to the vascularity of the part; in children being oftentimes very considerable. When the leech has had sufficient it drops off; but it is said that if the tail be snipped, the animal will continue to bite, the blood passing out posteriorly as fast as it is taken in by the mouth. I have tried several, but they usually let go their hold the instant the tail is cut. H. Cloquet (*Dict. de Médec.* art. *Sangsue*, p. 83) has made the same remark.

In order to disgorge the leech of the blood, the usual practice is to apply salt to its body; but it is objectionable (if you wish to preserve the animal), since the surface is frequently thereby blistered, and several days elapse ere the creature regains its former activity. Some advise squeezing the blood out by the mouth; others the application of diluted vinegar to the head. If no kind of emetic be employed, the blood remains for a considerable time in the stomach of the leech undigested, but without putrefying.

After-treatment.—When leeches have fallen off it is generally desirable to promote the sanguineous discharge. This is best done by the use of warm fomentations or cataplasms; or even, in some cases, by cupping-glasses. Great caution is necessary in the case of children. Some years since, the application of a leech was ordered to the chest of a child labouring under pneumonia; it was at the same time mentioned that the bleeding should be encouraged. The directions were literally fulfilled—the discharge of blood was assiduously promoted—until so large a quantity had been lost, that death was the result. No attempt was made to stop it, nor notice sent to the Dispensary, in the practice of which the case occurred. The child being illegitimate, and the mother evidently careless of its recovery, led some to suspect that this did not take place through mere ignorance. In another instance, two leeches were ordered for a child aged about eighteen months, suffering with pneumonic inflammation, a consequence of measles. The following day the poor little creature was found in a fainting, or rather dying, state, with face and lips completely blanched. On inquiry it appeared the leech-bites were still bleeding, and no attempt had been made to stop the discharge, the mother thinking it would be beneficial, more especially as the pneumonic symptoms had considerably abated. As predicted, the little sufferer died within twenty-four hours.

In some persons there appears to be an hereditary predisposition to hemorrhage, so that very slight wounds are attended with serious and even fatal effects. Mr. Wilson, quoted by Mr. Wardrop, (*op. supra cit.* p. 13,) has related the case of a child where one leech had nearly caused death, by the serious hemorrhage. When about three or four years old, this child bit its tongue, and notwithstanding that every attempt was made to stop the discharge, death took place from the loss of blood.

I have been called to many cases of hemorrhages after leech-bites, and never failed in stopping it by compression. Sometimes mere exposure to the air will be sufficient; or, if this fail, we may apply a dossil of lint and a bandage. In other instances this will not succeed. I usually employ compression, thus: roll a piece of lint into a fine cone, and introduce it into the bites by means of a needle or probe; over this lay a compress and bandage. Sponge may be substituted for the lint. Various other modes have been proposed; some, I think, exceedingly cruel, since I do not believe them ever necessary. I allude, now, to the application of a red-hot needle; and to passing a needle through the orifice, and wrapping thread round, just as a farrier stops the discharge of blood from the vein of a horse. Some employ absorbing powders, as gum arabic; or styptic washes, as a saturated solution of alum. One very effectual means is to apply a stick of lunar caustic scraped to a point, or powdered nitrate of silver. Sir Charles Bell, in one case, stitched up the wound.

Accidents from Leeches in the Mucous Cavities.—The ancients were very apprehensive of the ill consequences likely to arise from swallowing leeches. That their fears were not groundless is proved from the following circumstances, related by the celebrated Baron Larrey. When the French army entered upon the deserts which separate Egypt from Syria, the soldiers, pressed by thirst, threw themselves on their faces, and drank greedily of the muddy water, and which, unknown to them contained leeches (*Sanguisuga ægyptiaca*), having the form of a horse-hair, and the length of a few lines only. Many of them felt immediately stings, or prickling pains, in the posterior fauces, followed by frequent coughs, glairy spots, slightly tinged with blood, and a disposition to vomit, with a difficulty of swallowing, laborious respiration, and sharp pains in the chest, loss of appetite and rest, attended with great uneasiness and agitation. On pressing down the tongue of the individual first attacked, a leech was discovered, which was with difficulty removed by the forceps. Little or no hemorrhage followed, and the patient recovered. Those which had attached themselves to the posterior fauces were removed by the use of gargles composed of vinegar and salt-water. The Chief of Brigade, Latour-Mauberg, commander of the 22d regiment of chasseurs, swallowed two in the deserts of St. Makaire, a day's journey from the Pyramids, which so much weakened him, that his convalescence was long and difficult.

Derheims (*op. supra cit.* p. 140) relates a case where a young man, who had leeches applied to his anus, was so unfortunate as to have one enter his rectum unnoticed. The animal made several punctures; and was not expelled until some hours after, when salt-water injections were used. The wounds caused by the bites, however, did not heal for several months, during which time the patient suffered considerably, and constantly passed blood with the fæces.

Whenever practicable, salt-water injections should be resorted to. In the following cases related by Derheims (page 140) this practice could not be adopted. Two small leeches were applied to the gums of an infant during the period of dentition, and by the inattention of the nurse they fixed themselves at the back part of the mouth, and, becoming gorged with blood, caused great difficulty of respiration. The infant, by strongly closing the jaws, prevented the removal of the animals, who only ceased their hold when they were filled with blood. The hemorrhage continued for two hours.

Ill effects have resulted from swallowing leeches. A lady accidentally swallowed a leech she was applying to her gums. Acute cardialgia soon came on with a feeling of erosion, and creeping in the interior of the stomach; sometimes convulsive movements in the limbs and muscles of the face; frequency and irregularity of the pulse; universal agitation and paleness of the countenance. The physician who was called in, recollecting the fact ascertained by Bibiéna, that leeches could not live in wine, administered half a glass every quarter of an

hour. The symptoms were soon alleviated; and the fourth dose caused vomiting, by which the dead leech was evacuated, with much glairy matter, mixed with clots of black blood. By a proper subsequent treatment the patient recovered in eight days. (*Recueil périodique.*)

Class VI. *INSECTA*, Goldfuss.—*INSECTS.*

Essential Characters.—*Articulated* animals with six *feet* (*hexopoda*), one pair of *antennæ*, *a dorsal vessel* for circulation, respiring by *tracheæ*, and undergoing *metamorphosis* (being successively *ovum*, *larva*, *pupa*, and *imago*). *Head* distinct from the thorax.

Order I. COLEOPTERA, *Linnæus.*—BEETLES.

Essential Characters.—Four *wings*, of which the two upper or anterior (*elytra* or *wing cases*) are horny or leathery, united down the back by a straight suture; lower or posterior wings folded longitudinally. *Mandibles* and *jaws* for mastication.

CAN'THARIS VESICATO'RIA, *Latreille, L. E. D.*—THE BLISTER BEETLE OR SPANISH FLY.

Lytta vesicatoria, *Fabricus.*—Meloë vesicatorius, *Linnæus.*

(The whole fly, *E.*)

(Cantharis, U. S.)

History.—Hippocrates employed in medicine an insect which he calls (χανθαρὶς), whose effects were similar to those of our *Cantharis vesicatoria*. Hence it has been erroneously inferred by some writers that our blistering beetle is identical with that employed by the ancients. That this inference is incorrect is proved by the following facts. In the first place, many beetles agree in their effects on the system with those of Cantharis vesicatoria; secondly, the word χανθαρὶς merely signifies *a small beetle* or *scarabæus parvus;* thirdly, both Dioscorides (lib. ii. cap. 65) and Pliny (*Hist. Nat.* lib. xxix. cap. 30, ed. Valp.) refer to several kinds of *cantharides*, but remark that the most powerful are those with transverse yellow bands on the wings, and that those which are homogeneous in colour are weak and inert. It is tolerably clear, therefore, that neither of these ancient writers were acquainted with Cantharis vesicatoria. Now the characters assigned to the ancient blistering insect agree precisely with those of two species of *Mylabris*. Burmeister (*Man. of Entomol.* by Shuckard, p. 562, 1836) suggests that *Mylabris Füsselini*, a native of the south of Europe, was the species used by the ancients. *Mylabris Cichorii* is employed as a blistering beetle at the present day in China and some parts of Hindostan, and may, perhaps, have been used by the Greeks and Romans.

Zoology. **Gen. Char.**—*Antennæ* elongate, simple, filiform. *Maxillary palpi* with terminal joint somewhat ovate. *Head* large, heart-shaped. *Thorax* small, rather quadrate, narrower than the elytra, which are as long as the abdomen, soft, linear, the apex slightly gaping. *Wings* two, ample (J. F. Stephens). (*Man. of Brit. Coleopt.* p. 334, 1839.)

Sp. Char.—Bright glossy brass-green or bluish, glabrous; beneath more glossy, with a few hairs. *Breast* densely pubescent, finely punctured. *Head* and *thorax* with a longitudinal channel. *Elytra* with two slightly raised lines. *Tarsi* violaceous. *Antennæ* black, with the basal joint brassy (J. F. Stephens).

Form elongated, almost cylindrical. *Length* six to eleven lines. *Breadth* one to two lines. *Colour* brass or copper green. *Odour* nauseous, unpleasant. *Body* co-

Fig. 257.

Cantharides.

vered with whitish gray hairs, which are most numerous on the thorax. *Head* large, subcordate, with a longitudinal furrow along its top. *Eyes* lateral, dark brown. *Thorax* not larger than the head, narrowed at the base. *Elytra* from four to six lines long, and from 3-4ths to $1\frac{1}{2}$ lines broad; costa slightly margined. *Wings* ample, thin, membranous, veined, transparent, pale brown; tips folded. *Legs* stout, from four to six lines long, the hinder ones longest; *tibiæ* clavate, in the female all terminated by two small moveable *spurs;* in the male the two hinder pairs of extremities alone have this arrangement, the anterior ones having but one spur; last joint of the *tarsi* with a pair of bifid claws. *Abdomen* soft, broadest in the female. In the female, near the anus, are two articulated, caudal appendages.

The *internal organization* of these animals has been elaborately studied by Audouin (*Ann. des Scienc. Nat.* t. ix. p. 31,) and by Brandt. (*Med. Zool.* ii.) The Nervous System consists of a cerebro-spinal axis, and a double and single sympathetic system. The *cerebro-spinal axis* consists of a double nervous cord, and nine ganglia (two cephalic, one of which is the brain, three thoracic, and four abdominal). The *single sympathetic system* commences at the brain by two branches, which unite at the ganglium frontale, from which a single nerve proceeds along the œsophagus to the stomach, where it divides into two, forming at its division a small ganglion. The *double sympathetic system* consists of four ganglia placed on the œsophagus, two on either side of the single nervous cord just described, with which, as well as with the brain, they are connected by nervous twigs. The Vascular System consists of *a simple pulsating dorsal vessel*, which extends from the head to the extremity of the abdomen. The Respiratory System consists of ten pair (three thoracic, seven abdominal) of stigmata, which open into the tracheæ. The Digestive System consists of the *mouth*, which terminates in the *pharynx*. The latter contracts into a long muscular *œsophagus*, which ends in an elongated fusiform *stomach*. The latter is marked transversely by bands formed by the muscular coat. Between the stomach and intestine is a *valve* (pylorus) formed by four small, floating, kidney-shaped bodies. The *small intestine* forms two curvatures, and then proceeding directly backwards terminates in the swollen *cæcum*, which ends in the very short narrow *rectum*. The *biliary vessels* consist of six very long, filiform, convoluted tubes, which terminate anteriorly at the stomach near the pylorus, and posteriorly at the intestine near the cæcum. The Sexual System of the Male consists of a pair of spherical *testicles*, having externally a granulated appearance; two *vasa deferentia*, which have a ringed appearance; three or four pair of tubes (*seminal vesicles* or *epididymoid vessels*), the functions of which are imperfectly known; a *common spermatic duct;* and a *penis* which has three barbs or *hooks* at its extremity, and is enveloped by a *sheath*. The Female Organs consist of two large, hollow, egg-shaped *ovaries*, the cavities of which are called *calyces*. On their external surface is an immense number of pyriform *egg tubes*. From each ovary or calyx arise an *oviduct*, and the two oviducts by their junction form the *common oviduct*, the lower portion of which is called the *vagina*. Into the common oviduct passes a *tube* from a vesicular bag, called *spermatheca* (*vesicule copulatrice*, Audouin), and also of other *appendages* (*sebaceous glands*, Audouin).

I must refer to Audouin's paper for an amusing account of the amours of these animals.

Hab.—Europe, originally, perhaps, a native of the southern parts, especially Italy and Spain. Now found in France, Germany, Hungary, Russia, Siberia, and England. With us they are rare. In the summer of 1837 they were abundant in Essex and Suffolk. (Westwood, *Intr. to the Mod. Classif. of Insects*, vol. i. 1839.) They are found on species of *Oleaceæ* (as the ash, privot, and lilac,) and of *Caprifoliaceæ* (as the elder and Lonicera).

Mode of catching Cantharides.—In the south of France these animals are caught during the month of May, either in the morning or evening, when they are less active, by spreading large cloths under the trees, which are then strongly shaken, or beaten with long poles. The catchers usually cover their faces, and guard their hands by gloves. (Richard, *Dict. des Drog.* i. 550.) Various methods have been recommended for killing the insects; such as exposing them to the vapour of vinegar, (the practice mentioned by Dioscorides,) or of hot water, or of spirit of wine, or of the oil of turpentine. Geiger states, that if destroyed by dropping oil of turpentine into the bottle in which they are contained, they are not subject to the attack of mites; but I believe they are more frequently destroyed by immersing the cloths containing them in hot vinegar and water, and then drying on hurdles covered with paper or cloths.

Preservation.—Cantharides should be preserved in well-stoppered bottles,

and to prevent them from being attacked by mites (*Acarus domesticus*), a few drops of strong acetic acid should be added to them. I have found this a most successful mode of preservation. Besides mites, they are subject to the attacks of a moth (*Tinea flavifrontella*) and two coleopterous insects (*Anthrenus muscorum* and *Hoplia farinosa*).

Commerce.—Cantharides are imported from St. Petersburgh, in cases, each containing 160 or 170 lbs.; and also from Messina, in barrels or cases, holding each about 100 lbs. They are principally brought over towards the end of the year.

In 1839, duty (1s. per lb.) was paid on 16,376 lbs.

The cantharides from St. Petersburgh are the largest and most esteemed. They are somewhat more copper-coloured than the French or English varieties, which have rather a brassy than copper tint. Sir James Wylie (*Pharmacopœia Castrensis Ruthenica*, p. 243, Petropoli, 1840) states that they are very abundant in the southern provinces of Russia.

Characteristics for Medico-legal purposes.—There are no *chemical tests* for cantharides to be relied on. Orfila (*Toxicol. Gén.*) has published the effects of various reagents on tincture of cantharides; but they are unimportant. Cantharides are rarely met with in a sufficiently perfect form to enable us to recognise them by their *zoological characters*. Their *physical characters* are much more important. In all powders of cantharides you may distinguish golden green particles; these may be separated from the other contents of the stomach by immersing them in boiling water: the fatty matter rises to the surface, while the cantharides powder falls to the bottom. Orfila has recognised these particles in a body nine months after interment; so that they do not readily decompose, even when mixed with decaying animal matters. Some other insects, however, have the same golden-green colour, but are without vesicating properties; and *vice versâ*, there are many insects which vesicate, but which have not a golden-green colour. The physical characters of the particles, aided by their *physiological effects*, together form tolerably conclusive evidence of the presence of cantharides. To judge of the effects of cantharides, and their preparations, we should proceed as follows:—If the suspected matter be a liquid, evaporate it to the consistence of an extract; then digest in repeated quantities of sulphuric ether. The etherial solutions are to be mixed, and allowed to evaporate in the air: the vesicating properties of the residuum may be determined by applying it to the inside of the lip or to the arm. If the suspected matter contain solid particles, these are to be digested in ether, and the concentrated tincture applied to the inner surface of the lip. (See *Ann. d'Hygiène Publique*, 1835, xiii. p. 455.) Dr. Hastings (*Trans. of the Provin. Med. and Surg. Assoc.* vol. i. p. 402) has published an interesting fatal case of inflammation of the alimentary canal and urinary organs. The symptoms simulated those caused by excessive doses of cantharides; but the moral and other evidence seemed to negative the suspicion that these insects had been taken.

Adulteration and Goodness.—The goodness or quality of cantharides may be recognised by their odour, and freedom from other insects, especially mites. Sometimes the powder, but more commonly the plaster, is adulterated with powdered euphorbium. I have been informed, by persons well acquainted with the fact, that it is a common practice, amongst certain druggists, to mix one pound of euphorbium with fourteen pounds of powdered Spanish flies.

Composition.—Cantharides were analysed in 1803 by Thouvenal, (*Ann. de Chim.* xlvii. 230,) in 1804 by Beaupoil, (*Ibid.* xlviii. 29,) and in 1810 by Robiquet. (*Ibid.* lxxvi. 302.)

Thouvenal's Analysis.

Watery extract	37·50
Subsequent alcoholic extract	10·42
Subsequent etherial extract	2·08
Insoluble residuum	50·00
Total	100·00

Beaupoil's Analysis.

Black matter insoluble in alcohol, but soluble in water	12·94
Yellow matter soluble in water, alcohol, and ether	12·94
Green oil soluble in alcohol and ether	13·99
Parenchyma, salts, and oxide of iron	60·13
Phosphoric acid	?
Total	100·00

Robiquet's Analysis.

1. *Cantharidin.*
2. Green fatty oil, soluble in alcohol.
3. Fatty matter, insoluble in alcohol.
4. Yellow viscid substance, soluble in water and alcohol (osmazome ?)
5. Black matter, soluble in water, insoluble in alcohol.
6. Yellow matter, soluble in ether and alcohol.
7. Free acetic and uric acids.
8. Phosphate of lime, and phosphate of magnesia.

Cantharis vesicatoria.

1. Cantharidin (*Vesicatorin; Cantharides-Camphor*).—Has been found in *Cantharides vesicatoria*, *Lytta vittata*, *Mylabris Cichorii*, and other vesicating insects. Probably exists in all the blistering beetles. To procure it, concentrate an alcoholic tincture (prepared by percolation) and set aside: the cantharidin slowly crystallizes. It is purified by washing with cold alcohol, and boiling with alcohol and animal charcoal. Its properties are as follows:—It crystallizes in the form of micaceous plates, which are fusible, forming a yellow oil, which by a stronger heat is vaporizable, forming white vapours: these subsequently condense into acicular crystals of cantharidin. Dana regards it as an organic alkali, but without any just grounds; for it will not restore the blue colour of litmus paper reddened by an acid. Gmelin's opinion, that it is a solid volatile oil, seems to be correct. When isolated, it is not soluble in water, but becomes so by combination with the other constituents of cantharides; the yellow matter probably being the principal agent in rendering it so. This, then, is the reason why an aqueous infusion of the insects contains cantharidin in solution. Cold spirit, digested on cantharides, extracts cantharidin; which it can only do by the agency of some of the other principles of the flies. It is easily soluble in ether, oils (volatile and fixed), and hot spirit of wine; and from the latter it separates as the liquid cools. Concentrated boiling sulphuric acid dissolves cantharidin: the solution is slightly brown; when diluted with water it deposits small needle-like crystals of cantharidin. Boiling nitric and muriatic acids dissolve it without changing colour; the solutions, by cooling, deposit it. Cantharidin is dissolved by potash and soda; but when concentrated acetic acid is added to the solution, the cantharidin is precipitated. Ammonia is without action on it. According to Regnaud, it consists of *carbon*, 61·68; *hydrogen*, 6·04; and *oxygen*, 32·28.

Robiquet thus describes the effects of cantharidin:—The 1-100th part of a grain, placed on a slip of paper and applied to the edge of the lower lip, caused, in about a quarter of an hour, small blisters. A little cerate being applied served only to extend the action over a larger surface, and both lips were in consequence covered with blisters. Some atoms of cantharidin, dissolved in two or three drops of almond oil, were rubbed over a small piece of paper, and applied to the arm; in six hours a blister was formed, the size of the paper. The volatility of cantharidin at a comparatively low temperature, and the action of the vapour on the conjunctival membrane, are shown by the accident which happened to one of Robiquet's pupils, who was watching its crystallization, and felt acute pain in the conjunctiva, which was followed by inflammation, accompanied with small phlyctenæ and loss of sight for several days. Robiquet, who was not so near the liquid, suffered but slightly. I have suffered once in preparing this substance. I applied one drop of an etherial solution of impure cantharidin to the inside of the lower lip; but immediately afterwards, repenting of my temerity, I wiped it carefully off. In about an hour a blister had formed on the inside of the lip, and it was five or six days before the part had completely healed. Bretonneau, in his experiments on animals, has not found any marked aphrodisiac effect produced by cantharidin. He found that it rendered the circulation slower, and caused fatal lethargy.

2. Volatile Odorous Oil?—Orfila asserts, that volatile odorous oil is one of the constituents of the insects. The distilled water of cantharides is strongly odorous and milky; and its vapour affects the eyes and kidneys like cantharides.

The active and odorous principles of cantharides reside principally in the sexual organs of the animals. Both Farines and Zier tell us, that the soft contain more active matter than the hard parts. It appears, also, that the posterior is much more acrid than the anterior portion of the body; and Zier says the ovaries are particularly rich in this active matter. If so, it is evident that we ought to prefer large female to male insects. It is a well known fact, that the odour of these animals becomes much more powerful at the season of copulation than at other periods; and that persons sitting under the trees in which these insects are, at this season more particularly, are very apt to be attacked with ophthalmia and ardor urinæ.

Physiological Effects. *a. On Animals.*—The principal experiments

with cantharides on animals (dogs) are those of Orfila (*Toxicol. Gén.*) and Schubarth. (Wibmer, *Wirk. d. Arzneim. u. Gifte*, Bd. iii. S. 262.) It results from their investigations, that these insects cause violent inflammation in the parts to which they are applied, and an affection of the nervous system (spinal cord principally). Injected into the jugular vein, the oleaginous infusion caused tetanus; introduced into the stomach, the œsophagus being tied, the tincture produced insensibility (Orfila). Inflammation of the inner coat of the bladder was observed when the poison had remained in the stomach for a few hours before death.

β. On Man.—The topical effects of cantharides are those of a most powerful acrid. When these insects are applied to the *skin*, the first effects noticed are, a sensation of heat accompanied by pain, redness, and slight swelling. These phenomena are soon followed by a serous effusion between the corium and epidermis, by which the latter is raised, forming what is commonly termed a *blister*, or, in the more precise language of the cutaneous pathologist, an *ampulla* or *bulla*. The effused liquid has a pale yellow colour, with a very feeble taste and smell. Two analyses of it have been made:

Analysis by Dr. Bostock.

Albumen	6·00
Uncoagulable matter	0·14
Salts	1·00
Water	92·86
	100·00

Analysis by Brandes and Reimann.

Albumen	5·75
Animal matter, with muriate of ammonia, potash salts, carbonate, lactate, muriate and sulphate of soda	0·26
Water	93·99
	100·00

If the cuticle be removed, the subjacent corium is seen intensely reddened, and, by exposure to the air, oftentimes becomes exceedingly painful. If irritants be applied, a secretion of pus takes place, and sometimes a whitish-looking false membrane is formed. Long-continued irritation occasionally causes tubercular granulations. Not unfrequently I have noticed ecthymatous pustules around the blistered surface; and in one remarkable case, which fell under my notice, the whole body, but more especially the pectoral region (to which the blister had been applied), was covered with them. Sometimes the vesicles of eczema occur. Ulceration and gangrene are not uncommon: the latter effect is occasionally observed after exanthematous diseases, especially measles. I have seen death result therefrom in two instances. The constitutional symptoms frequently produced are excitement of the vascular system (as denoted by the increased frequency of pulse, heat of skin, and furred tongue), and irritation of the urinary and genital organs (marked by heat and pain in passing the urine, which is usually high coloured, or there may be complete suppression). It not unfrequently happens, that the part to which a blister has been applied remains considerably darker coloured than the surrounding skin. Rayer states, that the disappearance of these discolorations is hastened by the use of sulphurous baths.

When swallowed, cantharides act topically on the *gastro-intestinal membrane;* in poisonous quantities they excite inflammation of the mucous lining of the alimentary canal, with constriction and difficulty of swallowing, which is sometimes so great, that not a particle of fluid can be got into the stomach without the most inexpressible anguish; violent burning pain, nausea, vomiting, frequently of bloody matters, sometimes with flakes like the inner lining of the alimentary tube, and great tenderness to touch. These phenomena sufficiently indicate the gastric inflammation. Ptyalism is not an uncommon occurrence. The enteritic symptoms are, abundant and frequent evacuations, sometimes of blood, with horrible griping and burning pain, and exquisite sensibility of the abdomen.

The *volatile odorous matter* evolved by these insects is a local irritant; for it causes itching and even inflammation of the eyelids and conjunctiva, irritation of the air-passages, marked by epistaxis, convulsive sneezing, &c. If it be in-

haled, as is done when persons sit under trees on which the animals are found, or by breathing the vapour of the decoction of cantharides, an affection of the urinary organs may be brought on. The same remote effects may also be excited by blisters, by handling the insects, by applying them to wounds, by swallowing them, or by injecting solutions of their active principle into the veins. We may classify the *remote effects* of cantharides into those observed in the urino-genital, the nervous, and the vascular systems.

αα. *Action on the urino-genital system.*—The pain in the loins, and the alteration in the quantity and quality of the urine, are the symptoms indicative of the inflamed condition of the kidneys. The burning pain and tenderness in the hypogastric region, and the constant desire to pass the urine, with the inability of doing so except drop by drop, are evidences of the vesical inflammation. The action on the genital organs in the male is proved by priapism, which is sometimes accompanied by satyriasis, sometimes not; and by the occasional inflammation and mortification of the external organs. In the female, the action on the sexual system is shown by the local heat and irritation, and by the occasional occurrence of abortion.

ββ. *Action on the nervous system.*—The affection of this system is proved by the pain in the head, disordered intellect, manifested in the form of furious or phrenitic delirium, convulsions of the tetanic kind, and subsequently coma. It is deserving of especial notice, that sometimes several days elapse before the nervous symptoms show themselves: thus, in a case related by Giulio, they appeared on the third day; in another instance, mentioned by Graaf, on the eighth; and in a case noticed by Dr. Ives, they were not observed until the fourteenth day. (See Christison, *Treat. on Poisons.*)

γγ. *Action on the vascular system.*—The pulse becomes hard and frequent, the skin hot, and the respiration quickened; diaphoresis is occasionally observed.

The susceptibility to the influence of cantharides is by no means uniform. Werlhoff mentions the case of a lad who used to be attacked with priapism and involuntary emission by merely smelling the powder. Amoreux says, in one case a pinch of the powder caused death; while in another a spoonful occasioned only slight heat in the throat and ardor urinæ. Dr. Hosack has mentioned an instance in which a man took nearly six ounces of the tincture with the view of self-destruction, yet no dangerous symptoms followed. In contrast with this, I may instance a case that came within my own knowledge, where one ounce of the tincture produced serious symptoms. Orfila has seen twenty-four grains of the powder prove fatal.

1. *Action in small or medicinal doses.*—In very small quantities there are no obvious effects. If we increase the dose, a sensation of warmth is felt in the throat, stomach, and respiratory passages, with increased secretion from the alimentary tube. By continued use, a tickling or burning sensation is experienced in the urethra, with frequent desire to pass the urine, which may or may not be altered in quality and quantity. In some cases diuresis is observed, in others not: in the latter the urine is generally higher coloured than usual. Occasionally the sexual feelings are excited.

2. *Action in larger doses: Subacute poisoning.*—The symptoms are, heat in the throat, stomach, intestines, and respiratory passages; pain in the loins, burning sensation in the bladder, with frequent desire to evacuate the urine, which is sometimes bloody, and passed with difficulty. Painful priapism, with or without satyriasis. Pulse more frequent, skin hot, and the respiration quickened: the nervous system is frequently excited.

3. *Action in still larger doses: Acute poisoning.*—The symptoms observed are, in part, common to other irritant poisons; in part peculiar to the vesicating insects. Violent burning pain in the stomach, with exquisite sensibility and constant vomiting; extreme thirst, dryness, and fœtid odour of the mouth, and not unfrequently ptyalism. Burning pain and spasmodic contraction of the

bladder, giving rise to the most excruciating agony. Notwithstanding the incessant desire to void urine, nothing but drops of blood are passed, and with great pain. The constriction of the throat and difficulty of deglutition are most distressing and alarming: the unfortunate sufferer is constantly tormented with violent gripings, purging, generally of blood, extreme tenderness of the whole abdominal surface, faintings, giddiness, convulsions, and an almost hydrophobic aversion to liquids, with delirium terminating in coma.

The mode, and the immediate cause of death, are various: sometimes the nervous symptoms kill before gangrene makes its appearance; but more usually the patient dies from inflammation and subsequent mortification of the alimentary tube or of the genital organs.

Post-mortem appearances.—On opening the bodies of persons poisoned by cantharides, inflammation and its consequences have been observed in the alimentary tube, and the urinary and genital organs. The cerebral vessels have been found in a congested state. It is deserving of notice that inflammation of the urino-genital organs is more likely to be met with in patients dying within a few days after poisoning.

Uses.—Hippocrates used vesicating insects (under the name of cantharides) internally; but the practice was subsequently regarded as dangerous; and, so lately as the year 1693, the President of the College of Physicians committed Dr. Groenvelt to Newgate for daring to employ them!![1]

1. *Local Uses.*—Cantharides are frequently used as topical agents; sometimes as stimulants, sometimes as rubefacients, at other times as vesicants.

α. To stimulate topically.—Tincture of cantharides with water (in the proportion of three or four drachms of the tincture to a pint of water) has been employed *to stimulate ulcers;* more especially sinuses and fistulous sores. It is said, on the same principle that stimulant and irritant applications are made to the eye in ophthalmia; that is, to excite a new action, which shall supersede the old one. Matthew's once celebrated injection for fistula *in ano* is a wash of this kind. (Dr. Paris, *Pharmacologia.*) In *alopecia* or *baldness*, when this is not the result of old age, unguents of cantharides have been employed to promote the growth of hair. Powdered cantharides have been advised as an application *to the parts bitten by rabid animals.*

β. To produce rubefaction.—For this purpose the tincture may be mixed with soap or camphor liniment; or, when it is desirable to limit the effect to a particular spot, and especially if friction be objectionable, the common blistering plaster may be applied, allowing it to remain in contact with the part for an hour or two only. Rubefacient liniments are employed to *excite the sensibility of the skin in numbness and paralysis;* as also *to promote local irritation in neuralgic and rheumatic pains.* In the *inflammatory affections of children* it will be occasionally found useful to employ the plaster as a rubefacient merely.

γ. To excite vesication.—A considerable number of substances (mineral, vegetable, and animal) cause vesication when applied to the skin. Horse-radish, mezereon, liquor ammoniæ, and acetic acid, may be mentioned as examples. To these may be added heat, applied in the form of hot water, or a hot metallic plate. For facility of application, certainty of effect, and slightness of pain, no agents are equal to cantharides, and these are now almost solely used.

It was formerly supposed that the efficacy of blisters was in proportion to the quantity of fluid discharged. But the truth is, that the therapeutic influence is in proportion to the local irritation, and has no more relation to the quantity of fluid discharged, than that the latter is frequently (not invariably) in the ratio of the former. Stoll's axiom is, therefore, correct:—"Non suppuratio sed stimulus prodest." As to the precise manner in which blisters, or, indeed, any

[1] Groenvelt, *De tuto Cantharidum in Medicina Usu interno*, 12mo. Lond. 1698; Greenfield, *Treatise on Cantharides*, transl. by Martin, 1706.

remedies, influence diseases, we are quite in the dark. We are accustomed to refer their operation to the principles of counter-irritation (see vol. i. p. 153). I must refer those who feel interested in the question whether blisters ought to be applied in the neighbourhood of, or at a distance from, the affected part, to a paper by Barthez, in the *Recueil de la Société Médicale de Paris*. In this country we generally apply them near to the morbid part; to which practice Barthez assents, with some exceptions.

We employ blisters in inflammatory diseases, both acute and chronic; in the former, however, preceding their use by blood-letting. In chronic inflammatory disease we often employ what is termed a perpetual blister—that is, the cuticle is removed, and the blistered surface dressed with savine or cantharides ointment. This practice is advisable in chronic diseases of the chest, of the joints, of the eyes, &c. Blisters are sometimes useful in erysipelas; thus to localize the disease when disposed to spread, and as a revulsive, applied to the feet, in erysipelas of the head. A blister to the perineum has been sometimes found beneficial in gleet.

It is hardly safe to apply blisters to children immediately after exanthematous diseases, sloughing being not an unfrequent result. If it be required to produce in them counter-irritation, the best plan is to dilute the common blistering plaster, by mixing it with three times its weight of soap cerate. I have seen this compound frequently employed, but never observed any unpleasant results from it. Another plan, sometimes adopted, is to apply a common blister, for an hour or two only, so that it shall merely produce rubefaction.

2. *Remote uses.*—These will require examination under distinct heads, according to the particular object we have in view in employing cantharides.

α. To act specifically on the urinary organs.—In *dropsy* they have been used to excite diuresis, though they frequently fail in producing this effect.—In *diabetes*, cantharides have been employed, but without apparent benefit. In *paralysis of the bladder* they are frequently useful, when there are no marks of local irritation. Two opposite conditions may be the result of paralysis of this organ; namely, retention or incontinence of urine. The latter condition is not unfrequently met with in children, and is very likely to be relieved by cantharides. It is usually stated that they are particularly serviceable in that species of incontinence which occurs during sleep only; but I have seen them cure the disease during day, and fail in giving relief at night. The case alluded to was that of a boy, 14 years old, who had been subject to incontinence of urine since his infancy. He was a robust lad, and apparently in the most perfect health. I put him under the influence of gradually increased doses of tincture of cantharides, and within two months he was enabled to retain his urine by day, but it still passed involuntarily at night; and, though he continued the remedy for a considerable time, no further benefit was obtained. In incontinence of urine which occurs after lingering labours, from the long-continued pressure of the child's head, cantharides are sometimes serviceable. But their use must not be commenced until all the symptoms of local irritation have subsided.

β. To act on the organs of generation.—In consequence of the specific stimulus communicated by cantharides to the bladder, it has been supposed that the same influence might be extended to the uterus; and thus these insects have been employed *as stimulating emmenagogues*, in some cases with apparent benefit, but frequently without any obvious effect. Abortion has occasionally happened from their employment, as I have myself witnessed in one case.

Cantharides are also employed as *an aphrodisiac*, both in man and other animals (as horses, heifers, and asses). In man, if given in sufficient quantity to affect the sexual feelings, it endangers the patient's safety. Most of the cases in which we are requested to administer aphrodisiacs, will be found on examination, to require moral rather than pharmacological treatment. *In discharges from the genital organs*, beneficial effects are frequently obtained by the internal

use of cantharides. In gleet it has been often found serviceable. Mr. Roberton (*Pract. Treat. on the Powers of Cantharides*, 1806) explains their efficacy by saying, that they excite a mild inflammatory action on the urethra (shown by the discharge becoming thick, opaque, and puriform), which supersedes the previous morbid one. I have frequently found equal parts of tincture of chloride of iron and tincture of cantharides a successful combination in old-standing gonorrhœas. The dose is twenty drops at the commencement.

γ. *In chronic skin diseases.*—Pliny states that cantharides (*Mylabris*) were employed in a disease which he terms lichen. At the present time, tincture of cantharides is not unfrequently employed in *lepra*, *psoriasis*, and *eczema*. Having found other remedies very successful in lepra and psoriasis, I have rarely had occasion to try cantharides; but Rayer (*Diseases of the Skin*, translated by Dr. R. Willis) says, "Of all the energetic and dangerous remedies that have been used in lepra, the tincture of cantharides is, perhaps, that which has the most remarkable influence over the disease. The great objection to its employment is its liability to excite inflammation in the digestive organs and urinary passages, especially among females, which necessitates the immediate suspension, and occasionally the entire abandonment, of the medicine." Biett has found it successful in chronic eczema, as well as in the scaly diseases.

δ. *In diseases of the nervous system*, cantharides were at one time in great repute. The cases in which they were employed were hydrophobia, epilepsy, chorea, tetanus, and mania. Experience has shown that they deserve little attention in any of these complaints.

ε. *In obstinate sores*, Mr. Roberton recommends cantharides on the same principle that he uses them in gleet.

Administration.—*Powdered* cantharides are not frequently employed internally. The dose is one or two grains in the form of pill. The *tincture* is the safest preparation, and should, therefore, always be preferred.

Antidote.—In poisoning by cantharides, remove the poison as speedily as possible from the stomach. If sickness have not commenced, this may be effected by the stomach-pump, emetics, or tickling the throat (see treatment of poisoning by Opium, p. 710). Assist the vomiting by mucilaginous and albuminous demulcent liquids,—as linseed-tea, milk, white of egg, with water, &c. No chemical antidote is known. Oil was at one time thought to be an excellent remedy; but since the discovery of its being a solvent for the cantharidin, suspicion has been entertained that it is calculated to increase, rather than decrease, the patient's danger. This theoretical and plausible objection, first broached, I believe by Pallas, seems supported by experience. Orfila found that cantharides macerated in cold oil, and afterwards given to dogs, killed them in a few minutes; and Dr. Christison says, "The case mentioned in the Genoa Memoirs was evidently exasperated by the use of oil." I confess, however, I think farther experience is required to determine the hurtful consequences of employing oil; for, —as the editors of the "*Dictionnaire de Matière Médicale*" very properly observe,—on the same principles that oil is prohibited mucilaginous drinks ought also to be proscribed, since cantharidin aided by the yellow matter, dissolves in water; and on the other hand, oil, in some cases, has appeared to be beneficial. To counteract the effects of cantharides, blood-letting, both general and local, opium, and the warm-bath, must be resorted to. Camphor was at one time highly esteemed for counteracting the effects of cantharides (see p. 249). Oleaginous and mucilaginous injections into the bladder are recommended to relieve the vesical symptoms.

1. ACETUM CANTHARIDIS. (*Epispasticum,*) L. *Acetum Cantharidis*, E. *Vinegar (epispastic) of Cantharides.* (Cantharides, rubbed to powder, ℥ij.; Acetic Acid, Oj. Macerate the Cantharides with the acid for eight days, occasionally shaking: lastly, express and strain, *L.*—"Cantharides, in powder, ℥iij.; Acetic Acid, f℥v.; Pyroligneous Acid, f℥xv.; Euphorbium, in coarse powder, ℥ss. Mix the acids, add the powders, macerate for seven days, strain and ex-

press strongly, and filter the liquor," *E.*—Not fitted for internal employment. Applied to the skin as a convenient and prompt vesicant. In the formula of the London College, eight times as much cantharides are employed as in the tincture.

2. TINCTURA CANTHARIDIS, L. E. D. (U. S.)—*Tinctura Lyttæ. Tincture of Cantharides.* (Cantharides, in powder, ʒiv. [ʒij. *D.*]; Proof Spirit, Oij. [Oiij. *E.* Oiss. wine measure, *D*]. (Spanish flies bruised, an ounce; Diluted Alcohol, two pints, U. S.) Macerate for fourteen [seven, *E. D.*] days, [strain and express strongly the residuum, *E.*] and filter. "This tincture may be obtained much more conveniently and expeditiously by percolation, provided the cantharides be reduced to coarse powder, and left with a little of the spirit in the state of pulp for twelve hours before the process of percolation is commenced," *E.*)—It is to be regretted that the strength of this preparation is not uniform in the three British Pharmacopœias.—Dose ♏x., gradually increased to fʒj. Its effects on the bladder must be carefully watched. It should be given in some demulcent liquid, as barley-water or linseed tea. It is sometimes employed externally as a rubefacient.

3. CERATUM CANTHARIDIS, L. *Unguentum Cantharidis*, E. *Cerate of Cantharides.* (Cantharides, in very fine powder, ʒj.; Spermaceti Cerate, [Resinous Ointment, *E.*] ʒvj. [ʒvij. *E.*] Add the cantharides to the cerate, softened by heat, and mix.)—This preparation must not be confounded with the next one, than which it is more irritant. The uses of the two are the same. From the greater activity of the cerate more danger of the absorption of the active principle of the cantharides is to be apprehended. When this occurs the bladder becomes affected, and, in severe cases, inflammation of the absorbents, and fever, are produced.

4. UNGUENTUM INFUSI CANTHARIDIS, E. *Unguentum Cantharidis*, L. D. (U. S.) *Ointment of Cantharides.*—(Cantharides, in very fine powder, ʒj. (ʒij. U. S.); Distilled Water, fʒiv. (Oss. U. S.); Resinous Cerate, ʒiv. (ʒviij. U. S.) Boil the water with the cantharides down to one half, and strain. Mix the cerate with the strained liquor, then evaporate the mixture to a proper consistence, *L. D.*—"Cantharides, in moderately fine powder, Resin, and Bees' Wax, of each, ʒj.; Venice Turpentine and Axunge, of each, ʒij.; Boiling Water, ʒv. Infuse the cantharides in the water for one night, squeeze strongly, and filter the expressed liquid. Add the axunge, and boil till the water is dispersed. Then add the wax and resin; and, when these have become liquid, remove the vessel from the fire, add the turpentine, and mix the whole thoroughly," *E.*)—A milder and less certain preparation than the preceding. Used to excite a purulent discharge from blistered surfaces, and to stimulate issues and indolent ulcers.

5. EMPLASTRUM CANTHARIDIS, L. E. D.; *Emplastrum Lyttæ; Plaster of Cantharides; Blistering Plaster.* (Cantharides, in very fine powder, lb. j.; Plaster of Wax, lb. jss.; Lard, lb. ss. *L.*—Cantharides, in very fine powder; Resin; Bees' Wax, and Suet, of each ʒij. *E.*—Cantharides, in very fine powder; Yellow Wax, of each lb. j.; Yellow Resin, ʒiv.; Mutton Suet; Hog's Lard, of each lb. ss. *D.*—"Liquefy the fats, remove from the heat, sprinkle in the cantharides in very fine powder, and stir briskly, as the mixture concretes on cooling," *E.*)—(The *Ceratum Cantharidis*, U. S., *Cerate of Spanish Flies. Emplastrum epispasticum*, is the same as this. It is made as follows, Spanish flies, in very fine powder, lb. j.; Yellow Wax, Resin, Lard, each eight ounces. Melt the wax, resin, and lard, and stir in the flies until cool.) Dishonest druggists sometimes omit a portion of the cantharides here ordered, and substitute powdered euphorbium. In making blistering plasters, care must be taken not to add the cantharides while the melted lard is quite hot, as the heat gradually injures the vesicating power of the insect. For a similar reason the plaster should be spread by the thumb, a heated spatula being objectionable. To prevent the blister moving after its application to the skin, its margin should be covered with

adhesive plaster. In order to guard against any affection of the urinary organs, place a piece of thin book-muslin or silver (tissue) paper between the plaster and the skin. The efficacy of the blister depends on the fatty matter dissolving the cantharidin and transuding through the muslin or paper. Some recommend the paper to be soaked in oil, which is supposed to dissolve the cantharidin. Now oil, not being miscible with the blood, is not readily absorbed; and hence, it is supposed, arises its protective influence. The usual time requisite for a blistering plaster to remain in contact with the skin is twelve hours; the vesicle is then to be cut at its most depending part, and dressed with spermaceti ointment. When the irritation caused by these plasters is excessive, it is sometimes necessary to substitute a poultice for the ointment. When we wish to make a perpetual blister, the cerate of cantharides is employed as a dressing; or if we wish to excite less irritation, and prevent the possibility of the urinary organs being affected, the cerate of savine. The danger of applying blisters to children after exanthematous diseases, especially measles, has been already noticed (see pp. 776 and 778).

6. EMPLASTRUM CANTHARIDIS COMPOSITUM, E.; *Compound Plaster of Cantharides.* (Venice Turpentine, ℥ivss.; Burgundy Pitch, and Cantharides, of each ℥iij.; Bees' Wax, ℥j.; Verdigris, ℥ss.; White Mustard Seed and Black Pepper, of each ʒij. Liquefy the wax and Burgundy pitch, add the turpentine, and, while the mixture is hot, sprinkle into it the remaining articles previously in fine powder, and mix together. Stir the whole briskly, as it concretes in cooling, *E.*) "This is supposed to be a most infallible blistering plaster. It certainly contains a sufficient variety of stimulating ingredients." (Duncan, *Edinb. Dispens.*)

7. EMPLASTRUM CALEFACIENS, D.; *Warming Plaster.* (Plaster of Cantharides, *one part;* Burgundy Pitch, *seven parts.* Melt them with a medium heat; mix well and make a plaster.)—Stimulant, rubefacient, and, in some cases, vesicant. Used in catarrh, local pains, &c.

8. PANNUS VESICATORIUS; *Blistering Cloth; Taffetas Vesicant.* (Digest powder of cantharides in sulphuric ether. Let the ethereal tincture be submitted to distillation, and the residue evaporated, by means of a salt water bath, until ebullition ceases. The oily mass which remains is to be melted with twice its weight of wax, and spread on cloth prepared with waxed plaster,[1] *Henry and Guibourt.*) (*Pharmacopée Raisonnée*, 3me éd. p. 470, Paris, 1841.)—Employed as a substitute for the ordinary blistering plaster, than which it is a more convenient and elegant preparation.

The *Tela Vesicatoria* or *Blistering Tissue*, and *Charta Vesicatoria*, or *Blistering Paper*, are analogous preparations.

The *Papier épispastique* or *Epispastic Paper* of Henry and Guibourt is prepared as follows:—Take of white wax 8 parts, spermaceti 3 parts, olive oil 4 parts, turpentine 1 part, powder of cantharides 1 part, and water 10 parts. Boil slowly for two hours, constantly stirring it. Strain the fatty mixture through a woollen cloth, without expression, and spread on paper.

OTHER COLEOPTEROUS VESICANTS.

In Europe, the ordinary vesicating insect is the *Cantharis vesicatoria;* but in some other parts of the world other blistering insects are employed. Thus, *Cantharis vittata*, or the *Potato-fly*, *C. atrata*, *marginata*, and *cinerea*, are used in North America. In the Brazils, *C. atomaria* has been employed. *C. ruficeps*, a native of Sumatra and Java, is said to possess extraordinary blistering properties. *C. gigas* (*Lytta cærulea*, Pfaff), is a native of Guinea and the East Indies. *C. violacea* (*Lytta gigas mas*, Buchner), is a native of the East Indies. In Arabia, *C. syriaca* (*Lytta segetum*), is said by Forskal to be employed. *Mylabris Cichorii* is

[1] The *Toile préparée à la cire* used by the French pharmacologists, is prepared by spreading the following mixture on cloth:—white wax 8 parts, olive oil 4 parts, and turpentine 1 part (Henry and Guibourt).

used in China and some parts of the East Indies. *Meloe proscarabæus* is an indigenous vesicating insect which has in two instances caused death. *M. majalis* or *true Maywcrm* possesses similar properties.

Order II.—HEMIPTERA, *Linnæus.*

Essential Characters.—Two *wings* covered by *elytra*. *Mouth* formed for suction; the *rostrum* composed of a tubular articulated sheath, including four scaly setæ, in place of mandibles and jaws. *Elytra* in some crustaceous, with the posterior extremity membranous; in others almost similar to wings, but more extended, thicker, and coloured (Stark). (*Elem. of Nat. Hist.* vol. ii. p. 318.)

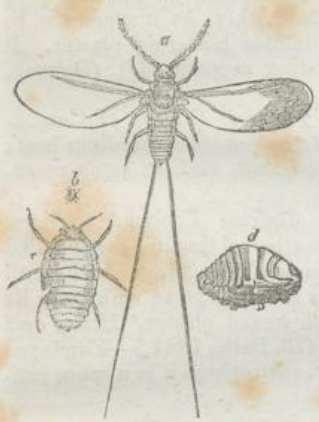
COC'CUS CAC'TI, *Linn. L. E. D.*—COCHINEAL INSECT.

(Cocci, *L.*—The entire insects, *E.*)
(Coccus, U. S.)

History.—The Spaniards, on their first arrival in Mexico, about the year 1518, saw the cochineal employed (as it appears to have been done long before) by the native inhabitants of that country, in colouring some parts of their habitations, ornaments, &c. (Bancroft, *Experim. Researches*, vol. i. p. 413; and Beckmann, *Hist. of Invent.* vol. ii. p. 192.)

Zoology. **Gen. Char.**—*Tarsi* with one joint, and terminated by a single hook. *Male* destitute of a *rostrum*, with two wings covering the body horizontally; abdomen terminated by two *setæ*. *Female* apterous, furnished with a rostrum. *Antennæ* of eleven joints, filiform and setaceous.

Fig. 258.



Cochineal Insects (*male and female*).

a. Male, with the wings expanded.
b. Adult female (natural size).
c. Adult female (magnified).
d. Impregnated female (natural size).

Sp. Char.—*Male* very small, with the *antennæ* shorter than the body: *body* elongated, of a deep red, terminated by two long diverging *setæ*; *wings* large, white, crossed above the abdomen. *Female* nearly twice as large as the male, bluish red, covered with a white farina; *antennæ* short; *body* flattened below, convex; *feet* short.

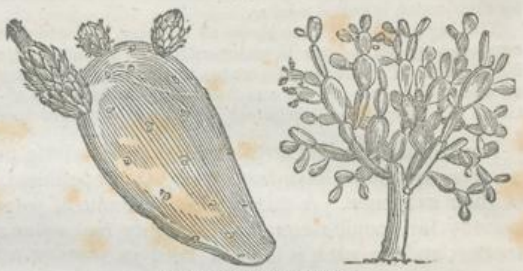
Wings of the male beautifully snow white. The females fix themselves firmly on the plant, which serves them as a habitation, and never quit this spot: here they couple, and increase considerably in size. Each insect lays several thousand eggs, which proceed from the body through an aperture placed at the extremity of the abdomen, and pass under the belly to be there hatched. Death then ensues; the body of the mother dries up; its two membranes become flat, and form a sort of shell or cocoon, in which the eggs are inclosed, and from whence the little cochineals soon proceed. The female only is of commercial value.

Hab.—Mexico.

Cultivation.—The cochineal insects feed on the *Nopal* (*Opuntia cochinillifera*). Mr. Ward (*Mexico in* 1827, vol. i. p. 84) says, the plantations are confined to the district of La Mĭstĕcā, in the state of Oăxācă, in Mexico. The animals are domesticated and reared with the greatest care. Plantations of these are cultivated for the nourishment of the insects. Here the impregnated females are placed; this operation being denominated *sowing*. Young ones are soon developed; and some months afterwards, when the females have become fecundated and enlarged, the harvest commences. The insects are brushed off with a squirrel's tail, and killed by immersing them in hot water, and afterwards drying them in the sun, or by the heat of a stove.

Three harvests are made annually; the first being the best, since the impregnated females alone are taken: in the second the young females also are collected; and in the third both old and young ones, and skins, are collected indiscriminately. Before the rainy season commences, branches of the nopal plant, loaded with infant insects, are cut off and preserved in the houses of the Mexicans, to prevent the animals being destroyed by the weather.

Fig. 259.



Opuntia cochinillifera.

Commerce.—In 1839, the quantity of cochineal on which duty (1s. per cwt.) was paid, was 489,997 lbs. In 1838, it was only 204,748 lbs. It is said that, on the average, one pound of cochineal contains 70,000 dried insects.

Description.—Cochineal (*coccus; coccinella*) consists of the dried female insects, which are about one or two lines long, wrinkled, of an irregular figure, convex on one side and flat or somewhat hollow on the other. They are inodorous, have a bitterish warm taste, tinge the saliva violet red, and yield a dark red powder. In burning, they evolve an animal odour, and leave a grayish-white ash. By infusion in water they swell up, show their ringed character, and even their feet, giving the liquid a red colour. Both the Honduras and Vera Cruz kinds are distinguished into the silver and black varieties. *Silver cochineal* (*cochinilla jaspeada* of the Spaniards) has a purplish gray colour; but in all the furrows and depressions we observe a whitish powder, which, examined by the aid of a lens, appears like fine wool. *Black cochineal* (*cochinilla renigrida* or *grana nigra* of the Spaniards) is reddish or purplish-black, and devoid or nearly so of the silvery character. *Granilla* (*cochinilla sylvestre* or *grana sylvestria*) consists of very small cochineal insects, and smaller, wrinkled, globular or ovate masses, (cocoons and new-born insects?) somewhat like fragments of the cochineal insect. (See *Granillo*, in Bancroft's *Exp. Research.* vol. i. p. 435.)

An extensive system of adulterating cochineal by a mercantile house in London was discovered a few years ago. The genuine article was moistened with gum-water, and then agitated in a box or leathern-bag, first with powdered sulphate of baryta, then with bone or ivory-black, to give it the appearance of black cochineal. By this means the specific gravity of the cochineal was increased from 1·25 to 1·35, and 12 per cent. of worthless heavy spar sold at the price of cochineal. (Ure, *Dict. of Arts and Manuf.* p. 305-6.) Powdered talc and carbonate of lead have been used to give the silvery appearance. But a lens will readily distinguish these powders from the real wool which gives the true silvery character.

Composition.—Two analyses of cochineal have been made; one by John, (*Gmelin, Handb. der Chim.* ii. 1474,) the other by Pelletier and Caventou. (*Ann. de Chim. et Phys.* viii. 250.) The latter chemist found the constituents to be *carmine*, *peculiar animal matter*, *fatty matter*, (composed of *stearine*, *olein*, and an *odorous acid*), and *salts*, (viz. phosphate and carbonate of lime, chloride of potassium, phosphate of potash, and a salt of potash, containing an organic acid).

Cochenillin (*Carmine*).—Obtained by digesting cochineal in ether, to extract the fatty matter, and then in alcohol, which dissolves the carmine. The colouring matter is a brilliant purplish-red substance, with a granular or crystalline appearance; unalterable in the air, easily soluble in water and alcohol, but insoluble in ether. It fuses at 112°, F. Chlorine

renders it yellow. Acids change its colour. The concentrated mineral acids decompose it. Alkalis render the watery solution of carmine violet. Lime-water forms a violet precipitate with it. The affinity of hydrate of alumina for it is most remarkable: the compound formed by their union is called a *lake*.

The pigment sold in the shops as *carmine*, and which is one of the most valuable colours employed by the painter in water-colours, is a compound, of which cochenillin is one of the constituents. Pelletier and Caventou regard it as consisting of cochenillin, animal matter, and an acid. Some mystery is attached to the manufacture of it. A fine clear day seems essential to the formation of a pigment of the most esteemed quality.

PHYSIOLOGICAL EFFECTS AND USES.—Diuretic, diaphoretic, antispasmodic, and anodyne qualities, have been assigned to cochineal, but without the least evidence of their existence. A mixture of carbonate of potash and cochineal is a popular remedy for hooping-cough. The only real value of cochineal is as a colouring matter, and as such it is used both in powder and solution. In the arts it is extensively employed in dyeing scarlet and crimson, and in the manufacture of *carmine* and *lake*.

ORDER III.—HYMENOPTERA, *Linnæus*.

ESSENTIAL CHARACTERS.—Four naked veined *wings* of unequal size. *Mouth* composed of jaws, mandibles, and two lips. *Lip* tubular at its base, terminated by a labium, either doubled or folded in, and forming a kind of sucker. *Females* with a compound ovipositor or sting at the anus (Stark).

APIS MELLIFICA, *Linn. L. E. D.*—THE HIVE BEE OR HONEY BEE.

(1. Humor è floribus decerptus et ab Ape præparatus, *L.*—Saccharine secretion, *E.*—Mel. *D.*
2. Cera; Concretum ab ape paratum; Cera alba; Idem dealbatum, *L.*—Cera flava; Waxy secretion; Cera alba; Bleached Bees' Wax, *E.*—Cera alba. Cera flava, *D.*)

(Mel. U. S. Honey. Cera alba, Cera flava, U. S.)

HISTORY.—This animal was very anciently known, and is frequently referred to in the Old Testament. In all ages it has been an object of admiration and attention, on account of its industry, curious economy, and policy.

ZOOLOGY. **Gen. Char.**—*Labium* filiform, composing with the jaws a kind of *proboscis*, geniculate and bent downwards. First joint of the posterior *tarsi* large, compressed. No spines at the extremity of the last two *legs*. Upper *wings* with one radial and three cubital cells (*Stark*).

Sp. Char.—Blackish. *Abdomen* of the same colour, with a transverse grayish band, formed by the down at the base of the third and following segment (*Stark*).

The honey bee lives in societies, called *swarms*, consisting of from fifteen to thirty thousand individuals. Each swarm is composed of three classes of individuals—viz.: a female, males, and neuters. The female called the *queen bee*, is narrower and longer than the others. The males, termed *drones*, are smaller than the females, and are devoid of stings. In each hive there are from 800 to 1000 drones. Towards autumn, when they can be of no further use, they are destroyed by the neuters. The neuters are termed *working bees*, and are by far the most numerous, since in each hive there are from fifteen to thirty thousand. They are in reality females, whose ovaries are not developed, in consequence, as some have supposed, of the nature of the aliment with which they are supplied while in the larva state.

The DIGESTIVE SYSTEM of the animal consists of highly developed *salivary organs* communicating with the proboscis, of an *œsophagus* (which enlarges at one part, forming the *crop*, *sucking stomach*, or *honey bag*), *a proper stomach*, *small* and *large intestines* and *biliary vessels*. The latter open into the alimentary canal immediately behind the stomach. The SEXUAL SYSTEM, in the *male*, consists of *a pair of testicles*, each having a *vas deferens*, which terminates in a *vesicula seminalis*. From the conjoined extremities of the vesiculæ proceed *a common duct* terminating in a *penis*. The *female genital organs* consist of *two ovaries* made up of tubes, each containing about twelve *ova*; the *two oviducts* from these ovaries terminate in a *vagina*, into which also opens *a duct* from *a roundish vesicle*. The POISON APPARATUS is

found in the females and neuters only. It consists of *two thin convoluted secreting organs*, opening into a *pyriform receptacle*, from which *a small duct* passes to a *sting*, which consists of two portions placed side by side, barbed at the extremity and contained in a sheath. The *poison* is said to be hot and acrid to the taste. The consequences produced by the sting of a bee are pain, redness, swelling, and hardness of the part; and might prove fatal if a swarm were to attack an individual. The removal of the sting (if left within the wound), and friction with salve, or with oil and hartshorn, is all the treatment usually required.

Hab.—Old continent (*Latreille.*) In a state of nature they reside in hollow trees; but they are almost universally domesticated, and are preserved in *hives*. Curtis (*Brit. Entomol.* xvi. 1, 769,) has described and depicted a remarkable instance of the nest of some hive bees attached to the arm of a tree. It was discovered in 1838, by Lord Malmesbury, in his plantation near the river Avon.

Bees furnish two products useful in medicine,—viz. *honey* and *wax*.

α. HONEY. Production.—Honey (*mel*) is secreted by the nectariferous glands of flowers, and is collected by the working or neuter bees, who take it up by suction or lapping, and pass it into the dilatation of the œsophagus denominated *crop*, *sucking stomach*, or *honey-bag*; beyond which, we presume, the honey does not pass, as it has never been found in the true stomach. When the animal arrives at the hive, the honey is disgorged by a kind of inverted peristaltic motion, and is probably somewhat altered in its properties by the secretions of the crop. It is used by the animal as food.

Physical Properties.—Honey varies in its taste and odour according to the age of the bees and the flowers on which they have fed. A hive which has never swarmed is considered to yield the best, which is, therefore, called *virgin* honey. The flavour of Narbonne honey, which is so much admired, is said to arise from the labiate flowers on which the animals feed; to imitate this, a sprig of rosemary is sometimes added to the honey obtained from other places.

Purity.—Flour, it is said, is now and then mixed with honey. It may be readily distinguished by its insolubility in cold water, and by the blue colour produced by the addition of iodine.

The London College directs that honey,—

Is not to be employed without being despumated. Dissolved in water, iodide of potassium and acid being added, it does not become of a blue colour.

Chemical Properties.—The constituents of honey vary somewhat according to the food of the bees, the season, the age of the animals, the mode of extracting it from the combs, &c. It must, however, be regarded at all times as a concentrated solution of *sugar* mixed with *odorous*, *colouring*, *gummy* and *waxy* matters. The saccharine matter is of two kinds: one crystallizable, and analogous to the sugar of grapes; the other uncrystallizable, and similar to the uncrystallizable brown syrup of the sugar-cane. Guibourt has found also mannite, which differs from sugar in not fermenting when mixed with water and yeast.

Physiological Effects.—Honey is emollient, demulcent, nutritive, and laxative. When fresh it is apt to occasion indigestion and colic. Collected from poisonous plants it has been found to possess deleterious qualities. The honey of Trebizond has long been notorious for its deleterious qualities. Mr. Abbott (*Lond. and Edinb. Phil. Mag.* vol. v. p. 313, for Oct. 1834) says it causes violent headache, vomiting, and a condition like that of a tipsy man. A larger dose produces deprivation of all sense and power for some hours afterwards. These effects agree with those assigned to this honey by Xenophon (*Anabas.* lib. iv.) in his account of the "Retreat of the Ten Thousand." Pliny (*Hist. Nat.* xxi. 44, ed. Valp.) also speaks of this poisonous honey. Tournefort (*Hist. de l'Acad. Roy. des Sciences*, 1704, p. 351) ascribes its venomous properties to the bees feeding on the *Azalea pontica*. Many other instances of poisonous honey are on record. (See Barton, *Phil. Mag.* vol. xii. p. 121; and in Beck's *Med. Jurisprud.*)

Uses.—Mixed with flour, and spread on linen or leather, it is a popular application to promote the maturation of small abscesses and furunculi. It sometimes forms a constituent of gargles, partly on account of its taste, partly for its emollient operation. It is also used as a vehicle for the application of other more powerful agents to the mouth and throat, especially in children. It is occasionally employed as an emollient and demulcent in inflammatory affections. In troublesome coughs, barley-water, mixed with honey, and sharpened with slices of lemon, and taken warm, forms a very agreeable and useful demulcent to allay troublesome coughs.

1. MEL DESPUMATUM, D. (U. S.); *Clarified Honey.* (Melt the honey in a water bath, and remove the scum.)—The object of this process is to deprive honey of certain impurities which render it apt to ferment; but the flavour and odour of the honey is somewhat injured by the operation.

2. OXYMEL. See vol. i. p. 356.

β. WAX. Secretion of Bees' Wax.—Bees' Wax (*cera*) was at one time supposed to be merely the pollen of plants elaborated by bees. Bonnet, however, so early as 1768, asserted it to be a secretion from the ventral scales. Hunter (*Phil. Trans.* for 1792, p. 143) and Huber have subsequently proved the correctness of this assertion. The latter writer, indeed, proved that the pollen is not at all essential to the production of wax, for bees fed on honey and water equally secreted it, and formed the usual waxy cells. With this wax they construct the *comb* (*favus*), the cells (*alveoli*) of which are hexagonal with angular bottoms.[1] The substance called *Propolis* is collected by the bees from the buds of trees. It is of a resinous nature, and is used for lining the cells of a new comb, stopping crevices, &c.

Other animals secrete wax. Thus the larva of the *Cicada limbata* or *white wax insect* of China is covered with a waxy powder, which is communicated to the trees upon which these insects are found, and is collected by the natives, who esteem it highly as a medicinal substance. (See Donovan's *Insects of China.*)

Fig. 260.

Cicada limbata.

Wax is also a product of vegetables; but *vegetable wax* is not employed in this country. *Myrtle wax* is obtained from the berries of the *Myrica cerifera*, a native of the United States of America. These are boiled in water and pressed. The wax exudes, floats on the water, is skimmed off, and is remelted. This kind of wax has a greenish-yellow colour. By saponification it yields stearic, margaric, and oleic acids, along with glycerine, so that it is rather fat than wax.

Preparation.—Wax is extracted from the comb, partly by allowing the latter to drip, partly by subjecting it to pressure. The comb is then melted in water, by which the impurities subside, and the wax is allowed to cool in moulds.

Properties of Yellow Bees' Wax.—Yellow wax (*cera flava*) has a remarkable and peculiar odour; its colour is more or less yellow, but varying in degree; its specific gravity varies from 0·960 to 0·965. It is said to be sometimes adulterated with suet, which gives it a fatty feel and disagreeable taste. Resin may be recognised by its solubility in cold alcohol; bean or pea meal, by its insolubility in oil of turpentine.

Wax Bleaching.—This is effected by melting yellow wax (either in a copper vessel, or in a large vat or tub, by means of steam), running it off, while in the melted state, into a trough, called a *cradle*, perforated at the bottom with holes, and placed over a large water tank, at one end of which is a revolving cylinder, almost wholly immersed in water. By this means the wax is solidified, converted into a kind of ribbon, and conveyed on the surface of the water to the other end of the tank. These ribbons of wax are here lifted out, and

[1] On their mathematical form, consult Waterhouse, in the *Penny Cyclop.* art. *Bee;* and Lord Brougham's *Dissert. on Subjects of Science connected with Natural Theology*, vol. i. p. 218, 1839.

conveyed in baskets to the bleaching grounds, where they are exposed to the air for one or two weeks (according to the state of the weather), being turned every day, and watered from time to time. The wax is then re-melted, re-ribboned, and re-bleached; it is subsequently refined by melting in water acidulated with sulphuric acid.

Properties of White Wax.—White Wax (*cera alba; cera dealbata*) is yellowish-white; I have never met with pure wax perfectly white. The circular cakes of commerce, as well as wax candles, always contain spermaceti, which the dealers add to improve the colour. Pure wax is solid, brittle, inodorous, or nearly so, insipid, fusible, and at a much higher temperature decomposable. Its specific gravity varies from 0·8203 to 0·965.

Composition.—According to John, wax is a compound of two other substances;—the one called *cerine*, the other *myricine*. These have been examined by Boudet and Boissenot. (*Journ. de Pharm.* xiii. 38.)

1. Cerine.—This constitutes at least 70 per cent. of wax. It fuses at 143½ F. It dissolves in 16 parts of boiling alcohol. By saponification with potash it yields margaric acid, a minute portion of oleic acid, and a considerable quantity of non-saponifiable fat called *ceraine*.

2. Myricine.—It fuses at 149° F. It dissolves in 200 parts of boiling alcohol of sp. gr. 0·833. It is not saponifiable by potash.

Ettling (Thomson, *Org. Chem.*) says that cerine, ceraine, and myricine, are isomeric, and composed of $C^{1}\ H^{19}\ O$.

More recently Hess (*Pharm. Central-Blatt für* 1838, p. 332,) asserts that pure wax is homogeneous, and possesses the properties of myricine; its composition being $C^{20}\ H^{20}\ O$. The difference between cerine and myricine he ascribes to the presence of *ceric acid* formed by the oxidation of myricin.

Physiological Effects and Uses.—Wax is an emollient and demulcent. It has been administered internally, in the form of emulsion (prepared with melted wax and soap, yolk of eggs, or mucilage), in *diarrhœa* and *dysentery*, especially when ulceration of the alimentary canal is suspected. In these cases it has been used by Hufeland and Wedekind. It has sometimes been employed as *a masticatory*, but its action is mechanical only. Its principal use, however, is *externally*, sometimes as a mild sheathing or protecting application, sometimes as a basis for the application of other agents. It is a constituent of all *cerates*, which take their name from it. The vapour evolved from wax placed on red-hot iron has been inhaled in phthisis.

1. EMPLASTRUM CERÆ, L. *Emplastrum simplex*, E. *Emplastrum attrahens. Wax Plaster.*—(Wax; Suet, of each, lb.iij.; Resin, lb.j. *L.*—Bees'-wax, ℥iij. Suet, and Resin, of each, ℥ij. *E.*—Melt them together with a moderate heat, and stir the mixture briskly till it concretes on cooling," *E.*)—Employed in the preparation of *Emplastrum Cantharidis*. Sometimes used to promote discharge from a blistered surface.

2. EMPLASTRUM AROMATICUM, *D. Aromatic Plaster.*—(Frankincense (*Thus*) ℥iij.; Yellow Wax, ℥ss.; Cinnamon Bark, powdered, ʒvj.; Essential Oil of Allspice; Essential Oil of Lemons, of each, ʒij. Melt the Frankincense and Wax together, and strain; when they are beginning to thicken by cooling, mix in the powder of cinnamon rubbed up with oils, and make a plaster.)—By keeping, as well as by the application of heat in spreading, the volatile oils of this preparation are dissipated. "It is used as a stimulant, applied over the region of the stomach, in dyspepsia and increased irritability of that organ, to allay pain and nausea and expel flatus." (Montgomery, *Observ. on the Dublin Pharm.*)

3. CERATUM, L. *Unguentum Simplex*, E. *Unguentum Ceræ albæ*, D. (*Ceratum Simplex*, U. S.) *Simple Cerate. Simple Dressing.* (Olive oil, f℥iv. [f℥vss. *E.*)]; Wax [White Wax, *E.*], ℥iv. [℥ij. *E.*], *L. E.*—White Wax, lb. j.; Prepared Hog's Lard, lb. iv. *D.* Add the oil to the melted wax, and mix [and stir the mixture briskly while it concretes on cooling, *E.*]).—(Lard, ℥viii. White Wax, ℥iv. U. S.) A mild and cooling dressing. Sometimes used as a basis for more active preparations.

4. UNGUENTUM CERÆ FLAVÆ, D. *Ointment of Yellow Wax.* (As the preceding, except that Yellow Wax is substituted for White Wax).—Effects and uses as the last.

5. LINIMENTUM SIMPLEX, E. *Simple Liniment.* (Olive Oil, *four parts;* White Wax, *one part.* Dissolve the wax in the oil with a gentle heat; and agitate well as the fused mass cools and concretes.)—Differs from the Unguentum simplex in its greater liquidity. Used to soften the skin, and to promote the healings of chaps, &c.

OTHER HYMENOPTEROUS INSECTS.

The tribe of hymenopterous insects, called *Gallicolæ* or *Diploleparіæ*, contains the insects which produce those excrescences on plants commonly denominated *galls* (see *Nutgall*, p. 190, and *Bedeguar*, p. 552). Latreille (in Cuvier's *Règne Animal*, t. v. p. 291, 1829), comprehends all the insects of this tribe in one genus,—viz. *Cynips*.

Class VII.—CRUSTACEÆ, *Cuvier.*—CRUSTACEANS.

The dietetical properties of the Crustaceans (Lobsters, Crabs, Cray-fish, Prawns, and Shrimps), have been already noticed (see vol. i. p. 88).

1. Astacus fluviatilis.—In the stomach of the *Crawfish* are found, at the time the animal is about to change its shell, two calcareous concretions, commonly called *Crab's Eyes* or *Crab's Stones* (*Lapilli Cancrorum*), which were formerly ground and employed in medicine, as absorbents and antacids, under the name of *Prepared Crab's Stones* (*Lapilli Cancrorum præparati; Lapides Cancrorum præparati; Oculi Cancrorum præparati*). They consist of carbonate of lime and animal matter principally, with a little phosphate of lime. Their use is now obsolete. In the shops, imitations of them (prepared with chalk and mucilage, or size) are still met with.

2. Cancer pagurus.—The *Black-clawed or Large Edible Crab* was at one time an officinal animal. Its *Claws* (*Chelæ Cancrorum*) when prepared by grinding, constitute the *Prepared Crab's Claws* (*Chelæ Cancrorum præparatæ*) of the shops. Their composition and uses are similar to those of prepared Crab's stones. For an account of the effects and uses of carbonate of lime, see vol. i. p. 503.

Division II. Vertebrata.—Vertebral Animals.

Essential Characters.—Animals furnished with a *skull* and *vertebral column* for the protection of the brain and spinal marrow.

Class VIII. *PISCES*—*FISHES.*

Essential Characters.—*Vertebrated* animals with cold red *blood*, respiring by *gills* or *branchiæ*, and moving in the water by the aid of *fins*.

No article of the Materia Medica, contained in the British pharmacopœias, is derived from this class of animals; but the important uses of *Isinglass*, and the extraordinary efficacy, in various diseases, ascribed by some writers to *Cod's Liver Oil*, render it necessary to notice both of these productions.

1. ICHTHYOCOL'LA, (U. S.)—ISINGLASS.

History.—Ichthyocolla (ἰχθυοκόλλα, from ἰχθύς, *a fish*, and κόλλα, *glue*) is mentioned by both Dioscorides (lib. iii. cap. 102) and Pliny. (*Hist. Nat.* lib. vii. cap. 57; and lib. xxxii. cap. 24, ed. Valp.) The latter of these writers ascribes its invention to Dædalus.

Zoology.—Isinglass is obtained from various fishes, some only of which have hitherto been ascertained. The finest kinds are procured from different species of *Acipenser*. Several other genera,—as *Silurus*, *Morrhua*, *Gadus*, *Otolithus*, *Lota*, and *Polynemus*, also yield it.

The organ from which isinglass is usually procured, is the *air-bag*, or *swimming-bladder*, sometimes termed the *sound*. It is a membranous sac filled with air (containing from 69 to 87 per cent. of oxygen), and placed under the spine,