

III. *An Extract of a Letter from Mr. Anthony van Leeuwenhoek, F.R.S. Dated October the 12<sup>th</sup>. 1713. Concerning the Fibres of the Muscles, &c.*

GENTLEMEN,

**I**N compliance with your desires, I here send you a Copy of the Observations I communicated to the great Pensionary *Monsieur Heinsius*, concerning the Membranes with which the *Fibrillæ* of the Muscles appear to be encompassed, both in the Flesh of a Whale, Cod-fish, Salmon, and Smelt; and also in that from an Oxe to a Mouse; in all which the appearance was the same.

The Flesh of the Whale, was a small piece cut off near the Tail of the Fish, which I desired a Sea-Captain to bring me, that I might observe how the Flesh in that part was joined to the Tendons in so large an Animal. Viewing this thro' the Microscope, I judged the Fibres thereof to be four times as large as those I had formerly observed in another piece of Whale's Flesh, taken from another part of the Fish; which made me consider, whether the Fibres of that part might not be, by Nature, furnished with larger Fibres for its greater strength.

Cutting the said Flesh-parts length-wise, and across the Fibres, I discovered more plainly than before, that each Particle or Flesh-fibre, was enwrapt in a fine thin Membrane.

To have a better Idea of these Flesh-fibres of a Whale, I cut a thin slice of it across, which I laid on a wetted piece of Glass, that the Flesh which was very dry and shrunk, might, by the moisture be swelled, and thereby distended to the natural size it had when on the Body of the Fish itself. In this state, placed before the Microscope, it appeared as I caused it to be drawn in the Figure. *A B. C. D.* in which the Parts were so close together, that their encompassing Membranes, represented by the black Lines, were but just discernable, some whereof appeared larger than others: these, if attentively viewed, seem'd  
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plainly

plainly to be divided into multitudes of others, cut also transverse, the bigness of which was no larger than a common Sand to the naked Eye. These were so close crowded together, that their Figure was very irregular, as well as their sizes different; for tho' each seem'd encompassed with six others, yet some of them were twice as large as the other.

Having formerly mentioned the slenderness of these *Fibrille* in the Flesh of a Whale, and judging these, as I said before, to be four times as large, I took a thin slice of the formerly mentioned Whale-flesh (which I had still kept by me) and after having made it thoroughly wet, I viewed it with the same Microscope as I had done this of the Tail. This appear'd as is represented (*Fig. 2.*) *E. F. G. H.* Letting the moisture dry away from these slices, so stuck on to the Glass, the Particles became much smaller, and the Membranes with which each was encompassed, became very visible; that is, those which were not shrunk away; which was a very entertaining Object to the curious; and as often as I made new Cuts, a new Object presented it self.

A small Particle of this Flesh I caused to be drawn, as in (*Fig. 3.*) *I K L M.* These Particles seem'd to touch and be joined to others; but now being dried, they shrunk in from the Membranes round about them; for the Membranes could not shrink, because they were all joined to one another.

Along these Flesh-fibres there runs some such thick Membranes, that they equal the thickness of a Hair or more, which are scarce distant the breadth of a Sand from each other; from these larger Membranes other parts are spread, dividing each Fibre into numerous *Fibrille*; so that it may be said, each flesh Fibre, no bigger than a Hair, is a little Muscle encompassed in its peculiar Coat or Membrane, as I have said before. Whereas the Designer had not the same apprehension of the size of these Fibres, as I and some other Persons had, I made him draw a little piece as large as it appeared to my apprehension, as in (*Fig. 4.*) *N. O. P.* whence appears the difference of one Man's sight from another.

I have also often seen some few of these Fibres, tho' joyned to others, yet but one Fourth of their bigness to which they were joined.

When I again moistend those represented in the Third and Fourth Figures, (dryd up and shrunk) they would be again so swelled and distended, as to fill up the spaces between the Membranes, and re-assume the Shape they had before they were dried. Among several little pieces of Flesh placed before another Microscope, and moisten'd as before, there was one, whose Particles were not separated upon drying, which I supposed to be, from the splitting and tearing asunder of a large Membrane that run thro' the middle of it, as may be seen in (*Fig. 5.*) *Q. R. S. T. V. W.* where between *S. T.* and *V.* the dried Particles remain unseparated; these being cut a little thicker appeared also of a darker hew, and if they had been sliced yet thicker would have appeared of a dark red. By *S. W.* is represented the thick Membrane dividing this piece, which was about the bigness of a Hair; this at *T.* sent out a Branch, and near *W.* is split into two, I apprehend that a great number of Blood-vessels are spread over this Membrane, which by their smallness are not visible; for it is by these the Nourishment is convey'd. Between *R. S.* and *Q. W.* the exceeding fine Membranes torn from the great are visible.

Is it not amazing that in such vast Animals as a Whale, such exceeding small *Fibrille* should be found? nay, such they are in small Animals; and that the whole fifth Figure is not so large as a coarse grain of Sand.

This Whale was so large, that the upper part of its Body yielded 60 Quarteels of blubber or Fat, which allowing 30 *Rotterdam* Stopes (making each about 3 English Quarts) to one Quarteel, it will nearly amount to 24000 Pound weight; besides, there is a very great deal of Fat about the Entrails.

Then I caused a very little piece, consisting only of five *Fibrille*, to be drawn lengthwise, as they were seen thro' the Microscope, as (in *Fig. 6.*) *A. B. C. C. E. F.* in which Figure at *A.* and a little at that place, it is divided into two *Fibrille*. Between *C.*

and *F.* are to be seen the little Membranes which encompass the *Fibrilla*, which are here torn asunder.

I have frequently, with pleasure, observed these Flesh-fibres lengthways, to be as it were corrugated or wrinkled, which I imagined to be the Representation of their Rest or unbent Posture; and yet more, when the Part to which they belong is bowed together, or brought nearer; but when the Muscle is extended, and its Antagonist acts, there is not the least wrinkle observable in these *Fibrilla*.

However, all the little Inequalities in these *Fibrilla* must not be taken for those Corrugations, since many of them are only the Articles torn off from the Membranes which encompass the *Fibrilla*.

Figure (7) *G. H. I. K.* represents four little Fibres of a piece of Whales-Flesh I had procured two Years since; this I caused to be drawn to shew the difference. By the two Figures 6 and 7, is visible the Diameters of the Fibres are as big again in one, as in the other, therefore the Fibres must be four times as big in *Fig. 6.* as in *Fig. 7.* Now each Flesh-fibre being composed of a great many smaller *Fibrilla*, we may imagine each of these in-lying Fibres do likewise consist of others of the like Nature.

I have a-fresh viewed several small Fibres of Ox-Flesh, and observed, that each of the *Fibrilla* in them was encompassed with a thin Membrane. But I cannot shew these Membranes so clearly to other Persons in Cows-Flesh, as in Whales-Flesh; because the Parts of the former are of a much more compact and close Texture than that of the Whale, from whence they do not shrink so much in drying.

I am of Opinion, that what I have said of the Membranes (encompassing the Fibres and *Fibrilla*) of the Flesh in a Whale, will likewise hold true in other kinds of Flesh; yea even down to that of a Rat or a Mouse: Concerning which I shall prosecute my Observations. I conclude, &c.

Fig. 1.

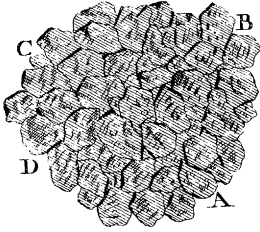


Fig. 2.

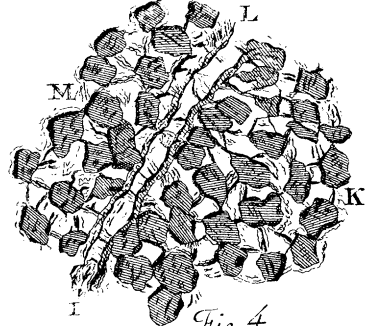
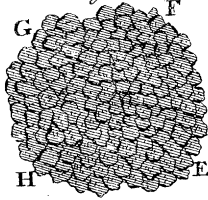


Fig. 5.

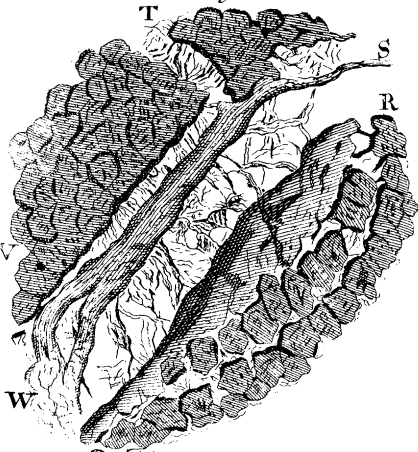


Fig. 7.



Fig. 4.

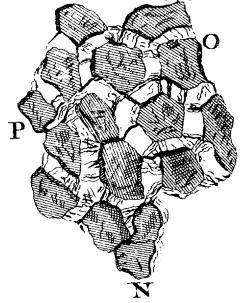


Fig. 6.

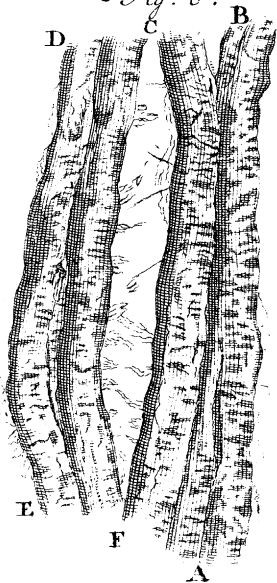


Fig. 8.

