A Philology of Ὀλοθόυριον: From Ancient Times to Linnaeus, including Middle and Far Eastern Sources

Compiled and annotated by

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Dångkolo na Saina Ma'åse!

SUMMARY

The starting point of modern zoological nomenclature is ostensibly the tenth edition of Linnæus's *Systema Naturæ* published in 1758. However, terms likely referable to our totem beasts, the holothuroids, occur sporadically in Western literature as far back as Classical times. In this report, I trace holothuroid nomina from a dubious first mention circa 450 B.C. by the comic poet Epicharmus to the lively series of emendations in disposition within the twelve editions of *Systema* that included as congeners hydrozoans, tunicates and a priapulid worm. From medieval times through the Enlightenment, the suggestively shaped animals continued to be known by occasionally quite lurid colloquial names. The etymology of the current term itself, holothuroid, is uncertain. Indeed, what Aristotle referred to as *'όλοθούριον* was doubtless not a sea cucumber at all, but the name, nevertheless, came to designate the class, probably via the earliest known mis-ascription in 1554 by Rondelet in his well-illustrated *Libri de Piscibus Marinis*. Nevertheless, the name *Holothuria*, and thus Holothuroidea, competed in scientific discourse with several alternate nomina until the ICZN finally settled the 2,500 year-old disagreement over the proper ascription in 1924.

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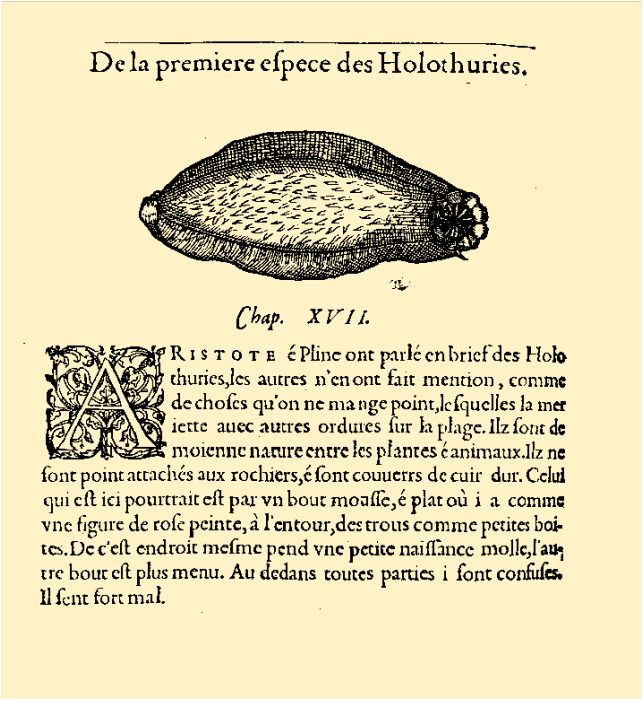
INTRODUCTION

A holothuroid, or sea cucumber, is essentially an "echinoderm worm" (Smiley, 1994). They are elongate, mostly soft-bodied animals with tubefeet often concentrated ventrally. The mouth, ringed with large digitate, peltate or dendritic feeding tentacles, lies at or near one end and the anus, opposite. Holothuroids possess a single gonad in contrast to the multiple and radially arranged gonads of other echinoderms. Found exclusively in this group, is the calcareous ring, a circum-pharyngeal calcitic band of usually 10 plates that may be homologous to echinoid apical plates (David and Mooi, 1996). Hyman (1955) provides a comprehensive account of holothuroid gross anatomy, Smiley (1994) covers microscopic aspects, while Smiley *et al.* (1991) review reproduction and larval development.

The etymology of “holothuroid” and its variants is obscure. The name derives from a term, *ὀλοθούριου* or "holothurion," appearing once in each of two works by Aristotle (ca. 350 BC). *Ὸλος* signifies whole, or complete, while the translation of the stem *–θούριου* is uncertain. Ludwig (1889-1892) suggests that it is derived from a similar word that can be translated as “lecherous” or “unseemly.” Ludwig supports this interpretation by citing the many ancient to modern names for holothuroids that refer to the animal’s resemblance to a penis, e.g., *genitale marinum*, *priapus marinus*, *phallus*


De la premiere eſpece des Holothuries.

Chap. XVII.

ARISTOTE é Pline ont parlé en brief des Holothuries, les autres n'en ont fait mention, comme de choſes qu'on ne mange point, leſquelles la mer iette auec autres ordures ſur la plage. Ilz ſont de moienne nature entre les plantes é animaux. Ilz ne ſont point attachés aux rochiers, é ſont couuerts de cuir dur. Celui qui eſt ici pourtrait eſt par vn bout mouſſe, é plat où i a comme vne figure de roſe peinte, à l'entour, des trous comme petites boites. De c'eſt endroit meſme pend vne petite naiſſance molle, l'autre bout eſt plus menu. Au dedans toutes parties i ſont confuſes. Il ſent fort mal.

Figure 1. The earliest known illustration of an undoubted holothuroid is from Rondelet's (1558) French edition of *L'Histoire entiére des Poissons*, showing an apparent holothuriid or stichopodid aspidochirote.

marinus, *pudendum*, and *cazzo di mare*. The root is also similar (to my eye, anyway) to Greek words for "rushing," a place name of mythological significance, and less implausibly perhaps, though it pains me to speak of my totem thus, "ugly" (see Liddell and Scott 1940).

The following lists include every mention I can find in early literature, Ancient to the mid-18th century and Linnaeus, of what we now call holothuroids. There are four lists, those from Western literature, the editions of Linnaeus's *Systema*, and Middle to Far Eastern works. The reliance on e-versions had its advantages and drawbacks. Primarily, translations are older to sidestep copyright infringement. This ultimately stalled my uncovering of some ancient references. For example, *αίδοιου θαλασσιου*, invariably translated as "sea phallus" by modern Greek classicists (e.g., Janko 2005), is discreetly *cum* opaquely rendered "beauty of the sea" by Yonge in his 1854 translation of the *Deipnosophistae*. One pauses - perhaps, an arbor of etymological fig leaves chastens other direct references to our suggestively-shaped organism.

The first list is of Western literature to 1739 that potentially mention sea cucumbers. For completeness, I also include references mistakenly thought to contain same, as well as those by early major author(s) on natural history that I suspect might mention cukes. For completeness, I have also included major, yet rare works that I have checked, yet have failed to find a mention. In those lacking a cuke citation, mention of other echinoderms is noted. I include the earliest references I could find for a nomen, whether or not it was correctly applied. Unless mentioned otherwise, the texts have been examined by me. Manuscripts were usually viewed as electronic versions and can most readily be accessed via a web search engine with the provided MS number and the phrase "digital facsimile."

The second list, essentially a continuation of the first, gives changes to the name *Holothuria* in Linnaeus' *Systema Naturae*, editions I-XII (1735 – 1768), the editions as recognised by Linnaeus himself in the preface to the tenth and twelfth editions (Soulsby

1933). I have seen all editions in facsimile online save the XIth, the disposition of holothuroids in this edition is based on the cited authors.

The third list gives major Arab and Persian works on zoology that might include references to echinoderms.

The fourth list provides Chinese and Japanese *materia medica* that discuss holothuroids or compilations that might conceivably hold a reference. The bulk of these references to holothuroids derive from a translation of Terajima (1712) generously provided to me by Robin D. Gill (see also Gill 2003). All others were gleaned from an unpublished MS by Sasaki and Kawakatsu (2001) that traces ancient mention of terrestrial bipaliid platyhelminths. Authors of eastern *materia medica*, such as Terajima (1712), are generous, and apparently scrupulous, in citing previous works. This made it possible to identify several older potential references, as well. These Eastern works are listed by date of publication then by title (rather than author), since that is how I usually found them referenced.

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Table I. Western European literature to 1739 mentioning (or potentially mentioning) sea cucumbers and other echinoderms.

Date	**Author** and Remarks
ca. 470 BCE	**Epicharmus** (ca. 540 - ca. 450) Athenaeus of Naucratis in *Deipnosophistae* bk III sec 64-65 says *colybdaena* mentioned in Epicharmus' *Marriage of Hebe* is called by Nicander *aidioin thalassion*, sea phallus, though the context plainly indicates it's legged and a crustacean. Still, the name is mentioned by Belon (1553) and Rondelet (1554) under their entries for, respectively, an undoubted and a probable holothurian.
440	**Herodotus of Halicarnassus** (ca. 480 - ca. 421) his *History* is among the sources for animals in *Physiologus* (see below Anon. ca. 300 CE), but no cukes or echinoderms (Rawlinson 1875).
ca. 350	**Aristotle** (384 – 322) mentions the name holothourion in *History of Animals* Book I part 1; *On the Parts of Animals* Book IV part 5; see also *History of Animals Book* IV Part 7 for mention of another cuke-like animal, thought by J. Mueller (in Ludwig 1889-1892) a more likely candidate for a cuke.
ca. 325	**Theophrastus of Eresus** (ca 371 – ca 287) Wrote extensively on natural history and a contender to have mentioned holothuroids and other echinoderms, having written according to his 3rd c. biographer Diogenes (Yonge 1853) at least 22 books on animals, including six summarising Aristotle's works on animals, which do mention holothuroids and other echinoderms. But most of these 22 books don't survive. "On Animals that Change Their Colour" and the fragment of "On Animals Who Dive in Holes," from Athenaeus' *Deipnosophistae*, don't mention echinoderms. A recent translation (Sharples 1992; see also Sharples 1995, review in Longrigg 1996) exists of his "On Fishes," but it contains no mention of echinoderms.
ca. 300	**Menander of Athens** (b 342/1 – 292/1) Under his entry for *genitale marinum*, an undoubted holothuroid, Belon (1553) provides a name, *callyonimus*. This is presumably the *callionymus* in Pliny's *Natural History* (liber xxxii, chap 53 and 24). However, in the latter chapter, Pliny clearly describes a teleost fish. The earliest mention that I can find for this name also comes via Pliny, who notes that Menander in his *Comedies* opines on the medical value of *callionymus'* gall. At this point, Bostock and Riley (1855) insert a footnote that Menander's mention of *callyonimus* is found in the fragment of his play *Messenia* preserved in Aelian's *Hist. Anim*. B. xiii. c. 4. *Callyonimus* is currently a valid Linnaean genus of fish commonly known as dragonets.
ca. 150 BCE	**Nicander of Colophon** (fl. 130 BCE) Athenaeus of Naucratis in *Deipnosophistae* bk III sec 64-65 says *colybdaena* mentioned in Epicharmus' *Marriage of Hebe* is

Date	**Author** and Remarks
	called by Nicander *aidioin thalassion*, sea phallus, though the context in Epicharmus' passage plainly indicates it's a crustacean. Liddell and Scott (1940) cite *aidioin thalassion* from Nicander, fragment 139, and say it's possibly a pennatulacean, a speculation no doubt due to Cuvier, who provided highly cited provisional identifications of animals mentioned in Classical works (reference).
77 CE	**Pliny the Elder** (23-79) in his *Natural History* mentions Aristotle's *holothuriis*, bk ix c 71, as well as two mentions of a marine *cucumis*, ix.2 and xxxii.53; and sea lungs bk xxxii c. 32, Bk. ix. c. 71, and Bk. xviii. c. 85. Discusses sea urchins and starfish too. Despite repeated attributions to the contrary, nowhere does Pliny write "*cucumis marinus.*" Rather, the binomial (as "*Cucumer marinus*") was first used by the German botanist Leonhart Fuchs (1542; see Eisendrath 1961) for a salt-tolerant(?) variety of the curcurbitacean *Curcurbita pepo* L., a species that includes squashes and pumpkins. The first application of *cucumis marinus* to a probable holothuroid was by Rondelet (1554).
ca. 100	**Plutarch** (45-120) Bostock and Riley's (1855) translation of *Natural History* gives a footnote below Pliny's discussion of the sea urchin that includes a reference to Plutarch's "On the Instincts of Animals." The closest in Plutarch's extant works I find are two titles from his *Moralia* or "Moral Essays": 959. "Whether land or sea animals are cleverer" and 985. "Beasts are rational." His fragments may also contain this reference to sea urchins (see Plutarch 1969).
ca. 150	**Oppian of Corycus (or Anabarzus)** (fl. 2d cent.), Greek author of a didactic poem (in five books of hexameter) on fishing, *Halieutica,* which mentions sea urchins in B. ii. 1. 225 (Mair 1928); but no cukes.
ca. 200	**Aelian** (ca. 175 – ca. 235) Wrote nothing on cukes, but mentions sea stars in his *De Natura Animalium*, B. xi. c. 22 and sea urchins B. vii. c. 44. See entry under Menander for Aelian's role in preserving a likely mistaken reference to cukes.
ca. 200	**Athenaeus of Naucratis** (ca. 170 - ca. 230) in *Deipnosophistae* bk III sec 64-65 says *colybdaena* in Epicharmus' *Marriage of Hebe* is called by Nicander *aidioin thalassion*, sea phallus, though the context plainly indicates it's a crab or lobster (see Yonge 1854).
ca. 250	**Solinus** (fl. early 3d cent.) wrote *De Mirabilibus Mundi* which mostly circulated under the title *Collectanea rerum memorabilium* ('Collection of Curiosities'). It contains a short description of the ancient world, with remarks on historical, social, religious and natural history questions. The greater part concerning animals is taken from Pliny's *Natural History*. Mentions *polypi/us*, squid, but not echinoderms. (See Mommsen 1864 and Panckoucke 1847).

Date	**Author** and Remarks
ca. 300	**Anonymous** The *Physiologus* is a book of animals written in Greek probably in Alexandria between 100 and 300 CE and is derived from early Indian, Hebrew and Egyptian folklore, as well as ancient writers, largely Aristotle, Herodotus and Pliny. Medieval bestiaries were largely based on the *Physiologus* and sometimes discuss sea urchins. However, I cant find a version of the *Physiologus* mentioning any echinoderms: Epiphanius of Cyprus (c 310 – 403; see Platin 1588 and Migne 1864), Theobaldus (early 11th c. published 1492. Cologne; see Rendell 1928), Philippe de Thaon (c 1120; MS 249 Merton Coll Libr – Univ Oxford; see Wright 1841), the Middle English *Physiologus* (mid 13th c; Arundel MS 292 fol 4v-10v Brit. Libr.; see Morris 1872 and Armistead 2001); and MS Ii 4 26 Univ. Libr. Cambr. (undated; see James 1931).
ca. 634	**Isidore de Seville**. (ca. 575 – ca. 636) Wrote *Etymologiae* (also called *Origines*) largely based on Pliny and Solinus. section 56 in Libri XII De Animalibus mentions sea urchins; no cukes.
846	**Rabanus Maurus** (c.780 – 856) wrote *De rerum naturis* also known as *De Universo* is an encyclopedic compilation which he assembled between 842 and 846 and part of which is based heavily on Isidore's *Etymologiae*. In Bk 8, chapter 5, De piscibus, he mentions molluscs, incl squid, and crabs, but no echinoderms.
ca. 950	**Anonymous.** The Greek Anthology is a collection of over 6,000 short Greek poems composed by some 300 poets over more than a millennium of Greek culture. The majority of the poems come from a single manuscript, the so-called "Palatine Anthology," and were assembled in the 10th century. Others were collected by late 13th-century monk Planudes. Douglas (1928) says theres no mention of sea urchins, anemones or coral. But theres sponges four times, squids, paper nautilus, murex, oyster and a shell used for trumpeting. One poem, Maecius Quintus' epigram 6.89, entreats a "Priapus" dwelling on a rocky seashore, but the context undoubtedly indicates the eponymous Greek deity of fertility, rather than a cuke.
ca 1194	**Alexander Neckham** (1157-1217) wrote the encyclopaedia *De naturis rerum* around 1180 – 1194. I have only seen a table of contents lacking provenance: Book 2, Chap. 34: *De echinis*.
ca. 1200	**Anonymous** The medieval bestiaries were largely based on the *Physiologus* and Isidore's *Etymologiae*. They sometimes mention sea urchins, but no other echinoderms: *The Aberdeen Bestiary* (ca. 1200) and MS Ii.4.26 Univ Libr Cambr written between 1200 – 1210 (see White 1960). The line between the *Physiologus* and early bestiaries seems to be a blurred one, but other later bestiaries do not include the sea urchin: The 12th c *Bestiaire de Gervaise* (see Meyer 1872), *The Bestiarius of Anne Walshe* from 1400 – 1450 (KB GkS 1633

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	4° Kongelige Bibliotek, Copenhagen).
1220	**Michael Scot** (c.1175–c.1234) completed a Latin translation, *De animalibus*, of Aristotle's works on animals, including *On the History of Animals* and *On the Parts of Animals*, both of which mention *holothourion*, as well as undoubted echinoderms (see van Oppenraaij 1998). Havent seen it.
1240	**Thomas de Cantimpré** (1201 – c 1272) wrote *De Natura Rerum* an influential medieval encyclopaedia. Havent seen it, but van Maerlant's (c 1287) *Der Naturen Bloeme* is according to Gysseling (1981) essentially a Flemish/Middle-Dutch translation and it mentions sea urchins, but not cukes. Albertus Magnus copied parts of *De Natura Rerum* for the last five chapters of his *De Animalibus* (see Aiken 1947). A search of the index in Albertus Magnus (1999) does not contain mention of holothuroids in this part of the work.
c. 1242	**Bartholomaeus Anglicus** (d. 1260) wrote *De Proprietatibus Rerum* (On the Order of Things), an influential medieval encyclopaedia, book 18 concerning animals. The index of animals included in ms 84-61 (McPherson Library, University of Victoria), an incomplete copy, does not list any echinoderms.
c. 1250	**Vincent de Beauvais** (c 1190-1264) wrote *Speculum Naturale* a widely read encyclopaedia often citing de Cantimpré's *Natura Rerum* (Aiken 1947); hence it may also include Cantimpré's discussion of sea urchins.
post 1256	**Albertus Magnus** (c.1208-1280) wrote *De Animalibus*. He mentions cuke-like animals, in sections based on Aristotle in Book I, Chapter III paragr 32 and Book IV, Chapter VIII paragr 72. Also discusses at some length sea urchins and starfish. Magnus's work mentions cukes, but only in passages taken from Aristotle not seen in van Maerlant. So it seems that other important encyclopaedias based on de Cantimpré (see Gauvard et al. 2002) will at most only discuss sea urchins: Bartholomaeus Anglicus (1242 – 1247) *De proprietatibus rerum* and Vincent de Beauvais (c 1250) *Speculum naturale*.
c. 1287	**Jacob van Maerlant** (1235-c. 1291) wrote *Der Naturen Bloeme*. It mentions sea urchins, but not cukes. The book is, according to Gysseling (1981), essentially a Flemish/Middle-Dutch translation of Thomas de Cantimpré's *Natura Rerum*.
1542	**Leonhart Fuchs** (1501-1566) was a German botanist and author of *De Stirpium*. Despite repeated attributions to the contrary, nowhere does Pliny in his *Natural History* write "*cucumis marinus.*" Rather, the term (as "*Cucumer marinus*") was first used by Fuchs for a salt-tolerant(?) variety of the curcurbitacean *Curcurbita pepo* L., a species that includes squashes and pumpkins (see also Eisendrath 1961). The first application of *cucumis marinus* to a probable holothuroid was by

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	Rondelet (1554) who derives it from Pliny.
1553	**Pierre Belon** (1517-1564) Gives a single entry under *genitale marinum* in volume II of *De aquatilibus*. He also included the entry in a revised and expanded French edition called *La nature et la diversite des poissons*. Also provides a name, *Callyonimus*, presumably the *callionymus* in Pliny, who clearly describes a fish and is now a valid genus from Linneaus known as dragonets.
1554	**Guillaume Rondelet** (1507-1566) Provides the first illustrations of holothuroids *Libri de piscibus marinis*. This is republished in French in 1558 as *Histoire entière des poissons*. First I believe to use the binom *cucumis marinus* to describe a cuke (as Pliny, from whence the term derives, only used *cucumis*).
1558	**Konrad Gesner** (1516-1565) for his volume IV of *Historiae Animalium*, he borrows the account of *genitale marinum* from Belon, as well as the two species of *holothuriis, concombre de mer* and v*it du mer* (as *pudendo marino*) from Rondelet. Includes entries for callionymo and *colybdaena*. Discusses at length the disposition of these and other ancient names presumed synonyms, e.g., *aidioin thalassion.*
1606	**Ulysses Aldrovandi**. (1522 – 1605), for volume IV of his *De Reliquis Animalibus*, borrows the accounts of *holothuriis, cucumere marino* and *mentula marina* from Rondelet, apparently via Gesner. He also discusses sea urchins, asteroids and ophiuroids.
1607	**Edward Topsell** (1572 – 1625) wrote the popular *History of Four-footed Beasts* London, essentially a translation of Gesner's volume on mammals. In 1608, Topsell published selected translations from Gesner's other volumes, including volume IV, where Gesner placed holothuroids. However, I don't know if Topsell's translation includes the cukes. If so, they must ultimately derive from Belon or Rondelet.
1616	**Fabius Columna** (1567– c 1650). Wrote *Aquatilium et terrestrium aliquot animalium aliorumque naturalium rerum observationes*. Rome. H. Ludwig (1889-1892) writes, "...Columna, refers to a specimen under the name *pudendum regale* that is nearly identical in form to that of *Stichopus regalis*." Provides an illustration.
1650	**Johannes Jonstonus**. (1603-1675) Also borrows the accounts of holothuroids from Belon and Rondelet for his *Historiae Naturalis de Exanguibus Aquaticis Liber IV. De Zoophytis sive Plantanimalibus.* Jonstonus (1650) bases the figures in his three plates of zoophytes on that from Aldrovandi (1606), but also includes *holothurius*, *vit de mer* (using Gesner's name *mentula marina*) and *cucumis*

Date	**Author** and Remarks
	marinus, all of which are figures ultimately deriving from Rondelet, perhaps by way of Gesner.
1686	**John Ray** (1627–c.1705) wrote *History of Fishes*, which I haven't seen, so no idea if it mentions echinoderms, much less cukes. Wrote in other works about fossil sea urchins and crinoids, but I haven't seen these either.
1705	**Georgius Everhardus Rumphius** (1628-1702) Includes two species of holothuroids under the heading *Phallus Marinus* in his posthumously published (1705) *D'Amboninsche Rariteitkamer* or "Ambonese Curiosity Cabinet" (Rumphius 1999).
1739	**Giovanni P.S. Bianchi** or **Janus Plancus** (1693-1775) Wrote *De Conchis minus notis.…* Venice, J.P. Pasquali aere Auctoris, 1739. H. Ludwig (1889-1892) writes, "...Bianchi...illustrated and described a species obviously of the cucumarian type, (probably today's *Cucumaria Planci* v. Marenz. [= "Br." in errata]), …'" Provides an illustration of a holothuroid resembling a dendrochirote.

Table II. Changes to the name *Holothuria* in Linnaeus' *Systema Naturae*.

Edition	Citation and notes
I	1735. *Systema Naturae, sive, Regna tria Naturae systematice proposita per classes, ordines, genera & species*. Joannis Wilhelmi de Groot: Lugduni Batavorum. 16 pages long. Holothurium is given under Animale, Vermes, Zoophyta, and Tethys, having "a body of a variable, soft and nude form." Echinus and Asterias are also under Zoophyta.
II	1740. *Systema Naturae in quo Naturae Regna tria secundum classes, ordines, genera, species systematice proponuntur*. Gottfr. Kiesewetter: Stockholmiae. Swedish names are given in the Mineralogical and Zoological portions of the work, but not in the Botanical. Some nomenclatural changes from first edition. Holothurium (in Tethys) or Asterias remain under Zoophyta. Echinus are moved from the order Zoophyta to Testacea.
III	1740. *Systema Naturae, sive Regna tria Naturae systematice proposita per classes, ordines, genera et species*. Gedruckt mit Gebauerischen Schriflen: Halle. A reprint of the first edition, in which only the order of the matter is rearranged (Gill 1872; Soulsby 1933). Accompanied by a German translation in parallel columns. Holothurium (in Tethys), Echinus and Asterias are all under Zoophyta.
IV	1744. *Systema Naturae, in quo proponuntur Naturae Regna tria secundum classes, ordines, genera & species*. Boptistae Coignard: Parisiis. French equivalent names are added throughout, the Swedish being omitted. Otherwise, this edition does not differ in any important respect from the second edition (Soulsby 1933). Holothurium (under Tethis - note spelling change) and Asterias in Zoophyta; Echinus in Testacea.
V	1747. *Systema Naturae, in quo Naturae Regna trio secundum classes, ordines, genera, species systematice proponuntur*. Halcae Magdeburgicae. A reprint of the second edition (Gill 1872; Soulsby 1933). The Swedish names have been replaced by German. Holothurium (in Tethys) and Asterias are under Zoophyta; Echinus in Testacea.
VI	1748. *Systema Naturae, sistens Regna tria Naturae, in classes et ordines genera et species redacta, tabulisque aeneis illustrata*. Godofr. Kiesewetteri: Stockholmiae. The names of the animals and minerals are given in Swedish, as well as in Latin. Some nomenclatural changes from fifth edition to Quadrupedia. Holothurium (in Tethys) and Asterias are under Zoophyta; Echinus in Testacea.

Edition	Citation and notes
	Under Zoophyta is also raised the monotypic Salacia with species Physalus.
VII	1748. *Systema Naturae sistens Regna tria Naturae in classes et ordines genera et species redacta…* Godofr. Kiesewetteri: Lipsiae. A reprint of the sixth edition by the same publisher, but with German, instead of Swedish, names (Soulsby 1933). Holothurium (in Tethys), Echinus, Asterias and Physalus (in Salacia) are under Zoophyta.
VIII	1753. *Indelning i Ört-Riket, efter Systema Naturae, på Swenska öfwersatt af Johan J. Haartman, &c*. Trykt hos Lars Salvius: Stockholm. [Regnum Vegetable only] 1753. *Regnum Lapideum, sive Mineralogia in in* [sic] *nuce*. Scaris. 1753. *Delineatio Regni Animalis secundum Caroli Linnaei Systema Naturae*. Scaris. Printed in three separate parts: Vegetable, Mineral and Animal (Soulsby 1933). Gill (1874) says the eighth edition is of the Vegetable Kingdom only, but Soulsby (1933) says Linne counted the Mineral and Animal volumes as among the eighth edition. The *Regni Animalis* volume is in Latin with Swedish names; the 1919 reprinted edition is of 16 pages, but not available online. Hence, this may only be a reprint of an earlier edition and the attributions of the echinoderms unchanged.
IX	1756. *Systema Naturae, sistens Regna tria Naturae, in classes et ordines genera et species redacta, tabulisque aeneis illustrata*. Thèodórum Haak: Lugduni Batavorum. Based on the seventh edition, with some additions, as to Fishes, Insects by others and as to Plants by Linnaeus himself. The German names are replaced by French. Under Zoophyta, he retains Holothurium (in Tethys), Asterias and Salacia with its single species Physalus; Echinus is in Testacea.
X	1758. *Systema Naturae per Regna tria Naturae, secundum classes, ordines, genera, species, cum characteribus, differentiis, synonymis, locis*. *Tomus I.* Laurentii Salvii: Holmiae. Vermes, (pp 641-823) in 69 genera with 936 species. A total of 312 genera with 4,378 species. In this edition, the binomial system previously employed by Linnaeus in his work entitled *Museum Tessinianum* (1753) was extended to all the kingdoms of nature (Soulsby 1933). Linnaeus places Tethys, Echinus and Asterias under Mollusca, jettisons Salacia, retains Holothuria (no longer spelt Holothurium), also under Mollusca, but did not include in the latter any holothurians as now recognised. In Holothuria, he places Physalis (no longer Physalus) and adds three species of ascidians. In synonymy under Physalis is the name Holothuria from Rumphius

Edition	Citation and notes
	(1705; see Rumphius 1999) who clearly used the name for the siphonophore cnidarian *Physalia*.
XI	1762. *Systema natvrae per regna tria natvrae, secvndvm classes, ordines, genera, species, cvm characteribvs, differentiis, synonymis, locis. Tomvs I.* Lipsiae. I havent seen the this edition. However, Gill (1874) notes that Linnaeus criticizes it, "Furtim prodiit vitiosa. Nil additum." ["A covertly produced faulty edition with nothing added."] Hence, it is presumably identical to the previous edition in its arrangement of the echinoderms.
XII	1766. *Systema Naturae per Regna tria Naturae, secundum classes, ordines, genera, species, cum characteribus, differentiis, svnonymis, locis . Tomus I.* Laurentii Salvii: Holmiae. Tethys, Echinus, Asterias and Holothuria remain under Mollusca. In Holothuria, he retains physalis (now not capitalised). About holothuroids in this edition Gill (1907a) writes, "…[under Holothuria] all species of the former edition were retained, but the diagnosis was altered and four holothurians of recent authors were added,." and again (Gill 1907b), "In the twelfth edition (I., p. 1089) Linnaeus modified his definition and, while including the four species of the tenth, added five species, (1) *frondosa* (*Cucumaria*), (2) *Phantapus* (*Psolus*), (1) *tremula* (*Holothuria* of moderns), (8) *pentactes* (*Cucumaria*) and (9) *priapus* (a worm).". The change in the diagnosis was to accommodate true holothuroids (Samyn 2003).
"XIII"	Gmelin, J. F. 1788-1793. *Caroli a Linné systema naturae per regna tria naturae, secundum classes, ordines, genera, species, cum characteribus, differentiis, synonymis, locis. Tomus I. Editio decima tertia, aucta, reformata*. Beer: Lipsiae. An unrecognised edition translated, revised and edited by Gmelin and under whose name the edition has been invariably recognised. He includes many new species not found in Linnaeus's twelve editions. Holothuria now includes 24 entries: the twelfth edition's original nine and another fifteen species of true holothuroids. The portion containing the echinoderms, Tomus I. Classis VI. Vermes, was published in 1791.

Table III. Potential early Arabic and Persian references to echinoderms.

Date	**Author** and remarks
ca. 865	**Al-jahiz** (776 – 869) or Abu 'uthman 'amr Ibn Bahr Ibn Mahbub Al-jahiz. His most famous book 'Kitab al-Hayawan' (Book of Animals) is an encyclopedia of seven large volumes. Seems he wrote it between 815 and 865. One of the best bets for an Islamic reference of echinoderms. However, a recent partial French translation by Mestiri (2003) doesn't mention echinoderms.
ca. 1260	**al-Qazwīnī** (d. 1283) or Zakarīyā' ibn Mu□ammad al-Qazwīnī wrote *'Ajā'ib al-makhlūqāt wa-gharā'ib al-mawjūdāt* (Marvels of Things Created and Miraculous Aspects of Things Existing), which covered all wonders, including animals and strange creatures at the edges of the inhabited world. So, maybe it mentions cukes or other echinoderms, but I haven't seen it.
1291	**Abū Sa'īd** wrote *Manāfi' al-Haiawān* (Description of the Nature of Things) near the close of the 13th c. The codex dated 1291 and discussed by Yohannan (1916) states that part four includes aquatic animals.
1372	**al-Damiri** (1341 – 1405) or Mu□ammad ibn Musá al-Damiri wrote *Hayat al-hayawan* (The Life of Animals) a popular encyclopaedia of animal lore with 1069 entries (though some animals are discussed several times under different names). Used much of the scientific and linguistic information from al-Jahiz, but eliminated the anecdotes, poetry, digressions and jokes. Havent seen it, but along with al Jahiz' book, among the best bets for an Islamic mention of echinoderms.

Table IV. Chinese and Japanese references to sea cucumbers from ancient to the early 18th century. This list is likely quite incomplete.

Date	**Book** and remarks
712	**Kojiki** In the Japanese creation story, holothuroids are mentioned as first recorded in the *Kojiki* or *Records of Ancient Matters*.
934	**Wamyosho** The full name of the work is *Wamyouruijushou*, literally, "Japanese Names Selection," a 20-volume treatise completed during the Heian period between 931 and 938, often cited as 934. The first to translate Chinese natural science into Japanese, Minamoto no Shitagou, chief editor. Contains a great number of animal, plant, food, stellar, geographic names, etc. in Chinese characters and corresponding Japanese pronunciation in manyogana and followed by references. There exists a short edition of 10 volumes and a long one with 20 volumes but the relationship between them is unclear. Havent seen a translation, but according to the *Wakan Sansai-Zue* by Terashima Ryoan (1712), it mentions “sea rat”, a sea cucumber.
c 1350	**Shih Wu Pen Ts'ao** or 'Edible Herbal' by Li Tung-wan in the Yuan Dynasty (1280-1368). Havent seen a translation, but according to the *Wakan Sansai-Zue* by Terajima Ryoan (1712), it mentions two kinds of cukes, the first resembling a *Stichopus*.
1596	**Pen Tsao Kang Mu.** One of the best known Chinese medical works, “The Great Herbal,” compiled in the Ming dynasty (1368-1644) by the physician, Li Shih Chen (1518-1593). It includes descriptions of 1892 herbal medicines. P'en-Ts'ao Kang-Mu (wood-block book) was published from 1590 to 1596 by Li, Shin-Chen. (1518-1593) and his son. This bulky book (52 vols.) of materia medica includes 1892 entries on various plants, animals, minerals, and natural phenomena. Almost all articles found in previous materia medica are reproduced under each item of Li's book with his detailed notes or comments. For this reason, Li's book serves as an Encyclopedia of the Natural History of that age in China (the late 16 c.). Appears he got the sea slug info from an earlier text.
1642	**Shokumotsu honsou** (also spelt honzo or honzô), a japanese translation of Edible Things Herb[al] an important 14th century Chinese work, the *Shih Wu Pen Ts'ao* by Li Tung-wan that mentions cukes.
1666	**Kinmô-zui** an encyclopaedia illustrated with wood-cuts was published in Kyoto in 1666 by Nakamura Tekisai (1629-1702). The title may be translated literally as “The Vocabulary with Pictures to Enlighten the Ignorants.” Kinmô Zui was published in 1666 by Tekisai Nakamura (1629-1702), a Confucianist living in Kyôto, Central Japan. The Japanese name of the book means ‘An Illustrated Encyclopedia for the Peoples’ (22 sections., 14 volumes). This book contains 1482 articles, of which 686 are related to plants and animals. A second edition was

Date	**Book** and remarks
	published in 1668.
1672	**Kôsei Honzô-Kômoku** published in 1672 (39 vols.). This is a reproduction of Li's (1590-1596) P'en-Ts'ao Kang-Mu printed by the new wood-blocks carved in Japan. The book was compiled by Ekiken Kaibara (1630-1714), who was a naturalist of the warrior class mainly living in Chikuzen (= Fukuoka Pref.) in northern Kyûshû.
1712	**Wakan Sansai-Zue** an encyclopaedia illustrated with wood-cuts compiled by the Ôsaka physician Ryôan Terajima (sometimes spelt Terashima) and completed in 1712. Ryôan emulates the early 17th-century Chinese work Sancai Tuhui by dividing the 81-volume work into 105 sections, each on a specific subject. The name means 'An Illustrated Encyclopedia of the Chinese and Japanese Natural History'. It is believed that Nakamura's "Kinmô-Zui" (1666) served as a model for Terajima's 1713 book. Long section on different kinds of cukes, most taken from other sources, which he cites.

Below are comprehensive and well-known Chinese and Japanese compendia of natural history and medicines that I have not examined, but might also have references to holothuroids. Nearly all citations are from an online unpublished ms on bipaliid platyhelminths by Sasaki and Kawakatsu (2001).

Date	**Book** and remarks
c 500 CE	**Shen-num P'en-Ts'ao Ching** (ms., 3 vols.) is known as the oldest Chinese Materia Medica compiled by Tao, Hung-Ching (C.E. 452-536) in the beginning of the 6th Century (ca. C.E. 500). He collected and compiled considerable popular herbal knowledge present among the people at that time.
c 500	**Chi-Chu P'en-Ts'ao**. Tao, Hung-Ching (C.E. 452-536) also compiled another Materia Medica including his many notes in nearly the same age: Chi-Chu P'en-Ts'ao (7 vols.).
659	**Hsin hsiu pen-ts'ao**. The pharmacological literature compiled between the Liang and Sung dynasties also reflects a liaison of philosophy and medicine. The first explicitly official edition of the materia medica, the Hsin hsiu pen-ts'ao of 659 mentions for example the Chuang tzu [book]. Hsin-Hsiu P'en-Ts'ao (ms., 20 vols.) was completed by Su, Chin. in C.E. 657 in the T'ang Dynasty (C.E. 618-910). The basal knowledge or data for this herbal and natural historic works was undoubtedly based upon Tao's ms. completed some 150 years earlier (see above).

c 740 **Pen-ts'ao shih i** The Shih tzu and the Huai-nan tzu [books] are cited in the Pen-ts'ao shih i compiled by Ch'en Ts'ang-ch'i (fl. c. 740). For the HNT and Shih tzu mentioned in the PTSI see Chung-hsiu cheng-ho ching shih cheng-lei pei-yung pen-ts'ao 19.22a. For the sake of convenience, the long title of this late Sung materia medica is here abbreviated as CPT.
P'en-Ts'ao She-I (ms.) was completed in C.E. 739 by Chen, Tsang-Ch'i. Although its original copy was lost, we can discover the contents of that ms. from several citations in some Materia Medicas written and/or printed after the late 8th Century.

860 **Yu-Yang Tsa-Tsu.** In their bibliographic work (Kawakatsu, Ogren, Froehlich and Murayama, 2001), an authentic record of a Chinese bipaliid animal was recognized in the ms. of Materia Medica written in C.E. 860 entitled "Yu-Yang Tsa-Tsu" (by C.-S. Tu'an). Yu-Yang Tsa-Tu (ms.) was completed around C.E. 860 by Tu'an, C.-S., the literary man living in the mid-eastern China in the T'ang Dynasty. The contents of Tu'an's (860) ms. cited above is undoubtedly based upon Ch'en's (739) ms.

1108 **Cheng lei pen ts'ao** Tang Shen-wei, a physician from Szchewan published Cheng lei pen ts'ao in 31 books using movable type in 1108 (movable type "invented" in Europe in the 1440s) reprinted in Japan in 1625. Cheng-Lei P'en-Ts'ao published by T'ang-Wei (ca. 1100). The photo was taken from the lithographic reproduction book (vol. 21, p. 437; 1957, Beijing) of Cheng-Lei P'en-Ts'ao published by T'ang, Shen-Wei (ca. 1100). The two lineages are known of T'ang's (ca. 1100) Materia Medica mentioned above. One is the Chéng-hu routes and another, the Ta-kuan routes. It is known that some characters used are different in each lineage. The photo shown here (see above) belongs to the Cheng-hu routes.

c 1350 **Jih Jung Pen Ts'ao.** Wu-Jui's 'Herbal for Daily Usage'

1709 **Yamato-Honzô** published in 1709 (16 vols.) by E. Kaibara. The Japanese title means "Japanese Materia Medica". The book contains 1362 articles. It was written by a mixed style of Chinese characters and many letters of the Japanese syllabary. This means the book could be read by the educated common people at that age.

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