

H. 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.)

SPONGIA OFFICINALIS, 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 faecal orifices or vents, carrying along

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.

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with its 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 commerce¹ two kinds of sponge are met with, which are respectively known as Turkey and West Indian.

a. 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, ℥j. to ℥iij. It is given in the form of electuary or lozenges (*burnt sponge lozenges*; *trochisci spongiæ ustæ*).

CLASS II.—POLYPIPERA, Grant.—POLYPIPEROUS ANIMALS.

The polyperous animals have received their name from the circumstance of their bearing tubes called *polyperes*. 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 (*polyperes*), each of which, at its external orifice, is surrounded by *tentacula*.

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.



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 official substance is obtained from the Radiata.

SUBDIVISION III.—MOLLUSCA, Latreille.—MOLLUSKS OR SOFT ANIMALS.

MALACAZOEA, Blainville.—CYLO-GANGLIATA, Grant.

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

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. Kirklaud, 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 laminae. Heart simple. Impregnation effected without the assistance of a second individual.

OSTREA EDULIS, Linn. L.—COMMON EDIBLE OYSTER.

(Testa, 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 ostreae*). The hollow valves are preferred, as they contain carbonate of lime. When calcined, oyster shell yields a quicklime formerly much esteemed as a lithon- triptic.

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.		Pasquier's Analysis.	
Carbonate of lime.....	98.6	Ozmazome.....	} 12.6
Phosphate of lime.....	1.2	Gelatine.....	
Alumina.....	0.2	Mucus.....	
Albuminous matter.....	0.5	Albumen.....	
		Fibrine.....	} 87.4
		Water.....	
Oyster shells.....	100.5	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 OFFICINALIS, Linn.—COMMON CUTTLE FISH.

The substance called *os sepia* 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 Ratzburg, *Med. Zoolog.* ii. 299.)

Os sepia 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 oesophagus.

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.

SANGUISUGA, Savigny.—THE BLOOD-SUCKING LEECHES.

Iatrobella, 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

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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 aegyptiaca* is the species referred to. The leeches referred to by Herodotus (*Euterpe*, lxxviii.) 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 cepisse appellari adverte."

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. *Sanguisuga*) *Introbella*, (from *ιατρις* and *βδέλλα*, a leech,) by Savigny, (*Desc. de l'Égypte, Hist. Nat.* t. 1^{re}, part. 3^e, 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 *Hemopsis sanguisorba*, Savigny; but Blainville says it was *Hemopsis nigra*.

Species.—1. *SANGUISUGA OFFICINALIS*, Savigny. *Hirudo provincialis*, Carrena, *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 Hamburg.

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 Hamburg.

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 Ratzburg, *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 subcuticular *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 *oesophagus* 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, Oesophagus.
- b, c, d, e, f, g, h, i, k, l, m, Cells of the stomach.
- n, Cecal sacs.
- o, Funnel-shaped pylorus.
- p, Irregularly expanded commencement of (q) the small intestine.
- r, Cecal 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. u. d. Blutegel*. Wien, 1820.)

The **RESPIRATORY SYSTEM** consists of small apertures (called *stigmata* or *spiracula*) 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 vesiculae 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 development 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 development, 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.

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

FIG. 256.

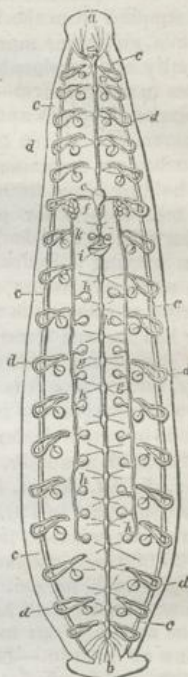


Diagram illustrative of the internal anatomy of the leech.

- 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, Vesiculae seminales.
- g, Vasa deferentia.
- h, Testicles.
- i, Uterus.
- k, Ovaries.

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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 McCulloch's *Dictionary of Commerce*.

All our leeches are imported from Hamburg. The Hamburg 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.) Féé (*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 coagululum 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

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 snapped, 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 aegyptiaca*), 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 feces.

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*, *Linnaeus*.—*BETTLER*.

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.

CANTHARIS VESICATORIA, *Latreille*, *L. E. D.*—THE BLISTER BEETLE OR SPANISH FLY.

Lytta vesicatoria, *Fabricius*.—*Meloë vesicatorius*, *Linnaeus*.

(The whole fly, *E*)

(*Cantharis*, *U. S.*)

HISTORY.—Hippocrates employed in medicine an insect which he calls (*κάνθαρις*), 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 *κάνθαρις* merely signifies a small beetle or *scarabeus 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 Fasselini*, 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 1½ 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 ganglion 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* (*vesicula 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, privet, 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. Petersburg, 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. Petersburg 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 versa*, 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 ethereal 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.* xvii. 230,) in 1804 by Beauvoil, (*Ibid.* xlviii. 29,) and in 1810 by Robiquet. (*Ibid.* lxxvi. 302.)

<i>Thouvenal's Analysis.</i>	
Watery extract.....	37.50
Subsequent alcoholic extract.....	10.42
Subsequent etherial extract.....	2.08
Insoluble residuum.....	50.00
Total.....	100.00

<i>Beauvoil's Analysis.</i>	
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

<i>Robiquet's Analysis.</i>	
1. <i>Cantharidin.</i>	
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 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:

<i>Analysis by Dr. Bostock.</i>		<i>Analysis by Brandes and Reimann.</i>	
Albumen	6.00	Albumen	5.75
Uncoagulable matter.....	0.14	Animal matter, with muriate of ammonia, }	0.26
Salts.....	1.00	potash salts, carbonate, lactate, muriate }	
Water.....	92.86	and sulphate of soda.....	93.99
	100.00	Water	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 ecchymatous 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.

aa. 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 foetid odour of the mouth, and not unfrequently ptialism. 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.

a. 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. 1693; 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.

a. *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. Robertson (*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." Bielt 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. Robertson 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, ℔j. Macerate the Cantharides with the acid for eight days, occasionally shaking: lastly, express and strain, L.—"Cantharides, in powder, ℥ij.; 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 Lyttae*. *Tincture of Cantharides*. (Cantharides, in powder, ℥iv. [℥ij. *D.*]; Proof Spirit, Oij. [Oij. *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 ℥℥j. 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, ℥j; Spermaceti Cerate, [Resinous Ointment, *E.*] ℥vj. [℥vij. *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, ℥j. (℥ij. U. S.); Distilled Water, f ℥iv. (Oss. U. S.); Resinous Cerate, ℥iv. (℥vij. 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, ℥j; Venice Turpentine and Axunge, of each, ℥ij; Boiling Water, ℥v. 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 Lyttae*; *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 ℥ij. *E.*—Cantharides, in very fine powder; Yellow Wax, of each lb. j; Yellow Resin, ℥iv.; 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 ℥ij.; Bees' Wax, ℥j.; Verdigris, ℥ss.; White Mustard Seed and Black Pepper, of each ℥ij. 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, *Henry and Guibourt*.) (*Pharmacopée Raisonnée*, 3^{me} 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 carulea*, 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

* The *Tuile 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 Mayworm possesses similar properties.

ORDER II.—HEMIPTERA, *Linnaeus*.

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.)

COCCUS CACTI, *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 cochinitifera*). Mr. Ward (*Mexico in 1827*, vol. i. p. 84) says, the plantations are confined to the district of La Misteca, in the state of Oaxaca, 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 (*Carmin*).—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, *Linnaeus*.

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 ð floribus descriptus et ab Ape preparatus, *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 *oesophagus* (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 vesiculae 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*.

a. 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 (*Anab.* 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

FIG. 260.



Cicada limbata.

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*.)

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-ribbed, 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.

Etling (Thomson, *Org. Chem.*) says that cerine, ceraine, and myricine, are isomeric, and composed of C¹ H¹⁰ 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 C²⁰ H⁴⁰ 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 *diarrhoea* 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.ij.; Resin, lb.j. L.—Bees'-wax, ℥ij. 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*) ℥ij.; Yellow Wax, ℥ss.; Cinnamon Bark, powdered, ℥vj.; Essential Oil of Allspice; Essential Oil of Lemons, of each, ℥ij. 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 Cerae albae*, D. (*Ceratum Simplex*, U. S.) *Simple Cerate*. *Simple Dressing.* (Olive oil, ℥iv. [℥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 *Diptolepariæ*, 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.

I. ICHTHYOCOLLA, (U. S.)—ISINGLASS.

HISTORY.—*Ichthyocola* (ἰχθυοκόλλα, from ἰχθὺς, 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,

in the middle of the back, and above the centre of gravity. In most fish it communicates with the œsophagus, or stomach, by the *ductus pneumaticus*. In others it is an imperforate sac. Occasionally there are two sacs, which communicate with each other. In the *Acipenser stellatus*, according to Brandt, (Brandt and Ratzeburg's *Medicinische Zoologie*, p. 27, Berlin, 1833,) the bag is composed of three membranes: an external, silvery one, derived from the peritoneum; a middle, membranous (*hautigen*) one; and the most internal, very vascular, and, as it were, pulpy membrane. The latter, he states, yields the fish gelatine. But unless the sound of this fish differs considerably from that of other fishes, there must be an error in this statement. I have examined all the purse and pipe isinglasses of commerce, and find the internal to be an insoluble membrane. In the cod the innermost membrane is very thin, and is perhaps analogous to the epithelium. External to this is a highly vascular thin coat, and still more external is the gelatinous coat, which appears devoid, or nearly so, of vessels.

PREPARATION.—The mode of preparing the swimming bladder for sale as isinglass, varies in different countries. Sometimes the bag is dried unopened, as in the case of the *purse*, *pipe*, and *lump* isinglass of the shops. At other times it is laid open, and submitted to some preparation; being either dried unfolded, as in the *leaf* and *honeycomb* isinglass; or folded, as in the *staple* and *book* isinglass; or rolled out, as in the *ribbon* isinglass. When it arrives in this country it is *picked* or *cut*. Formerly it was picked into shreds by women and children, but it is now usually cut by machines worked by steam.

DESCRIPTION.—Many varieties of isinglass are imported: the Russian kinds are the most esteemed; but the Brazilian, on account of its cheapness, is the most extensively-used kind.

1. Russian and Siberian Isinglass.—The isinglass produced in the Russian empire is principally obtained from the Sturgeons. These cartilaginous fishes constitute the genus *Acipenser*.

The following are the generic characters of *Acipenser*:—Body elongated and angular, defended by indurated plates and spines, arranged in longitudinal rows; snout pointed, conical; mouth placed on the under surface of the head, tubular, and without teeth (Yarrell). (*History of British Fishes*, ii. 360.) The species are badly determined. Brandt (*Med. Zool.* ii. 1 & 349) has described and figured eight. *Acipenser Sturio*, or the *Common Sturgeon*, is occasionally caught in the river Thames. The species from which ISINGLASS is procured is the following:

1. A. HUSO, Linn. The *Beluga* or *Bieluga*.—Inhabits the Caspian Sea and its tributary streams. Its roe (ovary) is esteemed as *caviare*. Its swimming bladder, when properly prepared, yields *leaf isinglass* of three qualities, *fine firsts*, *firsts*, and *seconds*.

2. A. GULDENSTADTI, Brandt and Ratzeburg. The *Ossetr* or *Osseler*.—Inhabits the Caspian and Black Seas and their tributary rivers. *Caviare* is prepared from its roe (ovary). From its swimming bladder are obtained both *staple* and *leaf isinglass*. The varieties of the *staple* are, the *Patriarch Astrakhan*, and *Astrakhan firsts*, *seconds*, and *thirds*. The *leaf* varieties are *firsts*, *seconds*, and *thirds*. (T. W. C. Martius, *Lehrb. d. Pharm. Zool.* S. 76, 1838.)

3. A. RUTHENUS, Linn. The *Sterlet*.—Inhabits the Black and Caspian Seas and their tributary rivers; and the Arctic Ocean. Its roe yields *caviare*. *Leaf* and *book* (*first* and *second*) *isinglass* are obtained from the swimming bladder.

4. A. STELLATUS, Pallas. The *Sevruga*.—Inhabits the Caspian and Black Seas and their tributary rivers. Yields *caviare* and *leaf isinglass*.

But in Russia the *acipenser* is not the only genus from which isinglass is obtained, for it is also procured from *Silurus Glanis*,¹ which Dr. Royle² suggests may be the source of the *Samovey*³ isinglass of commerce.

Brandt⁴ thus describes the preparation of Russian isinglass. The swimming

¹ Pallas, *Reise durch verschiedene Provinzen des russischen Reichs*. Theit. i. S. 139. Petersburg, 1771.

² On the production of Isinglass along the Coasts of India, with a notice of its Fisheries, p. 29. Lond. 1842.

³ This word is sometimes written *Samovey* or *Simory*. I have been unable to trace its derivation. Dr. Royle's suggestion appears to me probable, since the Russian name for the *Silurus Glanis* is *Som*, while Albertus Magnus calls it *Sumus*. The Poles term it *Szum*. (Brandt and Ratzeburg, *op. supra cit.* vol. ii. p. 31.) Moreover Martius says that *staple*, *leaf*, and *book isinglass* are produced from this fish. Now these are the three forms of the *Samovey isinglass*.

⁴ Though the account above given by Brandt agrees with the statements of Pallas, Gmelin, Georgi, and Tooke, there must be some inaccuracy in it. I have before stated (above) that the innermost membrane of the

bladder is cut open, washed, and then exposed to the air with the inner silvery membrane turned upwards. The latter is then stript off and placed in damp cloths, or left in the outer covering, and prepared or kneaded. It is then taken out of the cloths, and either merely dried (*leaf isinglass*) or twisted in a serpentine manner, between three pegs into the shape of a horse-shoe, heart, or lyre (*long and short staple*), or folded in the manner bookbinders fold printed sheets of paper (*book isinglass*). Jackson (Royle, *op. supra cit.* p. 21) has given figures to illustrate the manner in which the staple and book isinglass are made to retain their shapes by skewers.

Several kinds of *leaf isinglass* are imported from Russia. The finest kind is that from Astrakhan, of which one kind is said to be obtained from the Beluga (*Acipenser Huso*). These are imported from St. Petersburg. The *Samovey leaf* is an inferior kind brought from Taganrod. *Sisane leaf* is the produce of a small fish; each leaf measuring only about $2\frac{1}{2}$ inches each way, and weighing about a drachm: it looks like pieces of dried bladder, marked by two fibrous or muscular bands. *Kroski isinglass* I have not seen; but I am told it is in small circular membranous disks.

Long staple isinglass is of fine quality. It is the produce of the Oural. Of *short staple* three kinds are known: the finest is from the Oural, and is distinguished by the name of Patriarch, but it is very scarce. The *Astrakhan short staple* is one of the best kinds. The *Samovey short staple* is of inferior quality.

Two kinds of *book isinglass* are met with. That from the Oural is of excellent quality. *Samovey book* is an inferior kind.

Siberian purse isinglass is of moderately good quality, and is in general demand.

3. Brazilian Isinglass.—This is imported from Para and Maranh; but it has not hitherto been ascertained from what fishes it is procured; though it is obvious, from a superficial examination of the commercial specimens, that they must have been obtained from at least several species or genera. Mr. Yarrell (*Phil. Trans.* vol. lxiii. 1783) suggests the genera *Pimelodus* and *Silurus* as the source of it. It comes over in the form of *Pipe*, *Lump*, and *Honeycomb*.

Pipe Brazilian isinglass must have been procured from a large fish. It is prepared by drying the swimming bladder unopened. In some cases this bladder is imported distended with air. The dried bladders, or *pipes*, as they are called, are from 10 to 12 inches in length, and 2 or $2\frac{1}{2}$ inches broad. Their weight is about 5 ounces. Their shape is somewhat conical, tapering at one extremity, and broader at the other, where, on either side, is a conical cæcal prolongation. It is devoid of smell. *Lump Brazilian isinglass* consists of two swimming bladders placed side by side, considerably separated at one end, and communicating at the other extremity with each other. When perfect, each lump somewhat resembles in shape a torpedo. Its size varies. A perfect, though not very large specimen, now before me, is 8 inches long, and, at the broadest part, 5 inches in breadth. Its weight is $6\frac{1}{2}$ ounces. It consists of three portions, separated by constrictions. The largest portion is 5 inches broad, and $3\frac{1}{2}$ long; flattish in front, rounded posteriorly. It consists of two sacs, placed one on either side. The middle portion is oblong, 3 inches long, and 2 broad; it consists of two sacs, which communicate with those of the preceding portion. The third portion is oblong, $1\frac{1}{2}$ inches long, and $\frac{2}{3}$ of an inch wide. It consists of one sac only, into which both the sacs of the middle portion open. *Honeycomb Brazilian Isinglass* appears to be the largest portion of the lump kind split open.

swimming bladder is insoluble. But according to Brandt's statement, the innermost is the gelatinous membrane. The account which T. W. C. Martius (*Lehrbuch d. Pharmaceut. Zoologie*, p. 71, Stuttg. 1838.) gives of the preparation of isinglass in Russia, confirms my views. The swimming bladders, he observes, are first placed in hot water, carefully deprived of adhering blood, cut open longitudinally, and exposed to the air, with the inner, delicate, silvery membrane upwards. When dried, *this fine membrane is removed* by beating and rubbing, and the swimming bladder is then made into different forms.

The lump variety is sometimes softened, and rolled out into thin ribbons, in this country. On account of its deeper colour and inferior solubility, Brazilian isinglass is not in demand for domestic use; though, as it is sold in the cut state, it is probably intermixed by shopkeepers with the finer kinds of Russian isinglass, and sold as such. As it is moderately cheap and soluble, while it is free from any fishy smell, it is in extensive use for fining by brewers, who are the principal consumers of isinglass.

3. *New York Isinglass.*—Occasionally *ribbon* isinglass is imported from New York. It is in thin ribbons of several feet long, and from an inch and a half to two inches in width. It is but little used in this country. It is less soluble than the Russian, and affords a dark-coloured solution.¹ Dr. J. V. C. Smith,² author of a work on the fishes of Massachusetts, states, that it is obtained from the air-bladder of the common Hake (*Gadus merluccius*), which is thrown into water to macerate for a little while, and is then taken out and pressed between two iron rollers, “by which it is elongated to the extent of half a yard and more. It is then carefully dried, packed, and sent to market. The common cod (*Morrhua vulgaris*) yields a poorer kind of isinglass; but the hake only is known to the extensive manufacturers as fit for their purposes.”

4. *Hudson's Bay Isinglass.*—I have been unable to ascertain from what fish this isinglass is procured.³ It comes over in the *purse* form. A specimen now before me measures 12 inches in length, and $3\frac{1}{2}$ inches in diameter; its weight is $1\frac{1}{2}$ ounces. It is light yellow, translucent, and free from taste and smell. The inner lining of the sac, which may be readily stripped off, is insoluble in water: the remaining membrane dissolves in boiling water.

5. *East India Isinglass.*—It appears that, for a long period, this has been exported from Calcutta to China, but it has only recently occupied the attention of Europeans. It is probably the produce of a species of *Polynemus*.⁴ But the fishes called, by Dr. Buchanan, *Bola*, and several species of *Silurus*, especially *Silurus raita*, Buchanan, also yield isinglass (Royle). Most of the specimens of Indian isinglass which I have examined, have an unpleasant fishy odour, which renders them totally unfit for domestic use, and greatly deteriorates their commercial value. A specimen of *East India purse isinglass*, now before me, consists of an unopened swimming-bladder, flattened and dried. Its shape is oval-oblong; its length, 9 inches; its breadth, $3\frac{1}{2}$ inches; its weight, $7\frac{1}{2}$ oz. It has a strong fishy smell, and a dark colour.

Another kind (*East Indian leaf isinglass*) is merely the sac laid open and dried. It is 8 or 9 inches long, 6 or 7 inches broad, and about $\frac{8}{10}$ of an inch thick. A third kind, (*East Indian rolled leaf isinglass*) which I have received from Dr. Royle, appears to have been formed by rolling out the preceding kind into thin plates. A specimen before me is about 18 inches long, $3\frac{1}{2}$ inches wide, and $\frac{1}{10}$ of an inch thick. Some of the sheets are covered with a thin film of chalk.

Picked East India isinglass, kindly furnished me by Dr. Royle, is in small shreds, two or three inches long, and tapering at the extremities. It is hand-picked in India by the natives.

The composition of this isinglass has been ascertained by Mr. Solly, and will hereafter be stated.⁵

¹ *United States Dispensatory*: also *Journal of the Philadelphia College of Pharm.* iii. 17 and 92.

² In a letter to Dr. S. W. Williams, of Deerfield, Massachusetts, from whom I received the above information.

³ Richardson, in his *Fauna Boreali-Americana*, part iii. says, that the sturgeons of North America are equally numerous with those of Asia, but that their sounds and roes are utterly wasted.

⁴ Mr. McClelland (*Journ. of the Asiatic Society of Bengal*, vol. viii. p. 203.) states, that Indian isinglass is yielded by *Polynemus Sele* of Buchanan. But, inasmuch as he obtained only 66 grains of isinglass from one of these fishes, while some of the specimens of commerce weigh from half to three quarters of a pound, it seems tolerably clear that the Indian isinglass of English commerce cannot be obtained from *P. Sele*, but must be procured from some larger fish. It may be the produce of *Polynemus teria*, Buchanan, or the new species of *Polynemus*, referred to by Dr. Cantor (*Journ. of the Royal Asiatic Society*, vol. v. p. 106, Lond.) as the *Salliah* or *Saccolth*.

⁵ For further details respecting East Indian isinglass, see Dr. Royle's work *On the Production of Isinglass along the Coasts of India, with a Notice of its Fisheries*. Lond. 1842.

6. Cod Sounds.—Cod sounds, in the dried state, are brought from Scotland, and used as a substitute for foreign isinglass. They are, however, usually preserved soft by salting and dressed for the table.

PURITY.—When isinglass is reduced to small shreds (*picked or cut isinglass*) it is scarcely possible to distinguish, by the eye, some of the inferior from the finer kinds. The best criteria are its whiteness, freedom from unpleasant odour, and its complete solubility in water.

SUBSTITUTION.—Hartshorn shavings and sole skins (when clean, sweet, and well prepared) are sometimes substituted for isinglass in fining. For domestic uses, *patent gelatine* is frequently used as a substitute for isinglass.

GELATINE.—Gelatine may be extracted from bones, by boiling them in water under pressure; or, more readily, by employing bones, which have been previously digested in hydrochloric acid to extract the phosphate of lime. In this way a nutritious soup is prepared in Paris for the hospitals and other pauper habitations.¹ Gelatine has even been extracted from fossil bones. A soup was prepared from one of the bones of the great Mastodon, by the Prefet of one of the departments of France.

Nelson's Patent Gelatine is obtained from glue-pieces, freed from hair, wool, flesh, and fat.² It is probable that inferior kinds of isinglass are also employed. Two kinds of this patent gelatine are made up:—the best (called *gelatine of the first quality*) is opaque; it is, by preference, made from cuttings of the hides of beasts, or from the skins of calves; the inferior kind (called *gelatine of the second quality*) is transparent; it is made from non-transparent glue-pieces. Both kinds are sold, cut somewhat in imitation of picked isinglass.

French gelatine is sold in cakes, marked like those of common glue, with the nets on which they have been dried. They are either uncoloured, or coloured red, green, or blue.

Country.	Place of Produce.	Place of Export.	Name and Character.	Prices		Remarks.	
				Per lb.	English.		
Russia	The Oral (Ural)	St. Petersburg.	Long Staple Ural 1st & 2d	s. d. 14 6	s. d. 13 6		
	The Irtysh and Obi	"	Short ditto Patriarch		none	Very choice and dear.	
	Oural and tributaries	"	Ditto ditto 1st & 2d Book	14 6	13 0		
	Astrakhan	"	Thin Leaf 1st & 2d..	14 6	to 9 6	} These are the sorts which yield the cut.	
	The Volga and tributaries	"	Beluga 1st & 2d	14 6	10 6		
			Cut by machine or hand	16 0	14 6		13 6 to 9 6
		Tributaries of Black Sea	Odessa	Pickings (the brown ends)	8 0		Refuse of the above Seldom imported.
		Tcherenskoy	Taganrog	Sisane Leaf	2 6		
		The Don and tributaries	"	Kroski or Krosky ..	6 0		Ditto inquired for.
		Ditto	"	Samovey Leaf 1st & 2d	3 9	3 3	Used for finings. In great demand. Seldom imported.
		"	Ditto Book 1st & 2d..	4 0	3 6		
		"	Ditto Short Staple ..	5 0			
Siberia	The Irtysh and Obi	St. Petersburg.	Siberian Purse	8 6	7 6	In good esteem.	
North America	Hudson's Bay and rivers	Hudson's Bay..	Purse	5 6	6 0	A thin insoluble membrane lining the inside.	
	United States ..	New York	Ribbon	No price	—	Not in use.	
South America	The Brazils	Maranham and Para	Pipe Brazil	5 0	4 0	} In general demand.	
			Lump ditto	5 0	4 0		
			Honeycomb ditto..	3 6	2 0	Not in much repute.	
			Cut Brazil	7 6	6 6	6 0	Used perhaps for mixing.
E. Indies	Bay of Bengal ..	Calcutta	Purse	2 0	4 0	} Objected to on account of its fishy smell and imperfect solubility. When carefully prepared may equal the Brazilian kind.	
			Leaf	3 0	4 0		
			Pickled				
Scotland	Coasts of Scot..		Cods Sounds	1 9 to	1 6 if dry and sweet.		
England	England		Sole Skins	0 10 if clean, sweet, and well prepared.			

¹ See D'Arcet, *Recherches sur les Substances Nutritives que renferment les Os*, Paris, 1829; also, Edwards' *Recherches Statist. sur l'Emploi de la Gelatine*, Paris, 1835; and *Quarterly Journal of Science*, April, 1827.
² See the specification of his patent in *The Mechanic and Chemist* for 1840.

For the preceding table of the different kinds of isinglass at the present time known in the London market I am principally indebted to Mr. James Metcalfe, wholesale dealer in isinglass, of No. 20, Artillery Place, Finsbury Square.

COMPOSITION.—Isinglass of fine quality was analysed by John, (Gmelin, *Handb. der Chemie*, ii. 1468,) who found the constituents to be, *gelatine* 70.0, *osmazome* 16.0, *membrane* insoluble in boiling water, 2.5, *free acid* (lactic?), with *salts of potash and soda*, and some *phosphate of lime*, 4.0, and *water* 7.0. These results, however, can scarcely be accurate; for dried flesh, as Berzelius (*Traité de Chim.* vii. 668) observes, does not contain more than 8 per cent. of osmazome; and if isinglass contained 16 per cent. it could not be kept dry when exposed to the air.

Mr. E. Solly, jun. (Royle, *On the Production of Isinglass*, p. 40, Lond. 1842,) examined three specimens of Bengal isinglass, and found the constituents to be *gelatine*, *albumen*, a small portion of *saline* and *earthy substances*, *osmazome*, and a minute trace of *odorous oil*. The quantities of *gelatine* in three specimens were respectively 86.5, 90.9 and 92.8 per cent.; while those of *albumen* were 13.5, 9.1, and 7.2 per cent.

EFFECTS AND USES.—The *dietetical* properties of *gelatine* have been before noticed (vol. i. p. 82). Considered *medicinally* it is an emollient and demulcent. It is employed, dissolved in water or milk, and rendered palatable by acid and sugar, as a nutritious substance for invalids and convalescents.

A solution of isinglass, with some tincture of benzoin, is brushed over black sarcenet to form *Court* or *Black Sticking Plaster*. *Liston's isinglass plaster* consists of oiled silk coated with isinglass. (*Pharmaceutical Transactions*, vol. i. p. 145.) The preparation of *Gelatine Capsules* has been already described (see p. 599).

It is also employed as a clarifying or fining agent (for coffee, wines, beer, &c.) Some of the constituents of these liquors unite with the *gelatine*, and form insoluble compounds, which precipitate, and in the act of precipitation the *gelatine* incloses within its meshes the matters which rendered the liquid turbid. The great consumers of isinglass are the brewers,¹ who employ principally the Brazilian variety.

2. OLEUM JECORIS ASELLI.—COD LIVER OIL.

(Oleum Morrhuæ.)

HISTORY.—The oil obtained from the livers of the Common Cod, and various other allied species of fish, appears to have been for a long period a popular remedy, in various countries of Europe, for rheumatism, and some other diseases, though its use by medical practitioners is comparatively recent. In 1782 it was strongly recommended in chronic rheumatism by Dr. T. Percival, (*Lond. Med. Journ.* vol. iii. p. 393,) and in 1807 by Dr. Bardsley, (*Medical Reports*, p. 18,) who states that it was in high repute in Lancashire.

ZOOLOGY.—This oil is principally procured from the common cod (*Morrhua vulgaris*; *Gadus Morrhuæ*) formerly called *Asellus major*;² also from allied species, as the Dorse (*Gadus callarias*), the Coal-fish (*Merlangus carbonarius*), the Burbot (*Lota vulgaris*), the Ling (*Lota molva*), and the Torsk (*Brosmius vulgaris*).³

PREPARATION.—In different countries the mode of preparing the oil varies somewhat. The cod oil met with in the London market is the produce of Newfoundland, where, according to Pennant (*Arctic Zoology*, vol. iii. p. 305, 1792), it is thus procured:—"They take a half tub, and, boring a hole through the bottom, press hard down into it a layer of spruce boughs; upon which they place

¹ Full particulars respecting the mode of fining beer are given by Jackson in his *Essay on British Isinglass*, Lond. 1765.

² See Schonevelde *Ichthyologia*, p. 18, Hamb. 1624. Pliny (*Hist. Nat.* lib. ix. cap. 28, ed. Valp.) mentions two kinds of *Asellus*,—namely, a smaller kind called *callaris*, and a kind termed *bacchi*, caught in deep water only.

³ See Dr. J. H. Bennett's *Treatise on the Oleum Jecoris Aselli*, p. 17, Lond. 1841.

the livers, and expose the whole apparatus to as sunny a place as possible. As the livers corrupt the oil runs from them, and, straining itself through the spruce boughs, is caught in a vessel set under the hole in the tub's bottom." "At Newhaven, near Edinburgh, the fishermen simply boil the livers in an iron pot, and then filter it [the oil] through a towel containing a little sand." (J. H. Bennett.)

DESCRIPTION.—Among London dealers I have met with but one kind of Cod-liver oil. Its colour is chestnut brown, and its odour is like that of boiled cod's liver. It is the *Cod Oil* of commerce, the *oleum jecoris aselli fuscum* of continental pharmacologists. It is extensively used by curriers in dressing leather.

Three other varieties are met with in Germany. They are distinguished as the White (*oleum album*), the Yellow (*oleum flavum*), and the Red (*oleum rubrum*), Cod Liver Oils. These differences in colour depend probably in part on the species of fish from which each variety is procured, and in part also on the mode of preparation. Thus the Dorse (*Gadus callarias*) yields a white oil. In Germany the deep golden yellow-coloured oil is, for the most part, used medicinally.

COMPOSITION.—Cod oil has been analysed by several chemists. The most recent analysis is that of Marder, (*Pharm. Central-Blatt für 1837*, p. 536.) In 200 grs. of the oil he found the following substances:—

In the Clear Oil.		In the Brown Oil.	
Green soft resin.....	0.104	(brown resin)..	0.130
Brown hard resin.....	0.026	(black resin)...	0.156
Gelatine.....	0.312	.....	0.936
Oleic acid.....	111.833	.....	95.000
Margaric acid.....	20.625	.....	8.000
Glycerine.....	16.832	.....	18.000
Colouring matter.....	11.500	.....	25.000
Chloride of calcium.....	0.1046	.....	0.2092
Chloride of sodium.....	0.1179	.....	0.1883
Sulphate of potash.....	0.0361	.....	0.0614
	161.4906		147.6809

Since the above analyses were made *iodine* and *bromine* have been detected in this oil. Herberger (*Ibid. für 1839*, p. 854,) examined several oils, and obtained the following results:—

1000 parts of Cod Liver Oil.	Iodide of Copper.	Bromide of Potassium.	Iodine.	Bromine.	
1. White Oil. {	From Bremen.....	1.355	0.255	0.903	0.170
	Mainz.....	—	—	—	—
	Mannheim.....	0.439	—	0.293	—
	Frankfort.....	—	—	—	—
2. Brown Oil. {	From Stuttgart.....	0.563	—	0.375	—
	Mannheim.....	2.347	0.435	1.564	0.290
	Hamburg.....	—	—	—	—
	Bremen.....	2.586	0.441	1.723	0.294

PHYSIOLOGICAL EFFECTS.—At the commencement of its use it frequently causes nausea, disagreeable eructation, and occasionally vomiting. In the dose of a tablespoonful it acts as a laxative, diaphoretic, and diuretic, (Schenk, *Hufeland's Journal*, Bd. xxii. 1822.) But Taufflied (*Lond. Med. Gaz.* Feb. 28, 1840,) declares that in doses of from two to four spoonsful a day, he never found it "exert any appreciable influence upon the urine or perspiration, or produce any disturbance in the economy." The disagreeable flavour of the oil sometimes creates nausea and sickness, but when habit has surmounted the repugnance to it these effects cease. In several cases it has proved emmenagogue (Bennett, *op. supra cit.* pp. 46 and 47); and on some occasions has given rise to a cutaneous eruption (*Ibid.* pp. 16 and 47). Dr. Bardsley found that most patients were disposed to get fat under its use.

USES.—Though it has been used more or less successfully in a considerable number of diseases, the cases in which it has proved most successful are those

of a gouty, rheumatic, or scrofulous nature. But even in these it requires a very long-continued use to prove successful. The most recent writer on its employment observes that its use must be continued long, "at least a month, often six weeks, and sometimes for years." As the oil contains iodine, and as it proves most successful in those maladies in which this element proves successful, it has been suggested that iodine is its active principle. Taufflied, however, denies this, and asserts that the properties of the two are not identical, for the one succeeds where the other fails. Is bromine the active agent?¹

The oil is best adapted for relaxed, torpid, and phlegmatic temperaments, and for scrofulous subjects. In plethoric habits, and where irritation of the stomach and bowels, or inflammation, exists, its use is contra-indicated.

Rheumatism and *scrofula* are the diseases in which its employment has proved most successful. In *rheumatism* it is indicated in the chronic forms of this disease, where the muscles and tendons are rigid, and the joints nearly inflexible. In chronic *gout* it is said not to be so efficacious. In *scrofula* it has proved successful in most of the forms of this disease, but especially when it affects the bones (as in rickets, caries, &c.), and in *tabes mesenterica*. In the latter most intractable form of the disease, its efficacy has occasionally been most surprising. Even in *phthisis*, benefit is said to have been obtained by its use.

The oil has also been employed in some other diseases, with more or less success. In *chronic skin diseases* attention was drawn to its use, some years since, by Dr. Marshall Hall. (*Lond. Med. Gaz.* vol. x. p. 796.) In *tinea favosa*, *impetigo*, and chronic *eczema*, it has been found efficacious as a topical application. In *chronic ophthalmia*, especially of a scrofulous kind, it has been given internally, and, in some cases, applied to the eye with benefit. In *paralysis* also it has been found beneficial by Schuppmann.²

ADMINISTRATION.—For an adult, the dose at the commencement is a table-spoonful, which may be gradually increased to six times this quantity (!). This dose is to be repeated two, three, or four times a day for several weeks, or even months. One patient consumed thirty-six lbs. of oil in two years and a half!! (Taufflied). Dr. Bardsley gave from ζ ss. to ζ iiss. twice or thrice a day in warm table beer. For children of twelvemonths or under, the dose is a teaspoonful night and morning. The addition of some aromatic oil (as of lemon, peppermint, cassia, or anise) partly covers the unpleasant taste and smell. It is sometimes taken in the form of an emulsion. Peppermint water and lozenges have been recommended for covering the unpleasant taste of the remedy.

CLASS IX. AVES.—BIRDS.

ESSENTIAL CHARACTERS.—Vertebrated animals, with red and warm *blood*, respiring by *lungs*, and the young of which are produced from *eggs*. Body covered with *feathers*, and general conformation organized for flying.

ORDER I. GALLINÆ, *Linnaeus*.—GALLINACEOUS BIRDS.

ESSENTIAL CHARACTERS.—*Bill* short, convex, in some genera covered by a *cere*. Upper *mandible* bending from its base or only at the point; nostrils lateral, covered by a membrane, naked or feathered. *Tarsus* long. Three *toes* before, united at their base by a membrane; hind toe articulated on the tarsus above the junction of the anterior toes.

GALLUS DOMESTICUS, *Temminck*.—THE DOMESTIC COCK AND HEN.

Phasianus Gallus, *Lin.* L. E.

(*Ovum*, L.—The Egg, E.)

HISTORY.—No mention is made of this animal in the Old Testament. Both

¹ For an account of Ascherson's speculations on the *modus medendi* of this oil, see Dr. Bennett's *Treatise*, before cited, p. 53.

² For further details respecting the therapeutic uses of this oil, the reader is referred to Richter's *Ausfuhr.* *Arzneim.* Bd. i. S. 235; Dierbach's *Neuest. Entd. in d. Mat. Med.* 1828, p. 270; and *Ibid.* Bd. i. p. 352, 1837; also Dr. Bennett's *Treatise*, already quoted.

the male and female are referred to in the New Testament. (*Matthew*, xxvi. and xxiii.) Aristotle (*Hist. de Animal.*) calls the cock ἀλεκτρούων,—the hen ἀλεκτορίς.

ZOOLOGY. Gen. Char.—*Bill* of medium size, strong, base naked. Upper *mandible* arched convex, bent towards the point. *Head* surmounted by a crest or plume. *Ears* naked. Three *toes* before, united to the first joint; the hind toe raised from the ground. *Tarsus* with a long and bent *spur*. Middle *feathers* of the tail arched. *Wings* short.

Sp. Char.—*Comb* dentated. *Throat* wattled. *Feathers* of the neck linear and elongated. *Body* variegated with beautiful colours. *Tail* compressed and ascending. *Comb* and *wattles* of the female less than those of the male.

Some doubt exists as to the origin of our domestic cock and hen. Sonnerat (*Voy. aux Ind. Orient.* ii. 148,) affirms, that all the varieties originate from the *Jungle Fowl* (*Gallus Sonnerati*); while Temminck refers them to the *Javan Fowl* (*Gallus banchiva*).

STRUCTURE OF THE OVARIVM AND DEVELOPEMENT OF THE EGG.—The **OVARIVM** (*racemus vitellorum*) or *egg-organ*, consists of a cluster of ova, in a hen beginning to lay, about 500 in number. The stalk by which each ovum is attached to the ovarium is called the *petiolus*. The size of the ova is exceedingly various: when quite ripe, they are as large as the yelk of an egg; the smaller ones are white, the larger ones yellow. Each ovum, when ripe, is composed of a *calyx*, the *yelk-bag*, and the *yelk*. The *calyx* constitutes the outer coat or covering of the ovum, and consists of two layers—an outer one, derived from the peritoneum, and an inner one, which

FIG. 261.

A Segment of the Yelk.

(The division has been made in the direction from the cicatricula to the centre.)



FIG. 262.

Cumulus cicatricula.

The convex portion faces the yelk. On the top is a small crater, the inner opening of the pore.

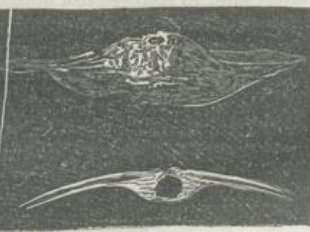
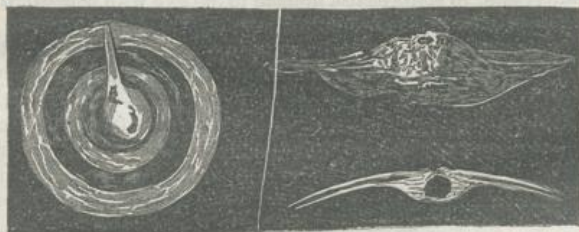


FIG. 263.

Section of the Cicatricula, showing the vesicula in situ.



is somewhat thicker. Between these two coats the vessels ramify. The *petiolus* is merely a prolongation of the calyx: it is studded with a number of small ova, resembling vesicles. On that part of the calyx of a ripe ovum which is opposite the petiolus, is a whitish curved stripe, called the *stigma*, indicating the spot where the calyx bursts, to allow the escape of the yelk. The *yelk-bag*, or *membrana propria vitelli*, is within the calyx, and closely invests the yelk. It is a flocculent, delicate, fine coat. In the early state of the ovum, the *yelk* is constituted of a pellucid fluid lymph, and is hardly distinguishable from the *vesicula cicatricula*. It then becomes whitish, and subsequently yellow, globules of oil making their appearance. In a ripe ovum, it is viscid, tenacious, and of an orange yellow colour; and lies in the calyx, with its long axis towards the petiolus. It is composed of three layers, the middle one having the deepest colour; the innermost enclosing a white fluid called the *albumen centrale* (or *substantia alba vitelli*), from which passes a little canal to that part of the surface of the yelk called the *cicatricula*.

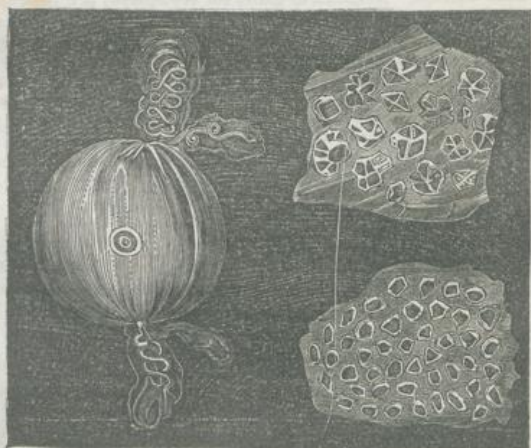
The internal surface of the yelk-bag is lined with a very thin stratum of globules, in form and figure like those of the blood, but arranged organically. The *cicatricula*, or *tread*, (as it is improperly called), is formed by an accumulation of these globules forming a mammiform heap, the convexity of which is towards the centre of the yelk, and is usually situated nearer the petiolus than the stigma. In the top of this is the so-called pellucid *pore*, which is occupied by a small vesicle discovered by Parkinje, (*Symb. ad ovi avium histor. ante incub.* Lipsiæ, 1830,) and called by him the *vesicula germinativa* or *vesicula cicatricula*. It is found in all the ovarian ova, and seems to be a natural organ, since it is found in the ova of fowls which have never had access to the male. When the yelk falls into the infundibulum, this vesicle disap-

pears. The OVIDUCT has some resemblance to a convoluted intestine. It is situated on the left side of the animal. Its superior expanded free extremity is called the *infundibulum*, the edges of which are fimbriated. Inferiorly, the oviduct opens into the cloaca. It is attached to the spine by the *mesometrium*. The *infundibulum*, or expanded portions of the tube, receives the ovum as it escapes from the calyx of the ovarium. The upper part of the oviduct is lined by a fine villous membrane, covered with follicles secreting the albumen or glaire, and thrown into a number of longitudinal folds. The first layer of albumen which the ovum receives forms the *membrana chalazifera* of Dutrochet; at either end of which is a soft, pellucid,

FIG. 264.

FIG. 265.

(Yolk, and its Appendages.)



The spiral chalazæ are seen at the extremities of the yolk; the circular cicatricula in the middle; and the zona albicans extending from one chalazæ to the other.

Polygonal pieces (crystals?) of Chalk, forming the rudiments of the Shell of the Egg.

albuminous nodule, which may be regarded as the *rudimentum chalazarum*. During the descent of the ovum in the oviduct, it receives fresh deposits of albumen; and, as it undergoes spiral rotations in its passage, the above-mentioned processes become curved spirally, and in the perfect egg constitute the *chalazæ, grandines, appendices albuminis*, or the *poles* or *treadles*. From one chalazæ to the other are observed, in many eggs, one or more white striæ, formed by a thickening of the *membrana chalazifera*. Vicq d'Azyr called this appearance the *zona albicans*.

The *albumen, glaire, or white* of the egg, is not uniform in its consistence. The thickest portion is that which is first deposited around the yolk. Proceeding from without inwards, the three layers of albumen are denominated *albumen primum, a. secundum, and a. tertium*. Just before the egg arrives at that part of the oviduct called the uterus, it receives its outer coat, the *pellicula ovi*. In the middle, or so-called uterine portion of the oviduct, is formed the *calcareous shell*. Some eggs are expelled without it; these are termed *bon eggs*. The chalk is first deposited in small polygonal pieces, having a crystalline appearance; but, when the deposit has attained a certain thickness, all traces of crystallization are lost.

Hab.—Domesticated in all the four quarters of the globe.

DESCRIPTION.—Eggs (*ova*) are too well known to need much description. Their specific gravity varies from 1.080 to 1.090. By keeping they become lighter, by the evaporation of a portion of the water. Dr. Prout (*Phil. Trans.* for 1822, p. 377.) found, that in two years an egg lost $544\frac{3}{10}$ grains. The relative weights of the different parts of the egg are, according to the same authority, as follows:—*shell and membrane*, 106.9; *albumen*, 604.2; *yolk*, 288.9; (total, 1000). By boiling in water an egg loses two or three per cent.

1. **EGG-SHELL** (*Testa Ovi; Putamen Ovi*).—This consists, according to Prout, of *carbonate of lime*, 97; *phosphate of lime and magnesia*, 1; *animal matter, with traces of sulphur and*

iron, 2. The chalk renders the egg absorbent and antacid; hence its use to neutralize the acidity of wines.

2. *PELLICULA OVI (Membrana Putaminis)*.—An albuminous membrane which lines the shell. It is soluble in alkalis, and from its solution is precipitated by acids. It weighs about 2.35 grains (the whole egg being supposed to be 1000 grains). At the larger end of the egg it forms the *follicula aeris*; the air of which, according to Bischoff, contains 23.475 per cent. of oxygen.

3. *WHITE OR GLAIRE (Albumen seu Album Ovi)* consists of two or three laminæ, which are not homogeneous, as two parts at least are discernible,—viz. a solid, probably organized albumen, having the appearance of a very fine delicate membrane, forming a series of cells, in which is contained the liquid albumen. Glaire or white of egg consists, according to Gmelin, of albumen 12.0, mucus 2.7, salts 0.3, and water 85.0. The coagulability of albumen by heat distinguishes it from caseum. Albumen or glaire (or *ovalbumen*) is distinguished from albumen of the serum of the blood (*seralbumen*) by its being coagulated by ether. The membranous tissue in which the liquid albumen of eggs is contained is said by Couerbe to be devoid of nitrogen: he calls it *albumenin* or *oonin*.

4. *YELK (Vitellus Ovi)* is a kind of yellow emulsion, consisting of oil suspended in water by means of albumen, and enclosed in a sac called the *yelk bag*. On its upper surface is seen the *cicatricula*. At the extremities are the twisted flocculent *chalazæ*. The yelk consists of yellow oil with crystallizable fat, 28.75, albumen containing phosphorus 17.47, and water 53.8. The yellow oil (*oleum ovi*) may be obtained by boiling the yelk hard, and digesting in ether or alcohol, which dissolves the oil. By distilling off the alcohol from the filtered tincture, the oil is left behind.

PHYSIOLOGICAL EFFECTS AND USES.—Both the glaire and the yelk are highly nutritive; the latter, on account of the oil which it contains is somewhat less easy of digestion than the white. Both are more readily assimilated when in the soft state than when hardened by heat. Considered as medicinal agents, they are emollient and demulcent. The glaire is a valuable agent in the treatment of poisoning by bichloride of mercury (see vol. i. p. 623), sulphate of copper (see vol. i. p. 640), and the bichloride of tin. Its efficacy in these cases depends on its chemical properties. The glaire is also used as a demulcent or sheathing agent in all cases of corrosive or acrid poisons. The yelk is a constituent of the *mistua spiritus vini gallici* (see vol. i. p. 323.) It is also used for preparing emulsions. Its oil has been applied to cracked nipples.

The white or glaire is employed as a clarifying agent for wines and some other liquids. Its efficacy depends on its coagulation, by which it entangles in its meshes the impurities, with which it either rises to the surface or precipitates. When the liquid to be clarified does not spontaneously coagulate the albumen, it is necessary to apply heat. Bookbinders use the glaire as a varnish.

CLASS X.—MAMMALIA, Linnæus—MAMMALS.

ESSENTIAL CHARACTERS.—Vertebrated animals with red and warm blood, breathing through lungs, viviparous, and suckling their young with milk formed in their breasts or *mammæ*.

ORDER I.—CETACEA, Linnæus.—THE CETACEANS.

ESSENTIAL CHARACTERS.—Body pisciform, terminated by a caudal appendage, cartilaginous, and horizontal. Two anterior extremities formed like *fins*, having the bones which form them flattened and very soft. Head joined to the body by a very short thick neck. Two pectoral or abdominal *mammæ*. Ears with very small external openings. Brains large. Pelvis and bones of the posterior extremities represented by two rudimentary bones lost in the flesh.

PHYSETER MACROCEPHALUS, Linn. L. E.—GREAT HEADED CACHALOT.

(Concretum in propriis cellulis repertum, L.—Cetine nearly pure, E.—Cetaceum, D. [U. S.]])

HISTORY.—Cuvier (*Rech. sur les Ossemens Foss.* t. v. p. 328,) is of opinion that this animal is perhaps the *Physeter* of Pliny, (*Hist. Nat.* ix. 3, and xxxii. 53, ed. Valp.)—the *Orca* of some other Latin writers.

ZOOLOGY. **Gen. Char.**—Inferior teeth eighteen to twenty-three on each side of the jaw. Upper jaw broad, elevated, without teeth, or with these short and

concealed in the gum; *lower jaw* elongated, narrow, corresponding to a furrow of the upper, and armed with thick and conical teeth entering into corresponding cavities in the upper jaw. *Spiracular orifices* united at the upper part of the snout. *A dorsal fin* in some species, a simple eminence in others. *Cartilaginous cavities* in the superior region of the head, filled with *oily matter*.

Sp. Char.—*Lower teeth* twenty to twenty-three on each side, recurved and pointed at the extremity. Small conical teeth concealed in the upper gums. *Tail* narrow and conical. *A longitudinal eminence* on the back above the anus. Upper part of the body blackish or slate blue, a little spotted with white. *Belly* whitish. *Length* forty-five to sixty feet.

The *snout* of the cachalot, notwithstanding its prodigious length, is formed only by the maxillæ on the sides, by the intermaxillæ towards the median line, and by the vomer on this line. The intermaxillæ project to form the anterior part of the snout. Posteriorly the right one ascends higher than the left. The *spout hole* is single (in most cetacea it is double), and directed towards the left side, so that whenever the animal spouts water, it is to that side only.

SEAT OF SPERMACETI.—Spermaceti is found in several parts of the body of the animal mixed with the common fat. The head, however, is the grand reservoir for it. Here it is found (mixed with oil) in a large excavation of the upper jaw, anterior to, and quite distinct from, the true cranium which contains the brain. Mr. Hunter (*Phil. Trans.* vol. lxxvii. 390.) states that the spermaceti and oil are contained in cells, or cellular membrane, in the same manner as the fat in other animals; but that besides the common cells there are larger ones, or ligamentous partitions going across, the latter to support the vast load of oil, of which the bulk of the head is principally made up.

There are two places in the head where this oil lies; these are situated along its upper and lower part: between them pass the nostrils, and a vast number of tendons going to the nose and different parts of the head. The purest spermaceti is contained in the smallest and least ligamentous cells. It lies above the nostril, along the upper part of the head, immediately under the skin and common adipose membrane. These cells resemble those which contain the common fat in the other parts of the body nearest the skin. That which lies above the roof of the mouth, or between it and the nostril, is more intermixed with a ligamentous cellular membrane, and lies in chambers whose partitions are perpendicular. These chambers are smaller the nearer to the nose, becoming larger and larger towards the back part of the head where the spermaceti is more pure.

Mr. Hunter discovered about the nose, or anterior part of the nostril, a great many vessels, having the appearance of a plexus of veins, some as large as a finger. On examining them, they were found loaded with spermaceti and oil; and some had corresponding arteries. They were most probably lymphatics, whose contents had been absorbed from the cells of the head.

Hab.—Pacific Ocean, Indian and Chinese Seas. Especially off New Guinea and parts adjacent, Timor, Australasia, Polynesia, Peru, &c.

EXTRACTION OF SPERMACETI.—In the right side of the nose and upper surface of the head of the whale is a triangular-shaped cavity, called by the whalers "the case." Into this the whalers make an opening, and take out the liquid contents (oil and spermaceti) by a bucket. The dense mass of cellular tissue beneath the case and nostril, and which is technically called "junk," also contains spermaceti, with which and oil its tissue is infiltrated. The spermaceti from the case is carefully boiled alone, and placed in separate casks, when it is called "*head matter*."¹

PURIFICATION.—The substance called "*head matter*" consists of spermaceti and sperm oil. Its colour is yellow. Its consistence varies with the temperature. In cold weather it consists of a congealed mass (spermaceti) surrounded and infiltrated by oil. To separate the latter as much as possible, it is put into filter bags. The solid thus obtained is then submitted to compression in hair bags, placed in an hydraulic press. It is then melted in water, and the impurities skimmed off. Subsequently it is remelted in a weak solution of potash. It is then fused in a tub by the agency of steam, ladled into tin pans, and allowed slowly to concrete into large, white, translucent, crystalline masses.

¹ Beale, *Nat. Hist. of the Sperm Whale*, p. 186, 1839; also F. D. Bennett, *Narrative of a Whaling Voyage round the Globe*, from the year 1833 to 1836, vol. ii. pp. 153, 228, Lond. 1840.

PROPERTIES.—Commercial spermaceti (*cetaceum*; *sperma ceti*) usually contains a minute portion of sperm oil, which is best removed by boiling in alcohol. Absolutely pure spermaceti (called *cetine*) is a white laminated substance, without taste, and almost odourless. By the addition of a few drops of alcohol or almond oil, it may be reduced to powder. It is insoluble in water, and slightly soluble only in alcohol, even at a boiling temperature. By saponification with potash, 100 parts of spermaceti yield 60.96 parts of margaric and oleic acids, 40.64 parts of ethal, and 0.9 parts of a yellow extractiform substance.

ETHAL is a crystalline solid, composed of $C^{16} H^{17} O$. By distillation with phosphoric acid, it yields an oily substance called *cetene*, composed of $C^{16} H^{16}$. So that ethal may be regarded as a hydrate of cetene.

COMPOSITION.—The ultimate analysis of pure spermaceti or cetine was made by Chevreul. (Gmelin, *Handb. d. Chem.* ii. 440.) The proximate composition of the same substance has been ascertained by Dumas and Peligot. (*Ann. de Chim. et de Phys.* t. lxxii. p. 5.)

Chevreul's Analysis.		Dumas and Peligot's Analysis.		At. Eq. Wt.			
		At.	Eq. Wt.		At. Eq. Wt.		
Carbon	81.660	Margaric Acid .. 2	1064	} or {	Margarate of Cetene 2	1288	
Hydrogen	12.862	Oleic Acid	1040		Binoleate of Cetene 1	1152	
Oxygen	5.478	Cetene	336		Water	3	27
		Water	27				
Cetine	100.000	Cetine	1	2467	or	1	2467

PHYSIOLOGICAL EFFECTS AND USES.—Emollient and demulcent. Internally it has been employed in irritation and inflammation of the alimentary canal (as diarrhoea and dysentery) and of the bronchial membrane (catarrh); but its internal administration is now nearly obsolete. Its principal medicinal use is in the preparation of cerates and ointments.

ADMINISTRATION.—When employed internally it is generally exhibited in the form of an emulsion (*spermaceti mixture*) made with the yolk of egg. Or it may be made with mucilage.

I. CERATUM CETACEI, L. (U. S.); Ceratum simplex, E.; Unguentum Cetacei, D.; Spermaceti Cerate. (Spermaceti, ℥ij.; White Wax, ℥viii.; Olive Oil, Oj. *L.*—Olive Oil, 6 parts; Bleached Bees-wax, 3 parts; Spermaceti, 1 part, *E.*—White Wax, lb. ss.; Spermaceti, lb. j.; Prepared Hogs Lard, lb. iij. "Heat the oil gently, add the wax and spermaceti, stir the whole briskly when it is fluid, and continue the agitation as it cools," *E.*)—[Spermaceti, ℥i.; White Wax, ℥iij.; Olive Oil, f℥vi. *U. S.*]—If cold oil be added to the wax and spermaceti, the preparation is apt to be somewhat lumpy. As the white wax of commerce is always largely mixed with spermaceti, this preparation has never the precise composition intended by the College. Practically, however, this is of no consequence.—This preparation is employed as a mild and simple dressing for blisters and excoriated surfaces.

2. UNGUENTUM CETACEI, L.; Spermaceti Ointment. (Spermaceti ℥vj.; White Wax, ℥ij.; Olive Oil, f℥iij. Having melted them together with a slow fire, stir assiduously until they become cold.)—A softer preparation than the preceding, but used in the same cases.

AMBERGRIS.—The substance called Ambergris (*Ambra grisea*) is procured from the Cachalot or Sperm Whale. (*Phil. Trans.* vol. lxxiii. p. 226, for the year 1783.) In this country it is used as a perfume only: on the continent it is employed in medicine. It appears to be the indurated faeces (perhaps somewhat altered by disease) of the animal. Mr. Beale (*op. supra cit.* p. 135.) collected some of the semi-fluid faeces, and found that the dried mass had all the properties of ambergris. It is a solid, opaque, grayish, striated substance, having a pleasant musk-like odour, and which is supposed to be derived from the Squid (*Sepia moschata*) on which the animal feeds; and in support of this opinion it must be mentioned that the horny beaks of this animal are found imbedded in the masses. Its sp. gr. is 0.908 to 0.92. John analyzed it, and found it to consist of a peculiar non-saponifiable fat (ambreine) 85, sweet balsamic alcoholic

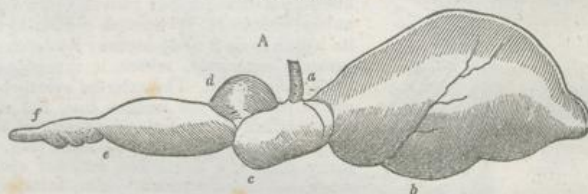
extract, with benzoic acid, 2.5, aqueous extract, benzoic acid, and chloride of sodium 1.5. Ambreine is soluble in alcohol, and by the action of nitric acid furnishes a peculiar acid called ambreic acid. The effects of ambergris on the system are said to be analogous to those of musk. In the shops is kept an alcoholic tincture (called *essence of ambergris*) which is employed as a perfume only.

ORDER II.—RUMINANTIA, Cuvier.—RUMINANTS.

PECORA, Linnæus.

ESSENTIAL CHARACTERS.—No incisors in the upper jaw; in the lower usually eight; a vacant space between the incisors and molars, but in which, in some genera are found one or two canines. *Molars* twelve in each jaw, the crown marked with two double crescents of enamel, of which the convexity is outwards in the lower jaw, and inwards in the upper. No *clavicles*. *Extremities* disposed for walking. Two *toes* furnished with hoofs; metacarpal and metatarsal bones united. Four *stomachs*; *intestines* long. Two or four inguinal *mammæ*. *Horns* in the males, and often in the females of most species.

FIG. 266.



The four Stomachs of the Sheep.

a, The gullet.—b, The paunch.—c, The honeycomb.—d, The manyplies.—e, The reed.—f, The commencement of the duodenum.

MOSCHUS MOSCHIFERUS, Linn. L. E. D.—THE MUSK ANIMAL.

(Hamor in folliculo præputii secretus, L.—Inspissated secretion in the follicle of the prepuce, E.—Concretum *Moschus* dictum, D.)

(Moschus, U. S. Musk.)

HISTORY.—Aristotle, Pliny, Ælian, and Oppian, make no mention of this animal. Ætius (*Serm.* xxvi. t. ii. cap. cxliii.) is the earliest writer who notices the perfume. None of the etymologies hitherto given for the word *Musk* (*μύσχος*) are satisfactory.

ZOOLOGY. **Gen. Char.**—*Incisors* $\frac{2}{3}$. *Canines* $\frac{1}{6}$ — $\frac{1}{6}$. *Molars* $\frac{6}{6}$ — $\frac{6}{6}$ = 34. *Canines* wanting altogether in the females; superior canines large in the males. *Ears* long, pointed. *Body* slender. *Feet* with hoofs, separated and enveloping the last phalanges. *Tail* very short. Two inguinal *mammæ*.

Sp. Char.—*Fur* of a gray-brown; *hair* coarse. A *pouch* before the prepuce of the male, filled with an unctuous musky substance. *Size* of the roebuck.

The absence of *horns* and the presence of canine teeth distinguish the animal from the Deer (*Cervus*). The *Stylocerus moschatus* is the connecting link between the deer and the musks. It has the horns of the one, and the canine teeth of the other.

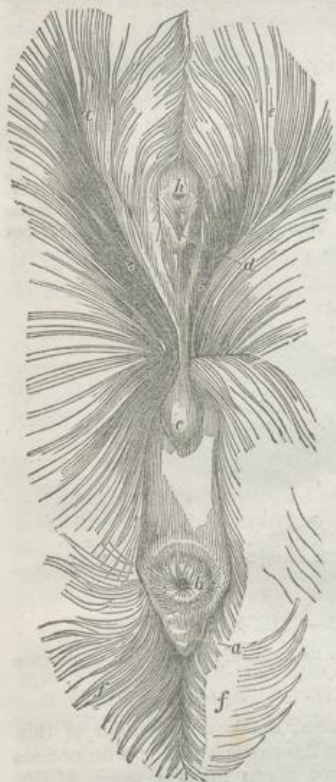
The most interesting part of the musks is the *preputial musk sac*. Cuvier (*Règne Animal*, i. 259, nouv. ed. 1829,) says no other species of *Moschus* possesses a musk sac; but this statement is not correct. *M. Altarcus* Eschscholtz (*M. Moschiferus Altaicus* Brandt), *M. Napu*, and *M. Javanicus*, are also said to possess musk sacs.

FIG. 267.

*Moschus moschiferus.*

ANATOMY OF THE MUSK SAC.—The sac is peculiar to the male animal. If he be supposed to be laid on his back, and the belly examined, we observe behind the navel, and immediately in front of the preputial orifice, a small aperture (*external aperture of the musk sac*) leading into the *musk canal*, which terminates in the cavity of the *musk sac*. The aperture is about half an inch from the umbilicus, and usually about a line, or a line and a half, from the preputial orifice. In some preparations in my possession the distance is much greater. The preputial orifice is somewhat more prominent, and has a number of longish hairs projecting from it, in the form of a brush or hair-pencil; whereas the external musk aperture is placed in a depression, and is smooth. The relative position of the parts is shown by the subjoined sectional view of the musk sac *in situ*, (p. 803, from Brandt.)

FIG. 268.



Belly of *Moschus moschiferus*.
(From Pallas.)

a. Tail. b. Anus. c. Scrotum. d. Preputial orifice. e. Abdomen. f. Orifice of the musk sac.

On the inner surface of the muscular fibres is a number of small oblong or roundish glands compared by Pallas to the meibomian glands of the palpebræ.

3. *Fibrous coat*.—This is the most external of the proper coats of the musk sac. On its inner surface are numerous depressions or cells, surrounded by ramifying folds, within which the blood-vessels ramify. This coat is continuous (through the musk orifice) with the corium.

4. *Pearly coat*.—A soft delicate membrane, shining like mother-of-pearl. It lines the cells, and covers the folds of the fibrous coat.

5. *Epidermoid coat*.—It is the inner lining of the sac. Its external layer is silvery white; its internal one yellowish or reddish brown.

6. *Musk glands*.—In each of the depressions observed on the internal coat of the musk sac, are found two or more irregular shaped bodies of a yellowish or reddish-brown colour. These bodies consist of a central brownish mass (supposed to be glandular), covered by a fine membrane.

7. *Contents of the Musk Sac*.—Pallas found, that, in young animals, the sac was empty and contracted. In the adult animal it contained about a drachm and a half of musk, and in old animals more than two drachms. But these quantities must be below the average, since the dried pods of commerce contain on the average more musk than this. Mr. Campbell (*Journ. of the Asiatic Soc. of Bengal*, vol. vi. p. 119, Calcutta, 1827) describes the musk found in the sac as soft, reddish-brown, granular, and having the appearance of soft gingerbread.¹

¹ For further details respecting the structure of the musk sac consult Brandt and Ratzburg, *Med. Zool. Bd. i.*

The *musk sac* is of an oval form, rather broader at the anterior than at the posterior part. It is flat and smooth above, where it is in contact with the abdominal muscles, but convex below (supposing the animal standing). Its breadth is from $1\frac{1}{4}$ to $1\frac{3}{4}$ inches; its length from 2 to $2\frac{1}{2}$ inches; its depth varies, being greatest anteriorly, where it is about one-half or $\frac{3}{4}$ ths of an inch. The *external aperture* of the musk sac is placed in the median line, but nearer to the anterior than the posterior extremity of the sac. The *musk canal* is about 1 or $1\frac{1}{2}$ lines long, its diameter being about one line. The *internal aperture* of the musk sac is surrounded by fine hairs, which readily fall off, and are found in the musk of commerce.

The following are the parts of which the musk sac consists:—

1. *Outer or hairy coat or skin*.—This is a continuation of the hide, and covers the convex portion of the sac. Its hairs are stiff and smooth, and disposed in a circular manner around the external musk orifice.

2. *Muscular coat*.—This consists of two strata of fibres which surround the sac in a circular form. Pallas (*Spicileg. Zoolog. fasc. xiii.*) states, that they arise from the groin and unite anteriorly with the panniculus carnosus. He regards them as the compressors and retractors of the follicle and of the prepuce, when the genital organ is thrust out. The same naturalist has described two retractors of the penis.

Between the two strata of muscular fibres is placed the *penis*, which is remarkable from the circumstance of the urethra projecting beyond the extremity of the glans. In its usual state the penis lies rolled up within the belly.

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Hab.—Asia, between 16° and 58° north latitude, and 92° and 155° of east longitude. Especially on the Atlas and Himalayan ranges. China, Cochin-China, Tonquin, Tartary, and Siberia, have all been celebrated for the musk. The animal is timid, and dwells in cold mountainous districts, where coniferous plants abound.

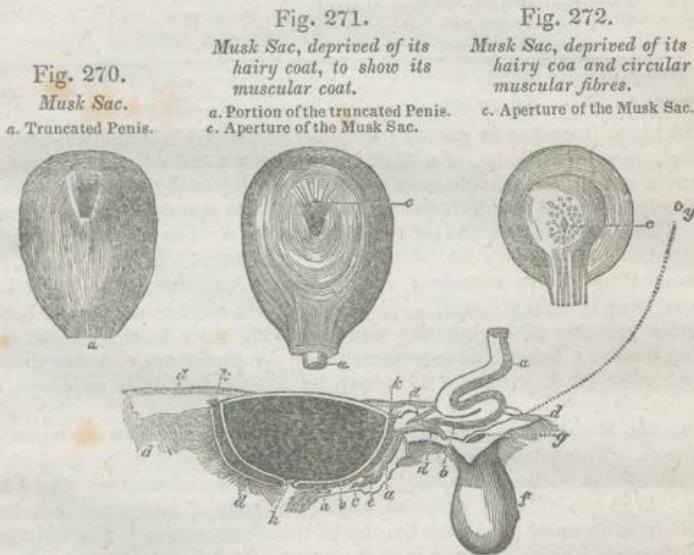


Fig. 269.

Vertical Section of the Musk Sac in situ.

a. The penis.—c. Urethra.—d, d, d. The hide.—e. Glans penis.—f. Scrotum.—g. Spot where the spermatic cord is cut off.—h. Aperture of the musk-sac.—i. Preputial orifice.—k, k. Muscular coat of the sac.—y. Position of the anus.

CAPTURE OF THE ANIMALS.—Various methods of catching the animals are adopted. Sometimes they are taken by snares or gins, sometimes by pitfalls, sometimes by shooting them. The Tungouses, one of the native tribes of Siberia, employ the bow and arrow only.

DESCRIPTION.—Three kinds of musk are described, viz. *China*, *Russian*, (or *Kabardine*), and *Bucharian*. I am acquainted with the two first only.

1. China, Tonquin, or Thibet Musk, (*Moschus tunquinensis* seu *tibetanus*).—This is imported in small rectangular boxes (*catties*), about $7\frac{3}{4}$ inches long, $4\frac{3}{8}$ inches broad, and $4\frac{1}{2}$ deep; covered externally by silk, and lined with sheet-lead and paper. These boxes contain about twenty-five sacs or pods, each wrapped separately in paper. On the outside of the lid of some of the boxes is marked "*Lingchong Musk*;" and on the inside of the lid is a rude Chinese representation of the musk hunters, some shooting the animal, others cutting out the musk-bag. On the paper, which envelopes each pod, are similar rude representations in blue or red ink.

*Pod musk (*moschus in vesicis*)* consists of roundish, or somewhat oval pods, which are generally broader at one end than at the other. The hairs are brownish yellow, or grayish, or whitish, bristle-like, and stiff; arranged in a concentric manner around the orifice of the sac. A careful examination will always discover the remains of the penis. The pods are about $2\frac{1}{2}$ inches long, and $1\frac{3}{4}$ inches broad. The weight of each pod, as well as of the contained musk, is very variable. I am indebted to Mr. Noakes, druggist, of Snow Hill, for the

following account of the weights of six pods, and of the grain musk obtained therefrom :

Pods of Musk.	Weight.	Contents.
1.....	3vss.....	} Grain Musk,..... 3xvj. grs. xv.
1.....	3ivss.....	
1.....	3vij. grs. xxxvijs.....	
1.....	3ix. grs. xlvijss.....	
1.....	3v. grs. xx.....	
1.....	3ijss.....	
Total. 6.....	3xxxvij. grs. xv.....	3xvj. grs. xv.
Average, 1.....	3vj. grs. xijss.....	3ij. grs. xliiss.

Grain musk (*moschus in granis*; *moschus ex vesicis*) is granular, unctuous to the feel, mixed with hairs, of a dark reddish-brown colour, a bitter aromatic taste, and a strong, remarkable, very persistent smell (*musky odour*). Its odour can scarcely be called peculiar, since it is common to several animals and vegetables. Thus, the musk-ox and the musk-cat evolve it. The submaxillary gland of the crocodile secretes an unctuous musky substance. Among plants, *Erodium moschatum*, *Malva moschata*, and *Centaurea moschata*, may be referred to as possessing a musky odour. When mixed with other scents, musk has the remarkable property of augmenting and improving their smell, without much imparting its own; hence it is extensively used by perfumers. A few drops of potash added to musk increases its odour, by setting free, it is supposed, ammonia.

2. *Siberian, Russian, or Kabardine Musk* (*Moschus sibiricus, rossicus seu cabardinus*). This is an inferior kind. The pods are said to be more oblong or oval than those of the China kind; the hairs longer and whiter. But I have examined large quantities of Siberian musk, the pods of which are not distinguishable from those of the China by any of these characters. The only invariable distinction I have observed is in the scent, which is remarkably different; it is much less powerful, and more nauseous and disagreeable, being somewhat empyreumatic. Geiger says, it is sometimes accompanied by an odour similar to that of the sweat of a horse. This kind of musk is imported in wooden boxes, and all the pods that I have examined were in a good state of preservation; but frequently, I am told, this is not the case.

BUCHARIAN MUSK (*Moschus bucharicus*) is described by some pharmacologists, but I have never met with it. The hairs are said to be yellowish or reddish-brown. The musk has a weak odour, and is of very inferior quality.

ADULTERATION.—The great sophisticators of musk are the Chinese. I have seen several *artificial* pods of musk which had been imported from Canton. T. W. C. Martius (*Lehrb. d. pharm. Zool. S. 39, 1838*) calls this artificial kind *Wampo Musk*, and says that, for some years past, it has been extensively introduced into commerce. The hairy portion of the sacs is formed of a piece of the skin of a musk animal, (readily distinguished by its remarkable hairs,) coarsely sown at the edges to a piece of membrane, which represents the smooth or hairless portion of the sacs. These pods are distinguished from the genuine ones by the following characters:—the absence of any aperture in the middle of the hairy coat; the hair not being arranged in a circular manner; and the absence of remains of the penis (found in every genuine musk sac). These false sacs, as well as the genuine ones, are sometimes enveloped in papers marked, "*Musk collected in Nankin by Jung-then-chung-chung-kee.*" The odour of the musk of the false sacs is ammoniacal.

Grain musk is sometimes imitated by dried blood, and perhaps by other substances. The fraud is to be detected by a careful examination of the appearance and odour of the particles, and by their chemical characters. An infusion of genuine musk gives *no* precipitate with a solution of bichloride of mercury, but does with tincture of nutgalls, and acetate of lead. By incineration genuine musk

leaves behind a grayish white ash, whereas blood yields a reddish one. *Artificial musk* is said to be prepared by rubbing in a mortar dried bullock's blood with caustic ammonia, and mixing the half-dried mass with genuine musk. Another kind of artificial musk has been already described (see vol. i. p. 373).

COMMERCE.—“At an average of the three years ending with 1832, the imports of musk, from all places eastward of the Cape of Good Hope, with the exception of China, amounted to 4,965 ounces a-year.” (McCulloch's *Dict. of Commerce*.) In 1839, duty (6d. per ounce) was paid on 2,389 ounces.

COMPOSITION.—In 1803, Thiemann (*Berl. Jahrb.* 1803, S. 100) analysed musk. In 1805, Bucholz (Pfaff, *Mat. Med.* Bd. iv. 401) examined it. In 1820, Blondeau and Guibourt (*Journ. de Pharm.* vi. 105) published an analysis of it. Afterwards, Westler, (Buchner's *Rep.* Bd. xvi. S. 222, 1824,) Buchner, (*Ibid.* Bd. xxii. S. 152, 1825,) and Geiger and Reinmann, (Gmelin, *Hand. d. Chem.* ii. 1449,) submitted it to chemical investigation.

Guibourt and Blondeau.

1. Volatilized by drying	{ Water..... 46.925	{ Ammonia..... 0.325
2. Extracted by ether—Stearine, oleine, cholesterine, fatty acid with ammonia, traces of a volatile oil...	13.000	
3. Extracted subsequently by alcohol—Cholesterine, fatty acid with ammonia, sal ammoniac, chlorides of potassium, sodium, and calcium, and an undetermined acid combined with the same bases.....	6.000	
4. Extracted subsequently by water—Gelatin, carbonaceous matter soluble in water, the preceding chlorides, and an undetermined combustible acid.....	19.000	
5. Extracted subsequently by ammonia—Albumen and phosphate of lime.....	12.000	
6. Fibrous tissue, carbonate and phosphate of lime, hairs, and sand....	2.750	
	100.000	

Geiger and Reinmann.

	Quantity
1. Peculiar volatile substance.....	undeterminable.
2. Ammonia.....	Ditto
3. Peculiar, fixed, uncrystallizable acid...	Ditto
4. Stearine and oleine.....	1.1
5. Cholesterine (with some oleine and resin).....	4.0
6. Peculiar bitter resin.....	5.0
7. Osmazome (with sal ammoniac, chlorides of sodium and calcium, and the above acid, partly free, partly combined with the bases).....	7.5
8. A mouldy-like substance, in part combined with ammonia, by which it is made soluble in water, with small quantities of phosphates of lime and magnesia, sulphate of potash, chlorides of potassium and sodium, carbonate of potash or soda, and trace of iron.....	36.5
9. Sand.....	0.4
10. Water, some volatile odorous matter, the above acid in part combined with ammonia, and loss.....	45.5
	100.0

ODOROUS PRINCIPLE.—Has not hitherto been isolated. The strong and diffusive odour of musk would lead us to expect that its odorous matter was highly volatile. Yet such is not the fact; for we cannot deprive musk of its peculiar odour by distillation, though the distilled liquid has a musky smell. As it is destructible by heat, it is obviously organic. It is not peculiar to musk, since many other substances exhale an analogous odour. Some have suggested that it is the result of putrefaction of one or more of the constituents of musk; and in support of this statement it is asserted that, by Leslie's method of desiccation, musk may be dried and rendered odourless. I have repeatedly performed this experiment with every care, but without obtaining odourless musk. Robiquet was of opinion that many odorous substances owed their odour to a certain quantity of ammonia, which, being disengaged, carried off with it substances not otherwise volatile, which masked the ammoniacal smell. In applying this hypothesis to musk, it must be admitted that it harmonizes well with several of the circumstances observed. Thus musk evolves ammonia; water distilled from musk contains ammonia; and potash added to a solution of musk heightens its odour (by facilitating the evolution of ammonia?)

PHYSIOLOGICAL EFFECTS.—Musk disturbs the functions of the stomach, acts as a stimulant to the vascular system and brain, and afterwards proves narcotic. Jörg (*Material zu einer Argneimittel*, Leipzig, 1825; and *Lond. Med. Gaz.* vol. xxvi. p. 952) and his pupils submitted themselves to its influence in doses of from 2 to 15 grains in water or mixed with magnesia. Its primitive effects were eructation, weight at the stomach, diminution or increase of appetite, dryness of the oesophagus, heaviness of the head, vertigos, and headache. The secondary effects were more marked on the encephalon than on the digestive canal: disposition to sleep, faintness, and a feeling of heaviness in the whole body. Lastly, deep and long-continued sleep. In very large doses the action on the nervous system was very marked; trembling in the limbs, and even

convulsions, were observed. The pulse was increased in frequency, and somewhat fuller. These effects show that musk belongs to the cerebro-spinants (see vol. i. p. 177). It is a stimulant to the nervous and vascular systems, and an irritant to the stomach. Its effects are by no means uniform. Trousseau and Pidoux, (*Traité de Thérap.* t. i. p. 25,) suffered from its use neither excitement of the vascular system nor sleep. Its influence is more manifested in some constitutions (those, for example, commonly termed nervous, in whom there is a very sensible or excitable condition of the nervous system), than in others (as the phlegmatic). Moreover, its effects are more marked in some morbid conditions of the cerebral functions (of the hysterical kind), than in the healthy condition of these functions. In some persons the nervous system appears to be peculiarly susceptible of the odour of musk; for it is reported that headache, giddiness, and even fainting, have been induced by it. When the digestive apparatus is previously in a state of irritation, musk increases the local disorder, giving rise to pain, nausea, vomiting, and diarrhœa. Sometimes the stimulant influence of musk is directed to the sexual organs. Trousseau and Pidoux (*op. supra cit.*) experienced from it "une assez vive excitation des organes genitaux." In the female it has occasionally provoked the catamenial discharge. In persons disposed to epistaxis it has at times appeared to bring on the hemorrhage. Occasionally diaphoresis or diuresis has seemed to result from its use.

The odorous principle of musk is absorbed, and subsequently thrown out of the system by the excretories. Barbier (*Traité Elem. de Mat. Méd.* ii. 143, 2d ed. 1824) observes that the urine and the sweat of persons who have taken this substance are powerfully impregnated with its odour—now and then so strongly, that the hand, applied for the purpose of feeling the pulse, retains the odour for some time. On post-mortem examination, the brain, and the cavities of the chest and abdomen, in those who have taken it during life, sometimes emit a strong smell of musk. Tiedemann and Gmelin (*Vers. u. d. Wege auf welch. Subst. ins Blut gelang.* S. 63, 69, 71, 73, 1820) recognised the odour of musk in the blood of the mesenteric, splenic, and portal veins; but they failed to detect it in the contents of the lacteals. Trousseau and Pidoux mention that in their experiments, the excretions acquired a feeble odour of musk. Jörg, however, denies that the excretions of those who have taken musk have the smell of this substance.

USES.—The effects of musk, already alluded to, show that it is a remedy which will be useful where we want to excite the nervous system; and, *vice versa*, that it will be hurtful where there exists a determination of blood to the brain, and in those constitutions denominated plethoric. The cases in which experience seems to have shown that musk is sometimes useful are the following:

1. Those diseases which are attended with convulsive movements, and which, therefore, are called *spasmodic*. Such, for example, as hysteria, epilepsy (especially of children, and where the disease does not depend on organic changes, or on plethora), chorea, and even in some cases of tetanus. The employment of musk here has led to its denomination of antispasmodic.

Dr. Cullen, (*Mat. Méd.*) on whose practical information I place great reliance, says, "I maintain that musk (when genuine) is one of the most powerful antispasmodics that we are acquainted with. I have found it, with Dr. Wall, to be a powerful remedy in many convulsive and spasmodic affections, and in some of a very peculiar kind. I had once a gentleman affected with a spasm of the pharynx, preventing deglutition, and almost respiration. This, when other remedies had failed, was relieved by the use of musk, which often showed its power; for the disease continued to recur at times for some years after, and was only obviated or relieved by the use of musk."

2. In *low fevers* which are accompanied with delirium, twitchings of the muscles, a small contracted pulse, and convulsions, musk has been occasionally

employed, and with benefit. Like opium, its use in these cases is always uncertain—in one instance relieving, in another increasing the malady, though the cases may be to all appearances parallel.

3. In *retrocedent gout*, as where gout attacks the stomach or the head, giving rise to headache or delirium, musk has been found beneficial. Cullen relates a case where immediate relief was obtained by the exhibition of fifteen grains of genuine musk.

4. In the *delirium* which sometimes occurs in pneumonia, but which bears no relation to the intensity of the latter, and is accompanied with adynamia, Recamier (Jacquet, *Biblioth. Méd.* t. lix.) has found it beneficial.

5. Lastly, during the late severe visitation of *malignant cholera*, musk was one of the remedies tried. I saw it employed several times, but without obvious relief. The experience of others was various; but the result is, that the profession has formed a very low estimate of its power in this disease.

ADMINISTRATION.—Musk should be given in *substance*, either in the form of boluses, or suspended in water by means of saccharine or mucilaginous substances. Its dose is from eight to fifteen grains. In children it may be sometimes used in the form of enema.

1. MISTURA MOSCHI, L.; *Musk mixture*. (Musk; Gum Arabic, powdered; Sugar, of each ℥ij.; Rose Water, Oj. Rub the musk, with the sugar, then with the gum, the rose water being gradually added.)—One fluidounce of this mixture contains nine grains of musk. In practice it will be sometimes found convenient to employ twice as much gum, and half as much again of musk.—Dose, ℥j. to ℥ij.

2. TINCTURA MOSCHI, D.; *Tincture of Musk*. (Musk in powder, ℥ij.; Rectified Spirit, Oj. Digest for seven days, and filter.)—Principally valuable as a perfume. Each ℥j. is prepared with only gr. viijss. of musk; or each ℥j. with somewhat less than one grain. It is obvious, therefore, that a dose of the tincture which contains a medium dose of musk, would be dangerous, from the large quantity of alcohol it contains.

ESSENCE OF MUSK, used as a perfume, is ordinarily prepared from the musk pods from which the grain musk has been extracted. The following formula has been furnished me, as one in common use:—Grain Musk, ℥xiv. (or Musk Pods, ℥vij.); Boiling Water, Oss. Digest until cold; then add, of Rectified Spirit, Ovjss.; Carbonate of Potash, ℥ss. Digest.

2. CERVUS ELAPHUS, Linn. L. E.—THE STAG.

(Cornu, L.—Horn, E.—Cornua Cervina Ramenta, D.)

HISTORY.—Both the hart and the hind (the male and female stag) are repeatedly mentioned in the Bible. (*Deut.* xiv. 5, and *Psalms* xviii. 33.) The stag is also noticed by Hippocrates, Aristotle, Pliny, Galen, and Avicenna.

ZOOLOGY.—*Gen. Char.*—*Incisors* $\frac{0}{8}$, *canines* $\frac{0}{8}$ — $\frac{0}{8}$, or $\frac{1}{8}$ — $\frac{1}{8}$, *molars* $\frac{6}{8}$ — $\frac{6}{8}$ = 32 or 34. *Canines*, when they exist, compressed and bent back. *Head* long, terminated by a muzzle. *Eyes* large, pupils elongated transversely. *A lachrymal sinus* in most. *Ears* large and pointed. *Tongue* soft. *Body* slender. Four inguinal *mammæ*. *Horns* solid, deciduous, palmated, branched, or simple, in the males; females, with one exception, without horns.

Sp. Char.—*Horns* with three anterior antlers, all curved upwards, the summit forming a crown of snags from a common centre. *Lachrymal sinuses*. *Fur* red-brown in summer, brown-gray in winter. *A pale disc* on the buttocks.

The stag usually begins to shed his antlers in February or March, immediately after which their reproduction begins, and by July he has completely renewed them. The first sensible phenomenon of the formation of these parts is the vascular excitement about the frontal bone. The arteries are observed to be enlarged, and to pulsate more strongly than usual; the heat is increased, and, in fact, all the symptoms of active inflammation come on. Very soon we perceive two cartilaginous tubercles, one on each side; these enlarge and elevate

the skin, by which they acquire, from the distention of the latter, a velvety covering. These tubercles are soon converted into real bone; but the deposit of ossific matter does not stop here: it continues around the base of the antlers, thus giving rise to what has been usually termed the *burr*. These osseous prominences, the antlers, are supplied with two sets of vessels—an external or cutaneous, which is the most efficient, and an internal. By the pressure made on the former by the burr, they are obliterated: the covering of the antlers no longer receiving a supply of blood, soon ceases to live, dries up, and falls off. The internal vessels continue to keep up the life of the bone for a few months longer, when death takes place. This occurrence may be in part owing to the imperfect nutrition, and partly, perhaps, to the exposure of the bone to the air without any envelope; but it arises principally from some unknown changes in the vital actions. The antlers being now dead, nature soon sets about their separation. To effect this, the living parts at the base are rapidly absorbed, so that the antlers being left but slightly adherent to the frontal bone, readily fall off by a gentle knock. A few hours only elapse before the irregularity on the surface of the os frontis is covered by a thin pellicle, and shortly afterwards the formation of a fresh pair of antlers is commenced. Castration stops the growth of the antlers.

Hab.—Europe, Asia, and North of Africa.

DESCRIPTION AND COMPOSITION.—The antlers of the stag are commonly called *hartshorn* (*cornu cervi vel cornu cervinum*). Though simply designated *cornu* (*horn*) in the London and Edinburgh Pharmacopœia, their composition is very different to that of the horns of the ox or the sheep, and which are sometimes called *true horn*. The latter consists principally of coagulated albumen; whereas hartshorn has the same composition as bone. According to Merat-Guillot (quoted by Berzelius, *Traité de Chim.* vii. 643) it consists of *soluble cartilage (gelatine)* 27.0, *phosphate of lime* 57.5, *carbonate of lime* 1.0, *water* and *loss* 14.5.

Hartshorn shavings or *raspings* (*rasura vel ramenta cornu cervi*) readily give out their gelatine by boiling in water.

PHYSIOLOGICAL EFFECTS AND USES.—Decoction of hartshorn is nutritive, emollient, and demulcent. It does not possess any superiority over calf's foot or other gelatinous liquids. It has been used in intestinal and pulmonary irritation. It is generally taken flavoured with sugar, lemon, or orange juice, and a little wine.

Hartshorn shavings are directed to be used in the manufacture of *Antimonial Powder* (see vol. i. p. 551), but manufacturers generally substitute bone sawings.

Brewers and others sometimes employ decoction of hartshorn for fining beer and other liquors. It is preferable to isinglass on account of its cheapness. The gelatinous matter of bones being less soluble than that of antlers, bone sawings or shavings do not answer as a substitute for hartshorn.

CORNU USTUM, L. *Pulvis Cornu Cervini Usti, D.; Burnt Hartshorn.* (Burn pieces of horn in an open vessel until they become perfectly white; then powder and prepare them in the same manner as directed with respect to chalk.)—Burnt hartshorn is similar in its composition to bone-ash (see vol. i. p. 505). It has been used in the same cases, but its employment is now nearly obsolete. Its dose is ℞j. to ℞j.

3. OVIS ARIES, Linn. L. E. D.—THE SHEEP.

(Sevum, L.—Fat, E.—Adeps Ovillus, D.)

(Sevum, U. S. Suet.)

HISTORY.—The sheep is one of the anciently known animals. It is mentioned by Moses, (*Genesis* iv. 2,) by Herodotus, (*Thalia*, cxiii.) Aristotle, and other ancient writers.

ZOOLOGY. Gen. Char.—*Incisors* $\frac{0}{3}$, *canines* $\frac{0}{0}-\frac{0}{0}$, *molars* $\frac{0}{0}-\frac{0}{0} = 32$. *Horns* common to both sexes, sometimes wanting in the female, thick, angular, wrinkled

transversely, pale coloured, turned laterally in a spiral form. *Ears* small. *Legs* slender. *Hair* of two kinds. *Tail* more or less short. Two *mammæ*.

Sp. Char. [*O. Musimon*.]—*Horns* very strong, arched backward, and curved downwards, and towards the point. General *colour* fawn, more or less brown, white on the face and legs, and under the belly; a darker streak on the dorsal line, on the flanks, and often black about the neck.

FIG. 273.



Ovis Ammon.

FIG. 274.



Ovis Musimon.

The immense number of races of this animal in cultivation are well known; and it is now difficult, perhaps impossible, to determine its native condition. Modern zoologists, however, ascribe our domesticated sheep to the *Ovis Ammon*, called the *Argali* of Siberia, or to *Ovis Musimon*, termed the *Mouflon* or *Mufion* of Sardinia.

Hab.—Domesticated every where.

DESCRIPTION.—Mutton suet (*sebum*; *sebum ovillum*; *adeps ovillus*) is the fat from the neighbourhood of the kidneys of the animals. It is prepared (*sebum preparatum*) by melting it over a slow fire, and straining through linen or flannel in order to separate the membranous portions.

COMPOSITION.—The ultimate analysis of mutton suet has been made by Chevreul and Bérard. (Gmelin, *Handb. d. Chem.* ii. 439.) The first of these chemists also ascertained its proximate composition.

	Ultimate Analyses.		Proximate Analysis.	
	Chevreul.	Bérard.		
Carbon	78.996	65.0	Stearine	} principally.
Hydrogen	11.700	21.5	Elaine or Oleine	
Oxygen	9.304	13.5	Margarin, a little.	
			Hircin, a little.	
Mutton Suet	100.000	100.0	Mutton Suet.	

PHYSIOLOGICAL EFFECTS AND USES.—Like other fatty bodies, mutton suet is nutritious, but difficult of digestion. Its local effects are emollient and demulcent. In medicine it is used as a basis for ointments, cerates, and some plasters; being preferred, in some cases, to hog's lard, on account of its greater consistence.

4. BOS TAURUS, Linnaeus.—THE OX.

(Lac.)

HISTORY.—An animal very anciently known and highly valued. It is repeatedly mentioned by Moses.

ZOOLOGY. Gen. Char.—*Incisors* $\frac{2}{2}$, *canines* $\frac{0}{0}$ — $\frac{0}{0}$, *molars* $\frac{6}{6}$ — $\frac{6}{6}$ = 32. *Body* large. *Members* strong. *Head* large; forehead straight; muzzle square. *Eyes* large. *Ears* generally funnel-shaped. A fold of the skin, or *dew-lap* on

the under side of the neck. Four *mammæ*; tail long, tufted; horns simple, conical, round, with different inflections, but often directed laterally, and the points raised.

Sp. Char.—*Horns* round, lateral arched, with the point turned outwards. *Face* flat, or a little concave. *Occipital crest* in the same line as the base of the horns. *Mammæ* disposed in a square form. *Hair* fawn-coloured, brown or black, not sensibly longer at the anterior than the posterior parts. About seven feet long.

MAMMARY GLANDS two, placed close together, and constituting the *udder*. Each gland consists of a number of *lobes*, made up of *yellowish* or *reddish soft granules*, which consist of very fine blood-vessels, nerves, and the commencement of the *milk* or *lactiferous ducts* (*ductus galactophori*) which unite to form eight or ten principal ducts, which open into the *large duct*, or *duct of the teat*. This tube is conical, and has a number of folds on its internal surface.

Hab.—Domesticated every where.

DESCRIPTION.—Milk (*lac*), or, to be more precise in our description, *cow's milk* (*lac vaccinum*), is an opaque, white emulsive liquid, with a bland sweetish taste, a faint peculiar odour, and a sp. gr. of about 1.030: the latter property is subject to considerable variation. When recently drawn from the animal it is slightly alkaline. Subjected to a microscopical examination, milk is observed to consist of myriads of *globular particles* floating in a serous liquid. These globules are exceedingly minute: according to Raspail (*Chim. Organ.*) the diameter of the largest does not exceed in size the 0.0003937 (about 1.2500th of an inch). They instantly disappear by solution on the addition of a drop of caustic alkali. Both Donné (*Lond. Med. Gaz.* xxv. 302,) and Sir A. Cooper (*On the Anatomy of the Breast*, 1840,) have separated the globules by repeated filtration: the filtered liquid was transparent. The milk globules consist essentially of *butter*. Donné denies that they contain any caseum, since they are soluble both in alcohol and ether, which do not dissolve caseum. Being specifically lighter than the liquor in which they are suspended, they readily separate by standing. They, therefore, rise to the surface, carrying with them some caseum, and retaining some of the serum; thus forming what is called *cream*. The milk from which the cream is separated is termed *skimmed milk*.

Cream (*cremor lactis: flos lactis*) has a variable sp. gr. The average, perhaps, is 1.0244. The upper stratum of cream is richest in butter, the lowest in caseum. By agitation, as in the process termed *churning*, the fatty globules unite to form *butter* (*butyrum*); the residue, called *butter-milk* (*lac butyratum*), consists of caseum, serum, and a little butter.

Skimmed milk, like cream, has a variable sp. gr.; perhaps the average may be taken at 1.0348. If left to itself, it readily acquires acid properties, while white coagula, commonly termed *curds*, separate from it. If an acid or rennet (an infusion of the fourth stomach of the calf) be added to it, this change is immediately effected. The curd separated by rennet is called *caseum*. But after rennet has ceased to produce any more coagula, acetic acid will cause a further quantity to be formed. The curd thus separated by the acid is termed *zieger* or *serai*. The *whey* (*serum lactis*) left after the separation of the caseum and serai, yields, on evaporation, sugar of milk, one or more nitrogenous substances, lactic acid, and some salts.

COMPOSITION.—Milk has been the subject of repeated chemical investigation. (See Berzelius, *Traité de Chim.* vii. 583.) The recent analysis of several kinds of milk, published by MM. O. Henry and Chevalier, has been already stated (see vol. i. p. 85).

The following table shows the composition of several domestic preparations of milk.

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		CONSTITUENTS.	
MILK.	Cream.....	Butter.....	{ solid fat..... 1. Stearine. liquid fat..... } 2. Butyrine. 3. Oleine.
		Butter-milk...	{ caseum. serum or whey.
	Skim-milk...	Matters coag- ulable.....	{ by rennet..... 4. Caseum. not by rennet, but by acetic acid, 5. Zeiger or Serai.
		Whey or se- rum.....	{ saccharine matter..... 6. Sugar of Milk. azotized matter..... 7. Osmazome. soluble in alcohol..... 8. Alkaline and earthy lactates & phosphates. salt { soluble in water, not in al- 9. Alkaline sulphate and cohol..... 10. Earthy and ferrugi- insoluble in water..... nous phosphates.

1. **CASEUM** or *Casein*; *Albumen of milk*; *Lactalbumen*.—An albuminous substance distinguished from the albumen of the egg and of blood by its not coagulating when heated, and by the products of its spontaneous decomposition. When dried it is yellowish and transparent, like gum; it is odourless, and has a very slight taste. It is soluble in water. If its solution be boiled in contact with the air it becomes covered with a white pellicle insoluble in water. The acids unite to form with it, when they are in excess, insoluble compounds. Various salts (as sulphate of copper, bichloride of mercury, nitrate of silver, bichloride of tin, &c.) form insoluble compounds with it. Its composition has been already stated (see vol. i. p. 82).

2. **BUTTER**.—This well-known substance consists of three fatty bodies, *stearine*, *elaine* or *oleine*, and *butyrine*. The latter substance is characterized by yielding, by saponification, three volatile, odorous, fatty acids, viz. *butyric*, *capric*, and *caproic acids*. A small quantity of these acids exists in ordinary butter, especially when it has been exposed to the air, and gives butter its peculiar odour.¹

3. **SUGAR OF MILK**; *Lactin*; *Saccholactin*.—Obtained from whey by evaporation. As used in commerce it occurs in cylindrical masses, in the axis of which is the cord which serves as the nucleus for the crystals. It is extensively made in Switzerland. M. Hess (*Journ. de Pharm.* xxiii. 498.) has shown that, under certain conditions, caseum is susceptible of fermentation, as was before inferred from the fact that the Tartars prepare a vinous liquid, called *Koumiss*, (*Travels in various Countries of Europe*, vol. i. p. 238, Lond. 1810.) from mares' milk. It is gritty under the teeth, and is very slightly soluble in alcohol. It is much less sweet, and less soluble in water, than common sugar. By the action of nitric acid it yields, like gum (see p. 571), saccholactic or mucic acid; so that it forms, as it were, a connecting link between sugar and gum. The composition of it, according to Prout, has been already (see vol. i. p. 77) stated. The formula of crystallized sugar of milk is $C^{24} H^{10} O^{10} + 5 \text{ aq.}$

4. **LACTIC ACID**.—This, though stated by Berzelius to be a constituent of milk, is probably a product of its decomposition.

5. **SALTS**.—Some of these are soluble in alcohol, as the lactates of potash (principally), soda, ammonia, lime, and magnesia; others are soluble in water, but not in alcohol, as sulphate of potash and the phosphate of potash and soda; lastly, the salts insoluble in water are the phosphates of lime, magnesia and iron. The latter are held in solution in milk by the caseum principally. Berzelius says by the lactic acid also.

CHARACTERISTICS OF GOOD MILK.—The changes produced in the quality of milk by diseased conditions of the cows has recently attracted considerable attention in Paris, owing to the prevalence of a malady called the *cocote*, among the cows in that capital. (See *Journ. de Pharm.* vol. xxv. p. 301-318.) The following are the essential morbid changes which have been recognised in milk: want of homogeneousness, imperfect mobility or liquidity, capability of becoming thick or viscid on the addition of ammonia, and presenting, when examined by the microscope, certain globules (agglutinated, tuberculated, or mulberry-like, mucous or pus globules) not found in healthy milk.² Hence, then, good milk should be quite liquid and homogeneous; not viscid; and should contain only spherical transparent globules, soluble in alkalis and ether; should not become thick when mixed with ammonia; and should form a flocculent precipitate with acetic acid, but not be coagulated by heat. The relative

¹ For some remarks on the physical and microscopical characters of butter, by Turpin, see *Journ. de Chim. Méd.* t. vi. 2nde Sér. p. 117.

² *Recherches microscopiques sur divers laits obtenus de vaches plus ou moins affectées de la Maladie qui a régné pendant l'Hiver de 1838 à 1839, et désignée vulgairement sous la dénomination de Cocote*, par M. Turpin, in the *Mémoires de l'Académie Royale des Sciences de l'Institut*, t. xvii. Paris, 1840.

quantity of cream afforded by milk is estimated by a graduated glass tube, called a *lactometer*.

I have repeatedly submitted the milk supplied to me by a respectable dealer in this metropolis, to examination by the lactometer, but the results have been most unsatisfactory, as the quantity of cream which I procured varied from 5 to 23 per cent. by measure. I have usually found the afternoon's milk to yield less cream than the milk supplied me in the morning. On one occasion I found 11.5 per cent. of cream in the morning milk, but only 5 per cent. in the afternoon milk.

PHYSIOLOGICAL EFFECTS.—The dietetical properties of milk have been already considered (see vol. i. p. 85). As a medicinal agent it is regarded as a demulcent and emollient.

USES.—The dietetical uses of milk have been already noticed (see vol. i. p. 85).

As a *demulcent* milk is an exceedingly valuable substance in irritation of the pulmonary and digestive organs. It is an excellent sheathing agent in poisoning by caustic and acrid substances, and in some of these cases it acts as a chemical antidote; for example, in poisoning by bichloride of mercury, sulphate of copper, bichloride of tin, the mineral acids, &c. Milk is further employed on account of its demulcent qualities in the preparation of the bread and milk poultice, which requires to be frequently renewed on account of the facility with which it undergoes decomposition, and acquires acrid qualities.

Milk is a constituent of the *Mistura Scammonii*, E. (See p. 383.)

Whey is an excellent diluent and nutritive. *Wine whey* (*serum lactis vinosum*) taken warm, and combined with a sudorific regimen, acts powerfully on the skin, and is a valuable domestic remedy in slight colds and febrile disorders. I have already referred to the uses of *cream of tartar whey* (see vol. i. p. 450), *alum whey* (see vol. i. p. 519,) and *tamarind whey* (see p. 518).

1. **LACTIC ACID.** $C^6 H^8 O^5 + Aq.$ This acid has been introduced into medicine by Magendie. (*Formulaire pour la préparation et l'emploi de plusieurs nouveaux Médicaments*, Paris, 1835.) As it is one of the constituents of the gastric juice he proposed its use in dyspepsia, and as it is a ready solvent of phosphate of lime he suggested its employment in phosphatic deposits in the urine. An Italian physician (*Brit. and For. Med. Review*, vol. ix. p. 239) has more recently recommended it in gout, in consequence of its being a special solvent of the phosphate of lime. It has been exhibited in the form of lozenges, or in solution in water flavoured with sugar.

2. **OX BILE** (*Fel Bovinum* seu *Tauri*). Formerly extract of ox bile (*fel tauri inspissatum*) was employed in medicine as a tonic. It consists of *biliary matter*, *mucus*, *alimentary extract*, *chloride of sodium*, *lactate* and *phosphate of soda*, and *phosphate of lime*. The dose of it is a few grains in the form of pills.

ORDER III.—PACHYDERMATA, *Cuv.*—THE PACHYDERMS.

ESSENTIAL CHARACTERS.—Three kinds of *teeth*. Four *extremities*, with the toes variable in number, and furnished with strong *nails* or *hoofs*. No *clavicles*. *Organs of digestion* not disposed for ruminating.

SUS SCROFA, Linn. L. E. D. — THE HOG.

(*Adeps præparatus*, L.—*Fat*, E.—*Adeps ovillus*, D.)
(*Adeps*, U. S. Lard.)

HISTORY.—The hog is an animal very anciently known. By the Levitical law the Jews were forbidden to eat its flesh (*Levit.* xi. 7); on account of either the filthy habits of the animal, or its supposed tendency to engender skin and other diseases, more especially leprosy. The Mahometans are also interdicted from eating it.

ZOOLOGY. **Gen. Char.**—*Incisors*, $\frac{4}{8}$ or $\frac{6}{8}$; *canines*, $\frac{1}{1}$ — $\frac{1}{1}$; *molars*, $\frac{7}{7}$ — $\frac{7}{7}$; = 42 or 44. *Canines* bent upwards and laterally; *molars* tuberculous; lower *incisors* bent forwards. Four *toes* on all the feet, the two middle ones only touching the ground, armed with strong *hoofs*. *Nose* elongated, cartilaginous. *Body* covered with bristles. Twelve *teats*.

Sp. Char.—*Tusks* strong, triangular, directed laterally. No *protuberance* under the eyes. *Colour* blackish-gray in the wild animal, but varying much in the domesticated races.

The varieties of this animal are almost innumerable. They are most conveniently reduced to the following:

a. S. Scrofa ferus. The wild hog, or wild boar.

β. S. Scrofa domesticus. The domesticated hog, which varies in its form and colour.

γ. S. Scrofa pedibus monungulis. The hog with solid and undivided hoofs. This variety was noticed by Aristotle and Pliny.

Hab.—The temperate parts of Europe and Asia; the northern parts of Africa; America; the Islands of the South Sea, &c.

PREPARATION.—The fat of the animal is employed in medicine. That about the loins being firmer and denser than the fat of the other parts of the animal, is selected for medicinal use. In order to separate it from the membranes in which it is contained, it is melted over a slow fire, then strained through flannel or linen, and poured while liquid into a bladder, where it solidifies by cooling (*adeps præparatus*). Occasionally salt is added to preserve it; but unsalted lard should be employed for medical purposes. By melting in boiling water, lard may be deprived of any salt which may have been mixed with it. While solidifying, lard should be kept stirred, to prevent the separation of stearine and elaine.

PROPERTIES.—*Hog's lard* (*adeps suillus vel porci*) or *axunge* (*axungia*, so called from the use anciently made of it, namely, greasing the axle of a wheel, — *unguendi axem*) is at ordinary temperatures a white or yellowish white solid. Its melting point varies from 78.5° F. to 87.5° F. In the liquid state it should be perfectly clear and transparent; but if it be intermixed with water it has a whitish or milky appearance. It should have little or no taste or odour. By exposure to the air, however, it acquires an unpleasant odour and acid properties. In this state it is said to be *rancid*. This condition is induced by the oxygen of the air, part of which is absorbed, while a small portion of carbonic acid is evolved. As stearine does not become rancid in the air, while elaine does, the rancidity of lard is referred to the latter constituent. But it has been found that the purer the elaine the less readily does this change occur; whence it is assumed that some foreign substance in the elaine is the primary cause of rancidity, either by undergoing decomposition or by acting on the elaine.

COMPOSITION.—The *ultimate* composition of lard was ascertained by Chevreul, (Gmelin, *Handb. d. Chem.* ii.) as well as by Saussure and Berard. The first of these chemists also made a *proximate* analysis of rancid lard; and Bracconot determined the composition of fresh lard.

Ultimate Analysis.		Proximate Analysis of Rancid Lard.	
	Chevreul.		Chevreul.
Carbon.....	79.098	Stearine and Elaine.	
Hydrogen.....	11.146	Volatile non-acid matter having a rancid odour.	
Oxygen.....	9.756	Caproic (?) acid.	
Lard.....	100.000	Another volatile acid.	
		Oleic, margaric, and perhaps stearic acids.	
		Yellow colouring matter.	
		Non-acid, non-volatile matter, soluble in water.	
Proximate Analysis of Fresh Lard.		Rancid lard.	
	Bracconot.		
Stearine.....	} 38		
Margarine.....			
Elaine or Oleine.....	62		
Lard.....	100		

PHYSIOLOGICAL EFFECTS.—Lard, like other animal fats, is nutritious, but very difficult of digestion. Its topical effects are demulcent and emollient. Both the flesh and fat of the hog have been long supposed to dispose to cutaneous disease; but it is no easy matter to prove or disprove this opinion.

USES.—In medicine lard is principally employed as a basis for unguents. It has been used, by friction, as an emollient; but the practice is now obsolete.

In pauper establishments it is sometimes employed, as a substitute for spermaceti ointment, to dress blisters; but the salt which lard sometimes contains, as well as the facility with which this fat becomes rancid, are objections to its use. I have seen it occasion considerable irritation.

ORDER IV.—RODENTIA, *Cuvier*.—THE RODENTS.

GLIRES, *Linnaeus*.

ESSENTIAL CHARACTERS.—Two large *incisors* in each jaw, separated from the molars by a vacant space. *No canine teeth*. *Molars* with flat crowns or blunt tubercles. *Extremities*, the posterior longest, terminated by unguiculated *toes*, the number varying according to the species. *Mammæ* variable in number. *Stomach* empty. *Intestines* very long.

CAS'TOR FIBER, *Linn*. L. E. D.—THE BEAVER.

(Concretum in folliculis præputii repertum, *L.*—A peculiar secretion from the præputial follicles, *E.*—Castoreum, *D.* [U. S.])

HISTORY.—Castoreum was employed in medicine by Hippocrates, who considered it to possess the power of acting on the uterus. It was an ancient opinion that the castor sacs were testicles, and that when closely pursued by the hunter, the animal tore them off, leaving them behind as a ransom. (Juvenal, *Sat.* xii. v. 34.) Hence, it is said, arose the name of the animal, *à castrando*. This absurd notion seems to have been long ago disbelieved; for Pliny (*Hist. Nat.* lib. xxxii. cap. 13, ed. Valp.) tells us that Sextius derided it, and said it was impossible the animal could bite them off, since they were fastened to the spine. Thus was one error confuted by another; the truth being, the testicles are so placed in the inguinal region, on the external and latter part of the *os pubis*, that they are not discernible until the skin be removed. Moreover, female beavers also have castor sacs.

ZOOLOGY. *Gen. Char.*—Incisors $\frac{3}{2}$, canines $\frac{0}{0}$, molars $\frac{4}{4}$ — $\frac{4}{4}$ = 20. *Molars* composed of flat crowns, with sinuous and complicated ridges of enamel. Five *toes* on each foot, the anterior short and close, the posterior longer and palmated. *Tail* broad, thick, flattened horizontally, of an oval form, naked, and covered with scales (Stark).

Sp. Char.—*Fur* consisting of two sorts of hair, one coarse and brownish, the other downy, more or less gray. About two feet long.

The ordinary colour of the animal is brown; but yellow, black, and spotted, and white beavers, are met with. The two latter are very rare. Richardson (*Fauna Boreali-Americana*,) has never seen either of them, though he has met with black beavers which were kept as curiosities. The *tail* is remarkable for its scaly appearance. Its great breadth (often times five inches) depends not on the width of the caudal vertebræ, but on numerous strong tendons inserted on these vertebræ. *Incisor teeth* smooth, orange-coloured anteriorly, white posteriorly.

There is some reason for supposing that the European and American beavers are distinct species. The former are *burrowers*, the latter are for the most part *builders*.

ANATOMY OF THE CASTOR SACS.—It has been before stated, that both male and female beavers are furnished with castor sacs: hence it will be convenient to consider them in the two sexes separately.

I. OF THE MALE CASTOR SAC.—If the animal be placed on his back, we observe, near the tail, a hollow (called by some a *cloaca*) inclosed by a large wrinkled, somewhat hairy, cutaneous protuberance, which according to Perrault (*Mem. for a Nat. Hist. of Animals*, p. 85,

† See some remarks on the distinctions between the burrowing and building beavers, in *Jameson's Journ.*, vol. xxviii. p. 68.

FIG. 275.



Castor Fiber.

Lond. 1701,) is easily contracted and dilated, not by a sphincter, as the anus, but simply like a slit. In this hollow the anus, the prepuce, and the oil sacs open.

When the skin of the abdomen is removed, four eminences, covered by their appropriate muscles are brought into view. They are placed between the pubic arch and the so-called cloaca. The two nearest the pubes are the *castor sacs*, while those next the cloaca are the *oil sacs*. Between the two castor sacs, in the male, lies the *penis* with its bone (*os penis*); it is lodged in a long *preputial canal*, which terminates in the cloaca, and has some analogy to a vagina; so that there is some difficulty to determine, until the skin be removed, whether the individual be male or female.

The penis points towards the tail, not towards the navel, as in the dog. Its surface is covered with longitudinal wrinkles and pits: in each of the latter is found a dark-coloured warty-like body. The *testicles*, *vasa deferentia*, and *vesiculae seminales*, present nothing remarkable. There is no *scrotum*. Like most other Rodentia, the beaver has *vesiculae accessoriae*, or blind ducts, which open into the urethra near its commencement. Just at the point where the urethra joins the penis are observed *Cowper's glands*. The *castor sacs* open by a common aperture into the preputial canal. This aperture is about one inch in width, and is placed opposite the extremity of the *glans penis* in the relaxed condition of the organ, and about one inch from the orifice of the prepuce. Between this common orifice of the castor sacs and the *glans penis* is a semilunar fold. There is also a second, similar, but thicker, fold covering the rectum. The *castor sacs* are pyriform and compressed. They communicate with each other at their cervical portion; but their fundi diverge outwards and towards the pubes. Each castor sac is composed of an *external* or *cellular* coat which incloses *muscular fibres*. The latter are a continuation of the *panniculus carnosus*: their function appears to be to compress the sac. Within these fibres lies a very *vascular coat*, which covers the scaly or glandular coat, and sends processes in between the convolutions of the latter. The *scaly* or *glandular coat* forms numerous folds or convolutions, which are largest and most numerous in the fundus of the sac. Externally, it is shining, silvery, and iridescent. Internally, it presents numerous, small, lanceolate, oblong, or semilunar scales, which are mostly toothed at their margin, and envelope each a *brown body*, supposed to be a gland, and which is lodged in a small cavity. The inner surface of the castor sacs is lined with *epithelium* (a continuation of the epithelium of the prepuce), which invest the glands and scales of the scaly or glandular coat. In the cavity of the castor sac is found the *castoreum*, which, when recent, is thin, fluid, highly odorous, yellow or orange coloured, becoming deeper by exposure to the air. The quantity of this secretion is liable to great variation. The *oil sacs* are conglomerate glands, placed one on each side between the castor sac and anus: their ducts terminate in the cloaca. The secretion of these sacs is a fatty matter, having the consistence of syrup or honey, a peculiar odour, and a yellowish colour. It was formerly used in medicine under the name of *pinguedo seu axungia castoris*.¹

¹ For further details respecting the structure of the castor sacs consult Brandt and Ratzeburg, *Med. Zool.* i.

FIG. 276.



Castor and oil sacs, with their appropriate muscles.

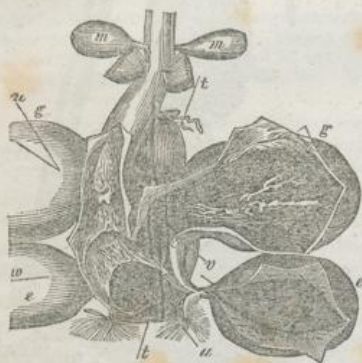
- a, Spermatic vessels.
- c, Anus.
- d d, Openings of the anal glands.
- e e, Anal glands.
- g g, Castor sacs.
- h, i, l, n, Compressor muscles of the castor sacs and anal glands.
- k, Penis.
- m, m, Cowper's glands.
- o, Urethra cut off.
- p, Lobes of the prostate gland.
- r, Testicle.

The figures refer to the probes passing from the caput gallinaginis to the vesiculae seminales and vasa deferentia.

The relative position of the castor and oil sacs, with respect to the pelvis of the animals, is shown in fig. 279, taken from Perrault. (*Op. supra cit.*)

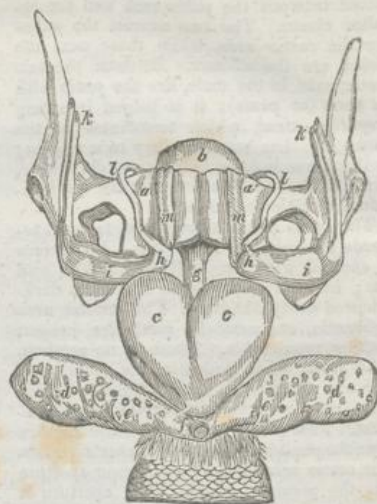
FIG. 279.

FIG. 278.



Castor and oil sacs laid open.

cc, Anal glands.
gg, Castor sacs.
mm, Cowper's glands.
tt, Probes passing into the rectum beneath a semilunar fold which separates the common aperture of the castor sacs from the penis.
uu and vv, Two probes passing into the right castor sac, behind a second semilunar fold.



Relative position of the castor and oil sacs and pelvis.

aa, Os pubis.
b, Bladder.
cc, Castor sacs.
dd, Oil sacs.
f, The false cloaca.
g, The commencement of the penis.
hh, The epididymides.
ii, The testicles.
kk, The spermatic cord.
ll, The vasa deferentia.
mm, The cremaster muscles.

2. OF THE FEMALE CASTOR SAC.—We are less perfectly acquainted with the anatomy of the female than of the male beaver. Indeed I am acquainted with three dissections only of the former; viz. one by Gottwaldt, a second by Hegse, (both referred to by Ratzeburg, *op. supra cit.*) and a third by Mortimer. (*Phil. Trans.* vol. xxxviii. 1735.) The subjoined description is from the memoir of the last-mentioned authority.

He says the animal had two ovaria, and an uterus dividing into two horns (uterus bicornis) as in the bitch. The bladder lay exactly over the body of the uterus. The meatus urinarius ran upon the vagina above two inches in length. Just below the os pubis, on each side of the vagina, above the meatus urinarius (supposing the animal laid on her back), a pair of pyriform bags were found, about $1\frac{3}{4}$ inches long, and 1 inch broad, diverging at their fundi or broad ends, but approximating most closely at their necks or narrow extremities, which were canals communicating with the adjoining glands. The membranes which formed these bags were tough, wrinkled, and furrowed, of a livid dirty colour. They were hollow, and capable of containing about an ounce of water. Upon opening them a small quantity of dark brown liquor, like tar, was found, having an odour like castoreum, and in addition a smell of ammonia. It is probable that the emptiness of the sacs, and the unusual quality of their contents, arose from the youth of the animal. About an inch lower, on each side of the vagina, were a pair of glands, (oil sacs), each about $1\frac{1}{2}$ inches long, and $\frac{1}{2}$ inch broad. Their form was oblong but irregular, and having several protuberances externally; their colour was pale flesh, like the pancreas. They seemed to communicate with the castor sacs, the sac and gland on each side opening externally, by one common orifice, around which were long black hairs.

HAB.—North America, from 67° or 68° to about 33° north latitude: Europe, from 67° to 36° north latitude, but becoming very scarce. It appears to have been indigenous.

CAPTURE OF THE BEAVER.—The beavers are caught in various ways;

sometimes in traps, sometimes in nets. But the usual method is to break up the beaver houses when the animals retreat to their bank holes, where they are easily taken.

COMMERCE.—Castoreum is imported from North America by the Hudson's Bay Company. The greater part of that brought over is sold for exportation. In 1839 duty (6d. per lb.) was paid on 801 lbs.

DESCRIPTION.—Two kinds of castor (*castoreum*) have long been known, viz. Russian and American. The latter, however, is the only one now met with in English commerce.

1. **American Castor** (*Castoreum Americanum*).—It usually consists of two isolated sacs, frequently wrinkled, and which are connected so as to form two parts, like a purse, or like two testicles connected by the spermatic cords. The size of the sacs is liable to considerable variation. They are elongated and pyriform. The penis or the oil sacs, or both, are sometimes attached to them. The colour and other external characters are variable. In December, 1834, I examined between three and four thousand pounds of castoreum, which was offered for sale by the Hudson's Bay Company. A considerable quantity of it was covered externally with a bluish white mouldiness, while the remainder was of a brownish colour. The brown colour, however, varies considerably; sometimes being dark, in some cases yellowish, or even reddish. Some castor sacs are found nearly empty, and present, in their dried state, a very fibrous character: these are of inferior quality. Others are found gorged with unctuous matter, and, when quite dry, break with a resinous character, presenting no fibres until they have been macerated in spirit of wine. In many well-filled sacs the castoreum is quite soft.

In English commerce, two varieties of American castoreum are made: one called the *Hudson's Bay*, the other the *Canadian*. Both are imported by the Hudson's Bay Company. The *Hudson's Bay castoreum* is usually considered the finest variety. The specimens of it which I examined at the house of the Company, in December, 1834, came from York Fort and Moose River. The finest samples were superior to any of the Canadian kind, though the average quality was much the same.

2. **Russian Castor** (*Castoreum Rossicum*).—This is exceedingly scarce. When met with it fetches a very high price. I have paid for a museum sample £2 per oz., while American castor fetched only twenty shillings per lb. There are at least three kinds of castor sold as Russian. *Chalky Russian Castor* occurs in smaller and more rounded sacs than the American kind. (See *Lond. Med. Gaz.* vol. xvii. p. 296, fig. 41.) A pair of sacs in my museum weighs 557 grains. The specimens which I have seen had neither penis nor oil sacs attached. The colour is ash-brown. Its odour is peculiar, empyreumatic, and readily distinguishable from that of the American kind. Under the teeth it breaks down like starch, has at first little taste, then becomes bitter and aromatic. It is readily distinguished from all other kinds by dropping it into diluted hydrochloric acid, when it effervesces like a lump of marble. I have seen another kind of castor from Russia which may be termed *Resinous Russian Castor*. The sacs were large, well filled with resin, did not effervesce with hydrochloric acid, and had an odour very similar to that of American castor. The *Russian castor* described by Guibourt (*Journ. de Chim. Méd.* t. viii. p. 602) appears to have been subjected to some preparation. (See *Lond. Med. Gaz.* vol. xvii. p. 297, fig. 42.)

COMPOSITION.—Castoreum has been subjected to chemical analysis by several chemists. Those whose results deserve especial reference are Bonn (quoted by Gmelin, *Handb. d. Chem.* ii. 1449) and Brandes. (*Ibid.*)

Brandes's Analyses.

Volatile oil.....	1.00	Volatile oil.....	2.0
Resin.....	13.85	Resin.....	58.6
Castorin.....	0.33	Cholesterine.....	1.2
Albumen.....	0.05	Castorin.....	2.5
Osmazome.....	0.20	Albumen.....	1.6
Carbonate of lime.....	33.62	Gelatine.....	10.4
Other salts.....	2.82	Osmazome.....	2.4
Mucus.....	2.30	Matter soluble in alcohol.....	1.6
Animal matter like horn.....	2.30	Carbonate of lime.....	2.6
Membrane.....	20.00	Other salts.....	2.4
Moisture and loss.....	22.83	Membrane.....	3.0
		Moisture and loss.....	11.7
Canadian Castor.....	99.30	Russian Castor.....	100.0

These analyses do not agree with my experiments and observations. The quantity of carbonate of lime assigned to Canadian castor is much too large. By incinerating 60 grains of American castor in a platinum crucible I found only 1.2 grains of ashes, which if the whole were lime would be equal to little more than 3.57 per cent. of chalk.

1. VOLATILE OIL OF CASTOREUM.—This is obtained by distilling the same water several times with fresh portions of castor. It is pale yellow, and has the odour of castor, with an acrid bitter taste. Bonn says he obtained 34 per cent. of oil, but there must be some error in this statement.

2. CASTORINE; *Castoreum Camphor*, Gmelin.—A crystalline, fatty, non-saponifiable substance. It is fusible, and in the liquid state floats on water. When pure it is quite white. It is soluble in ether and boiling alcohol. By long ebullition with nitric acid, it is converted into a yellow crystallizable acid, called *castoric acid*. The super-castorate of ammonia is crystallizable, and forms white precipitates with the salts of silver, lead, and protoxide of iron, and green precipitates with the salts of copper. Castorine is obtained by boiling castor in alcohol; the castorine deposits when the liquor cools. Scarcely any can be got from American castor.

3. RESIN.—This is dark brown, has an acrid and bitter taste, and a slight odour of castor. It is insoluble in pure ether, but dissolves readily in alcohol. Water precipitates it from its alcoholic solution.

PHYSIOLOGICAL EFFECTS.—Castor is usually denominated a stimulant and antispasmodic. Since the time of Hippocrates it has been regarded as endowed with a specific influence over the uterus.

In 1768, Mr. Alexander (*Experiment. Essays*, p. 83) took it in various doses to the extent of two drachms; and the only effect he experienced from it was disagreeable eructations. In 1824, Jörg and his pupils, males and females, (*Material. zu einer kunst. Arzneimittell.* Leipzig, 1824; *Lond. Med. Gaz.* vol. xxvi. p. 952.) submitted themselves to its influence; but the only effects were a slight uneasiness in the epigastric region, and disagreeable eructations having the odour of castor, and which were not allayed by breakfast or dinner, and only ceased at night when sleep came on.

These facts seem to show that castoreum possesses but little medicinal power: yet Dr. Cullen (*Mat. Med.*) declares that on many occasions it is certainly a very powerful antispasmodic. Its odorous particles become absorbed, for they have been recognised in the urine by their smell.

USES.—Castoreum was formerly in great repute in those affections of the nervous system denominated *spasmodic*, such as hysteria, epilepsy, and catalepsy, more especially when these diseases occurred in females, and were attended with uterine disorder. In those kinds of fever called *nervous*, this medicine has also been recommended. In the northern parts of Europe it is used for its supposed *uterine influence*, as, to promote the lochial discharge, and the expulsion of retained placenta. It is, however, little employed here, partly, perhaps, in consequence of its disagreeable taste and smell, its variable quality, and its high price; but, for the most part, I believe, because practitioners consider it an almost inert remedy.

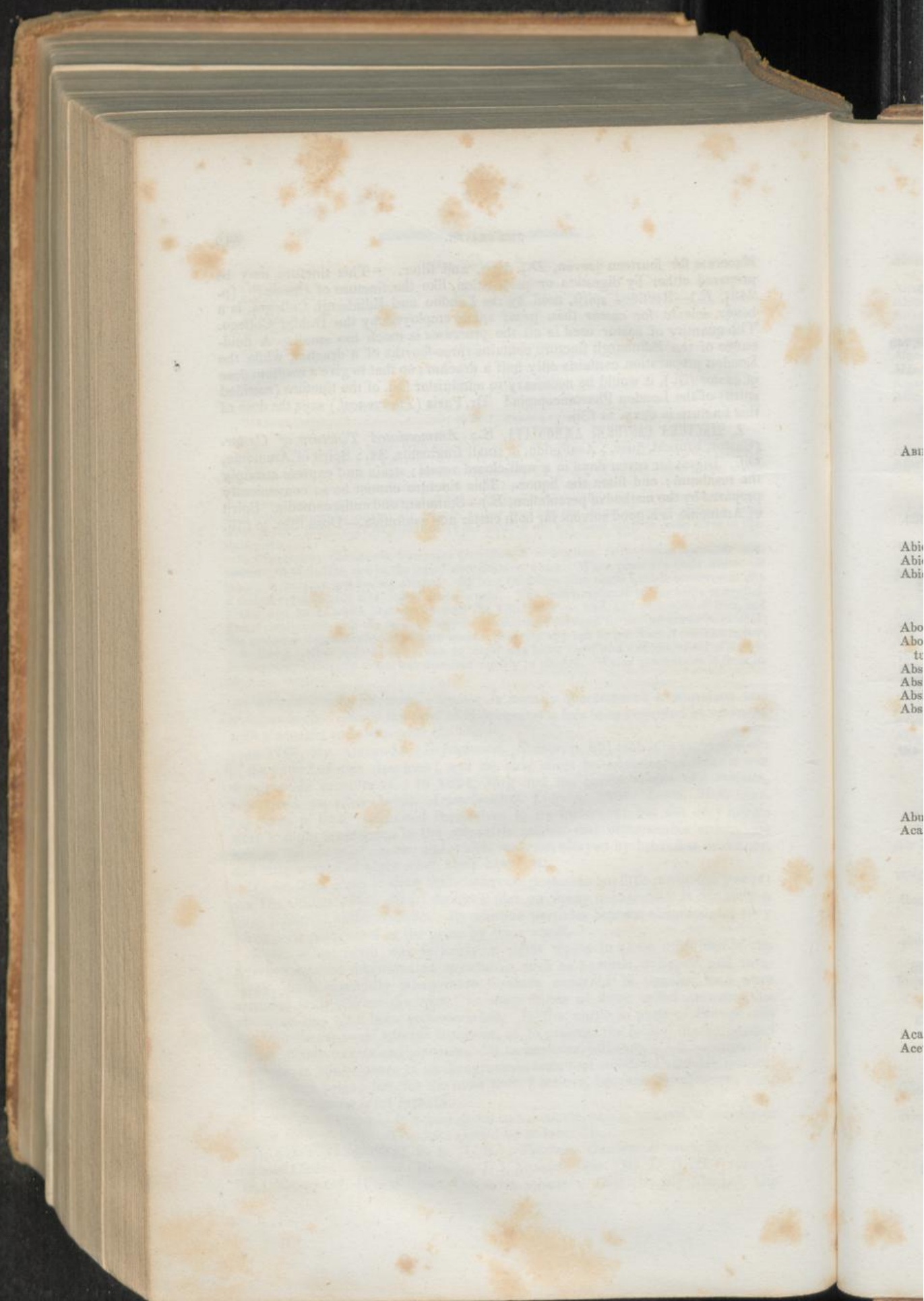
ADMINISTRATION.—It is best given in substance, either reduced to powder or in the form of pills. The dose should be at least ʒij.

1. TINCTURA CASTOREI, L. E. (U. S.); *Tinctura Castorei Rossici*, D. *Tincture of Castor*. (Castor [Russian, D.], bruised, ʒijss. [ʒij. D. (U. S.)]; Rectified Spirit, Oij. [Proof Spirit, Oij. wine-measure, D.]; (U. S.) Alcohol, Oij.

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Macerate for fourteen [seven, *D.*] days, and filter. "This tincture may be prepared either by digestion or percolation, like the tincture of Cassia." [p. 243], *E.*)—Rectified spirit, used by the London and Edinburgh Colleges, is a better solvent for castor than proof spirit, employed by the Dublin College. The quantity of castor used in all the processes is much too small. A fluid-ounce of the Edinburgh tincture contains three-fourths of a drachm, while the London preparation contains only half a drachm; so that to give a medium dose of castor (ʒj.), it would be necessary to administer ℥ij. of the tincture (rectified spirit) of the London Pharmacopœia! Dr. Paris (*Pharmacol.*) says the dose of this tincture is ℥xx. to ℥ij.

3. TINCTURA CASTOREI AMMONIATA, *E.*; *Ammoniated Tincture of Castor.* (Castor, bruised, ℥iiss.; Asafetida, in small fragments, ʒx.; Spirit of Ammonia, Oij. Digest for seven days in a well-closed vessel; strain and express strongly the residuum; and filter the liquor. This tincture cannot be so conveniently prepared by the method of percolation, *E.*)—Stimulant and antispasmodic. Spirit of Ammonia is a good solvent for both castor and asafetida.—Dose ℥ss. to ℥ij.



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