

I. *Microscopical Observations on the Palates of Oxen, &c. By Mr. Anthony van Leeuwenhoek, F. R. S.*

Delft in Holland, October 9th, 1708.

I Took a Cow's or Oxe's Head, and cut out of the Mouth of it the Roof or Palate, close to the Throat, while it was yet warm; and having prest it gently, I cou'd perceive that there issued out of several Parts of it, small, round, protuberant, and transparent Drops; and having prest it a little harder, there followed a yellow Moisture.

I took the uppermost Skin of the said Part, and viewed it thro' a Microscope, and observed, That upon most of the Places from which the aforesaid Moistneis or Liqueur proceeded, there was a round Ring or Circle, that was of something a darker Colour than the Skin or Membrane that was next it; I cou'd likewise perceive, in some of the said Places, out of which the Liqueur came, that there were small Holes or Orifices.

These moist places were not all of equal distance from each other.

From these Discoveries I began to consider, whether the closed Parts (which I had observed in the Membrane after it was slipp'd off) out of which the Moisture proceeded, were not Valves, thro' which the Moisture was brought into the Mouth, but none of it admitted to return the same way.

Moreover

Moreover I discover'd in the said Skin or Membrane, a very great number of exceeding small Protuberances, that stood closer by one another than the Hair upon a Man's Head; I likewise observed in the uppermost thin Skin, Holes, that were so very small that they almost escaped my sight, tho' I viewed them thro' a Microscope; for notwithstanding the Skin appears to our naked Eye very smooth and polished, yer I cou'd discover that several parts of it were overspread with protuberant Particles, which far exceeded the aforementioned in largeness; I judg'd 'em to be thicker at the Root than a Hog's Bristle, and that they were in height about the Diameter of the same: When these last protuberant Particles were divested of the Skin that lay upon them, I cou'd perceive that each of them was armed with pointed Particles.

Thereupon I viewed the rough Skin or Bark that lay under the thin ones, and I perceived also in the same, such slender Fibres or Bristles that were of a darkish colour, and pass'd strait thro' the said Skin, agreeing with the small Protuberances and little holes that I had discover'd in the uppermost Skin.

From this Observation I imagin'd, that the last mention'd holes or Orifices, and the little Fibres which I saw in the thick rough part, were those long Particles that receive the Juices, and which also produce that Sensation, which we call Taste.

After this I viewed those Parts that lie under the thick rough part, which appeared to me in some places to be nothing else than Yellow and White Glandules, about the bigness of a course Sand; and each of these Glandulous Matters were again compos'd of a great number of smaller Particles, having each of 'em a different Figure, lying, as it were, involved in one another, and being about the bigness of the Particles of Fat, and which indeed one wou'd take to be such Particles; but when I

let them dry they were so shrunk in together, that one could hardly discover any parts of them, but when I moistned them again, they resumed their former Figure ; whereby I was fully convinc'd, that they were no Particles of Fat : And between the said parts there ran a great number of Vessels, but I did not take them to be Blood Vessels; and it also seem'd to me that each Glandule was surrounded with a Membrane.

The uppermost Skin was cover'd with a very thin Membrane, which was not very closely united to the said Skin ; and this Membrane is in my Opinion that which by the hot or sharp Moisture is easily separated from the Skin that lies under it.

The second Skin (in which the abovemention'd Valves were) I have often separated from that rough part that lies under it, and which one might also call a Skin, and which in some Places was about six times as thick as the uppermost Skin ; and I have as often observed, that the Skin which I separated, did not only always remain fasten'd to the Valves, but likewise several times part of the Vessels, to which the Valves were united, remain'd fasten'd to it, which Vessels run into the Figure of a Tap or Funnel, that is to say, narrower Inwards.

Now that we may have the better Idea of the Roof of that part of the Palate of an Oxe or Cow, where it is cut off next to the Throat, I caus'd a small Particle of the Skin or Membrane of the same, to be drawn by my Painter, as it appear'd to him thro' a Microscope.

Fig. 1. A B C D, represents a small Particle of the aforementioned Membrane, in which the round protuberant Particles are oppos'd to the Sight ; and there also are describ'd by E, F, the beforementioned Valves, which are seldom so close together as they are here shewn ; and in the middle of which, in the dark part of them,

them, I several times discover'd an Orifice or Opening, which I judg'd to come by Chance, and which is entirely shut or clos'd up when there were no Juices conveyed out of them.

I told you before, that the small Protuberances stood as close to one another as the Hair upon a Man's Head; at the same time I also discover'd several long slender pointed Particles, which I conceived to be rooted or planted in the Skin with a pointed end, and that these caus'd the aforementioned Protuberances; and notwithstanding that I did not perceive near so many of these long Particles, as I did of the Protuberances, yet I conclude, that the long Particles were at first as numerous as the other, but that a great many of them in the separating of the Skin might have remained sticking in it, as it has often happen'd to me in Operations of the same nature.

Afterwards I observ'd, that when I dissected the Skin, in which the aforesaid long pointed Particles were sheath'd, the said Particles were united to the Parts that lay under, and that they were there twice as thick as the upper end of them; and as near as I could measure them by my Eye, they were as long as four Diameters of the Hair of one's Head.

Now as these pointed Parts, which were fixed in the aforesaid Protuberances, were oppos'd to the sight with the Points uppermost, one cou'd not easily make any Observation of them; wherefore I cut off one of the slender Particles from the rest, that I might give you the better view of the pointed Parts.

Fig. 2. F, G, H, I, represents a small Particle of the aforesaid long Particle, so as it appear'd thro' a Microscope, of which F G shews the undermost part, which is as it were the Socket of the pointed Parts, and I H are the said pointed Parts.

When I had separated the Skin of the Roof of the Mouth of a second Oxes Head, and had cut the same thro' into very thin Parts, I observed abundance of little Holes, and a great many more Parts that were stopt, in which the long-pointed Parts remain'd sticking; whereupon I cut the same across, and observed, that the aforesaid pointed Parts stood so thick by one another, that there was not a Hairs breadth space between them.

Having observed that the Roof or Palate of the said Head, was closely united to the Bone that lay under it, I examined the external part of that Bone, and, with wonder discover'd so many Pores or Holes in it, that the Hairs of ones Head do not stand so near one another as the said Pores did; however I perceived that a great many of them were so closely shut, that one cou'd discover no opening in them, and the biggest of those Pores, which were but few in number, were as large as the Diameter of the Hairs of one's Head, and in one of them there also seem'd to be a Blood Vessel.

I must not omit that I was desirous to search into the inward Parts of the Nostrils of an Oxe or Cow, as well as I was able; in doing which I saw that each side of the Mouth (which one might call the Lips) was furnished with a great many pointed Parts, that were very thick in the inward Skin, and being round ran into a very slender Point; these Particles seem'd to me at first very strange, being unable to Guess for what end they were framed.

I likewise made my Observations upon the Skin of several of the said Parts, which were very strongly united to the Parts that lay in it; and found that one of those Parts that lay within, did consist of a great many pointed Particles, which were much thicker and longer than those that I had discover'd in the inward Parts of the Tongue of an Oxe or Hog.

I caused a very small Particle of the forementioned Parts to be drawn, so as it appear'd to the naked Eye, as you may see in *Fig. 3.* K, L, M, N; only with this difference, that that which is drawn is not so thick and large as it shou'd be, because the Parts were dry'd and shrunk in, and they were moreover of the smallest size of any that I had dissected.

Fig. 4. O, P, Q, R, S, T, is a very small piece of the foremention'd Particle, which was strip'd of its second Skin, and in which some few of the pointed Parts were standing out, but most part of them lie close upon the said Particle.

I observed, that that pointed part, represented by S. stood out longer than the rest, and that it was composed of several long Particles united together, the longest of which was standing out above the rest, and ran into such sharp Points, that they appeared thro' the Microscope just as the Point of the smallest Sewing Needle does to the Eye; and the reason why we can't see these sharp-pointed Particles always in each part, is in my Opinion, because they are so united to the two Skins, with which they are as it were cover'd, that they can't be separated from them without leaving some part sticking in one or other of them; I have also observed some, of which the extream Parts consisted of four distinct Points of equal length.

In some of those sharp Particles that are standing out in *Fig. 4.* such for instance as are described by Q and R, we cou'd see very plainly, that each of 'em consisted of three long Particles, the middle of which was the longest; from whence I considered, whether each of those long Particles were composed of other long Particles, which, upon the Account of their exceeding smallness, might escape our sight.

I have said in my former Letter, that the thinnest part of the Tongue of an Oxe is composed of Bony Particles, and that in those Parts there is no Taste.

Now we know, that an Oxe in the Chewing of his Victuals, does not only grind it by opening and shutting of the Mouth, but by the continual Motion of the lower Jaw from the left to the right side does as it were scower it over the hindermost Teeth, by which the Meat is yet more broken and grinded than it could be by the direct opening and shutting of the Mouth as aforesaid.

Now if we suppose, that by the aforementioned Motion, the Victuals are conveyed among the manifold Parts, a small Particle of which has been before described in *Fig. 3.* K, L, M, N; and that those Parts by the Motion of the Mouth, do cause such a pressing or kneading of the Particles of the Meat, lying amongst them, that the said Meat is, as it were, insinuated into the Parts, and by this means a stronger sensation of Taste is produced in the Chewing of it again, than the Tongue enjoy'd at first; and thus that which is wanting to the Tongue to enjoy the Taste, is doubly made good to it by those Parts that are in the side of the Mouth.

As little as the space is between the aforementioned pointed Particles, I thought with my self that there might be other and yet smaller pointed Particles lying in the Skin between the greater, and fastned in the lower Parts; and thereupon I discover'd that there were a very great number of pointed Particles shut up in the Skin, and which lay so close by one another as the Hair of one's Head; the Points of these seemed to me to be mostly blunted: Afterwards I observed, that a great many of them were thick, close at the Root, and that the upper part of them was three times as slender as the undermost; from which Discovery I concluded, that they were all of them of such a Figure, and that in separating them from the Skin, most of the slender Parts were broken.

broken off, and left sticking therein ; and when I follow'd them into the under Parts, I found that they were three times as long as they had lain in the Skin that was taken off ; and they were also (so far as it appeared to me) where they ended in a great number of very small Vessels, about four times as thick as where they were fixed in the Skin.

I have often thought with my self, that as according to my Opinion the said Particles were endued with a little of the Juices of the Meat, which we name Taste, whether each of these Particles might not imbibe a small Quantity of those Juices, and carry them on so far, till they arrived at the exceeding small and slender Blood-Vessels, which we call Veins ; and that these Juices are, as it were, filtrated or strain'd thro' the Tunica's of the Veins, and so conveyed to the Heart ; and thus from the Mouth does the Body enjoy a little Nourishment : but I submit this Thought of mine to the Judgment of the Honourable Society.

Now if each of those Particles in the Mouth shou'd derive down to the Body no more than the thousandth part of a very small drop of Moisture, or Juice of that Food which the Oxe Eats or Chews, in the space of an Hour, what a vast quantity of Nourishment must the Body receive from the Mouth in any continued time ?

