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Cross sections of Muscles and Tendons in a Pyrenean Mastiff, and ratios of the same.

Name of muscle.	Cross section of muscle, in square inches.	Cross section of tendon, in square inches.	Ratio of cross section of muscle to that of tendon.
1. Gastrocnemius	2.631	0.0520	50.6
2. Fl. carp. rad.	0.283	0.0059	48.0
3. Fl. dig. long.	0.195	0.0045	43.3
4. Ext. carp. rad.	0.632	0.0160	39.5
5. Fl. carp. uln.	0.176	0.0056	31.4
6. Fl. hall. long.	0.680	0.0228	29.8
7. Biceps humeri	0.909	0.0449	20.2
8. Fl. dig. subl.	0.319	0.0251	12.7
9. Fl. dig. prof.	0.902	0.0830	10.9
10. Ext. carp. uln.	0.181	0.0197	9.2

These results, obtained from measurements made upon a freshly killed animal, confirm those found from observation of the human subject, and prove that the ratio of the cross section of the muscle to that of its tendon depends upon the amount of friction experienced by the latter, the coefficient being greater in proportion as the friction is less.

The following observations, made upon a Wallaby Kangaroo, confirm in a general way the preceding results:—

Cross sections of Muscles and Tendons in a Wallaby Kangaroo, and ratios of the same.

Name of muscle.	Cross section of muscle, in square inches.	Cross section of tendon, in square inches.	Ratio of cross section of muscle to that of tendon.
1. Gastrocnemius	1.313	0.0356	36.9
2. Fl. long. dig.	0.354	0.0246	14.4

It appears from the preceding investigation that the cross section of a muscle does not bear a constant ratio to the cross section of its tendon, unless the friction experienced by the muscle and tendon be also constant, and that there may even be a *surplusage* of strength in the tendon beyond what is absolutely necessary to resist the combined force of the muscle and friction. This surplusage, however, cannot be supposed to be large, if the principle of *economy of material* in nature be admitted.

“On *Holtenia*, a Genus of Vitreous Sponges.” By WYVILLE THOMSON, LL.D., F.R.S., Professor of Natural Science in Queen’s College, Belfast.

During the deep-sea dredging cruise of H.M.S. ‘Lightning’ in the autumn of the year 1868, the dredge brought up, on the 6th of September, from a depth of 530 fathoms, in lat. 59° 36’ N., and

long. $7^{\circ} 20'$ W., about 20 miles beyond the 100-fathom line of the Coast-Survey of Scotland, fine, grey, oozy mud, with forty or fifty entire examples of several species of siliceous sponges. The minimum temperature indicated by several registering thermometers was $47^{\circ} \cdot 3$ F., the surface-temperature for the several localities being $52^{\circ} \cdot 5$ F.

The mud brought up consisted chiefly of minute amorphous particles of carbonate of lime, with a considerable proportion of living *Globigerinæ* and other Foraminifera, and of the "coccoliths" and "coccospheres" so characteristic of the chalk-mud of the warmer area of the Atlantic. The sponges belonged to four genera: one of these was the genus *Hyalonema*, previously represented by the singular glass-rope sponges of Japan and the coast of Portugal; and the other three genera were new to science. One of these latter was the subject of the paper.

Associated with the sponges were representatives, usually of a small size, of the Mollusca, the Crustacea and Annelides, the Echinodermata, and the Cœlenterata, with numerous large and remarkable rhizopods. Many of the higher invertebrates were brightly coloured and had eyes.

Four nearly perfect specimens of the sponge described in the memoir were procured.

HOLTENIA, n. g.*

H. CARPENTERI, n. sp.

The body of the sponge is nearly globular or oval. Normal and apparently full-grown specimens are from $9''$ to $1' 1''$ in length, and from $7''$ to $9''$ wide. The outer wall consists of an open, somewhat irregular, but very elegant network, whose skeleton is made up of large separate siliceous spicules. These spicules are formed on the sexradiate stellate type; but usually only five rays are developed, the sixth ray being represented by a tubercle. To form the framework of the external wall, the four secondary branches of the spicule spread on one plane, the surface of the sponge, while the fifth or azygous branch dips down into the sponge-substance. This arrangement of the spicules gives the outer surface of the sponge a distinctly stellate appearance, the centres of the stars being the point of radiation of the secondary branches of the spicules. These quinquerradiate spicules measure about $1'' 5'''$ from point to point of the cross-like secondary branches; and the length of the azygous arm is from $7 \cdot 5'''$ to $1''$.

Smaller stars, formed by the radiation of smaller spicules of the same class, occupy the spaces between the rays of the larger stars.

The rays of each star bend irregularly, and meet the rays of the spicules forming the neighbouring stars. The rays of the different spicules thus run along for some distance parallel to one another,

* The genus is named in compliment to M. Holten, Governor of the Faroe Islands; and the species is dedicated to Dr. W. B. Carpenter, V.P.R.S., with whom the author was associated in the conduct of the expedition. [A figure of the species is given at p. 120 of the present volume of the 'Annals.']

and are held together by a layer of elastic sarcode, which invests all the spicules and all their branches. Between the rays of the spicules, over the whole surface, the sarcode forms an ultimate and very delicate network, its meshes defining minute inhalant pores.

At the top of the sponge there is a large osculum, about 3" in diameter, which terminates a cylindrical cavity, which passes down vertically into the substance of the sponge to a depth of 5" 5". The walls of this oscular cavity are formed upon the same plan as the external wall of the sponge; and the stars, which are even more conspicuous than those of the outer wall, are due to the same arrangement of spicules of the same form. The ultimate sarcode network is absent between the rays of the stars of the oscular surface.

The sponge-substance, which is about 2" in thickness between the oscular and the outer walls, is formed of a loose vacuolated arrangement of bands and rods of greyish consistent sarcode, containing minute disseminated granules and groups of granules of horny matter, and minute endoplasts.

Towards the outer wall of the sponge the sarcode trabeculæ are arranged more symmetrically, and at length they resolve themselves into distinct columns, which abut against and support the centres of the stars, leaving wide, open, anastomosing channels between them. The sarcode of the outer wall, and that of the wall of the oscular cavity, is loaded with minute spicules of two principal forms—quinqueradiate spicules with one ray prolonged and feathered, and minute amphidisci.

Over the lower third of the body of the sponge, fascicles of enormously long delicate siliceous spicules pass out from the sarcode columns of the sponge-body in which they originate, through the outer wall, to be diffused to a distance of not less than half a metre in the mud in which the sponge lives buried; and round the osculum and over the upper third of the sponge, sheaves of shorter and more rigid spicules project, forming a kind of fringe.

The author referred all the sponges which were found inhabiting the chalk-mud to the Order Porifera Vitrea, which he had defined in the 'Annals and Magazine of Natural History' for February 1868. This order is mainly characterized by the great variety and complexity of form of the spicules, which may apparently, with scarcely an exception, be referred to the sexradiate stellate type, a form of spicule which does not appear to occur in any other order of sponges. The genus *Holtenia* is nearly allied to *Hyalonema*, and seems to resemble it in its mode of occurrence. Both genera live imbedded in the soft upper layer of the chalk-mud, in which they are supported,—*Holtenia* by a delicate maze of siliceous fibres, which spread round it in all directions, increasing its surface without materially increasing its weight—*Hyalonema* by a more consistent coil of spicules, which penetrates the mud vertically and anchors itself in a firmer layer.

It appeared to the author and to Dr. Carpenter, who had had their attention specially directed to this point as bearing upon the continuity and identity of some portions of the present calcareous

deposits of the Atlantic with the Cretaceous formation, that the vitreous sponges are more nearly allied to the *Ventriculites* of the chalk than to any recent order of Porifera. They are inclined to ascribe the absence of silica in many *Ventriculites*, and the absence of disseminated silica in the chalk generally, to some process, probably dialytic, subsequent to the deposit of the chalk, by which the silica has been removed and aggregated in amorphous masses, the chalk flints.

The Vitreous Sponges, along with the living Rhizopods and other Protozoa which enter largely into the composition of the upper layer of the chalk-mud, appear to be nourished by the absorption through the external surface of their bodies of the assimilable organic matter which exists in appreciable quantity in all sea-water, and which is derived from the life and death of marine animals and plants, and, in large quantity, from the water of tropical rivers. One principal function of this vast sheet of the lowest type of animal life, which probably extends over the whole of the warmer regions of the sea, may be to diminish the loss of organic matter by gradual decomposition, and to aid in maintaining in the ocean the "balance of organic nature."

"On *Palæocoryne*, a Genus of Tubularine Hydrozoa from the Carboniferous Formation." By Dr. P. MARTIN DUNCAN, F.R.S., Sec. Geol. Soc., and H. M. JENKINS, Esq., F.G.S.

Palæocoryne is a new genus containing two species, and belongs to a new family of the Tubularidæ. The forms described were discovered in the lower shales of the Ayrshire and Lanarkshire coal-field; and an examination of their structure determined them to belong to the Hydrozoa, and to be parasitic upon *Fenestellæ*. The genus has some characters in common with *Bimeria* (St. Wright), and the polypary is hard and ornamented. The discovery of the trophosome and probably part of the gonosome of a tubularine Hydrozoon in the Palæozoic strata brings the order into geological relation with the doubtful Sertularian Graptolites of the Silurian formation, and with the rare medusoids of the Solenhofen stone.

"On the Rhizopodal Fauna of the Deep Sea." By WILLIAM B. CARPENTER, M.D., V.P.R.S.

The author commences by referring to the knowledge of the Rhizopodal fauna of the Deep Sea which has been gradually acquired by the examination of specimens of the bottom brought up by the sounding-apparatus; and states that whilst this method of investigation has made known the vast extent and diffusion of Foraminiferal life at great depths—especially in the case of *Globigerina-mud*, which has been proved to cover a large part of the bottom of the North Atlantic Ocean—it has not added any new generic types to those discoverable in comparatively shallow waters. With the exception of a few forms, which, like *Globigerina*, find their most