" monſtroſa hæc bina corpora duplici mente ac ſpi-
" ritu regantur. Nam ſive cor faciamus, ſive cere-
" brum ſtatuamus animi ſedem, ex utrolibet idem
" nullo negotio evincitur. Adde tot actiones multi-
" plices, cogitationes rerum diverſas, ſenſa animi varia,
" quæ, ut aliud nihil ſit, iſthuc pariter nos docent.
" Unum præcipuè hic admirandum venit, quod
" commemorare ſuperiùs memoriâ excidit; poſt
" prodigioſum videlicet hunc difficilemque partum
" natos eſſe matri alios liberos, ex eodem patre pro-
" creatos, ſanos et valentes, corpore, ſpecie ac forma
" integros, qui monſtri nihil admixtum habeant."

XL. *Obſervations on the Origin and Uſe of the Lymphatic Veſſels of Animals: being an Extract from the* Gulſtonian *Lectures, read in the Theatre of the College of Phyſicians of* London, *in* June 1755. *By* Mark Akenſide, *M.D. Fellow of the College of Phyſicians, and of the Royal Society.*

Read Nov. 10, 1757.

IT is proved, by a multitude of experiments, that the lymphatics communicate with the blood-veſſels. They may be diſtended by blowing air, or by injecting water or mercury, into an artery: and the lymph, which they carry, is frequently, in a morbid ſtate, found tinged with a mixture of the red globules or craſſamentum of the blood. Upon this foundation two different

different theories have been raiſed, concerning the connection of the lymphatics with the arteries.

Of theſe, we ſhall firſt conſider that of the late famous profeſſor Boerhaave. He obſerved, that every artery of the body is greater, in its diameter, than any of its branches: and this obſervation being found true, as far as our eye and the microſcope can inform us, he inferred, by analogy, that it held good even thro' the moſt minute ſubdiviſions of the arterial ſyſtem. But, ſays he, proportionable to the diameter of the canal is the ſize of the particles moving thro' it: therefore, if an ultimate capillary artery, admitting only one red globule at once to paſs thro' it, ſend off lateral branches, theſe branches will be capable of receiving ſuch particles only as are ſmaller than a red globule. But the particles next in magnitude below the red globules are the yellow ſerous ones; and the lateral veſſel, thus receiving them, is a ſerous artery, and the trunk of a ſecond order of veſſels. In like manner, this trunk, being continued on thro' many leſſening branches, will at laſt grow ſo minute, as to admit only one ſerous globule: its lateral branches, therefore, will receive only ſuch particles as are ſmaller than the ſerous ones: but theſe are the particles of the lymph; and this lateral branch is a lymphatic artery, and the trunk of a third order of veſſels. Thus, in the red arteries are contained all the circulated fluids of the body; in the ſerous arteries, all except the red blood; in the lymphatics, all except the red blood and ſerum: and this ſubordination is, according to the ſame laws, continued down thro' fluids more ſubtile than the lymph, to the ſmalleſt veſſel, which is propagated from the aorta.

Such was Boerhaave's doctrine concerning the vaſcular ſyſtem of animal bodies; like many of his other notions, ingenious, plauſible, and recommending itſelf, at firſt ſight, by an appearance of geometrical and mechanical accuracy: but founded upon inſufficient data, and by no means to be reconciled to appearances.

For, in the firſt place, ſhould we admit his hypotheſis, it is certain, that the conical or converging form of the aorta, and the change of direction in its branches, muſt, in the diſtant blood-veſſels, occaſion a great reſiſtance to the moving blood, and a great diminution of its velocity. Suppoſe that this reſiſtance be, in any capillary red artery, to the reſiſtance in the trunk of the aorta, as any larger aſſignable number is to unit: the reſiſtance, then, in a capillary ſerous artery will, to that in the aorta, be as the ſquare of that number is to unit; in the capillary lymphatic, as the cube; and ſo in progreſſion: that is, the velocity of the fluids, in the remoter ſeries of veſſels, will be, phyſically, nothing. But we know, on the contrary, that ſome very remote ſeries of veſſels have their contents moved with a very conſiderable velocity; particularly the veſſels of the inſenſible perſpiration: and in anatomical injections, the liquor thrown into an artery ſcarce returns more eaſily or ſpeedily by the correſponding vein, than by the moſt ſubtile excretory ducts. Moreover, there are an infinite number of obſervations of morbid caſes, in which the red blood itſelf has been evacuated thro' ſome of the moſt remote ſeries of veſſels, merely from an occaſional temporary obſtruction in one part, or a præternatural laxity in another; and without

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any laſting detriment to the ſtructure and ſubordination of the veſſels; which yet, upon this hypotheſis, muſt have been utterly deſtroyed before ſuch an irregularity could have happened.

The other theory concerning the origin of the lymphatics has been maintained by ſome very eminent phyſiologiſts later than Boerhaave; and ſuppoſes, that theſe veſſels receive their lymph from the blood-veſſels, or from the excretories of the larger glands, by the intermediation of only one ſmall veſſel, which theſe authors term a lymphatic artery, inviſible in its natural ſtate, nor yet rendered ſubject to the ſenſes by experiments. But to this it may be anſwered, that the lymphatics are traced into many parts of the body, and loſt there; and therefore moſt probably have their origin there, where no large gland nor blood-veſſel is to be found in their neighbourhood: that it contradicts the whole analogy of nature, to ſuppoſe the motion of an animal fluid more diſcernible in the veins than in the arteries: and, finally, that it ſeems rather an inſtance of want of thought, and of being impoſed upon by words, to call the lymphatic veſſels veins, becauſe they are furniſhed with valves; and then, becauſe they are called veins, to take for granted, that of courſe they muſt be the continuation of arteries.

In attempting to inveſtigate matters too ſubtile for the cognizance of our ſenſes, the only method, in which we can reaſonably proceed, is by inferring from what we know in ſubjects of the ſame nature: and our concluſion thus inferred, concerning the ſubject ſought, will be firmer and more unqueſtionable, in proportion as it reſembles the ſubject known. But

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if the ſubjects be really of the ſame kind; if no difference can be ſhewn between them, in any reſpect material to the inquiry, in which we are engaged; in this caſe our inference from analogy becomes the very next thing to a phyſical certainty: and this I apprehend to be true in relation to the problem before us, concerning the origin of the lymphatic veſſels. Tho' in general we cannot, by experiments, arrive at the extremities of thoſe tubes, nor ſatisfy ourſelves, by inſpection, in what manner they receive their fluid; yet in a very conſiderable number of them we can do both. There is a certain part of the human body very abundantly provided with lymphatics; in which part we can actually force injections thro' thoſe veſſels into a cavity, where their extremities open: and from this cavity, on the other hand, we can at pleaſure introduce a coloured liquor into their extremities, and trace it from ſmaller into wider canals; from capillary tubes, without valves, into large lymphatic trunks copiouſly furniſhed with them. We know likewiſe, that into this cavity are continually exhaling an infinite number of watery and mucous veſſels, both arterial tubes and excretory ducts: that theſe keep it moiſt with a perpetual vapour, which the extremities of thoſe lymphatics are, in the mean time, perpetually imbibing. Does it not ſeem ſtrange, while theſe particulars are known and acknowleged by all the world, that the great authors of anatomy and phyſiology ſhould never have reaſoned from them; but ſhould run into complex and obſcure ſuppoſitions, in order to explain a proceſs, which they may at any time examine with their own eyes? But perhaps this inadvertency may be accounted

accounted for, if we recollect, that at the time when theſe veſſels, and the ſtructure of this part, were diſcovered, the lymph, and every thing belonging to it, was utterly unknown; and that the veſſels in queſtion were firſt ſeen and conſidered as performing another and more remarkable office: which circumſtance, it ſhould ſeem, has prevented ſucceeding authors from being duly attentive to them in the capacity of lymphatics. However this be, it is certain, that the lymphatics of the meſentery, commonly called the lacteals, differ from thoſe of the other parts in no one particular, ſave that occaſionally they carry chyle inſtead of lymph; or rather carry lymph mixed, at ſtated times (that is, for two or three hours after the creature has taken food) with an emulſion of vegetable and animal ſubſtances, and coloured white by that mixture. At other times, (that is, during ſixteen or eighteen hours out of the twenty-four) they contain nothing but lymph; and are, in every reſpect, mere lymphatic veſſels, not to be diſtinguiſhed from thoſe in any other part of the body. Their ſtructure is the ſame; the membrane of which they are formed, their valves, the lymph which they contain, the glands thro' which they paſs, their direction from ſmaller tubes to larger, and from theſe to the blood, differ in nothing from what we obſerve of the other lymphatics. Their lymph, in the mean time, is without doubt or controverſy ſupplied from the cavity of the inteſtines; being the watery moiſture continually exhaled there for the purpoſes of digeſtion, and for the preſervation of the alimentary canal, and as continually taken up by the roots or extremities of theſe veſſels, in order

order to be carried back to the blood, after it has performed its office in the bowels. Let it alſo be remembered, that theſe veſſels, in other places of the body, are generally, when we trace them, loſt in muſcular, tendinous, or membranous parts: and then, I ſhould preſume, it may fairly, and with a good degree of evidence, be concluded, that the lymphatics of the body, in general, have their origin among the little cavities of the cellular ſubſtance of the muſcles, among the mucous folliculi of the tendons, or the membranous receptacles and ducts of the larger glands: that their extremities or roots do, from theſe cavities, imbibe the moiſture exhaled there from the ultimate arterial tubes, juſt as the lacteals (the lymphatics of the meſentery) do on the concave ſurface of the inteſtines: and that the minute imbibing veſſels, by gradually opening one into another, form at length a lymphatic trunk, furniſhed with valves to prevent the return of its fluid, and tending uniformly, from the extremities and from the viſcera, to reconvey to the blood that lymph, or that fine ſtream, with which they are kept in perpetual moiſture; a circumſtance indiſpenſibly neceſſary to life and motion: while, at the ſame time, the continual re-abſorption of that moiſture by the lymphatics is no leſs neceſſary, in order to preſerve the blood properly fluid, and to prevent the putrefaction, which would inevitably follow, if this animal vapour were ſuffered to ſtagnate in the cavities where it is diſcharged.