

II. *Observations upon the Membranes enclosing the Fasciculi of Fibres, into which a Muscle is divided.* By Mr. Leeuwenhoek, F. R. S. Translated by Dr. Sprengell, F. R. S.

Delft, Jan. 9. 1720.

S Ometime ago I mis'd a small piece of Flesh, which I had left standing before a Microscope, and endeavouring to procure such another, I cut off several thin slices from a piece of Beef; in doing which, whenever I cut the fleshy Fibres thro' transversly, I could plainly discover the Membrane, as it is commonly call'd, which runs between and envelopes the fleshy Fibres, and especially the larger *Fasciculi* of them, as they run lengthwise along the Muscle. Between these *Fasciculi* the Membrane is of a considerable thickness, but spreads out every way into Ramifications exceedingly small. I had observ'd some Weeks before, that this Membrane was composed of an inconceivable number of very small Vessels, which were plainly to be discern'd not only where the Membrane appear'd of some considerable breadth, but even where it was not so broad as a single Muscular Fibre; but how far this held, I could not determine, forasmuch as these small Ramifications of the Membrane, did again spread themselves into other Ramifications so exceedingly fine, especially where they enclosed the single Muscular

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Fibres,

Fibres, that they were in a manner invisible even through my best Microscopes.

The very small Vessels, which compose this Membrane, (as it is call'd) are doubtless framed to convey some nutritious Juices, yet they are so small, that the Globules of Blood cannot pass through them.

That this might be the better understood, I caus'd a small piece of the Membrane to be designed, as at Fig. 1. *A. B. C. D.* which, with the adjoining fleshy Parts, is cut thro' transversly, and since it was impossible for the Designer to draw the extraordinary number of Vessels, which compos'd it, on account of their being so exceeding small, he has represented them only by Points.

Altho' in my former Letters I gave some Draughts of the Carnous Fibres cut thro' cross-way along with the Membranes, yet for the satisfaction of those who have not seen my other Letters, I have given them here another Draught of the same. See Fig. 1. between *E. F. G.* and *H. I.*

These carnous Fibres, when wet, lay so close to each other, that the space between *E. F. G.* and *H. I.* was quite fill'd up; but when dry'd, the Fibres were so shrunk, that one might see such Spaces between them as are here delineated.

Now as we see, upon the drying of the Membranes *A. F. G.* and *D. E. G.* with the Muscular Fibres between them, what a number of small Ramifications proceed from the Membranes, as is here represented between the muscular Fibres; we must not imagine, that these Ramifications proceed only from the points here represented, but that they are continued the whole length of the Fibres, and subdividing

viding themselves into still finer Ramifications, they enclose every single Fibre in the whole Muscle.

Amongst several pieces of Flesh, where the carnous Fibres were cut transversly, I happen'd on one piece with its Branches so plain, that the Membranes and Fibres look'd like so many Boughs of Trees, with the Leaves on them, as may be seen at Fig. 2. *K. L. M. N.* where *M.* shews the so call'd Membrane torn off from another, as also how many Branches it runs into, and the many Fibres it covers.

All these carnous Fibres, with the so call'd Membranes, lay very compact together, when I cut them off from the piece of Flesh, as likewise when I laid them on the Glass, and moistened them; but as the moisture dry'd away, they shrunk again, in the manner here represented, and altho' the Designer could plainly distinguish the small Vessels which were cut thro', the largest of which appear'd at *M.* Fig. 2. yet he was obliged to mark them only with Points. Here you may observe, that all the carnous Fibres, having been closely tied together by the said Membranes, by which they were enveloped, which are nothing but a congeries of Vessels, could not be separated from each other upon drying, but by tearing asunder those Membranes.

The carnous Fibres along with the so call'd Membrane, at Fig. 2. *K. L. M. N.* do not take up so much room, but that a grain of Sand may cover it, and yet one might very distinctly observe, in some of those carnous Fibres, the parts of which they were composed.

This Observation I was resolv'd to pursue in the Flesh of a Whale, of which I had kept two pieces by me, for about 7 or 8 Years, of about a Span long,

and two Inches thick ; from these I cut several Slices transversely, but found that the carnous Fibres so cut through did easily separate from one another, so that I could not find my account in this, but thought that the Membranes were rotten. Therefore I did cut off the outside with a Table-Knife, and then with a very sharp Knife I cut the inner part into very fine Slices, and there I found the Excrements of Mites, which were very small, but globular, and some of them as small as I had ever seen before, and so going on, I found these Excrements every where, especially where the Membranes were thickest; then looking into such places where the Membranes were thinnest, insomuch that I was satisfied, that a Mite, tho' just come from the Egg, could hardly find room there, there it was that I discover'd in the so nam'd Membranes, the aforesaid Vessels, and that in as great a number as I had seen them in the Oxe's Flesh, and as plain as one can see the holes in a Thimble with the naked Eye.

After the former Discoveries that I had made concerning the Circulation of the Blood, particularly that the Blood Vessels had no Endings, I began to consider how the Fat-Particles could be formed, since I did not think that they were separated from the Blood, and came out of the Blood-Vessels. But having now plainly discover'd, that the so call'd Membranes were nothing but very small Vessels, and believing that they were created for no other end but to transport Nutriment, as also that there was no Circulation in these Vessels, I imagin'd that the Matter which we call Fat, was brought into them, which, when there was too great a supply of Nutriment, so that it could not be forced farther on, must  
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be driven out of these Vessels; for all the Particles of Fat, that I have as yet observ'd, are inclosed in small Films.

This Original of the Fat is to me much more credible, than that it should be forced out of the Blood Vessels; and yet how these fatty Particles, which consist of small globules, and those out of still smaller globules (as it appears to me) are made and formed, I cannot as yet determine: As also where these Vessels, which constitute what we call Membranes, have their beginning, and how this Fat is brought into them.

I had in my Drawer a piece of Oxe's-flesh, that I believe had lain there about four Years, wrapp'd up in a Paper, which Piece I found in some places to be cover'd with a Membrane; from this I cut off several small Slices along with the Membrane, and I found that near the Membrane, there lay about 16 or 18 Nervous Fibrils, which, in the drying of the Flesh, were so squeez'd together, that they were almost twice as long as they were broad. In some of which I saw very distinctly those Vessels, which are in the Nerves.

These Nervous *Fibrilla* were enclosed by a sort of half round, separating them from the Muscular Fibres, which half round consisted of a row of small Tendinous *Fibrilla*, each of which was about twice as thick as a Hair of a Man's Beard. Without these Tendinous *Fibrilla* lay the Muscular Fibres, that had been cut through transversly, and in this part of the half round there were several Apertures, which seem'd in the Microscope to be big enough for Hemp-seed to pass through them, which might well be taken for Vessels, but that there lay so many of them.

them together. But considering that the Nerves are commonly cover'd with fatty Particles, I concluded that these Apertures were no Vessels, but meer fatty Particles, which I found to be true when I had cut thro' them, and discover'd that the inward Fat was eaten out by the Mites, which had left only the Husks, or *Cortices*, of the Fat Globules behind: Which *Cortices* I never had as yet been able to discover, because the *Cortices* of the Fat Globules would, upon any heat, melt away as fast as the inward Fat.

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III. *Observations upon the Vessels in several sorts of Wood, and upon the Muscular Fibres of different Animals. By the same Curious and Inquisitive Person.*

Delft, Jan. 24. 1721.

SEEING some reddish Boards carry'd into a House in my Neighbourhood, and enquiring what use they were design'd for, I was answer'd that they were bought of the *India* Company to make Cabinets of, and that they came from the Island *Amboina*.

I procured a piece of that Wood saw'd off at the end of a Board, as likewise some of the Chips, in order to observe the Vessels therein; and, cutting the Wood through all manner of ways, I found that in one place the Wood appear'd whitish, that at a small distance

