Lect: 54th —

We have been considering Gentlemen y^e^ difference between Vegetable & animal matters, as we discover these by certain Chemical tryals, & with regard to these whether they are applicable universally to all sorts of Vegetable or Animal Matter, I do not say, but they apply very generally — But I must observe that there is indeed a very considerable Exception to be marked — I was not ignorant of this when I made up this Text, but I think the matter is not yet upon such a footing as that I could have inserted it. In the 211 ^Parag: When I say that the common matter of Vegetables may be considered as —— two that in a certain Explanation may be still true. But when I afterwards say with regard to the matter which is formed of the Saccharine and Oily combined in different proportions, & when I say that Farinaceous Matters are these that are especially distinguished from animal Substances by this, That it readily is susceptible of a Vinous ^&c

A member of the Bolognian Society, Beccari has made some Experiments upon the Farinacea that disturbs the general ^position & they have been repeated by M^r^ Caselmire of Strasburgh, If he takes a Quantity of Wheat meal and pours Water upon it, & performs the common Elutriation as is done for Starch

Beccari

Beccari found that in his Elutriations y^e^ quantity of Amylaceous Matter, was constantly diminishing while a portion of the Meal remained behind that was less liable to such a Operation, which was of a Glutinous consistence, and not ready to be washed off He has therefore distinguished the matter of the Wheat meal into the parts Amylacea & Glutinosa and he found that the Amylacea is Subject to the Vinous & Acetous fermentations, and that in Destillation it gives out the Acid &c — But that the Pars Glutinosa exactly in every part resembles Animal Matters, It is not capable of the Vinous fermentation, it does not give out the Acid in y^e^ first part of distillation, and in its Ashes there is no fixed Alkali, So that if these Experiments are accurate I have proceeded too rashly in my general Position, and I must allow that there is a Portion of the Farinacea that will not need the Assimilation of the other. I have only to add as a matter of Curiosity, that these Experiments succeeded easily with the Wheat-meal, but in the Rice, Barley, Oats &c there is hardly any Sensible portion of the Pars Glutinosa to be brought out, They are entirely of the Amylaceous Nature and it is probable that these Experiments are so far founded, as to enable us to distinguish between

they

the Jasinacea, that the more Glutinous is the more Nutritious & e contraris, that such as have no portion of it at all will be less so, and the same difference will explain 50^mu^ difference in their being more or less easily assimilated in the Stomach. There is one Curious fact that Casselmire has added, that Wheat meal gives out such matter yet if that matter is mixed with a Quantity of Vinegar, it appears of the Nature of the Amylaceous part, and he gives an Account of the Experiments & of the conclusion But they have not been sufficiently prosecuted to admit of the Application that they may be capable of, there is one other fact to be added, which has been observed an variously applied; I say

215. These ——— mentioned. This is sufficiently known to all the Chemists & does not require any particular detail These Intestine Motions which I comprehend under the general Name of Fermentation are in a sort of Progress & if Animal matter is sufficiently Vegetable, I may say that all Animal matters, begin with the Vinous, proceed to the Acid, and so on towards the Putrifactive so that there is no other change of Vegetable Matter necessary to the rendering it Animal Matter than the carrying on the

formen—

fermentative Process to the degree of the Putrid, and it has been so considered, this is all that is necessary to be observed — and

216. The —— Progress. It is true that in every step of that Course, and in these several Motions the Changes are also going on therefore in the View of their nature they are not to be distinguished, but it is necessary to consider them seperately and first with regard to the Course that the Alimentary matters pass thro — It was necessary to give a compleatness to my little System, that I should describe this Course, but it will not require any Commentary here, as it will be plain to any body that has got as I may say the least any Tincture of Anatomy

217. The —— Mouth, perhaps there are other ways, by which the Aliment may be taken into the Body — and —— mondueation, the Mechanism of which I have neither here nor else where to explain, at —— Mouth, only the Mucous that we know of, with some —— Mass, which is necessary in order to pass, even the very next Passage —— In Stomach there needs no more here, but the Anatomy of the parts — In what manner the Fauces open into the Oesophagus and how the Oesophagus enters the Stomach only it will not be throughly understood, unless not only

only the Course, but the Motions in that Course are at the same time understood & considered, so this passage from the fauces into the Oesophagus will require the consideration of the Motions that here take place

218 – Here the Aliments is &c. You will observe a typograf.l Error here that it ought either to have been Aliment is, or aliments are detained ——— muscles, What is the pressure that here occurs, is to be considered afterwards – I take the common Language and admitting some pressure to take place, but the principal Circumstance that whatever the pressure is, the Motions are sufficient for the purpose, after some ——— duodenum, the Explanation of that is not very obvious, I only give it as a fact, and many observations show it, to be the fact, that the fluid parts are first pushed thro' the Pylorus, but that at length, the most Minute, dry, and solid matters are forced to take the same Course

219 – The ——— Canal. I speak here of the general result of the Motions of the Intestines, y.r general Result is that they are at length carried onwards – I shall indeed have occasion to say, if sometimes their Motion is inverted, but I speak here of what is the Ultimate effect, and in the whole

Course

Course, the Matters —— themselves. Here as before the amount of the pressure may be a question, but the chief Effect is that the whole Matters are kept by this motion in constant agitation.

220. Thro' the whole Course of the Intestines, so far we have spoke of the whole Mass as carried on together, but now there is a Seperation of the parts of the alimentary Mass, but especially in these named the small — I dont know if that be a proper English word, the Intestina tenuia. Observe that I say only, especially, I do not refuse the presence of Lacteals in the small guts the more —— Lacteals, take care here again, that I allow in general that every fluid Matter is this taken up from the Alimentary Mass & taken into the Lacteals, but at the same time I suppose that the Fluid named Chyle is a peculiar fluid, and what the Lacteals are by an Elective Attraction suited to take in. These, from —— accompanies it, still leaving room for the supposition of other Matters going along, first into —— called, whether, there are any Lacteals from the Intestines to the Receptaculum Chyli without passing thro the Glands is uncertain. the probability is that they all pass thro' one or more conglobate Glands. It is proper to observe here

here that. In one ——— body, as I hinted before 7.
there seems to be a particular purpose of Nature
in collecting this Fluid in the Lymphatic Vessels
and that it is to operate some change upon the
Chyle, and it is with regard to this pretty certain
I believe there are no Lymphatics that return their
Fluids to the mass of Blood, but that they either pour
it into the Receptaculum Chyli, the Thoracic Duct
or Subclavian Vein, & there are no Lymphatics
any where, that from their absorbent Extremities
go into any of the Receptacles without going
thro more or fewer Conglobate Glands in their
Course — 221 — The ——— body. By what
artifices and powers is to be explained by & by

222. This ——— State, after the Chyle has
entered the Subclavian Vein, the whole Alimen-
tary Matters are carried to the Heart & thro' the
Lungs, but there we cannot consider them any
ways as in a seperate State, and we reserve that
to an after consideration — Of ——— course, wch.
I say are next to be considered, we here have hinted
at the motions that it is subjected to, the several
Organs & their Actions are many & various, but
we think proper to pass over ——— Muscles, if
these are to be considered, they properly would be
long to our 6th Section. Where we are to consider
all

all the several Animal Motions, and these properly can't be considered unless we were to lay down certain general principles, by which the Action of the muscles is commonly conducted, and, I think it was unsuitable in Dr Boerhaaves plan to engage a Student in the Consideration of such a Complex Function, as that of Deglutition, before these Actions are reduced to any general principles and it is a subject so strictly connected with Anatomy, that it can't be taught seperately from it the functions of which I say are —— itself which will not be understood to arise as in the other Muscular Motions ——

223. The —— it. The Anatomists will readily understand the peculiarity of my Expression, when I say forming a Chain — I would be understood to mean, that they are not one continuous Muscular Fibre surrounding the Canal the proper muscular part, the Belly is of no great length, but immediately after proceeding a little way, it seems to show a tendinous Extremity wch is twisted aside and united with other Tendinous fibres, and it is by these that the chain is formed and it is marked to obviate a former Notion, that they were again continued in several other Circles in the form of a Spiral — I expect it will be understood

understood, when I say that they are chiefly — it

I know that the Oesophagus is plainly provided with Longitudinal Fibres, and I have no doubt that these have an Effect in the protrusion of the Bolus of Aliment, but it was not necessary to Embarrass ourselves with a more Complex View

This Tube ——— Contraction, That depends upon a principle with regard to the Muscular Contraction, That extension, and here with respect to the Circular fibres, that dilatation produces an Irritation, which excite them to a contraction, so that they easily yeild to a dilatation, but are again excited to a contraction, and how that should have an effect in protruding the Contents is easily understood

But ——— Peristaltic, as they are successively dilated, so they will be successively contracted, so these first dilated will be first contracted and therefore they will be first dilated towards the very beginning of the Tube and so on successively to any Adjoining portion, and according to the Bulk of the Bolus will larger or smaller portions of the Oesophagus be thus successively dilated and contracted, and it will give the appearance of a Vermicular Motion or a Flexuous Motion like that of Serpents, Worms and other Animals which

which is called Peristaltic, the Original Sense of which implies an embracing & pressing Motion but it has been common to call all such flexuous motions peristaltic motions —

This ——— downwards, That we know in fact as the Contents of the Mouth go into the Stomach and these of the Stomach come into the Mouth) and ——— extremety, For as the dilatation so the Contraction will be successively in the portion first dilated, and so on to the next adjoining, So when it is begun from the Pharynx, it will go progressively downwards, and when begun from the Cardia it may be progressively upwards, May not only when it is begun at either Extremety, does it go on thro' out the whole Course, but we also observe that it sometimes Stops at the middle) perhaps, ~~it~~ is inverted, thus we have several Instances of Persons labouring under a Constriction in any part of the Oesophagus, especially at the orifice of the Stomach, where some Schirrosity or other Cause of pressure straitens the Oesophagus which induces a Spasmodic Constriction in Swallowing their drink, it will descend down till it finds a resistance, & in a few moments we find & we hear it with a sort of Gurgling Noise return to the) Mouth, and the Oesophagus is a part that from

Various

various Causes is liable to, and powerfully liable to various Constrictions, and this is commonly most strong in the upper part of the Oesophagus where there is a much greater quantity of Muscular Fibres that serve to constringe the Pharynx. So in Hysteric Affections, where Spasmodic affections are produced variously, and powerfully in the Intestinal Canal, when the Globus has mounted from the Flexure of the Colon on the Left side, it passes, even the Resistance at the Valve of the Colon and proceeds upwards thro' the small Intestines, and overcomes to the resistance at × the Pylorus and Cardia, till it stops at the Contraction of the Muscular Fibres in the Upper part of the Pharynx, and constringe it and then gives the Hysteric Globus, which the Antients considered as an Actual rising of the Uterus to these parts —

I go on to consider the Motions that occur in the Stomach, & I must observe that

224. The —— Simple. In Consequence of its Figure and complicated Muscular Fibres, however we can readily say that

Its —— contraction, It is not immediately obvious in the Idea that we commonly have of the Stomach, as a large and empty Bag

that

that the small Portion of matter in one Bolus thrust into one Cavity, should have any Sensible Effect in producing such Contractions, as we have described in the Oesophagus, but this notion is in the main false, it appears that the Stomach is adapted to its Contents, that it is never in that collapsed state, that can explain the Attrition of it as a Cause of Hunger, It is always by a Contraction of its Muscular Fibres accommodated to its Contents, so that any Moderate Stimulus will support the alternate dilatation and contraction ——

But, tho —— right. I observe that this word is too absolutely put, I should have said but tho the direction of such motions is commonly or for the most part from the Left to the Right, this does not immediately push the Contents of the Stomach into the Intestines or through the Pylorus ——

It seems —— Stomach, And therefore nature has employed the following means to Effect this ——

Any —— other, There are a sort of Longitudinal Fibres that are diffused over the Surface of the Stomach, but there is a very remarkable Band of these, that are more numerous and more

more closely connected together that run upon to we call its upper part or rather its Anterior part between the two Orifices, and these must draw the two Orifices nearer to one another — What irritates them may be difficult to Explain, but the dilatation of the Stomach swells it towards its Bottom, and turns it into a Horizontal Situation, but however that may be explained, the fact seems to be so for we have many Instances of the Stomachs being distended by a preternatural quantity poured into it or in other Cases, where the Matter is of a remarkable fermentative Nature which preternaturally distends the Stomach as in the Case of a Cow taken into a field of fresh Clover, or in Consequence of taking in very fermentible Substances, which have had the same Effect, and in several other Instances where Persons have had their Stomach over distended we have found upon dissection, that the Pylorus was drawn towards the Upper Orifice and very closely contracted, and tho we could not explain the manner, the Supposition is absolutely necessary to explain the Phenomena and I would need no other proof of it than this that we can at any time Excite Vomiting by

throwing

throwing in a large bulk of Liquor into the Sto
mach. Vomiting happens partly by the Con
traction of the Fibres of the Stomach it self
but more considerably from the United presure
and Simultaneous Contraction of the Diaphragm
and Abdomenal Muscles squeezing the Sto
mach as if it were in a press now why does
such force applied urge the contents of the Sto
mach upwards? Why does it not urge them in
to the Pylorus? Certainly there is some power
that does constrict the Pylorus more strongly
than usual and this is one Explanation of it
that any considerable ——— one another
By this I say the Pylorus ——— pervious
These are two Causes which prevent the passage
by the Pylorus, they serve to retain the food
in the Stomach, or sometimes determine to
Vomiting. It is confirmed by observation
that in Examining the Stomach of Animals
after getting a full meal we do find the Pylorus
sensibly raised up, and likewise a portion of
the Adjoining Duodenum, that is brought up
along with it so that the food, will not readily
pass, For with regard to the Level of the Pylo
rus, we suppose it below the Stomach, but by
its being raised above its usual Level and brot
nearer

nearer to that of the Cardia, which will prevent the food from passing so readily, and the Oesophagus is not directly in a Vertical Situation with regard to the Stomach, it makes a Flexure and passes into a Horizontal Course.

And there is still another power, at the same time, the peculiar ——— pervious.

You know I suppose the Structure of the Pylorus, that there is here a duplicature formed from the Tunica, Nervea & Nervosa of the Stomach, which makes a Straiter Orifice and gives the form of a Valve, and there the fibres are in a greater number, and more compactly put together and therefore of greater force and from the principles in Parag: 144. We can presume that such a Contraction takes place

Lect 55

Lect: 55

After describing the course of the aliments, we have begun to Consider (the several motions or) the action of the Organs by which the Motions of it are carried on, Among these however, we are now to Consider only what depends upon the action of the Alimentary Canal itself, we have considered that of the Œsophagus and were beginning to Consider the action of the Stomach, With regard to this it is obvious that the aliment, even that of the most fluid kind, is for some time detained there, and not immediately allowed to pass into the Intestines, and it seems difficult to explain why, that fluid aliment does not at once take its Course by the Pylorus, which it does very freely afterwards, and it is obvious that it must depend upon this, that in certain circumstances of the Stomach, the Pylorus is not so pasible as at other times, and this is somehow connected with a degree of fulness, for it is in proportion to the fulness of the Stomach that the Pylorus resists the transmission of the Contents of it, this state of the Pylorus, in which it does not transmit the contents of the Stomach more readily we suppose is owing to two different causes, one is the Contraction of the Longitudinal fibres, which must bring these orifices nearer together, therefore while the Cardia is more fixed in that respect,

they

the more moveable pylorus is drawn towards the Cardia, so by being raised into a higher level, and into an erect position, it will have that effect, but that would not be enough, if the pylorus was not constricted, but there is a band of fibres, which certainly serve as a sort of Sphincter to it, but as much it would be equal, if there had been ligamentous fibres, or simply Elastic, but in fact they are Muscular, so that it is not merely in consequence of their tone or tendency to contract, which serves the ordinary purpose, but they cannot be further contracted, so as to resist ale passages, but this we suppose, and other Physiologists have supposed the same; At the same time I don't know of any Experiment that show that they are more fully contracted under the fulness of the Stomach, but I say that it is enough to consider the general law of the System, as it is expressed in 144. With regard to what has been called Sympathy or the concurrent action of a set of fibres in executing one purpose of the Economy, I say in the paragr. referred to, in the 2d part of it "When the action of —— Stimulus" there is no need for showing any particular Connection between the Nerves of the Nose & the Muscles of the body, if the Stimulus is applied to the Nose only, the connection that is established between ale the several Muscles that are necessary to Concur in such an action will produce Sneezing, in like manner it is enough, without

supposing

supposing any material connection; to suppose that there is a Stimulus applied to the Stomach, which Nature endeavours to throw off, and if in any one case I see that the concurrence of an Action is necessary, tho' I cannot explain the connection or Communication, I presume that it takes place, therefore tho' we can't explain this with regard to the common action of the Pylorus, we presume that such an action takes place, and that in this way, the retention of the food is to be explained. From this way, I might have expressed it otherwise, and said that the motion is commonly from the left to the Right, but sometimes also the contrary way, indeed if we view the Stomach of a living Animal, its difficult to say, that it continues one moment in any one direction, its frequently moving from the left to the right, and frequently also in the contrary direction, by which means the Contents of the Stomach are kept in a constant agitation, but we must conclude, that its most constantly in the first manner, because ——— as Phaqus, I have shown that the course of the Peristaltic motion in the Oesophagus is from the place in which it was begun, but if Causes occur, its converted into the contrary Course, therefore tho' the direction of the peristaltic motion in the Stomach is

from

from the left towards the right, yet if there occurs any resistance at the Pylorus, it may be converted into the contrary direction; but in Comparing the ballance that is between these resistances, I say, that the resistance is most frequent and certain upon the left, because I say, when it is —— Pylorus, supposing the Contents even pushed towards the Cardia, a resistance occurs from its higher situation, especially if they enter the Cardia, when they resist by their gravity, and from the Construction of this by the Diaphragm in inspiration, when the œsophagus passes the Diaphragm, the aperture has a Plexus of fibres on — each side, that must necessarily compress the œsophagus, and actual Observation has shown that it takes place, in the time of Inspiration, no thing passes out of the œsophagus into the Stomach, and from these facts, there is no doubt that the Contraction of the Diaphragm in Inspiration more or less crosses the Cardia, at least when the inverted motions of the Stomach meets with this Construction, it must be turned into the contrary direction, whether there is any set of fibres that operate as a Sphincter, With regard to the upper orifice of the Stomach is not clear but there is a particular Lacing of the of the longitudinal fibres of the Stomach, and we find — that the Cardia is contracted as well as ~~on~~ the Pylorus, there

is a presumption therefore that there are a set of Muscular fibres, that are thus fitted to act, in like manner as the Pylorus, to the pushing off the Contents there; may cause its Contraction, and there resistances are more considerable, than the resistance at the Pylorus. Whence the Contents —— Pylorus. but its proper to consider in what order the Contents do pass, and first I say the —— pylori, in most situations of the Stomach, the pylorus is rather lower then the Cardia, but that gradual straitning of the capacity of the Stomach, as it enters the pylorus, called antrum pylori is almost at all times the most depending part of the Stomach, and as such the more weighty part should fall into that place; and the animal meat is undoubtedly as taken in of a greater Specific gravity, and so should constantly be supposed to sink down, but it seems certain that the aliments, the Solid parts of it undergo more or less of a fermentation, at least to this degree, that a quantity of their fixed air is extricated, and that some of it still retained in their pores buoys them up, and diminishes their Specific gravity; this is shown by the Experiment, With regard to the ordinary Mixture of a quantity of bread Meat and Water, as has been done by Sir John Pringle, his experiments show that there is a quantity of Air bubbles adhering to the Solid matter by which it is buoyed up to the surface

surface of the Vial, and therefore it is truely the fluid contents of the Stomach, that are in the Antrum pylori, or part of the Stomach contiguous to the Pylorus, I say therefore, while the more ——— orifice if you have leisure you may look into Dr Hallers larger work, where he has detailed a variety of Experiments of five or Six different persons, upon brute Animals, and others from the occasion of Wounds and Ulcers subsisting in the Intestines, when they could observe the contents issuing, and they found that the more liquid matters the watery parts, if it is Milk, for example, that too soon succeeded, and then the other matters in a more or less diluted State, and in the order that we might think them capable of Solution, and these Experiments made by several persons, amount to the general Conclusion, that the more fluid parts pass out first, and therefore that the several contents pass out as they are of more or less easy Solution, but at the same time with regard to some of the facts, I shall give my reasons for doubting, with regard to the accuracy of that Conclusion, that they pass out according to the more or less degree of Solubility, as there may be a difference in different Stomachs, at different times according to the State of the body, there are a great many matters taken into our Stomach, that are noways changeable by the action of the Stomach, and retain their form to the last, but these Solid — Matters do not remain either, even these of a very small bulk are

ally

at last carried out of it, when at length, as —— relaxed. these are
consequences of the Cause we mentioned, the more constant motion
of the Stomach from the Left to the Right, whereby the Contents are
pushed towards the Pylorus, and the more fluid parts going off will
operate some depletion, and allow matters to pass more easily, in this
way, the Stomach from a very considerable bulk, is reduced to a small
size, and itis to be considered that at the same —— pylorus. Many
observations have shown, that the Stomach from its greatest size
can be Contracted to the size of one of the smallest Intestines, and
itis said further that the largest part is towd the left, and that it
Tapers towards the pylorus, and therefore itis there that its greatest
contraction will occur, so as even to embrace Needles &c as Dr
Haller mentions, and which accordingly have been carried into the
Intestines, and to very distant parts. This explains the ordinary
action of the Stomach in every respect, but itis necessary to add, —
This —— Pathology. It will not be properly separated from
the causes of producing these, therefore tho' just now the Considera
tion of these unusual and præternatural motions might throw
some light upon what we have been saying, it will not be nec
cessary to say here what must be repeated afterwards, and I go on
to mention the motion of the Intestines.

225. The —— œsophagus. The Canals are in the same
manner small, there are the same Membranes, and the same
muscular 2d

Into the Intestines, so that more elastic air may be separated in consequence of the mixture that only in course

Muscular fibres. Therefore any ——— begun in the same manner as we explained with regard to the motion of the Oesophagus only it is to be considered, what we observe in examining the Intestines of living animals, there we see a less steady direction of its Motion, and a much more frequent inversion, why these occur is not difficult to explain, I say, as the force ——— Irritations, the Canal being many times longer than the length of the whole body, could not be put into the Cavity of the Abdomen, without being put into different flexures, and Convolutions some of them with, and some of them against their gravity, and here there are particular irritations, as Spasmodic Constrictions and other possible irritations, and I shall have occasion to say presently that the Change going on in the Alimentary Mess are only compleated in a long course of time does occur, and the Acrimony may be more or less covered in different parts of the Course, and these Acrimonies may be produced, and evolved in different parts of this long course, and therefore possible Irritations are sufficiently obvious, and therefore this obvious ——— Motion, as we have said with regard to the Oesophagus, accordingly ——— Stomach, there is certainly nothing more frequent then the presence of Bile in the Stomach, and at the same time it will be agreed, that there is no other course for it, but from its being

poured

poured into the Duodenum, and its entering the Stomach by the pylorus but we have other proofs of it, that the motions are inverted, even from the lower Extremity to the upper part, thus we have instances of the contents of the Rectum being pushed up into the Stomach, and thrown there is difficultly, With regard to the resistances that are placed in the way of this motion, that may prevent its so frequently taking place, but when the power is so strong, as to overcome these resistances, they do take place, tho' the circumstances in which they yield are not perfectly explained, itis true that the motions of the Intestines are unsteady, and are in frequent inversions, but the effect is certain, and we say, but the Motions —— course. With regard to the farther progress, or farther motion of the Intestines, it deserves to be especially taken notice of, that in the Colon —— difficult, the fact is certain that the stagnations that we have occasion to discover, are commonly in the Colon, the stagnation of faeculent matter is certainly there nothing but what would be noxious to the System is intended to be thrown out by the Anus, and tho' the Alimentary Mass, has more and more of its fluid parts taken up by the Lacteals in its course in the small guts, yet itis still with the Intermixture of a considerable quantity of fluid, and even of Chyle, that might be taken into the System, so some degree of Stagnation takes place in the Colon, and itis by it's position suited to it, towards the Caput Coli, the contents are moved against their Gravity, the

Colon

Colon is not turned into a dependent situation, but goes from the right side towards the left, and there it is turned into a more vertical situation, there is commonly a very singular flexure that the Colon makes upon the left side, adjoining to the left kidney, as Eustachius an Anatomist of the greatest fidelity has painted it so, and this may be another cause of retardation there, and in explaining the business of flatulency, and other Morbid affections, we shall say, that in ~ 9 cases of 10 their Seat is in the Colon, and that it is the place from whence the disorders in Hysterical and Cholic affections arise With regard to its Structure, it is a matter not yet explained, why the Colon in the whole of its Course is contracted, and forms a kind of separate Cells, I don't see that Anatomists have described either Muscular or Ligamentous fibres, yet the fact is certain, it is in these Cells, that our faeces are so often formed into distinct Scybuli, and in other Animals this is more evident, and this requires a certain Mechanism, and I say, and it is therefore ——— Intestine, I have with regard to the Oesophagus passed over the consideration of the longitudinal fibres, they are incomodesable in the Intestines, but they are present, and probably do contribute to the progress of the Contents in so far as they have tendinous fibres, and somewhat of this kind may be suspected here, tho' by no means have the Anatomists relieved us, by showing that the longitudinal fibres are here in the Colon gathered into two or

three

three more remarkable fasciculi, but itis probable that they do not extend to the whole length, but are frequently cut into tendinous intersections, and these will be found to be inserted into these portions of the Colon, where itis contracted, and if so the action of these Longitudinal fibres, may be especially asisting in dilating the the Contracted portions, and by their means, the motion of the hardned faces thro' the Colon is especially promoted. I have thus considered the motions of the alimentary matters thro' the Intestinal Canal, I own that there remains a part to be mentioned, I ought perhaps to have inserted these motions by which the faces collected in the Rectum are pushed thro' the Anus, the action of the Elevatores ani are easily understood, but to be sure they operate in like manner, as the long fibres, which are again dispersed over the whole Canal, in order to be dispersed over the whole circumference of the Anus, and besides these the Elevatores ani are provided, but neither of these would be sufficient, the more consistent faces would not pass out in consequences of this dilatation itis necessary that they may be pressed by a full inspiration, and the Contraction of the Abdominal Muscles. I had a Patient with this remarkable circumstance in his Case, that he had pretty regular Evacuations of faces, that were hardly consistent, or rather fluid, but at the same time they never passed but very slowly and with difficulty, and

instead

instead of paping in a large Mash, they passed in a size not bigger than my little finger, like the faces of a little Child, I was at a loss to find the cause of this, it was a Complaint, the slowness and Consistence, and we afterwards discovered, that he had a Hydrothorax, in consequence of which it was, that he had not the power of Inspiration, which is a proof of this being a means of pushing out the Contents of the Rectum, I trace the Elementary matter also to the Subclavian Vein, it is necessary therefore to mention the means by which this is carried on.—

226. The —— Similar. I need only refer you to that paragraph to say, that it is pretty certain, that the Lacteals take in their fluids by an absorption, and that in a manner that is exactly analogous to the Lymphatics.— I now

227. The —— course, we take in even the Changes that happen in the Mouth.—

228. In —— Manducation. their is certainly nothing more easily broke down, than the most part of fish, but few can take fish without taking bread, and it is very probable that it is, lest that substance, being of a soft and lax texture, it might get down into the Stomach, without being broke down more or less, the import of this triture, has not been well explained, and certainly there are some people that swallow their meat half manducated, while

others

others are obliged to do it for want of teeth, and many of these still digest tolerably well, but very inconsiderable inconveniencies have arisen, With regard to imperfect digestion, from imperfect Mandu-cation, therefore itis the intention of nature that this should be made, and upon a Comparison itwill be found that these people do digest most readily and easily who give the best Manducation; itis sur-prising that no body has taken notice of this, the universal use of Bread, itmay be referred to an instinct merely to take in a quantity of acescent food, but if there are some nations that make bread of any matter, as we are told of the Norvegian Laplanders, who break down the bones of fish and make the matter up again in order to have somewhat in the form of bread. But

Lect: 56.

The introduction to my present Lecture is in parag: 127. — The —— Course. We have accordingly begun the Subject by considering the changes that take place in the Mouth. —

228. In —— Mastication, I have endeavoured to touch this problem, that I believe has not been solved before, With regard to the use of bread, we find it useful, with regard to the changes that happen in the Stomach, and the mixture that it forms there, but these considerations do not govern Mankind, and I conclude that nature has provided by a certain instinct that we should take in some dry matter, and there are generally several ends, answered by the same means, and I have alledged that it is that the Triture may be more complete, for the mixture of the several other Matters with our food, that is to be teiken down, and I say - by —— fluids; no minute triture is here necessary, only that the matters be so far divided, that the moisture of one kind or other should be pretty compleatly applied to the several portions of it, but it is not only necessary that moisture in general should be thus applied, but that particular fluids should be mixed with the Aliment, that the Saliva, which probably has a share in modifying the fermentation that ours in the Stomach; it is convenient then that this be pretty intimately mixed and applied, with the other fluids of

the

the Mouth, and the liquors we take in by drink for the purpose of maceration &c, and particularly it is mixed with a quantity of air that is entangled by these viscid fluids, it is obvious that where air of the common temperature of the External air is thus intermixed, when it comes into a warmer place, such as the Stomach is, there it will be expanded, and contribute to break down, and separate the parts of the Mass: and probably there is another curious application of it, we shall find reason to believe that such a resolution of our food takes place in the Stomach, as that the fixed air is now extricated, and brought into an elastic State, but in such Cases, the Communication with the Atmosphere is absolutely necessary, and without which, even under the powers of Elective attraction it does not take place, and that the presence of air contributes to the extrication and separation of the fixed air of Bodies, from which we perceive another effect of triture in the Mouth.

229. In —— Watery, the expression here is not correct, the word farther, should have been left out, for there is no previous solution made, I would say therefore, where it is dissolved, and 2dly begins to be changed to the nature of Animal, and 3dly the oily parts of the whole begin to be united with the Watery, which we express by the Changes, by Solution, Assimilation, and Mixture, which tho' they are going on at the same time, require to be separately Considered. —

230. The —— Menstruum. In all Cases Solution depends upon a certain Relation affinity, or attraction between the Solvent or body that dispolves, and the Solvendum or body to be divided, a slight view will show this, except where you may mistake division for Solution; it always depends upon the proper Menstruum, that has a relation with the body to be dispolved, all the other means of Solution are only apistances of this operation, These are chiefly the Mechanical —— Matter, this seems to operate in consequence of the division of bodies into smaller parts increasing their surface, so that the Solvent is applied to a larges Surface, whereby it will operate its attrition more readily, 2dly. by the agitation of the dispolving Mass, we know that the power of Solution of most Menstrues is limited, they take up a certain portion, but will not operate upon the other parts, when the Solution is allowed to go on in a Vessel at rest, and the body to be dispolved is of greater Specific gravity, and lies at the Bottom, the Solution takes place, with regard to the Solvent, and parts of the Menstruum that are contiguous only; thus if you throw in a parcel of Salt into Water, and allow the Water to continue at rest, the Water contiguous to the Salts will become saturated, and ly between the rest of the Solvendum and the unsaturated Menstruum, and in this way, by exposing the unsaturated part of the Menstruum to the Solvend, does the frequent agitation of the containing Vessel expede Solutions of all kinds.

They

The 3d and most considerable assistance is the application of heat, There are Menstrua that will operate upon their proper Solvents in any temperature, but we hardly know an exception of a Solvent whose attractive powers are not increased by the application of heat, both with respect to their more immediate action, and the quantity that they will hold suspended, and there are Menstrua that tho otherways suited to act upon other Substances don't show this, but under a certain temperature, sometimes only under a great degree of heat, the Solution depend I say upon the application of a proper Menstruum, but the Menstruum has not been ascertained, or at all understood, therefore all our Physiologists have taken more pains to explain the power of these assistances, so if you consider Dr Haller who is the first that gives us any tolerable account of this matter, you will find this to be the Case, Therefore I consider what may be the effect of these several assistances.

231. The —— Cookery. Why Man, and he almost alone employs Cookery is not explained, the purpose of this is probably very various, and I must not enter into the Consideration here, but one part of it is either softening the texture, or the actual division of the Solid, and this too is commonly done by the Maceration we have mentioned, but it must be owned that by either or both of these no very minute division is effected, nor from the consideration I was mentioning a little ago, is it very

necessary

necessary, itis either effected by a peculiar Menstruum, or itis the Operation of a fermentation, to which itis not necessary tohave a very minute division, but itis only necessary to insinuate moisture into all the several parts, the Phisiologists however have not been satisfied with this division, but have supposed that a further triture took place in the Stomach, and with regard to the birds that live upon grain as in the guzzards x of fowls the business of triture is carried on, the muscular parts of their Stomach are adapted to this, and Nature has directed them to take in hard bodies to assist it, and Physiologists, our Countryman Dr Pitcairn in particular has supposed the same, with regard to the Human Stomach, but there is nothing here of the same form of Stomach, there is no proof in fact that the Contraction of the Stomach goes so far as toperform any such triture, I need not enter into thereasons that determined Dr Pitcairn and his followers to conclude so, or yet to mention the reasons, that induced Dr Astruck and others to refuse this doctrine, now Itake it to be deserted by every Phisiologist, we say therefore but the Human Stomach —— division. A french Gentleman the Compt De Largyray, thought that he could operate such a division by the mechanical operation of the Menstruum upon the Solvent, his Experiments are now known since his papers fell into the hands

of

of. Mr McLiner, and itis true that he obtained Vegetable Solutions which had advantages over such as were obtained in the usual way, by putting the matter to be dissolved into a Vessel with a quantity of Water, and with a Machine to keep that in agitation for a length of time; and these agitations did abrade some parts of the Substance in a very minute form, and itis probable that he obtained Extracts, that were rather the matter in Substance, than in Solution, but even this Solution was very inconsiderable, and was only obtained by an agitation applied for a great length of time, as from Peruvian bark he obtained his Extract, but it cost several days before he cou'd obtain it in very moderate quantity. There is an agitation constantly kept up in the Stomach from various causes, which I have explained, but the Solution here performed is much more compleat, and is in the one tenth part of the time, that itis in the Compt Delarguray's machine, and itis not by the further division that we can suppose the agitation operates, but by the applying every separate part of the Mass by turns to every other, that the fermentation may operate more considerably, With regard to the 3d means the degree of heat, a great deal is to be expected from that, but in most of our experiments upon other Bodies, and upon the very substances, that are here to be dissolved if

we

we don't apply a peculiar Menstruum, the applying Water, or other fluids, in the degree of heat that occurs here is very inconsiderable, and does not operate but in five times the time, in which the solution takes place in the Stomach, I say therefore that

232. The —— body, and no more, it has been common for Physiologists to speak of the Contiguity of the Stomach to the heart for supporting that heat, to make up for Cold things thrown in, but no body alledges that any other heat takes place, and that we say may assist —— here, no sooner had Mr Papin invented the Digester that shewed such uncommon powers, than Physiologists thought of applying the Theory to animals, and even Dr Boerhaave and Dr Haller are at pains to point out the closness of the Stomach, by both its orifices being clos, and this to be sure does on many occasions occur to a very great degree, both are sometimes so closely shut that not the smallest elastic Vapour can get out of it, and it has gone the length, that the Stomach has burst sooner than the orifices have given way, but in the ordinary case of Digestion in healthy and sound persons, it is by no means so clos, We find that flatus is every now and then readily getting by the upper orifice of the Stomach, and from any observation with regard to the force we can't believe, that the Vessel is clos so as thereby

to

to affect the Digestion in any respect. It is necessary to consider the operation of the Digester upon this occasion. I said just now that heat assists the Solutions, but we find that in open Vessels fluids can take only a determined degree of heat, that which occurs at the boiling point, and if kept over the fire a hundred years, it would not increase beyond that; at the same time with regard to the heat of boiling water, we find that it is variable, and is according to the pressure that happens to be upon the surface of the liquor, and therefore is according to the different States of the Air, and Barometer, in proportion to which the boiling point is higher or lower, this is confirmed by the experiments of the son of the famous Baron Montesque who in mounting to the top of the Pyreneean Mountains, boiled water in different parts of their height, as he was going up, and as he descended again, and he found, that the heat was greatest, under the greatest weight of the Atmosphere and if you make a Vessel perfectly tight, and include with other matters a quantity of Air, as you increase the heat of the Air, you increase its strength and its weight upon the surface of the Water, and so by this means you prevent the boiling at the same point, and in this way you can carry it on to a prodigious degree, by increasing the quantity of Air upon

they

the Surface, you can increase the heat to an amazing degree, so as to burst the strongest Vessels, so that the experiments are not without nicety and danger, I have had an Experiment in consequence of which I am perswaded that the water included in the Vessels was red hot, at least the Vessel which afterwards burst was made red hot, but there is no analogy here, as the heat in the Stomach is not carried beyond the common temperature, and upon the whole —— Menstruum and hence our whole difficulty in this matter of Digestion, so far as Physiologists have not explained the nature and power of the Menstruum, they have done, but little towards the explaining of the Solution, We say

233, The —— liquors, in the plural number contrary to the common language, two of them we know, a very considerable quantity of Mucus from innumerable follicles and a liquor that is continually exhaling from the extremities of Arteries, which is called more strictly the Gastric liquor, but in all, or any of these, it may be supposed, that as there is a constant mixture of these, the drink Saliva and Gastric liquors, that a powerful Menstruum might be the result, but in all —— Stomach. When I wrote this, it was my opinion, and it has been the opinion of every

Physiologist

Physiologist that by any experiment made upon the li-
quors contained in the Stomach, we cannot show a Solu-
tion analogous to what was found in the Stomach, but
I am since informed that the ingenious Mr John Hunter
has found a liquor in the Stomach of certain Animals
that he can employ in experiments and shew that
it is possessed of a particular Solvent power, and there
fore I may be very much mistaken, I have not got any
such account of his experiments as just now to give you
them, therefore I must allow you to wait for further
information, but before I heard of this, I concluded
as follows —

234. However —— Solvent, From what happens in
the Stomach of fishes, and of the Amphibia, in which there is
not one of the assistances that we have mentioned, where not only
their Stomachs are not suited to effect such a Solution, but in fact
they have not the peristaltic motion going on when the Solution
is going on, thus we are told of a Rat getting half way into the
Stomach of a Snake, the half of it I say getting into the Sto-
mach, and the other half sticking in the Oesophagus, and the
portion that was in the Stomach was dissolved, while that part
which was in the Oesophagus, and kept the parts distended remained
entire, and from several observations to this purpose, where none

of the assistances can be supposed to take place we certainly conclude with regard to a strongly Solvent power, and the Solution is performed in all sorts of Stomachs, less in the human, than in that of a dog &c; Itis true that itis limited with regard to us, yet there are Solutions that go on in our Stomachs, that we cant imitate in the same time, so that there is ground I say to presume that there is a new Solvent in the Stomach of every Animal. But from any thing I have heard even with regard to Mr Hunters discovery, itis not certain whether —— State, whether analogous to Water applied to Salts, that indeed forms no sort of Decomposition, but suspends them in their Integrant parts, and goes on without any sort of resolution, or —— perceived fermentation in all sorts forms that we know of, does produce more or less of resolution, the precise degree to which it extends, is not well ascertained, but itis evident that all kinds have more or less effect in resolving very Solid Masses, the power of putrefaction is certainly universal, with regard to every kind of Animal or Vegetable Substance that we are only here concerned with, I do not pretend to determine which of these takes place, especially now, when we are informed of the Experiments that I have mentioned, but I give my opinion

235. The — appear, I think that is at present universally agreed on among Physiologists, tho it was formerly very much refused, Dr Boerhaeve allows that there is a beginning

of fermentation, but he suggests various means by which the progress of that is entirely stopped, but I could shew that his means are not sufficient, e.g. he says that the heat is here greater than is Compatible with the Vinous fermentation, but tho' the Vinous fermentation, may not be so easily conducted to its proper end in such a heat, yet in many instances we know that it does take place, under such a heat he also mentions the closeness of the Vessel, and alledges that no fermentation can go on without a Communication with the Atmosphere, but if a quantity of air is included in the Vessel, we know that a certain degree of fermentation will go on, and we know very well, that in case of Bodies included with very little air, that the air will begin the fermentation, and this will extricate more air, which will carry it on farther, I might go farther with regard to his objections, but it is not very necessary, the late experiments of Sir John Pringle, in imitation of Digestion as well as he can, by joining the several matters, that are commonly the subjects of Digestion, as bread &c, and constantly and regularly in the temperature of the human body a fermentation takes place so as to produce a Solution to a considerable degree, and produces the same effects as we have reason to beleive do take place in the Stomach, a degree of putrescency beginning, and a more considerable degree of Acescency, and it is evident that the circumstances of fermentation very constantly appear in the business of digestion, we find a

quantity

quantity of air extricated by the distension that follows, and in proportion to the quantity of fermentative matters taken in, and especially as the deviations — putrefaction I will not say what variety may be found in the several corruptions of our Alimentary matters in the Stomach, they are perhaps of a greater variety than has been exactly ascertained but certainly from many Observations, no other matters have been found, but these two that are to be distinctly marked the Acescency or the Alcalescency as it is called, or as I would say the putrescency of the matters in the Stomach, as these are the Morbid deviations, we may suppose that they commonly occur in a less degree, from the Morbid deviations, I say we presume that somewhat of this — kind is constantly going on, and therefore the Menstruum in the Human, and in analogous Animals Stomachs, is probably one that operates to a certain length in the way of fermentation. There is no part in the Animal Oeconomy more mysterious, than the — one we are now Considering, and I don't fancy that I can bring out the matter to your or to my own satisfaction, but we can go a certain length, that may be applicable in practice and further we may go some length in the way of Speculation taking care that it be done with a sound judgment, and that we apply it no further than it will apply, and upon that footing I give my Conjectures.

236. The —— matters. This is a supposition, but it is supported by fails, that I have been just now insinuating, there appears to be an Extrication of fixed air, of what nature, I would not determine, possibly it is merely atmospheric, in other Cases, it is both Inflammable and Mephitic, whether it was in these States, or if these states were induced upon the atmospheric air, from the application of other matters in the Stomach, I will not say, but such is the nature of the Menstruum that it begins in this way, for that is constantly the beginning of all fermentation, But

Lect: 57.

With a view to Consider more particularly the change of our aliment, that takes place in the Stomach, I have considered it under the three heads of Solution, Assimilation and Mixture. With

regard

regard to the second, I have observed that the several assistances, that have been the thing chiefly attended to here, amount to a small matter, and that without supposing a peculiar and powerful Menstruum, the solution cannot be accounted for by the help of these; we conclude therefore, that there is a particular Menstruum from the observation of what happens, in the Stomach of certain Animals, where neither Triture nor heat &c occurs, and Mr John Hunters experiments, are clearly in proof of a peculiar Menstruum, but with regard to it there is nothing ascertained, and particularly it is not ascertained, whether that be a Menstruum, that has the power of resolving the several alimentary matters into their Integrant and Constituent parts, without any thing analogous to fermentation, or merely a fermentative power, that can very suddenly induce such a fermentation, as will very entirely resolve both the texture and Mixture of Substances. From certain considerations we are inclined to the later opinion, because we observe a fermentation constantly taking place and particularly from this, that wherever we observe any considerable deviations in the course of Digestion, we observe these to be always an excess of fermentation, either Acescent or putrefactive. Having settled these preliminary points, I proceed to give my notion of these functions taken in a more complicated view, but I own that I consider myself as giving what may be called an Hypothesis, and

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I do not desire it to be received in any other way, but at the same time I shall point out facts that have not been hitherto attended to, and which we shall find to be of some application. —

236. The —— matter, there is so suddenly the mark of fermentation appearing more quickly, than would have spontaneously appeared on the same subject of it out of the Body, that is certainly some means of inducing this fermentation, and I conclude, that it is owing to the peculiar nature of the fluids of the Stomach, we have learned indeed that all the animal fluids, have a power of accelerating the first step in fermentation the Acescent, the Vinous or more generally the Acescent, I might make use of this, — but the fermentation here, seems to be rather of a contrary kind, in which an extraction of fixed Air is more considerable, it appears to be a matter that has the power of immediately inducing a putrefactive tendency, I speak therefore of this, as the first step towards putrefaction, and it is that which —— Bodies — for I need not say that there is no more powerful means of breaking down the texture of animal matters, and of Vegetable matters in a great measure, than this process towards putrefaction, and this I am led to from observing in the ingenious and accurate experiments of Sir John Pringle, this to take place, he puts together of Mixture of Animal and Vegetable matters, and the first Phœnomena are

any

an appearance of putrefaction, a certain degree of fetor that accompanies it, shows that there is the circumstance I mentioned, the Extraction of air, that makes the Substances, that are specifically heavier, rise to the Surface of the liquor, but we now — without. and this in proportion to the advancement of these bodies in putrefaction, that I derive from the same experiments, this first beginning of the putrefative fermentation is followed by an Acescent fermentation which goes on to a considerable degree, with regard to this matter you will observe that I am just now only considering the digestion of the Substances, that occur in the human Stomach, or in these of Animals that live on Vegetables entirely, or in a considerable part, With regard to Carnivorous Animals, the matter is in obscurity, but we shall find there also circumstances that rather support the general Hypothesis, I need only say here that the circumstances of such fermentation are present, there are none of Mankind that live entirely upon animal food, there are tribes that are more or less Carnivorous, but that they live without Vegetables, and particularly without Milk I don't know, so in this Country, one takes a smaller proportion of bread to his meat than another, but there is no person that lives without bread, or some other Vegetable matter, or at least without Acescent liquors, so that the human Stomach is hardly ever without Acescent matters, and we say that —— Stomach, and as we find in the experiments that I mentioned, that somewhat takes place

resembling

resembling this, so in the Stomach we would Conclude, that an Acescency is produced, and I have had no opportunity of examining by experiments the human Stomach, or the Stomach of other Animals that are omnivorous, or that take in a quantity of Vegetables, but the matter of such fermentation is constantly present, and I would conclude it with regard to the human Stomach, that there is not one person in a hundred that is made to Vomit heartily, but what discovers more or less of Acidity, and there are many persons that are liable to occasional eructations, and these are in 9 Cases of 10 more or less Acid, from all these considerations we not only say that it is probable that an Acid is produced, but we say that it is so in fact, we go on to make some application of it farther from the nature of Acids in resisting and restraining putrefaction, and from what happened in Sir John Pringles experiments, we say that this Acidity —— disappeer, so that putrefactive factor passes away while the Vinous odour comes to appear, but the Acidity in —— present we must not stop just now to Consider towhat purpose all this is, you will mind that we are here considering facts, and the application of this will come afterwards, and I say that the Acid which appeers in the Stomachs of so many Animals living upon Vegetables as Man in part does, that that Acidity disappeers, and tho' Acidity is sometimes found in the Intestines, it is a very rare occurrence for it to appear from experiments, or any effect of it, it is possible that the same

same Acidity may have appeared occasionally in the Chyle taken from the Receptaculum Chyli, and Thoracic duct, but it is as certain, that in immumerable experiments, there is no Acidity to be discerned in the Chyle, There must be some means therefore that occasions its disappearing, and we say that it is by mixture, there is another way by which this may take place, by urging on the fermentation to putrefaction, but there is no mark of any such progress, and tho' Acids dont appear commonly in the Chyle, it is found to be like milk, yet accescent, in some time an Acid is devoloped, but in recent Chyle or Milk, no Experiments discover the presence of an Acid which had been covered by a progress to putrefaction; and if it is not in this way the only other possible means is by somewhat to render it Neutral, therefore I conclude it as a fact, and I only hint that it is probably by —— present in the Stomach and intestines, and this finishes our view of this matter, and it is —— body. This is a new Idea upon this subject, if you look into Dr Boerhaeve's celebrated account of this matter, he finds it difficult to explain how the Vegetable matter does disappear, he offers no other consideration but the considerable proportion of Animal matters, that here covers it, without explainining any change of its nature, as by fermentation or any putrefactive process, nor does he explain it by mixture, but merely by diffusion, but let just now the proportion of Animal to Vegetable matter in a Calf be what you will, if that animal is

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going on to take in only Vegetable matter, it will be constantly prevailing while the animal is passing out of the body, and in time this diffusion will lose its effect, for the whole must in a certain length of time appear as Vegetable matter, and there must be some management of Mixture that can make the Vegetable matter disappear, at the same time the persons who have deserted this System, have had recourse to the progress of fermentation, and I say that Vegetable matters can be changed by only pushing on the putrefactive process, but I say that after our Vegetable matters have become Acescent, there is no proof, that there is any farther progress towards putrefaction, for tho' the Acid is covered in the Chyle and more effectually still in the Mass of blood, nothing can be properly called putrid does appear there, and it is only after some length of time, and when the fresh addition of Vegetable matter has been abstracted by fasting that any such putrescency does appear, therefore its probable that the animal fluid is made in the way of Mixture for a great number of years Animals are nourished by Acescent Substances, and yet the nature of their fluids remain the same, and we say that this double effect takes place, that while the animal fluids cover the Acidity, at the same time the Mixture of these Acid and Acescent matters does stop the progress towards putrefaction, and we learn from the history of the Scurvy, that our Vegetable Aliment is substracted for some length of time, our fluids advance towards putrefaction. There is one particular application of this doctrine, which to me is somewhat curious, it does explain why it is necessary for the new formed Animal

to

to adhere to the Mother for sometime in a fœtus state, or for sometime furnished with fluids provided by the Mother, upon this supposition that animal matters already animalized are a necessary foundation for the assimilation of the after nourishment, and therefore it is necessary that with such animalized and putrescent fluids, the vessels of animals should be filled, and copiously filled before the animal is in a condition to assimilate its own food, and therefore to take in those vegetable upon which it is entirely to live it explains why in so many animals not only the adherence to the Mother is necessary, but that the chief nourishment should be what is derived from the Mother, by milk, which is of a mean nature between vegetable and animal food, containing a vegetable matter that is liable to have its acescency restored, but which has at the same time a considerable portion of animal matter, in which the Combination is already formed independent of the assimilating powers of the new born animal, but by degrees it is accustomed to its proper aliment, when it is in a condition to form the Combination. The difficulty in receiving this notion of our fluids being thus formed chiefly arises from hence, that we can observe a prevailing acidity as a disease in the human Stomach it is very true that Acidity may prevail to a morbid degree but when we consider the daily —— probable, I say it is evident from the facts mentioned that an acid is constantly appearing, and in 100 instances, it is not with any morbid effects, there are many persons that are

liable

liable to Eructations that discover an Acid, but it goes on without any other effects, and itis made to disappear, and if nature has provided that an Acid should be produced, and that that again should be covered and rendered innocent, itis a proof that both these steps are a part of the Oeconomy of Nature. But I go on to touch other Considerations that serve to illustrate this matter. —

237, Thus —— aliment, when we consider the case of prevalent and Morbid Acidity, we can commonly distinctly refer it to different causes, as from the over proportion of Acid substances taken in, however itis surprising the length the human Stomach go in that respect, what a prodigious quantity of fresh fruits it can bear without any of the marks of a Morbid Acidity prevailing afterwards, and itis seldom, that we can impute it to the over proportion of the Morbid Ingesta, and itis only when the Stomach is particularly weakned, that it commonly does appear, with regard to that it would lead me into the Consideration of the other Phaenomena, and the causes preceding it &c, from which we conclude an imbecility of the Stomach but there is no Physician that does not observe it, or that seems to refuse it, that the prevalence of Acidity is accompanied with circumstances, that point out the imbecility of the Stomach as in fault, that matter is not very certainly explained, but if certain fluids are brought into the stomach, they are certainly for the purpose of Assimilation, and if an abstraction of the Saliva for instance is made it

it will induce a prevalence of acidity in like manner, With regard to the Gastric liquor, and the effusion of the Gastric liquor, will depend upon other Causes, but it will be poured out in less quantity in proportion to the action of the Stomach being weaker, as its certain that the peristaltic action of the Stomach emulges the exhalent Vessels and makes the liquor to be poured out in more or less quantity, so the quantity of fluid that should cover the acidity is not present — There is another way in which such an acidity may occur independent of this imbecility, from causes that retain the alimentary matters longer in the Stomach than they should be, here I have hinted at this, I say whether from the insolubility —— pylorus. I suppose that the solution depend upon a beginning putrefaction especially, its agreeable to this, that animal matters are more readily dissolved than Vegetable, and the more firm Membranous parts of Vegetables do pass out without any such change at all, and therefore they are very often among the last matters that are evacuated, I say, that in all our observations upon the digestion of different Vegetable matters, their more or less easy solution depend upon the firmness of their Texture, I give for an example Cabbage which is one of the firmest of the Olera, and which is long retained there, so the Cucumber and Melon, and there is a difference among our fruits, as between the Apple and pear, I have been a Dr Haller says a Cacostomachus, and I have known a peice of Apple remain in my Stomach for two days

thoy

tho' it was pretty well chewed, and after these two days be brought up again by Eructations, so that we have proofs that this retention depend upon the insolubility of the matter, and the greatest degree of morbid acidity occurs from the taking in these more insoluble matters and this particularly applies to the purpose here that the business of assimilation is not compleated, the entire covering of the acid is not effected, for such retention shows it only in a greater degree, and I have met scirrosities of the Pylorus, and where such occur in the Stomach in 9 cases of 10 they occur in the Pylorus or the neighbourhood of it, and there is no case in which the acidity prevails to the same degree as where this cause prevails for some time whatever was taken in I have seen it by eructation reject an acid that we can't imitate by art from any Vegetable matters, such as would corrode linnen that it was thrown upon, as if it had been a Vitriolic acid, so that this would go on if it were not from matters that serve to cover it, and which only occur in the after course of the aliment. I say in the next place therefore,

238. It —— Stomach. Upon this subject, you will observe that I don't pretend to enter into any explanation of the nature of Bile this not at all yet explained, therefore I don't offer to determine a priori that the Bile is any way fitted for this purpose, I have been led to think so from some direct experiments, as from the 18th Experiment in Dr Ramsays dissertation De Bile, Ex

accelo

acid & bil: &c I myself had an opportunity of seeing it, and of tasting it, But Dr McLurg tells me that I have reckoned without my Host, and I have that regard to the accuracy of Dr McLurg that I must suspend my faith with regard to this matter. there may have been some inaccuracy in Dr Ramsays experiments, and as Dr McLurg observes there certainly was this difference, that the Experiments were made upon the bile of Cows and Sheep only, while his was made upon the human bile, Therefore I say at present, as in Terence, "multo incertior sum quam dudum" — but we must suspend our belief with a fiat experimentum, Dr McLurg has been at a great deal of pains, but still it was difficult to repeat the experiments as often as might be necessary, and some uncertainty still remains, you may at your leisure compare his 29 & 30 experiment, where he gives an account of the affusion of vinegar a vegetable acid upon bile, he says there seemed to be a fluid squeezed out &c bitter, quite the contrary of Dr Ramsays experiments, and the juice of Lemons produced the same Phaenomena now, and these Experiments are extremely strong and pointed, but at the same time you will please to compare this with the 32 (36 or 29) which I am surprised has escaped the Author, he says without acidity, in the one the liquor was manifestly acid, in the other it was without acidity, I certainly would have required a repetition to determine what was the circumstances that gave the acidity in the one case, and took it away in the other, but still I say that this proposition

sition is a safe one, that it is especially the bile — Stomach; 1st I maintain it as a fact that the acidity is covered after the aliment has passed a little way into the Intestines, the formation of a perfect Chyle now appears therefore there does occur some means of Covering the acidity, which was somewhat short of Chyle, in its colour and appearance, and I presume, without saying how that, that the matter of fact — is that the acidity is covered, and I think I may say that the bile — has a considerable share, and it is agreed that Vegetable acids do enter into an union with the bile, and there is probably some purpose in Nature for this fitting the bile to unite with the Vegetable acids, as it does in these Experiments, and if it is very much covered, we say that it must be owing to the bile, and pancreatic juice, and to the further addition of the Intestinal fluids, which certainly do all contribute to cover the bile, and considering the pains that Nature has taken to provide the bile in such quantity, and — that it is laid down, in such a place as to be joined to the alimentary matters, it is certainly to make some important change upon them, and if this change takes place here it is still evident, that the bile has a principal part in that function, I say therefore that it is —— course. I would believe that tho' at length by the autonomy the acid produced is entirely covered so as not to be developed, but by the utmost force of fire, it is probable that this is not done all at once, in the Stomach, such an union is produced as prevents the morbid effects of acidity in the Intestines, it is carried on farther, but there are experiments that show an acidity in the Chyle, so that perhaps they

the full saturation is only by the Lymph being added to the Chyle
I offer these conjectures, and you will take them as such, but after——
it. we can with some confidence conclude that these changes are effected,
and that in some meanne upon the plan I have said, but why, both the
Bile and Pancreatic juice, matters of so different an appearance, are necessary
or how the one is more fit to be added after the other is what we are at pre-
sent very ignorant of

239. Ye——appellation. There have been many questions with regard
to what substances were capable of entering the Lacteals, some have found
an exclusion, and some have supposed an elective attraction, we find it
difficult to determine the exclusion of Sal Martis for example, and I
would not conclude any thing in that respect, much less can we maintain
the doctrine of Elective Attraction, we are very certain that a variety of
matters, that are not convertible into Sanguinem & Sanguinem, are
taken in and thrown out again by the various Excretories, but they
are so by being diffused with the Chyle, and in that way they may
enter the Lacteals, upon the supposition of an Elective Attraction,
but the whole train of the functions does infer, that there is a pecu-
liar mixture made in the Stomach, and Intestines that is fitted to be
the basis of the fluids that are afterwards formed, and are entituled
to the appellation of Chyle.

Lect 38

Lect: 58.

The first thing I must do to day is to correct the mistakes of yesterday, I was in a hurry led into a mistake in considering Dr McLurgs Experiments upon the bile, I quoted the 32d as in some measure inconsistent with the 9th and 10th, and I did not then observe, that the Experiment is the Vegetable Acid, powred into putrid Bile, I was only looking at the particular Experiments that relate to the Acid powred upon the Bile, and found the opposition that I mentioned, but I now observe my mistake, especially from a hint that a Gentleman was so kind as to give me, But it does not vary our reasoning upon the Subject, as we don't rest it upon the actual experiment, tho' we have that of Dr Ramsay very clearly in point, but we put it upon that, that an Acid appears in the Stomach, and is covered in the Intestines, and we presume that the bile has a principal share in it, and you may observe, that Dr McLurg agree with us in a principal fact, Viz.t. that the fermentation of the Stomach is carried to the Acetous stage, and that constantly an Acid is produced there, but we differ in this that he supposes that the Acid is prepared to produce a certain change in the bile, whereas we suppose that the bile is prepared in order to cover the Acid in the Stomach, I don't choose to enter into a controversy with my particular friend Dr McLurg, but I leave you to Judge which of the two opinions are best founded. And.

I go on with our business, and I say that there is a mixture of the

the Vegetable aliment, with our inguline fluids, and that of that mixture if formed, the fluid named the Chyle; it is true, that there are a variety of matters that enter the Lacteals, many of which cannot be supposed to constitute any part of the animal fluids, but it is still probable that there is a peculiar fluid produced ——— appellation. This Chyle does not appear in the Stomach, and I do not know that any Anatomist has discovered Lacteals as arising from the Stomach, the Chyle may be there, but it does not put on its appearance, the whole Mass is of an ashy coloured white, but it appears first in the Duodenum ——— Ileum, it appears immediately after the effusion of the bile, and pancreatic juice in the Duodenum, and more copiously still in the Jejunum, and first part of the Ileum; It appears ——— copiously, whether we examine the extent of the Intestines, or of the Lacteals arising from them, all shews, that there is a mixture, and at ——— intestines. I own that if it is the product of a fermentation, that it may be thus carried on, and rendered more compleat, but the same will apply to the case of Mixture, which is supported and rendered probable from this, and indeed the perfect mixture is not made compleet in the Intestines themselves, for some degree of the Vegetable Acid sometimes evidently appears still in the Chyle, and as there is a portion of fresh Intestinal fluid added in the whole of the course of the Intestines, that fluid which is produced in the Stomach, will not receive the whole of the parts of its mixture all at once but successively as the fluids are successively applied to it, and there is yet in the Lacteals themselves another fluid still to be added, it is not certain that it

serves

serves this purpose alone, but itis probable that it also serves the purpose of Mixture, and I have now finished all I can say with regard to the production of the Animal fluids, as depending upon the action of the Primæ Viæ, neither I, nor any body else indeed that I know of, can render the matter clear and distinct, I have only given an imperfect and gross idea of the matter, but if we see some of the principal steps, this we can't shew the application very fully, itis to be hoped, that after reflection will supply the rest. I have said that I would consider it as under the heads of Solution, Assimilation and Mixture, and I pointed out the Article of Mixture, as chiefly relative to the mixture of the Oily and Watery parts, but I would wish to put the matter more general, because the production of Animal fluids is finished by a mixture, but it still remains to speak of the other Article of mixture of the Oily with the watery parts of the Aliment, and I begin with saying —

240. This —— made. Itis evident, that a large quantity of Oil in a separate state, is taken in as a part of our Aliment, I need not say how much fat, we wish to accompany all our Animal food, or how many people Bolt, Bacon, and how much Butter is used in our Aliment, in the Northern Countries, and of Oil in the Southern, so that Oil is evidently taken in in large proportion, but tho' itis evident —— blood, it appears no where but in the Adipose Membrane, and there in consequence of a separation or Secretion as you please to imagine it, itis true that Dr Haller, who finds a particular necessity to explain his Separation of Oil, says that it was found present in a separate State in the Mass

of

of blood, but you will observe how feebly he supports it, he adduces one observation from Ruysch, and another from Malpighius who alledge that they have found oil in the common Mass of blood, but thousands have not observed it, I have looked upon blood a thousand times, and I never once saw a particle of oil floating upon that fluid, and I can appeal to you all, if you have ever seen any such thing, nor can any Elutria tion of water applied, or by any other artifice can the oil be washed loose, or rendered evident, and tho' the observations of Ruysch and Malpighius be true that there are Morbid Cases in which it appears, that will not touch the question, Therefore I hold it as a fact, that no oil appears commonly in a separate state in the Mass of blood —— mixture, and we are next to enquire, in which way it comes to be covered, and the only resource that can be left to those that would suppose it, is the taking up the opinion urged by Gaubius, that the red Globules of the blood are an oil, but if it is oil, it is very considerably changed, not only in its Colour, but its Specific gravity, but it is a very singular oil indeed that is to any extent diffusible in water, and is not ready to collect again, but remains separated and Suspended in the water. This argument against the presence of oil in the blood would be made stronger, if I could support an opinion, that I am much inclined to, that oil is taken in not only to supply that large portion that is laid up in the adipose Membrane, but that it really enters as a constituent part into our nutritious fluid, I own that it is difficult to prove this last, but

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we observe that in most instances our Aliments are manifestly more nutritious, as they hold a greater proportion of Oil, itis perhaps difficult to ascertain this with regard to Animal Substances, but even there itis probable; and with regard to the Vegetable matters, itis more clear, take the whole of the farinacea, that is the common Aliment of Animals, and you will find their bulk, growth, and strength very much in proportion to the more oily nature of the farinaceous substance employed, itis true, when we see a body is increased in bulk, itis chiefly an acquisition of fluids, and an increase of the Oil in the adipose Membrane, but as young Animals grew to a greater size, in proportion to the same Nutritious matter, itwill amount nearly to a proof that the great quantity of Oil may enter so far as to form a part of our Nutritious fluid. There is a curious proof, that indeed it does enter in part into the Mixture, so as to lose its separate Nature, and itis this among other purposes for which that is collected in the adipose membrane, that it may be reabsorbed into the Mass of blood, in consequence of an unusual degree of exercise, or of a prevailing Acrimony, which especially give occasion to this reabsorption, and we find that it no more appears in its separate State, and itis to be presumed that itis to be mixed with a portion of our fluids, to render them more bland, and to cover unusual Acrimony, itis true, that itis alledged that the mixture is not perfectly made, and itis by such an imperfect mixture that Mr Hewson explains the milky appearance

of

of the Serum, and it may be true that this is the case under certain circum
stances, but even this is an unusual appearance and does but very
seldom occur, therefore if it be taken as a proof of the absorption of Oil, I
would say that that milkiness again disappearing is a proof of its
entering into the mixture, I will not enter into all the application
that this may be capable of, but I would say that it enters as a Constitu
ent part of certain portions of our fluids, With regard to this union
of the Oil with the other parts, I say, Hitherto —— fluids, and with
regard to the application of bile, which has been much insisted upon,
I refer to Ramsays, Shapers, and Mr Lurgs experiments, which show
that it is by no means fitted for this purpose, but granting that this
could entangle the Oil, this can only occasion a diffusion, it can only
make an Emulsion, but it gives no perfect union by Mixture, but
as the fluid is perfectly transparent, it is necessary to suppose some other
means, what —— know, I own that if I was to attempt it, I have
only very uncertain conjectures to offer, but whatever these means are,
the effects of these means do not appear in the first passages, for —— State,
if there are animals as is at present alledged particularly of the Bird
kind, whose Chyle is even a transparent and homogeneous fluid, it
does not concern us here, as we are keeping in view the human Chyle
or that of analogous animals, and there the Chyle is only in a dis
fused State, and I say, and probably —— Lungs, where we are only
certain of all appearance of Chyle vanishing. Having said what

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oil with regard to the oil, and watery parts being mixed together, there is another part that itis curious to enquire into, and it will be of some advantage to point out even the many problems that still subsist with regard to it. I say.

241. It —— matter. Not to mention the experiments of Dr Hales, which were often made by the utmost force of fire, and not to mention the effects of fermentation, by more simple and less violent experiments, a quantity of air can be extracted from animal fluids, there are none of these put into the receiver, but they show a considerable quantity of air issuing from them, in like manner as common water, and in every other fluid, that we can examine, but it appears manifestly in the animal fluids, in more considerable quantity than it does in common water, or even in our drink, and none doubts, that air is mixed with the animal fluids, but what is the origin of this, whether itis present in every sort of alimentary matter taken in, and is brought to its Elastic state by the action of the oeconomy; or if the atmospheric air, that is entangled in the Viscid fluids of the mouth in Mastication, or when —— resolved. But we add that itis perhaps —— System, it would not be difficult to show that bodies differ considerably by having air united or separated from them, the least acquaintance with Chemistry, will sufficiently instruct you in this respect, so that we may judge of the nature of our fluids by finding that an unusual quantity of

air

Air is intermixed in some of them, while in others, it's more sparingly present, and that by the separation of it, many other properties be produced, but as this is all mere speculation, I do not enter farther into it — and I say, We —— State: if you take a portion of the Thoracic Duct, and apply two ligatures upon it, so as to intercept a certain portion of Chyle, and put it into the Air pump, it will not only swell but in some cases will burst, and even in an open Vessel a very considerable turgescence appears in the whole Mass, a quantity of froth appears on its surface, and this too may be rendered sensible by the Mercurial Gauge; we say farther, that —— lungs, that the Experiment has ever been made upon the blood of the Subclavian and pulmonary veins and compared with the corresponding Arteries I don't believe, but whatever experiments have been made, it appears undoubted, that in the receiver of the Air pump, a quantity of Air is detached from any portion of animal matter, yet examined, and from any portion of the blood, but here it is more slowly extracted than it is from the Chyle, it never appears with the same sudden Eruption, or in the same quantity, and that again in the different —— loose, whether in their Secretions less Air was any how extracted, from the Airs being more fixed, but if you examine for example, it has much less Air in it, than the Mass of blood has, and the small portion of Air here is with more difficulty brought to an elastic state, bubbles will form on the surface, but these will remain in the

recevery

receiver without breaking, so that it would appear that the air in the urine is either absent, or is much more fixed, and the last supposition is more probable, in others, it is much more loose, as in the saliva which is as flatulent as the Chyle, we may indeed suspect an Experiment, with regard to a fluid that is in Contact with the air, but this is also particularly the case in a fluid that is Secreted from Venous blood, it appears that the bile in its most recent State, shews a prodigious quantity of air ready to be extracted, and to be brought into an elastic state, you may see this Subject more fully detailed in Mr Senacs Traite de Cœur. I say, and it —— animals. I have no doubt that even by diseases the fluids are considerably changed in this respect, there are cases of Emphysemata, that are from no external cause, we can indeed artifically produce an Emphysema with the blow pipe, communicating the air to the whole surface, and Wounds penetrating the Cavity of the Thorax have been found to have this effect, the air insinuating itself into the Cellular Membrane and spreading over a considerable portion of it, but it sometimes arises from internal Causes, from some change in the fluids themselves, whereby they allow the air to be thus separated, and diffused over the whole body. There is a curious particular that is seemingly connected with this, Mr Senac has taken pains to point it out, that there is air in every the smallest portion of every Membrane of the human body constantly present in its elastic state, it is —

probably

probably taken in, into the Circulating Mass, and spread over the System by the same, and probably this in different conditions in different states of the Oeconomy, but I can't only point out this circumstance as curious, and as an object of important enquiry, and I go on to say.

242 We —— State, and explained the changes that they undergo as well as we can; but —— formed, I shall say hereafter what I call the animal fluids, such as they appear as a consistent part of the Mass of blood, but we find none of its ordinary Constituent parts present in the Alimentary Mass, or Chyle entering the Subclavian Vein, and —— mixed, the term mixed is indeed a faulty expression, but I had no other term, Mixture and mixed are used not agreeable to the strict notion of the Chemists, but we, take two portions of water and pour them together, and we say that they are mixed, but this not proper, they are confounded or blended together, "Mixed with —— Oeconomy, from the Subclavian Vein, there is a short course to the right Ventricle of the heart, and from thence it goes into the Vessels of the Lungs, before this carried to any other part of the body, and therefore we are ready to beleive from its being thus carried immediately into the Lungs, that it's there that it recieves its finishing form. This has been a subject of anxious enquiry among Physiologists of all times, but I must introduce it as follows.

243, What —— known. It will appear from what follows.

that

that none of the Physiologists have given me any assistance in this matter, and I do not pretend to carry the matter much farther, but I shall find it necessary to put it upon another footing I say, The ——— place, you know how much has been said of the pressure of the whole weight of the atmosphere, incumbent upon the lungs, and what Calculations have been made with the regard to the particular weight that they sustain, but the whole proceeds upon the most simple ground of fallacy, my hand has the whole pressure of the atmosphere incumbent upon its surface, but I lift it up without feeling any sort of resistance, because the air below sustains my hand, and as it follows my hand in motion, I feel little or no resistance to that motion, so with regard to the lungs, there is no intermediate time between the motion of the lungs and the surrounding parts of the Thorax, the lungs are constantly contiguous to them, and its no matter whether my hand be of the usual size or 10 times the thickness, still the air succeeding in one place takes off its pressure in another, and if the Lungs were a little more patent, and their communication with the atmosphere a little larger, the real pressure they sustain in expiration would not amount to a few grains, only while the Thorax is contracting, the glottis does not give free to the quantity of air in proportion to the Contraction, and indeed we know that the Lungs can be made to exert

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a considerable force in that respect as when we blow with any force, the Calculation has been made; and in proportion to that resistance, are the lungs in some measure presed, but that does not touch the case of ordinary respiration, and we may judge of it by this, take a bladder full of air, and open to the surrounding Atmosphere by a small orifice, if you pres it externally with any force it resists because the air cant pass by the Glottis, in proportion to the degree of presure, but if you enlarge the opening, or if you do it more slowly as our expiration commonly is, in that case the internal surface of the bladder suffers no more presure than the external does from the presure we employ, therefore I say that the supposed presure does not in fact take place, and therefore we need not speak of its effects, and suppose it did take place to a greater degree even to the weight of some hundred of some hundred pounds, as is supposed to be the case when we exert a strong blast, the consequences that have been derived from this are no ways consistent, we say with sound Philosophy. With regard to the aggregation that has been supposed to be occasioned thereby, it is not determined what Compresion our blood is capable of, but there is no proof that it has more effect than it has upon Water, which is very inconsiderable, tho' it is now supposed to be some, but it follows from our present a views of Chemistry that no mechanical presure has any effect in the change of Mixture, or that such force can break down the Mixture

ture, or insinuate any new ingredient, therefore we say, nor are
Philosophy, and therefore on ——— Mixture, if there are changes, and
we can ascertain these, there is no doubt, that we must seek for these
as all depending upon separation or Mixture, agreeable to the ge-
neral principles of Chemistry, and hereby I have thrown out a great
deal of the reasonings of former Physiologists, but now in seeking
for the separation or Mixture, we are not able to go any length, What-
——— reasoning it has been a question whether air is absorbed
into the Lungs, and it is still a doubtful fact, it is not enough that air
can enter by the Extremities of the Veins and Arteries, there are experi-
ments I know which show that, but this does not prove that any
such absorption takes place in the living body, where the inorganic
pores are by no means so patent, I say therefore that an absorption
of air in general, and especially of any particular matter in the air
is very uncertain in fact, Physiologists could not miss to observe a
change in the blood in the Lungs, and they supposed that this was
owing to a peculiar matter derived from the air, and their fancy soon
observed certain matters, that might be so derived, and they observed
that certain bodies absorbed matters from the air, but I could easily show
how often they have been mistaken, it does not appear, as has been
alledged, that a quantity of Alkaline Salt ever acquires an Acid from
thence, it will then indeed easily be brought into a Chrystalline form
which has made the Chemists think that they had produced a Neutral
Salt, or Vitriolic Tartar, But ———

Lect 59

Lect. 59

We have said that as the aliments taken in are different from the fluids circulating in the Vessels of living animals, and therefore that they require some conversion or assimilation in their passage towards the blood, and even still in the Chyle towards the Subclavian Vein we find nothing of these fluids, resembling what they are afterwards, and therefore we say that some further Conversion is necessary, and as that Chyle is immediately carried thro' the lungs before it is applied to any of the purposes of the economy, We say that here there is some further change made, and I think we cannot trace it any farther, where further Changes are still made, and therefore we presume that the action of the Lungs is what finishes the assimilation of animal food. The operation here is what we wou'd be anxious to understand, but I have been obliged to introduce it in this manner.

243. What ——— known, and here I am chiefly employed in point ing out what I think is imperfect and erroneous in the accounts of the others, and so with regard to the effects of pressure, which have been so much spoken of, I say, The Mechanical ——— Philosophy, and indeed it is evident that the Changes here effected must be produced by the Chemical separation or Mixture, but I can't go far in saying, what this is, the Conjectures with regard to it are by no means satisfying, Nothing has been more common than to say here, that the Air, or some peculiar

matter

matter from it is absorbed, or taken in by the Lungs into the Mass of
Blood, but whether the Air enters here is disputed as a point of fact, that
it may enter in a certain portion, we allow, but we can make no use
of it, and its absorption in general is a matter extremely doubtful in fact, x
but it has been supposed that tho' the whole body of the Air is not taken
in, what is commonly called the Air is a very heterogeneous Mass, and tis
probable that some of the parts of it are absorbed, yet there is no part
less clear in Chemistry than the nature and condition of these several
Contents of the Atmosphere, one of the most common opinions is that
there is an Acid floating in the Air, tho' they are not agreed whether it is
the Vitriolic or Nitrous, for a long time the opinion was in favour of the
Nitrous Acid, but I know no evidence of a Nitre being suspended in the
Air, and I am equally uncertain, with regard to the Vitriolic Acid, but
I would not speak so positively after so many Chemists have given
their opinion to the Contrary, I could advance Negative Experiments
tho' I acknowledge that these are not sufficient, I have exposed fixed
Alkali to the Air, and I found that this as more or less approaching
to a Caustic State, came to be sooner or later saturated with Air, and
came to be brought into a Chrystalline form, but if it is chosen from
a Substance that does not afford a Neutral Salt, as if you take Salt
of Tartar, when thus saturated, it was found to be merely the Alkali
in a Chrystalline state, and no particle of Vitriolic Tartar was to be
found, in short I find no certainty in the opinions with regard to the
nature of the matters floating in the Air, and that may be absorbed

into

into the Lungs, I say therefore that what —— fact and —— rea-
soning. The effects of either the Vitriolic or Nitrous Acid are by no means
ascertained, there is only this single slender Argument or fact alledged,
that these Acids under certain circumstances have the power of increasing
the florid colour of the blood, at least the Neutral Salts formed of them
have, and itis alledged that the blood before it enters the Lungs, is of a
dark colour, and that it acquires the florid Colour which it has in the
Arteries, in passing thro' the Lungs, but we shall find a more simple
and easy explanation of this matter, with regard to the Vivifying
spirits that have been supposed to be derived from the Air, the Pabu-
lum Vitæ &c they are merely hypothetical, and are neither supported
from Analogy nor experiment, and we are now led to take quite a dif-
ferent view of the matter, we are certain that somewhat is exhaling
constantly from the Lungs, I say that it —— Animals, that a Me-
phitic Air, discovering it self by a variety of Phænomena is constantly
thus exhaling from the Lungs no body can doubt, I say "and perhaps
some other matters" it alludes to certain Experiments that I mentioned
before of Dr Daniel Rutherfoords, who has informed me that having
collected a quantity of Air in which Animals had breathed for some
time, and having taken off the Mephitic Air from it, which may be
easily done by certain means with the utmost care and accuracy, he
found that that Air was still of a poisonous nature, and that Animals
were killed almost as soon as put into it, but as these experiments are
peculiar to himself, and as he declares that the means are still a

wanting

wanting to determine the nature of these matters, I have only said, and perhaps some other matters —— Lungs, and I say, This —— lungs — ~~and~~ I ~~say~~ think we know, but these three ways by which Mephitic air is separated from the bodies, into whose Composition it has entered, by burning, by Fermentation and by the power of Elective Attraction in decomposing certain mixtures, the case of burning will not apply here, the case of fermentation is more obscure in the Lungs than in the Primæ Viæ, or if we apply it, it is only effectual so far as it operates a Solution, and it is operating still upon a mixture, so that where it appears independent of the circumstance of burning, it is in consequence of some change of mixture, whether it be by attraction or fermentation that it is produced, and therefore its appearing here is an evidence that some change of Mixture is going on in the fluids passing thro' the Lungs but —— not, I perhaps should have said, but whether the Mephitic air arises from the fluids passing thro' the Lungs, or if there is another matter, which when applied to the Atmosphere, — comes out Mephitic air, or in what manner the Mephitic air may be produced, or, if it is in consequence of a seperation from the fluids, — from what portion of the fluids it is derived, or what change it produces in the remaining portion, is what we know not, and it would be superfluous to offer conjectures here, it may be alledged that the Chyle containing such a considerable quantity of air, in a loose state and only half fixed, that this is freed from that State, and gives the air in question, or it may be alledged on the other hand, that our fluids —

after they are fully prepared in consequence of their passage thro' the Lungs, are in consequence of their Circulating thro' the rest of the System changed, and that that change loosens an air, that was formerly fixed, and that this a reason, why the whole of the blood, after having undergone one Circulation, again passes thro' the Lungs, and it is equally probable that the Mephitic air is separated from the recent parts of the blood, and that it is from the Venous blood, having suffered some change in passing from the left till it returns to the right Ventricle of the heart, and indeed —— uncertain. I speak here of the action of the Lungs, and that would seem to allude to the pressure I spoke of, but I see that the expression may be mistaken, and therefore I would say, what are the effects of the motion of the blood thro the Lungs, we are very uncertain, and again with regard to the whole of this Chapter which I have entitled of Digestion. I say, upon —— Nature Tho the constant practice of the Physiologists have been to begin a priori to determine the nature of the animal fluids by considering the changes that they undergo in their several Stages, but I must own that we cannot conclude this a priori; from the consideration of their production or formation we have learned very little of their nature; we have learned perhaps to correct some false Theories, and some things that are applicable to practice, but with regard to the nature of the fluids, which was the chief thing in question, we have discovered very little but ——— Vessels. I proceed to my second title, which for reasons that are sufficiently obvious, I have not said as I wish I could have said, that

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treats of animal fluids, I am obliged to confine my views, and to con-
sider which is the necessary previous step indeed at any rate, The

Animal Blood, and I say

246. The —— Blood. We allege that the portion of the fluids circulating in the aorta, and its branches may be more especially considered as the common mass of blood, from which all the other fluids are more or less derived. I have avoided determining a question that has been started here, How far the several secreted fluids are to be found formally in the blood that is in the same quality, and condition as when they are separated from it, that is a matter which we shall consider afterwards; but it is enough to say that either formally —— fluids, that they are materially contained, cannot be doubted, there is not a part of the body in which fluids are found that has not an evident communication with the aorta and its branches, nor much that liquors injected into the aorta readily reach these places, and the appearance of that fluid is not found in that place, if the communication with the aorta is shut up. There is therefore little doubt that the whole of our fluids appearing in any part of animal bodies are derived from the common Mass of blood, and materially present there, I do not know what subtile objection may be thought of with regard to certain states of absorption, but these are singular and extraordinary, and even here the absorbed fluids always take the course

of

of the Lymphatics, are conveyed to the heart, and must be destributed to the aorta and its branches. In this way I limit the common Mass of blood. This —— parts, as we shall hereafter more clearly shew — The —— parts. And that has occasioned a question, whether or not the Venous blood, may be considered as a part of the common Mass, tis very proper to fix this, I say it is indeed true that the Venous blood probably has every where suffered the separation of certain parts that are present in the blood of the Arteries, but notwithstanding of this I say as the —— Mass. To understand this it is only necessary to consider, that tho' there is at the extremities of the Arteries, a separation of some parts, that were formerly moving in these; yet that it is in the course of one transmission, so inconsiderable a part that it cannot be supposed to have taken away the whole of any distinct part or portion of the blood, and if certain foreign and extraneous matters, are again entirely thrown out of the body, that is not done in the course of any one transmission of the blood, in the Arteries to the Veins, it is not necessary to consider these extraneous matters, but even the Excrementitious fluids, as the Urine, we allow that the Venous blood returning by the emulgent vein has less of it than the Arterial, but take it in this manner, at every Systole of the heart, a certain quantity of blood enters the emulgent artery, and a like quantity is in the same interval returned again by the Emulgent Vein, take it as low as you please, suppose that

they

the whole blood passing from the left Ventricle of the heart in one Systole is to the quantity of two ounces, and that two drams of blood passes by the emulgent Artery, in the time of every Systole, and let us suppose that one grain weight of Urine is separated from this, which is only the 120 part of this will supply the largest Secretion of Urine that we know of, in the course of a day, there will be about Eleven pounds of Urine, and it is possible, that such a quantity has occurred, but it is three times the quantity that is commonly separated, therefore the supposition of one grain of Urinary matter from two drams will do much more than account for the whole, and tho' there is a portion of what is in the Arteries not found in the Veins, yet it is a very inconsiderable quantity with respect to the whole, that was contained for the time in such Arterial blood, and it is only in consequence of a repeated Circulation, that such a separation is made, and therefore I say, but —— Mass, and therefore with regard to the experiments, which we shall adduce, it is of little consequence, whether they are made upon the Arterial or Venous blood, with regard to the pointing out the Constituent parts of both, To proceed therefore

245 This —— Aggregate, an Aggregate is a Collective Mass that may be divided into parts, each of which have the same Chemical parts, with every other, and with the whole of the Mass before division, there is some difficulty in applying this to

a[illegible]

a heterogeneous aggregate, where there may be different parts that indeed have different properties in the same heterogeneous aggregate, but if these are broken down, they still retain the same properties, as all the other similar ones do, and therefore we Consider it as an aggregate but as a heterogeneous aggregate and —— parts. —

246. We —— animal. I go on to describe this Spontaneous separation of parts

247, The —— weight, The experiment has been made more many times, I have attended to it myself, it is hardly possible to make the Experiment in the Coldest weather, which is most unfavourable to any such exhalation; but it can be made sensible, and that in the quantity of an ounce or two of blood, in the ballance; and that this diminution of weight is occasioned by, an exhalation is evident from the odour, from the sensible Vapour that arises, and if the blood is drawn, and allowed to run into a retort, this Vapour can be shown condensed, more —— itself, both the two first circumstances are exactly ascertained, that the Exhalation takes place in proportion as the blood is more or less fluid, or is exposed to more or less heat, and it is likewise according to the extent of Surface by which it is exposed to the air, as we would expect indeed, and I add probably, because I am not so certain of it, we have not had enough of experiments to ascertain it, but I say that it is probable, that it is also according to the different conditions of the blood itself, there is a danger of fallacy

my

in Experiments that are any thing nice, therefore tho' the blood in different persons does shew a different degree of Exhalation, if it appears as it does, that the blood of the frugivorous animals does afford less, than the blood of the Carnivorous animals, which is probable, but it has not been rendered sufficiently certain, therefore I add probably. The —— blood.

248. Soon —— fluidity. I dont pretend to say in what time, nor in what circumstances, whether in consequence of the application of Cold, or of rest alone, but it is agreed that soon after in no long space of time, in the Experiments that have been made with respect to it, it does not extend above 20 minutes or a little more, and generally indeed in a much shorter time, and —— Mesmena that are before your Eyes every day, but —— dense. There are circumstances in this seperation, that are very exactly ascertained, it is enough for us that the fact is very general, if not universal, there are cases in which the blood does not coagulate and in which the seperation of the thinner parts, readily takes place evidently, but we have reason to believe that these are either more fix circumstances, or certain singular circumstances that may sometimes apply to the blood after it is extravasated, and the account here is allowed to be very universal.

249. This —— almost always. I was doubtful whether I should express it in this manner, or to say, commonly takes place, and

and —— Crassamentum. there is perhaps no great occasion for the nicety of the expression; but there has been an Idea fixed to the term Cruor, that it was the red part of the blood, and it has been more especially annexed to this red part, so that it was necessary to get a term that was not liable to this ambiguity, and therefore with Gaubius and others I call it the Crassamentum; and now that I have mentioned Gaubius. I must observe that he is the first that has very clearly described this spontaneous separation, and therefore the next parcel is almost verbatim taken from him

250. Both parts seem homogeneous, but they are not, I add simple to avoid ambiguity, the Serum is homogeneous, but it is not simple, For —— ablution; so far I have copied or translated the words of Dr Gaubius, the experiment has been often repeated, and there can be no doubt with regard to any thing I saw here, except the last phrase, I would not determine when the ablution is compleet, and when nothing else remains, but this Mass, nor will I be positive that no portion is separable by the repeated ablution of Water, but very nearly it appears to be in this condition, in circumstances. now I say, alike —— blood. I cannot say that every portion of blood I have seen has been treated in this manner, but we are assured that there is not any portion of blood, but what will shew, in consequence of such ablution, a certain whitish, Consistent

but

but soft and tough Mass remaining, and while such experiments out of the body constantly shew a like matter, I add, and upon —— blood, besides this experiment of washing the Crassamentum we find it spontaneously separating when the blood remains in the Vessels, whether of the living or dead body, if there is any doubt with regard to the formation of Polypi, in the living body, which I think there is not, yet in Aneurisms both true and Spurious, we find a portion of this matter often separated from the blood, and that in such quantity and circumstances as not to leave any doubt that it was so separated, in the dead body it appears very frequent, it is allowed that the substance of Polypi in the heart and larger Vessels is a matter precisely the same as that obtained from the blood by the experiments I mentioned, and we have the greatest probability, that the most part of these Polypi are formed immediately after death; but more than that, now a more careful Inspection of dead bodies, and particularly the Dissections of Morgagni have shown that the blood found in the Ventricles of the heart and Neighbouring Vessels as the Pulmonary Artery &c that one portion of a Mass figured to the size of a Vessel, that one half of it consisted of the common red Crassamentum, and the other was a Polypous substance of the same nature with that procured by the Experiment that I have mentioned, and when —— blood, I have not said as to the condition of its being drawn out of the

Vessels

Vessels of a living Animal, we now every day see that in certain diseases the blood instead of separating into these two parts, does exhibit a portion very different from either the Crassamentum or Serum, a whitish, Consistent, Soft and tough Mass, which is found floating on the Surface of the blood, as collected in our blood letting, and which is found to have precisely the same nature, as the portion which is obtained from the experiment first narrated, and therefore we say that this only a spontaneous separation of that portion

Sect: 60.

We are now enquiring into the parts of the Mass of blood considered as a Heterogeneous Aggregate, we say, that this appears in consequence of a Spontaneous separation, which happens to the blood drawn out of the Vessels of a living Animal; Thus drawn out it separates itself into two parts, a fluid and a firmly Concreted part, the first we call the Serum, the second most properly the Crassamentum

This

This spontaneous separation however does not separate, all the parts that may be separated, each of these parts, the Serum and Crassamentum may seem homogeneous, but truely they are not, and first with regard to the Crassamentum, if this is washed in a proper manner, we find a red coloured part that is readily diffused in Water, and therefore easily washing away from a remaining part, that is not easily diffused in water, but is of a soft and tough consistent Texture, and such Experiments always shew alike matter present in the Mass of blood, I will not say what may happen in certain diseases, but there is no portion of blood drawn from a person in a healthy state, from which this part may not be obtained in a perfect manner, and I say that it even sometimes spontaneously separates from the other parts of the blood, when it is drawn out of the Vessels of the living Animal, while the blood is inclosed in these Vessels, and also in the Vessels of dead Animals, and as the same Consistent White Soft tough Mass appears I say on the surface of the Crassamentum when blood is let, I therefore conclude that it is a part constantly present in the Mass of blood, it should have been observed so early as the Experiments of Malpighi, but it was not attended to till within these twenty years past and then it was commonly thought of as a Morbid part that was produced in consequence of Disease, even Dr Gaubius who has taken so much pains to establish it as a Constituent part, is of opinion that the quantity may be

(It is also found in the Vessels of the living Animal)

increased

increased in Diseases, and that it may also be changed in its quality, now he is probably mistaken in both these particulars, as it has been but lately discovered, it has but lately got an Appellation, It is I say what Gaubius, after Malpighi calls the fibra sanguinis, when blood is let fall in warm water, there is a separation of its parts, and that part appears like fibres floating in water, which gave occasion to this Appellation, but Dr Pitcairn has demonstrated, that no such fibrous part can circulate in the Vessels. After Malpighi, the existence of this part was little attended to, till the time of Mr Senac who speaks of it in his Traite de Cœur, and names it the Coagulable Lymph, but as that term is ambiguous, and is a long expression, we shall speak of it I say under the title of the Gluten of the blood, as it was called by Dr Davis, who was the first who made Experiments with a view to this part. When it appears ——— Crust. It is only necessary to show that what Physicians have called by that name is indeed the same, and I need not tell you that its Spontaneous separation happens most commonly when the body is affected by Inflammation, but we must not infer from hence that it only occurs in such diseases, there are certain circumstances in the System in which no Inflammation is to be suspected, and yet this Spontaneous separation takes place. I have therefore ascertained one part of the Crassamentum, there remains another part of it which we shall may be washed off, and with regard to this part, we observe that

251

251 When ——— fluid, If the blood is allowed to Coagulate to a considerable degree, the red part is always mixed with a portion of the Gluten; so that we must take it soon after it is drawn out, in order to preserve its due fluidity, and when the blood is thus viewed, there ——— figure, take notice that I use a loose term, a round figure because I would not anticipate the question, whether these particles are Spherical or Spheroidical, whether they are perfectly round, or more or less Oval, to which however a round figure may be more or less applied, and also ——— Colourless, the Serum that spontaneously separates is with very little Colour, approaching to the milky, however there are circumstances in which it appears of a Yellow Colour, and I own that in many Cases it does appear of a Yellow Colour, when no portion of bile is diffused in it, which otherways produces it, but there are more rare occurrences, and the more ordinary case is, that it is with very little Colour, and particularly when it is viewed with a Microscope, there the Yellow tinge does not appear by refraction, but however that may be the deep-colour of the red part is always very distinguishable — The ——— Globules, you may admit the Appellation, tho' it is not mathematically fit, and it ——— only, we say that in consequence of the spontaneous separation, there is a large proportion of the Serum, and we cannot doubt that it was by the diffusion of the red Globules, that it had its Colour, in like manner where we separate

they

the Gluten, by an application for that purpose, itis equally without the red Gluten, while the remaining part of the Crassamentum is with a red colour, Therefore while the blood is wholly of a red Colour, itis because the red Globules were more universally diffused in it, and wherever we apply the Microscope to the Vessels of a living Animal, wherever no colour appears there, there are no figured particles, and where there is the Colour, there we can distinguish the Globular particles, and we can distinguish these as having such a Colour, while the rest of the surrounding fluid is perfectly colourless, there is little doubt therefore that this is the Colouring matter, and is the foundation of any red Colour that appears in a part, or in the whole of the blood, and I say, Itis ——— Crassamentum, I wish I could render that very certain, itis very difficult to put a Negative, that there is nothing washed away with it, but when we come afterwards, to Consider what other parts have been supposed, we shall render their presence improbable, and that there is no other evident matter at least in the Crassamentum. The Crassamentum we find is of a very loose texture examined as retaining its entire form, and we can discover some parts that are more fluid than the rest, and when cut into parts, every thing resembling Serum seperates from it. Therefore with the Gluten or red Globules there is a considerable portion of Serum entangled in the pores of the Concreting Mass, and I shall point out this to other purposes presently and we say—

252. The ——— gelly. Gentlemen who have looked into Mr Hewsons late Experiments will be ready to think that the Coagulating point is not so high; but you will find that any variety seems to occur from this, that Mr Hewsons experiments relate to the whole Mass taken together, but the Serum by itself requires such a heat, and perhaps somewhat more, for in such experiments, it is not easy to limit it entirely, and ——— taste, I perceive now that I should have added here, " and in most respects resembling the Halitus that we mentioned Spontaneously to exhale from warm blood", This thin fluid, not only resembles in its taste Colour and Odour that Halitus, but is in itself remarkably Volatile, and if it is volatilized and Collected it is found to be precisely the same fluid, with regard to it, it is proper to observe that in proportion as this fluid is more ——— Serosity, after Mr Senac, who has first imposed this term, tho' he is not strict in distinguishing between Serum and Serosity. I obviated just now a difficulty that might have risen here, when I mention only these parts of the Serum, when I mention only the red Globules, the Gluten and Serosity, it might have been asked what is become of that part, which is in the form of a Vapour, but I have now supplied this by saying that the matter exuding from the Coagulable Serum, and this Vapour is one and the same, and we mean to speak of it under the name of Serosity, And now.

253. From ——— Serosity, the existence of each of these will not be doubted, the difficulty is to say, if there are any other parts, and — I say, What ——— mentioned. having mentioned the properties of

these

these parts that we have now assigned, as their presence is to be concluded from Experiments made upon the whole, I shall say what other matters are certainly present, but which are not such as we allow to be ordinary Constituent parts, as the Mucous glutinous, Oily &c such parts are not ordinarily found, but the full Consideration of that matter will be more properly considered hereafter. We speak first of the red Globules—

254. The—— matter. Not very commonly indeed, but among the last Physicians, Gaubius in particular has taken pains to represent them as such; and this will account for their distinct and globular appearance, for if the Oil is poured into Water, in the most diffusion, it retains its distinct nature, and its several particles appear in a distinct globular form, I should therefore have no difficulty in understanding why the red parts appear of a globular figure, while they are of an Oily nature, and while the Serum is manifestly of an aqueous, but I can't admit this, for I say, but—— Nature Gaubius rests this upon two circumstances, one is, that where they are collected from the other parts of the blood, they are readily inflammable, but in experiments made to this purpose, I find that the Gluten, when equally dried, is as readily inflammable, as the portion of red Globules, or with very little difference, and even from this circumstance we must not conclude with regard to their entire oily nature, for some Substances are inflammatory in their whole mass, and yet we find that that depends upon a portion of the Oil intimately mixed with the other parts of it, therefore merely from the

its being Inflammatory we cannot conclude with regard to the pre-
sence of a separate Oil; another proof is the Chemical Analysis by
destillation, but I say that it cannot be applied, and if it should, it
only proves, that there is a greater proportion of Oil in the Globules
than there is in the Gluten, tho' itis not easily conducted, so as to
show that very sensible I presume therefore that there is any direct proof
—— improbable, There is not an Oil in nature that we are acquainted
with, at least that I can recollect, that is precisely of the same Specific
gravity as water, therefore in all Cases, they either Spontaneously
emerge to the surface, or sink down to the bottom, itis true that a portion
of them will remain Adherent, and thus our distilled Waters are impreg
nated with the Essential Oils, but not in any such proportion as to
show the distinct Globular appearance, This then is a very partic-
lar Oil, but that cannot be admitted, but further itis not only thus
united and blended, but itis seemingly diffusible in water to any degree,
which is what we know of no other Oily matter whatever, and when itis
diffused more or less in water, there is no means, by affecting the red
Globules themselves only, that will affect the separation, no appli
cation of Oil to which it should have a nearer affinity, will separate
the red Colour, I forgot to mention an observation when I was speak
ing of the globular appearance being easily accounted for, sup-
posing it of an Oily nature, but from this Globular appearance
we must not conclude it to be an Oil, for we know that any other
two,

two fluids, that are not rightly miscible, will show the same Globuler appearance, tho' they are not of an Oily nature, Thus a saturated Solution of fixed Alcali, in a fixed State is not miscible with Alcohol, the Alcohol will come to float above, and the lixivium as we may call it, will come to sink to the bottom, but when diffused to a certain degree they retain their appearance, and that always in a globular form, equally as if they were Water and Oil, having thus rendered it doubtful, with regard to any Oily nature in the red Globules, we go on to Consider what further is known with regard to them; and I say, as —— differently, every body knows that Microscopical Observations are extremely fallaceous, there is no person that has been the least conversant with such observations, but will allow this, and this is evident in the Observations of Lewenhock, who had more experience, and as good pretensions to knowledge in Microscopical observations as any other person whatever, and yet with regard to Animal fibres and other parts of the body, as well as with regard to the figure and size of the red Globules he is very different in different parts of his works, so that such differences are not so much owing to more or less skill, but it will give the general Conclusion, that such Observations are fallaceous, Accordingly some —— Spherical, this was the result of Lewenhocks observations with regard to these Globules, but while he is unsteady in representing their figure and Size, and has not very clearly pointed out

thus

out this, he was so much trusted, that Boerhaave and the Physicians of his ~~age~~ days readily adopted the account, and formed several theories upon it, that the red Globules was no other but six other Globules, and that in that State in consequence of a different density in the matter, or in consequence of a different size of the whole, the red Colour appeared, but that they again spontaneously separated or formed Serous particles &c that were now without the red Colour, See what Theories Boerhaave and his followers have formed with regard to these, in adopting a Ramification of the Arteries, to the size of the red Globules, See what Dr Martin has said, what pains he has been at in ascertaining what may be the Diameter of a Globule of the 10th Order, and indeed Leuenhoek gave occasion to all this, in supposing that they were thus infinitely divisible. However since that time other persons have not observed them, since the time of Tabes, and after him Lancisius, No microscopical observer has seen any such thing, Dr Haller never saw any thing like it, and Mr Senac for this and other reasons has equally deserted the supposition, but taking them to be of one kind only, there is a great difference among observers still with regard to their figure, To —— lenticular. Haller considers them as Spherical, while Senac alledges that by a little address they appear Oval, as oblate Spheroids, or as he calls them Lenticular, the variety still increases, To some —— Vesicles

if I am not misinformed both these appearances have occurred to a Gentleman, who is perhaps among the last who has been observing this matter, the ingeneous Mr Hewson, I know that he was of the opinion, that they formed a sort of Vacuity towards their middle, now I am told that he sees them in a different light, as if that middle part was a Vesicle, but how it is filled, or if it is entirely empty, I am not exactly informed, I only conclude in this manner, All—— them, for example, with regard to their size, which some observers have said is very exactly the same, on all the different occasions, and not only so with regard to the human blood, but in the blood of every Analogous animal, that has two Ventricles of the heart, that it is in the Mouse and in the Whale precisely of the same size, while other Observations make them not only of different sizes in different Animals, but in the same animal at different times, So with regard to the Colour, while they allege that it is of a more florid or intense red upon different occasions, Dr Haller gives us a curious observation, that in an animal starved or exhausted, the florid colour is in some measure lost, but upon the animal being again fed, it again recovers it, All this, I say, with—— some uncertainty, I am disposed to say a great deal, in microscopical observations and—— blood, and it was necessary to insert that Apology, because I would not come to any Conclusion with regard to these particulars, and upon the same occasion I think it necessary to add that, The—— precautions, nothing

nothing is more difficult than, with Boerhaave, to take a Mass of blood, and separate the Gluten, so as seemingly to obtain the red Globules, separate by themselves, by ablution, you will find a considerable portion of Gluten adhering, and even when diffused in Water, there is still a considerable portion of it accompanying them; for if you apply Alcohol, or if you apply Acids, they will form a Coagulum, and I hardly see that the red Globules can be got entirely from the rest, so that we can trust their saying that this part has peculiar Chemical qualities, I would rather acknowledge that the Chemical ——— untouched, because I cannot get but the experiments of a single person in favour of any particular opinion, and I can see that they have indulged in a great deal of Hypothesis, and any thing that has been said in explaining how these are produced from the Aliment we take, is purely Hypothetical, and upon the most precarious footing, so with regard to the changes that they undergo from putrefaction &c which have been insisted on by some, it is difficult to conclude any thing, and therefore with regard to the peculiar nature of these globules, the destruction that we presume does happen to them, we chuse to leave untouched, but we shall ——— blood, I have hinted before that among other opinions, with regard to their production, that their Colour might seem to depend upon the admission of the Air by the Lungs, as it has been alledged, that the peculiarly florid

appearance

appearance which is found in the pulmonary Vein, the Aorta and its branches is not to be found in the Venous System, there are several other suppositions, and particularly, as certain Neutral Salts when applied to the blood heighten the florid colour of it, it has given foundation to the opinion, that Nitre was applied to the Lungs, and gave the blood this colour there but without entering into such Hypothetical reasonings I think we can account for the changes that occur in the Mass of blood, upon a more simple foundation, I attempt it indeed too in the way of Hypothesis, but I hope that the Phæno-mena will confirm it.—

255, We ——— colour, agreable to all the Microscopical Observers, and ——— red, this is particularly the opinion of Mr Senac, in their Lenticular form, he suppose them to be in the condition of a piece of coloured Glass, drawn into thin plates, each of which appears almost colourless, but when they are laid upon one another, their Colour emerges sufficiently strong, so when a certain number of Globules are ——— red, but ——— darker red, now this is if you will a supposition, but upon this ——— Mass, when in consequence of the Spontaneous separation, both of Serum and of Gluten, the red Globules are collected, and more accumulated by themselves, they appear of a deep and dark Colour, but by diffusing them in a portion of Serum, we recover the florid Colour, in like manner the surface of the blood appears always

of a

of a more florid Colour than the bottom, and there is little difficulty in shewing here, that in the one case they are more diffused, while in the other portion, they are more accumulated, as we are certain from the Spontaneous separation of the Gluten, that it is of less Specific Gravity than the red Globules, and tho' it is not always buoyed up, it is always in a greater proportion in the upper parts.

Lect: 61.

After shewing Gentlemen that these three parts, The red Globules, The Gluten, and Serosity are, if not the only, at least, Constituent parts of our Mass of blood, I propose to Consider a little these in particular, and to say how far we can discover their nature respectively, with regard to the red Globules, I have concluded that we know extremely little, with regard to their peculiar nature, especially to say, how they are produced, and how they are again destroyed, for these appearances in fact, we cannot refuse, we perceive there are

powers

powers in the System that operate here, for where a considerable quan-
tity is drawn off by Spontaneous or Artifical hæmorrhages, they
appear to be soon restored in the same proportion as before, and if there
are such powers of generating them, probably there are causes of
their destruction, tho our experiments have not ascertained what they
are, but when I was speaking of these I observed that one effect is the
colour of the Mass, and as we are liable to judge of the appearance of
the extravasated Mass from this Circumstance, I thought it necessary
to consider the causes of the several Changes in the colour of the blood,
and I have for that purpose advanced an Hypothesis, I suppose the
blood in the condition of Coloured glass, which when drawn out into
extremely thin plates is almost Colourless, but when they are ap-
plied to one another, as their number is increased, the Colour under
goes a proportional change, becoming gradually darker and deeper,
now I suppose this to be the case with regard to the red Globules, that
taken singly they have a very faint colour, but when several of them
are laid upon one another, they have a stronger colour, are of a more
florid and Scarlet red, but when they are accumulated in still greater
quantity that florid Colour is obscured, and becomes darker, and I
have some trust to this hypothesis, because I find that this is
truely the case —— blood, thus in a Mass of Coagulamentum,
we find that on the upper surface which is exposed the air, the
Colour is more bright and florid, while at the bottom it is more
darky

dark and black, which may be explained in this way, that as it appears that the gluten of the blood is of less specific gravity, it is more or less buoyed up on the surface, and must have the effect of diluting the quantity of red Globules that is entangled with it, if it separates therefore, and these parts take a different place, the Colour will be darker, but if we keep it stirring, so as to occasion the Coagulation to take place equally over the whole Mass, the florid Colour is preserved, but when the red Globules, have taken a place by themselves, in that situation, the Colour is blacker, while by diffusion again in Serum or in water, the florid colour is recovered, we find this difference of Colour occur in the quantity of blood that is for the time contained in the Arteries and Veins, and, in spite of Dr Haller, we must believe that there is really such a difference, and Dr Haller himself acknowledges, that sometimes the Arterial Blood may be observed to be of a brighter Colour, and that of the Venous to be of a deeper and darker red, There is at the same time no sort of doubt, that the blood in the Arteries, is under a more considerable degree of agitation, and therefore more equally diffused, while the Venous is less agitated, and therefore the several parts, less equally diffused among one another, I might add that certainly at the extremity of every Artery, there is a Serous Vessel that goes off, it is true, that this, agreeable to what we have said, will not allow that in the way of Secretion there is

any

any considerable part Secreted, but this Secretion is considerable, with regard to the whole, and tho' it is returned, it is subject to less agitation, so that still the Globules are not so much diffuse, which will account for the difference we speak of, and it is in the Venous blood, as it passes thro' the Lungs, and becomes Arterious, that this change appears from the dark Colour which it has in the right, to the more florid, which it has in the Left Ventricle, and here there are the causes that I speak of taking place, there is the effusion of new Chyle added to the Venous blood, and a more considerable agitation, and all the means of diffusion more particularly applied than in any other part of the System, and therefore from the circumstances that take place here the more florid, or darker colour of the blood appears evidently to be occasioned, but from the last circumstances of the Colour being changed from the passage of the blood through the Lungs, it was common to suppose that the Contact of the air had some effect, and the florid colour of the surface, while the parts below are darker, in any quantity of blood drawn gave the same conclusion, and from the fact that I have given that the diffusion has a principal share in this change of Colour, it is possible that the Contact of the air may likewise have an effect, and there are Substances that applied to the blood, increase the florid colour, as almost all the Neutral Salts, and the Alkalies whether fixed or

Volatile

volatile, and possibly they do so by their Chemical qualities acting upon the red Globules, but we know that they are the Substances that prevent the separation, and keep up the diffusion of the blood, and probably in that way they are not directly against our Supposition, but make room for supposing that the application of air may have that effect, and of late we have had an experiment adduced by Mr Hewson, that has led him to Conclude, that the air has effect here, he tied up the Jugular Vein in three places, and in one of the Spaces included a quantity of air, and in that portion thus in Contact with the air, the globules were of a more florid Colour, and I would not refuse the Conclusion here, tho' there is this fallacy in it, that this very air occasioned a degree of separation of the parts, and gave a greater diffusion, but there is another experiment in which I can't join him, neither am I certain if he made it himself, as it has been mentioned a hundred times before, when you take the Crassamentum, from among the Serum, the Surface contiguous to the air, is of a florid Colour, and the other is of a darker black, and if you invert it, so as to render the Surface undermost, it is alledged that the Colour at the same time changes, and that now what was of a dark black, by this change of position and exposition to the air, becomes of a more florid Colour, but I have had the Experiment repeated in several instances no such Change took place, in other instances it does, but in my experiments which were made in company with Dr George Fordyce, it very often does not succeed, and

and where it does it is according to the laxity of the Crassamentum, when the Concretion is firm, as in the case of Inflammation, and there is no part that can move from one place of the Mass to another, no such change of Colour takes place, but in most cases it is so lax, that it has entangled a considerable portion of Serum in the Cells which is moveable from one part to another, and there it produces the Change of Colour, in such a case we can see that it has arisen and flows to the upper part, and sometimes we observe that it is variously spotted and that in proportion to the Serums being moved, and diluting the red Globules. These are the facts you may consider them at your leisure, and the application they will admit of, I go on to speak of the other portion of the blood, The Gluten.

256. The ——— Waste, with regard to the nature of the Gluten Chemically, I have not said anything particularly, here I was intent upon the Conclusion, that it is the principal part of Animal fluids immediately formed of the Aliment taken in, and intended for the growth of the body, but in that will be implied what is necessary to be considered in its Chemical qualities, on the one hand, we say it resembles the Albumen Ovi, the proof of this is the Gluten of the Coagulable part is the same with that which we obtain by washing the Crassamentum, the Coagulable part of the Serum every body allows to be of the nature of the Albumen Ovi, as by the application of Alcohol, Acids or any other Substance, the result is the same, and if we say

say that the Coagulable part of the Serum is a portion of the Gluten dissolved in the Serosity, whether it is obtained by spontaneous separation, or by washing the Crassamentum, if the Gluten I say is the same with the Coagulable part of the Serum, and the Albumen Ovi is the same with the Coagulable part of the Serum, then the Gluten and Albumen Ovi, by some Mathematical Language are the same with one another, and for that I refer you to the experiments of Dr Bidt, which you will now find in Saundefords Thesaurus, Therefore in taking the Chemical history of the Albumen Ovi, and these experiments of Dr Butts, you have all that I can afford you with regard to the Chemical history of this part of the blood, on the other hand I say it resembles the matter of the Solids of animal bodies, we find that these in their Chemical Analysis, and when by Decoction we obtain their soluble parts, we find I say that the same treatment applied to the Gluten has the same effects, the Solids are corrugated, and contracted by heat Acids, Alcohol, &c in the same manner as the gluten is, and therefore they may be considered as at least very nearly alike to one another and therefore our consequence follows, as the Albumen Ovi is provided by Nature for the formation of the Chick, for the formation of its Solid parts, so we presume that that portion of the blood is destined to the same purpose, and therefore that this is the purpose of taking in Nourishment, and so that it is this part which is immediately formed of the Aliment taken, and —— Waste, if there is a foundation for the last supposition in the order of the oeconomy, in the case of Diseases,

and

and in the case of filling up of wounds &c We go on to consider the third part of our fluids, the Serosity, here perhaps I take a measure that is not very safe, we determine the nature of the Serosity a priori by determining the manner in which it is produced, I say. —

257. But —— putrefaction, that is a fact that need not now be proved, after the innumerable experiments that have been made to this purpose, There have been some doubt with regard to the more putrescent nature of these different parts, and some Physiologists have supposed that the red Globules were more disposed to putrefaction than the Gluten, but in the experiments of Dr Butt the most of which I suggested and attended, it is the Gluten that is the most putrescent part, and the latest experiments in England and France afford the same conclusion, and —— place, many experiments have occurred with regard to Men and other Animals that have been starved to death by the abstraction of aliment, and it is agreed on all hands that they die with the Phœnomena of a considerable degree of Putrefaction taking place, what aliments are especially necessary to obviate this, and how far recent animal food will answer the purpose is not determined, but we allow the Scurvy to be a putrid disease, and we know that it is produced by the want of recent Vegetable or recent Aliment and it is in the case of the Scurvy that we have an opportunity of observing our third fact, that of certain —— place we have many reasons to think that the Urine and perspirable matters, are both putrescent matters to a considerable degree, and that as they are constantly thrown

out

out, they probably carry off the matter which would prove noxious, and so they have been termed Excrementitious Secretions, but this further appears from this consideration that nothing favours the production of Scurvy, so much as cold Climates, very much obstructing the perspiration, and in these cold Climates Men escape it, the Aliments being given, and the Cold the same in proportion to the degree of exercise they are engaged in, Its a curious enough fact, that is given us by a Gentleman in these dominions, that on the Coasts of the Baltic, in the Neighbourhood of their Docks and Arsenals, a considerable number of Country people are brought in and obliged to work in these matters, at the same time there is a quantity of Soldiers who are exempted from labour, and whose business it is to guard the Boors that they may not run away, and these Boors, tho living perhaps upon a worse aliment, by their constant labour escape the Scurvy or at least a month later in being seized with it, while the Soldiers are more affected, Therefore we say that the Animal fluids in general, and particularly the Gluten, is prone to putrefaction, and it is for this reason, that the Excrementitious Secretions are instituted, and we would see the putrefaction more remarkable if these Excretions did not carry off the putrescent matter, this putrefaction I say examined in its several Stages, and in its last effects is perhaps the decomposition of the whole, and a various separation of it into different parts, some of which are rendered Volatile, while others remain in the Mass, but it is constantly attended

worthy

with an evolution of a saline matter, a volatile alcali is evolved and separated, which will effervesce with acids, and give a particular odour in the exhalation, and this disappears because it is again involved and united with certain acids, which are perhaps the produce of putrefaction; it is by this process that we obtain Nitre, and here we find a quantity of Ammoniacal Nitre, which cannot be shown previous to the putrefaction, I say therefore hence ——— Serosity, it is in this manner a priori that we establish the nature of the Serosity, and here I mention, what I should have mentioned before We ——— blood, we find that the serosity, when separated from the Coagulable part of the Serum, is very volatile, and when it is collected, it appears the same, with the Spontaneous halitus from warm blood, we find that to the taste and other Experiments, both of them contain a saline matter, and here is another Conclusion, that is a little bolder, but to me is sufficiently probable, and that ——— Separation, I cannot say that this is made so evident, as is to be wished, there is no experiment, that shows that by applying the serosity to a portion of Concreted Gluten it will dissolve, and take it up, but saline matters, that approach the nearest to the Saline we have here, have that effect, as a Saturated Solution of Sal Ammoniac, the experiment is generally made with the common, but it also answers with the Vitriolic and Nitrous Ammoniac, if you take any quantity of blood, it is in it equally, and perfectly diffused to any extent, by the addition of Water, and considering that the Coagulable part

of

of the Serum is the same with the Gluten, and is here in a dissolved state, we know no other means, that this is effected by but by the application of a Saline matter, so the Conclusion is sufficiently probable, and we have thus as well as we can explained the different parts of the blood, and particularly this circumstance why the Gluten appears in its diffused state, and in its undissolved state at the same time.

258. The —— fluids. That there is an Ammoniacal Salt constantly present in the Serum, and in that portion which is to be considered as the Serosity is evident, the whole applied to certain Metals, as to Copper, which is readily corroded by an Ammoniacal Salt, corrodes it, and with the distinguishing marks of an Ammoniacal Salt present, with the blue colour &c, but it is not the Volatile Alcali, for that is engaged in composition, and only appears by the Elective attraction of the fixed Alcali, if you take Vegetable matters, and subject them to putrefaction, you find an Ammoniacal Salt, but that is the Nitrous Ammoniac, but the Neutral Salt here is an Ammoniac with a peculiar Acid, and this if it is not originally formed, is at least most copiously evolved in Animal fluids, and it contains the Acid which combined with the Phlogiston, gives the Phosphorus as it is called, which is only got from the fluids of Animals, tho' this is probably owing to its being most copiously evolved from thence, and there are observations

wholly

which show that in certain Vegetables there are marks of the Phos-
phorus acid present, as in Mush &c where it has been shown by a
peculiar encheiresis or management so you will see the reason
of my cautious expression, if we may & I take the proof of it from
the urine, which is formed from the Serosity, and shows an ammo-
niacal Salt constantly present, and I do not pretend to say that
it is the only Saline matter, the experiments of Margraef have
shown that there are other Salts, and Boerhaave found constantly
a quantity of common Salt, and he concluded from thence that
common Salt was a matter that was not to be assimilated in our
bodies, but the conclusion does not hold, for I say that it is in greater
proportion, than could be expected from the quantity taken in along
with our food, and we find that common Salt occurs in the urine
of animals, which hardly take it in at all, and a degree of putre
faction may in different circumstances evolve Salts of different
kinds. I have said all this to prevent our being hasty in employ-
ing our reasonings from a few facts observed, but with all this I
think that the matter will admit of an application, if we find
the Saline matters in more abundance in the blood, we must con-
clude that they are of this kind the Ammoniacal, or the Essential
Salt of Urine if you will, and if we attend to some very curious Expe-
riments, it would appear that Neutral Salts formed of fixed Alcalies

can be converted into Neutral Salts, containing only the Volatile Alcali, by the application of more or less inflammatory matters, and from thence it is probable, that if common Salt is taken in, in unusual quantity, it may not subsist in its own proper form, but may be converted into the Ammoniacal, and give occasion to the superabundance of that, but we shall have occasion to say more of that upon another occasion, I have upon many occasions tasted the Serum of the blood, and I never found it without more or less of a sensible and manifest Saline Acrimony, and it is very improbable to suppose that it is at any time without it, and if it is said, that persons have tasted it without its discovering any such Saline taste I will doubt of their fact, and will say that they are endeavouring to maintain some hypotheses, as from particular instances, I cou'd render probable. x

259. These —— blood, they contain a number of facts, but with regard to the Conclusion, they are but conjectures. And —— difficult, because from hints that I have given before, it is impossible to get any one of these three parts separately with circumstances, that will allow us to measure their quantity. But

Lect 62

Lect: 62

I have endeavoured to say, what are the Constituent parts of the blood, and tho' we may not have enumerated the whole, yet I think the three parts that we have assigned are constantly present there and make the chief part of it. And our next question is, In what proportion are these three parts with regard to one another, I say this will perhaps be always difficult, which arises from hence that these three parts are fitted for a certain union with one another, to such a degree, that it is almost impossible to get them entirely separate, the Serosity is not only intimately united with a portion of the gluten, but a considerable quantity of this Serum is constantly entangled in the pores of the Concreting gluten, so that it is difficult to obtain these parts separately, and even with regard to the red globules, they have an adhesion to the other parts of the blood, they are readily enough united in the same Concretion with the Gluten, and when they are seemingly separated, by applying Coagulating powers, it will appear that there is a considerable portion of Gluten still adhering to them, let any body therefore in making experiments upon this subject be well aware of these difficulties. And in ——— out. Nothing is more common than for Physicians upon the inspection of the blood drawn out

off

of the Veins, to judge of its condition, and to say that the Concreting parts of the blood, The red Globules or Gluten are in different proportions, I say that all the Judgments hitherto made, and probably all these that shall be hereafter made will always be at least precareous, nay for the most part they have been fallaceous, I take for my example; but one of the latest judgments of that kind, that is, one formed by Dr Haller, in mentioning the proportion of the different parts, he says, that the Cruor, by which he means the Crasamentum, that makes one half of the whole Mass, I dare venture to say, that this is certainly extremely false; as I think every body from their daily observation upon this Subject will perceive — that the Serum is very often separated in double, nay in triple the bulk of the Crasamentum; and he says that the Serum is not only the half, but in robore valido Serum minuitur ad tertiam partem; but that is more manifestly wrong, for in comparing the vigour of the persons in whom you draw blood, you find that according to the vigour of the body, abstracting from diseases, the inflammatory Crust is more ready to appear, than in those who are weaker, and therefore for the most part, if for example the blood is drawn into our ordinary China porcelain cups, the more inflammatory Crust is separated, the greater proportion of Serum is separated at the same time, and there is no case in which the proportion appears more large; and we never see a firmer Con-

crelion

cretion take place the whole being drawn almost into a Spherical
ball, and it is in these circumstances where the Concreting power of
the Gluten is greater, and there the Serum appears in larger pro
portion, these judgments therefore of Dr Haller are certainly falla
cious, and he was in a very precarious footing for forming any
such Judgment, for read over the part of his primæ Lineæ, or
in his larger work, entituled Sanguinis Nat: Invol: and you
will see that he did not clearly perceive the distinction between the
parts of the Crassamentum, when he speaks of the Coagulating of
the blood he applies it to the whole of the Cruor, and he did not
apprehend that it was confined to a portion of it, the Gluten, and
many other persons have formed a false Judgment, with regard
to the proportion of the several parts of the blood, and with regard
to the condition of these, as when they judge merely from the Spon
taneous separation, which can be varied by a prodigious num
ber of different circumstances, which I have said are the cir
cumstances of extravasation, and then in which the blood is
placed after being drawn out, you may possibly have taken
notice of these, but let me here point out the variety of these,
and first with regard to the circumstances of extravasation, it
differs by the size of the orifice, you may take the same quan
tity of blood in half the time from a large one, that you ~~take~~
can take it from a small one, and the orifice being given, as it de
pends upon the lancet, it is afterwards varied by different Circum
stances

stances, certainly every body has observed that there is a position of the Arm in which the lips of the wound are kept open, and one in which they are shut, but abstracted from both these Considerations of the first size of the Orifice, or of the posture of the Arm, from the Contraction of the neighbouring parts a portion of the Adipose Membrane is squeezed into the open wound, which we call tho improperly a Thrombus forming in the Orifice, the Contractility of the Skin presses it into the open space of the orifice in the Vein, and the effect of this is such, that from the moment the orifice is opened, till the blood ceases to flow, more or less of this takes place, and every orifice is straitned towards the end of the bleeding, and Haller observes that the edges of the Wound are a substance that attracts a portion of the Coagulable Lymph, which at length increases to such a quantity as to plug up and stop the orifice; another circumstance that affects this is, as the flow of the blood is more or less under the influence of the Arteries communicating with the opened Vein, the ligature may be so tight as to compress not only the Vein, but likewise the Artery, so that the blood may cease flowing till we untie the Ligature, when the blood flows more slowly we are apt to tighten the Ligature, but this may sometimes rather tend to take off the force of the Artery, and all these Circumstances can influence the Circumstances of Extravasation, and it is not easy to command them

all

also, as that they may be the same at different times, but the appearances are also affected by the circumstances in which out, for example, according to the temperature of the air, to which it is exposed, but Mr Hewson will not allow me to say so I shall touch the controversy immediately, and in the mean time I shall take the opinion of most Observators, that it is according to the temperature of the air, and the blood being affected by that, thus if it's under 50° the Concretion happens sooner and if under 40° (I do not go much farther for freezing is quite different from the Spontaneous separation) its influence is more considerable in producing a sudden Coagulation accordingly we find, that according to the Vessel into which the blood is received these appearances differ, it cools faster in a Metal one than in a porcelain one, and it differs farther according to the form, if it is spread out upon a shallow bottom the circumstances of Separation are affected, and are different from what takes place when the blood is collected into a narrow Vessel, where the heat is retained longer, and in like manner the circumstances of Separation are different according to its being taken into a number of small Vessels, or into one, another Circumstance is according to the different parts of the Vessel being exposed so as to Cool slower or faster, with regard to which a difference may arise from the form of the Vessel, and from

from the Contiguous bodies applied to it, the surface of the blood is cooled sooner than the bottom, and it is varied according to its being exposed to a stream of air upon the one hand, and to the heat of a fire upon the other, all which affect the separation and Conviction of the blood, and the conclusion is, that our judgment with regard to the proportion of the different parts, is very precarious if it depends upon the appearances of the Spontaneous seperation that are thus so variable; In short from the difficulties that I urged at first with regard to the finding the parts separable from one another, and from the circumstances just now mentioned, I conclude that there —— mentioned, and I dare not say that I am exact, or that I approach nearly to take the proportion, but here are some general views, I say, but —— whole, when you observe that the whole appears of a red Mass, you are ready to Conclude that the red part bears a considerable proportion, but taking the matter in another view, When we give up the Lewenhockian and Boerhaavian doctrine that merely by diffusion they can become colourless, and according to the present Physiologists consider them as of a permanent nature, from the proportion of Serum, that we can separate we Conclude with regard to the small proportion of the red part, that it appears very small; but further of the Crassamentum; that appears entirely one red Mass, by washing it

gently

with Water, the whole colouring part is washed off, and the half of the Crassamentum remains behind, and when the red Globules are washed off there is a considerable proportion of gluten adhering to them which goes along with them, tho' in what proportion I do not pretend to say, but it is evident that the Gluten is of —— proportion, there can be no doubt of this in every portion that is washed off there is a part of the Gluten carried along with it, and there does remain a greater proportion in a Coagulated State than of the part washed, and if to these we join the quantity in the Serum, we will see that the Gluten is in the whole Mass considerably larger in proportion than the red Globules, but further we say that the watering —— it. In order to shew that the watery part is in larger proportion, I proceed to say that the Serum is commonly in much larger proportion than the Crassamentum, the latter has always a considerable proportion of Serum entangled in it, and when the Serum is evaporated, or acted upon by such a heat as is not to be suspected to have operated any sort of resolution, it appears that 11/12 of the whole Serum can be separated by a heat that is not greater than that of the human body, therefore it is in that proportion, and as there is manifestly always a certain proportion of Serum, and therefore of Serosity entangled in the pores of

of

of the Concreting gluten, as is evident from the like experiment, by subjecting the Gluten to a like degree of heat, when it suffers a diminution to 7/8 of the whole of a pure watery Mass, the same has been done on the Albumen ovi, and a pure Water only obtained, it is therefore easy, I say, to see that the Watery portion, is the largest of all, and —— it, I am doubtful, if my expression here be very proper, whether or not I speak of a considerable quantity with propriety, it is a loose manner of talking, and determines no measure, but if you will compare Solutions, and the different proportions of Saline matter that may be in a Saturated Solution, there is no reason to suppose that it amounts to any thing like a Saturated Solution, such as is found in the Saturated Solutions of the Salts. Some Neutral Salts indeed are dissolved in smaller quantity in Water, but there is no suspicion that the Ammoniacal matter here is of such difficult Solution, therefore how far it justly can be said to be considerable or with a reference to what standard I cannot say. So far with regard to the several proportions of the different parts of the blood, and you will find this to be of considerable application afterwards, I next proceed to an equally difficult problem, I say

260. We —— preserved? The parts are diffused among one another, there is a portion of Gluten in the Serosity, forming the Serum, but that a very considerable proportion of the Gluten is only diffused, we conclude by its always separating and concreting from

from it, when the means of diffusion are no longer applied, with regard to the red Globules, the fact is more evident, that they are not dissolved, are not united by Solution, and only by adhesion; and therefore merely by a state of diffusion. The difficulty is to say, how this heterogeneous Mass consisting of Soluble and equally diffusible parts, is constantly preserved under a due degree of fluidity, and while the Sound and healthy state of Animals remains we may say that a Spontaneous separation, or a Concretion of the whole does never take place. I have attempted to answer the question by saying, that it's done ——— Blood. There are three circumstances, I say that have influence here, Motion, Heat and the parts being kept from the Contact of such Bodies, to which they would adhere more strongly than they do to one another, and it's this last that I shall explain first as being the more difficult circumstance. In Chemistry we find that dissolved Bodies are not readily separated from their Menstruums, but when they are in Contact with a third body, Therefore in the case of Chrystallization, when the Menstruum is more than saturated, we find that it takes place only where the fluid is contiguous to the Air, or to the bottom or sides of the Vessel, and then the portion thus formed serves the same purpose with respect to the rest, but this is particularly remarkable in the Chemical Vegetation, by taking a Vessel containing a Solution of certain Salts, in a dry Air, where they

the fluid will be evaporated, this Vegetation is always formed at the sides of the Vessel, and on the Surface, but this is not exactly the case, it does not adhere to the surface of the liquor, it rises a little above and as the Chrystallization goes along, it rises to that, and forms into Chrystals a degree above it, and thus we have a beautiful group of Chrystals, which is in the form of a Vegetation as it is called tho' not with any strict propriety, and we favour such Chrystallization, by immersing any foreign body in the Concreting liquor, and it not only goes thus far that bodies thus separate from their Menstruums when they are in Contact with a third matter, but in proportion to the Menstruums being cooled, or by the immersing a cold body into it, where no such Saturation has taken place — these matters will adhere in the same manner, we have unhappily instances of this with regard to the stone, which if certain other bodies are immersed in it, or if it is in Contiguity to the Side of a Vessel, it readily parts, with a considerable portion of a matter between Saline and Acid, and thus the most part of the Calculi are found to have had their formation from certain matters that had been by particular accidents introduced, as is known from the history of ordinary Calculi; Now it seems to be the same with respect to the gluten of the blood, if you take it as immediately drawn out it will be some time before the Spontaneous separation takes place, and it is commonly not with the seperation of the Gluten, but the Gluten and Globules adhere to one mass, but if you take

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a Stick, or a number of Rods, according to Ruysch's experiment the Gluten rushes to these, and is drawn out by them, and it is upon the same footing that Haller's observation proceeds, when the sides of the Vessel immediately become in place of the rod or stick here and attract the a portion of the Gluten, gathering to such a quantity as to stop up the orifice at last altogether, now this separation would very frequently take place, was it not that the blood is kept from the Contact —— blood, and accordingly we find, that if there is a part of an Artery that is inflamed, and deprived of its ordinary exsudation, for I should have observed, that the insides of the Vessels, are covered with a matter of the same nature as that of the Contents of the blood itself, and giving no particular adhesion; but when that is taken away, and the Vessel becomes dry, or if the Internal Coat is burst, and thereby the exsudation prevented, thus becomes a place for the Gluten to adhere to, it is thus that we explain the adherence of Gluten in Aneurisms of different kinds, it is thus that we explain the formation of Polypi in the great Vessels, for I say, that this is commonly the distinction between Polypi before death and after, the one are found by a part that may be called their root, adhering to the heart, or sides of the Vessels, which probably had suffered some degree of Inflammation which prevented the Exsudation, and as soon as one part of the Gluten is separated, the rest coming

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m Contact will follow and increase its bulk, you will under-
stand me then when I say that one of the means by which the Sepa-
ration, and consequently Concretion of this heterogeneous Mass is pre-
vented may be this, that the whole Internal surface of the Vessels
is covered with a fluid to which the Gluten has no more tendency
to unite, than it has to the Serosity, and that the Morbid Cases are
founded upon the Circumstances I have explained, but to go back,
This, I say we suppose to be done chiefly by Motion and Heat with
regard to the effect of motion here, tis at present disputed in con-
sequence of some experiments of Mr Hewsons, but except in conse-
quence of a Morbid State, Rest produces a separation and
Concretion. But with regard to the effects of heat the matter is
more disputable, and some experiments of Mr Hewsons are
seemingly in direct opposition to it, These I cannot doubt, and
I have such an opinion of Mr Hewsons accuracy, that I will
not doubt them till I have experiments refuting them, but there
are other experiments which seem to make for the contrary, and
many Considerations perswade me that heat and Cold have a con-
siderable influence upon the separation and Concretion, as these
Experiments of Dr Butts, which I had occasion to know the parti-
culars circumstances, and in these there were two circumstances
of separation took place, there is a greater or less quantity of Vali-
tus that escapes from the fluid blood, and there is a greater or less

separation

separation of Serum from the Crassamentum; now I think that
his Experiments have proved that the quantity of Halitus and
Serum; is correspondent to the different States of heat and Cold, ~
and to no other Circumstance that we can perceive, the influence
of the Air. I am ready to allow, that Mr Hewson, but I hold it for a
certain experiment, that if the blood upon being drawn is immer-
diately exposed to a Cold of 40° or under it in Farenheits Thermome-
ter, and above the freezing point, as between 40 & 36 it does not in
a great number of hours, lose any sensible portion by exhalation,
or show any sensible separation of Serum, while a smaller quantity
of blood in a higher degree of heat above 60, loses a sensible propor-
tion of its weight, and a proportion of Serum is separated, Dr Bull
has given the actual Experiments in both Cases, and these have
been repeated, and a priori one would say, that if we have two
portions of a fluid that can lose apart of their weight by exhala-
tion, that the one will lose more than the other, by being kept in a
warmer Temperature as is the Case with regard to all bodies that
can be Volatile universally, the different degrees of heat does in-
fluence the quantity exhaling in a given time, with regard to
the other the Serum, a priori, we cannot apply the same rea-
soning, but this in some measure I think we may, we find in dif-
ferent Cases, that more or less Serum is separated, and this is ~

not

not owing to there being more or less Serum present, but only to there being a different quantity entangled in the Concreting Mass; and the separation of the Serum requires time, and the more time that is allowed to it, the quantity separated will be the greater, and the lesser time must be owing to the quicker Concretion; but here there is no other cause of this but the degree of Cold that is applied, and if it is constantly found that in one case the Serum is but 1/3 of the quantity that it is in another, the degree of heat must have effect, and in Dr Butts Experiments the proportion was as five to two, and that under a constant repetition of the same circumstances, I cant doubt therefore that the different temperature did influence the separation and Concretion of the several parts, Therefore I say that Cold and Heat certainly have effect, and I leave you to reconcile these as well as you can, with the Contrary Experiments of Mr Hewson, but there is another Spontaneous Separation, the Gluten or Coagulable Lymph separates from the other parts of the Crassamentum, and Mr Hewson allows, that it is in proportion to the slowness of the bloods Concreting, if therefore I shall find that according to the heat or Cold being different the quantity of Gluten separated is in proportion, so that this will apply in some measure as the other, and in fact the same portion of blood concreting entirely, or separating more or less Gluten in Dr Butts experiments was often manifestly connected with the difference of temperature,

Only

but now we may go back to the Circumstances of Extravasation; and of these in which the blood is placed after being drawn out, the stirring of the whole blood prevents the separation of the Gluten, which is to be explained in no other way, but by the Glutens being drawn out, or by its being more quickly Cooled, and we observe that the small orifice, or any thing that lessens that orifice, or if the blood is put in Contact with other Bodies, and runs down the Arm, which is a Circumstance I omitted before, these prevent the separation; and these are all Circumstances, that give occasion to the Colds being more quickly applied to the Concreting Mass —

Lect. 63

Lect: 63. —

The blood of Animals when drawn out of their Vessels so readily separates into different parts, and some of these lose their fluidity altogether, so that it has been a difficult problem, to explain in what manner these several parts were kept very equally blended together, and the Concretion of any one of them was entirely prevented, To this problem we endeavour to solve as well as we can, and we say that it is done chiefly — blood, and I might have said, kept in some measure in Contact with one another, This last circumstance I have explained, With regard to the other two Causes, the Motion and heat, the effect of Motion is not disputed, as upon rest it does more or less separate and Concrete With regard to heat there may be some dispute, Mr Hewson has given some Experiments which seem to say that the degree of Cold has no share in its separation and Concretion, and I have that opinion ~~and accuracy~~ of his Judgment and accuracy, as to be very doubtful in opposing his Conclusion, but there are other Experiments, that will not allow me to think that it has no effect, from the consideration of three circumstances, The first is the quantity of Salitus that is Evaporated from the Mass of blood, The second is the quantity of Serum that is separated from the Crassamentum, and it appears very clearly that according to the different temperature of the Air more or less

Serum

Serum is separated from the Crassamentum; and we can hardly under
stand why less halitus evaporates, but by supposing where little evapo
rates that the blood is soon concreted and has stopped the Exhalation
The third Circumstance is the Spontaneous separation of Gluten
which when it does take place shows a slower Concretion of the blood
and if the several circumstances that have effect here are all Cir
cumstances that show a quicker Concretion, and that in conse
quence of Cold applied, it will lead to the same Conclusion; but
I will say no more upon this subject, I perhaps spend your time
improperly in disputing a matter of fact, and that is only to be further ascer-
tained by experiment, but I say what is necessary to support
some train of reasoning that I found necessary to employ. The dif-
fused —— up, That the red Globules are confined to these portions
of the Vessels in which the force of the heart is considerable is evi
dent. With regard to the Gluten that it's so is not so evident, but
if there is a portion of it diffused only, we know that agitation is
necessary to support all diffusion, and we may suppose that
Nature has provided that it should be only in these Vessels that are
exposed to Causes, that are able to support it, and therefore that that
portion of it which is only diffused is confined to the same Vessels
that the red Globules are, and I think that this supported by this
Consideration, that there only it can be kept diffused, and with
regard

as with regard to the Serum alone there is a certain Degree of Heat —

regard to the application of heat, I say, we suppose keeping to this modest expression "We suppose" tho' we are pretty confident with regard to it, that ——— Serosity, that the Serosity holds a portion of Gluten dissolved in it, I have already endeavoured to prove that this will have its Solvent powers increased by the degree of heat is sufficiently probable, therefore indeed the Gluten must not depend upon diffusion alone but upon the Solvent power of Serosity, and there heat will be allowed to have its share, and it not only increases this power, but with regard to any portion of matter that may be super-saturated, part of it dissolved, and part only diffused, such diffusion will be most easily supported by the increased heat of the Menstruum and I suppose that heat diminishes the Cohesion of the Gluten itself, in this there is some difficulty, in that a certain degree of heat, which instead of diminishing the Cohesion increases it, and gives occasion to its Coagulation, but notwithstanding of this, which is an Operation, whose Theory we do not understand it may be supposed that gluten follows the nature of all other Bodies to a certain length, that the Cohesion of the Gluten is in proportion to the Temperature that it is kept in, all Bodies have their Cohesion loosened, as their degree of heat increases, we have no very direct Experiment in proof of this, but we say it's probable that the heat preserves the Mixture and prevents the Concretion by these means, With regard to the Solvent

powers

power of the Serosity, I say, Experiments —— later, most of the Neu-
tral Salts mixed with recent blood has a considerable effect in preventing
the separation and Concretion of the blood, there are certain ones that are
very powerful in this respect, and tho' there are some of them that by the
addition of Water, do let it go again, there are other of the Neutral
Salts, and perhaps the Ammoniacal, that in due quantity preserve the
blood from separation and Concretion, so that none of the Coagulating
powers act upon it, but its probable that an Ammoniacal Salt
is contained in the Serum, and we may upon that suppose its Sol-
vent power, and there is one experiment of Dr Butts that is very
favourable to this supposition, tho' I think it has not been repeated
often enough; its very probable that its the Serosity especially that
furnishes the secretion of Urine, and the same kind of Saline matter
are probably present in both, now the Gluten diffused in the Urine
can be seemingly dissolved in it, tho' its not so powerful as some of
the Neutral Salts in afterwards preventing its Concretion upon a cer-
tain degree of heat, however there is a great probability in the Solvent
power of the Serosity that I speak of, I have added here another Con-
jecture as I must call it, I say, and —— Agitation, That there is
Air constantly mixed with the blood I formerly saw, and the Air pump
immediately discovers it, and there are few dead bodies in which we do
not find in certain empty portions of the System a quantity of Air
floating

floating separately, and if it is thus separated in the living body, it is the cause of much disorder, There is no sort of doubt that air is inter mixed with our blood, and that that does escape when it is exposed to the open air, but I must give two or three Chemical facts here, and I say there is perhaps no fluid, that has not a quantity of air present in it, and that too in a loose state, we find accordingly that every Solvent yet examined has its Solvent power increased by the presence of this air, and its quantity of any Solvend is in some measure determined by this, I have tried the Experiment and I find that Water put under the Receiver of an Air pump and freed of its air, if applied to the Solution of Salts, will not dissolve the same quantity, and a clear proof of this is that having taken Water in its usual condition and dissolved a quantity of Salts in it to the point of Saturation; if you put this under the air pump, as you exhaust the air in proportion a quantity of Salt does fall down again, the same experiment has been applied to the Acid of Nitre, which in this State will not dissolve the same quantity of Silver that it did when it contained its usual quantity of air, and there is an experiment of the Chemist Kunkle which applies to this. That with regard to any Menstruum that in dissolving a body produces an effervescence and occasions the escape of a quantity of air, if you introduce the Solvend to the Menstruum in some quantity, the effervescence is very considerable, and you may

saturate P

saturate the Menstruum, with an inconsiderable quantity of the
Solvend, and you cannot suspend in Solution the one half that you
will do by adding it by degrees, and occasioning less effervescence as you
have thereby weakned the Solvent, by the escape of the Air, now from
this general analogy, the Solvent power of our Serosity will be greater,
when it contains its usual quantity of Air, therefore a part of the
Concretion that happens to blood drawn out of the Vessels, may be
with some probability imputed to the Air escaping, and we can in
some measure adopt Mr Hewsons opinion that the application
of Air has a considerable effect in the Concretion of the blood, for
we observe that Air ready to escape from fluids in the Air pumps, or
from Elective Attraction escapes more readily when in Contact with
the Atmosphere, and that the Air that would otherwise escape does
not, unless from this very Communication, and even where the
pressure is not concerned, by giving more or less access to the Contact
of the External Air, its escape is more or less favoured. The first illustra-
tion of this arises from the Phaenomena of freezing Water, Water
we observe cannot be frozen unless the fixed Air is separated which
gives occasion to the opacity of Ice, and to the Air bubbles that are
observed in it, and therefore Water with a considerable degree of Cold
will not freeze if it is placed in Vacuo, or if it is shut up in glass
Vessels

Vessels, where the air cannot escape, tho' the Cold is greater than the freezing point, but the moment the glass is broke, or when the Cork is put out of the Vial, instantly the Water freezes, Thus too a quantity of Glaubers Salts, may be dissolved to the point of Saturation that will immediately Crystallize, if you shut it up it will not Concrete, but upon pulling out the Cork, it immediately shoots into a Solid Mass, and if you take two ordinary Wine glasses, and put out a quantity of Water in each, and expose one of them to the Air, that will soon freeze, but if by a light cover of paper, or more effectually if of glass you prevent the free communication of the Air, with the other it will take a much longer time to freeze, and in like manner by covering the surface of Water with Oil it will prevent its freezing for a long time now I think from all these Considerations, it is not improbable that our blood is acted upon by the Contact of the Air, which may have a very great share in its Concretion, but when I allow this it will not I think follow that because Water does not freeze, but in consequence of a certain Communication with the Air, therefore a certain degree of Cold is still not necessary to its freezing, the Cold must be down to 32d before you can make Water freeze, but tho' it is lower, without the Communication of the Air, it will not, and therefore tho' I can admit that the Air has a share, the degree of Cold also concurs in determining it to be more or less quickly for in the circumstances

that

that influence the Habitus, the Serum, or the seperation and Coneretion of the Coagulable Lymph in all of them. I cannot point out any difference in the application of the air, and the chief difference arises from the Temperature, tho' that there may not be Circumstances in which the air may operate, and the Temperature not be necessary I am not certain till we have further experiments with regard to it, and now, I say, It is supposed — place, It would be only repeating a great deal of what I have been saying to day and yesterday, and therefore I would leave you to study these circumstances more particularly.

261. We — considering, which is analogous to no other fluid in Nature that we are yet acquainted with It — distended, We shall by and by upon the subject of Nutrition say that it is probable that the growth of Animal Bodies depends upon the extension of the Arteries, by the blood propelled into them. —

(Enters Dr Gregory's Servant) Sir, you are desired to come and see Dr Gregory, who is taken very ill — —

Lect: 64

Lect. 64

I regrated the interruption of our Lecture yesterday, but that consideration was soon absorbed in the view of a much greater, the loss of a vertuous worthy Man, a valuable Physician, and an able Professor, while the circumstance of the suddenness of his Death, is no small aggravation of the loss, such instances of the precariousness of our Condition, cannot fail to impress us greatly, and whoever considers how much such a Calamity must affect the family concerned, must feel not a little distress, but the affairs of this World must go on; I own I have not been able to bestow my attention upon my affairs in the same manner I cou'd wish.

After considering the different parts of our blood, and in what proportion they may be to one another, and in what manner the equal mixture and fluidity of the whole is preserved.

260. I proposed to add a few words, on the use of this singular Composition, and I think I have offered Considerations which hitherto have not been attended to, tho' they are of great consequence in the Pathology, I say It —— distended, I formerly explained what I meant by the Vessels being distended, They are distended beyond that size they wou'd assume, if no distending power was applied, that our Vessels are in that condition many

Phaenomena

Phaenomena clearly show, The fact being so, it is enough to presume the necessity of it, but the purpose is also evident, it is probable that the growth of Animal bodies depends upon this constant distension of every Animal fibre, but that especially depends upon the distension of the Arterial System, I have formerly pointed out that a certain degree of tension is necessary to the Oscillation of every active fibre, so that it is necessary to the action of every moving fibre of animals, and while various causes concur the principal means is the distension of the Arteries, while we consider it as applied to the Organs of Sense, we can consider this as operating in no other way than as giving a Tension, and the abstraction of the fluids, as giving a state of flaccidity and relaxation, we have here to Consider how it is applied regularly and with constancy, but ——— Extremities, how necessary the various excretions are, you may readily understand, and if in these circumstances all the ——— minutes, if our fluids were of the same fluidity, were of the same permeability that common water is, they could no more be confined in our System than they could as we commonly speak be confined in a sieve, It is ——— effect, it is evident that fluids of a given size will be confined entirely to Vessels, that are only of a Diameter to admit them, That our fluids will be in the same condition is not so evident, but as the means of diffusion are the impulse given to the fluids, the diffusion

will

will in some measure depend upon that, but it will also depend upon the matter that is to be diffused, in what proportion its own adhesion is, as in proportion to the adhesion the means of diffusion will have more or less effect, thus Water and Spirit of Wine as their Cohesion is little, can be easily diffused to a great degree of subtility, but in the case of Water and Oil the later hewing more viscidity, it will not be by the same Agitation so entirely diffused, and 3dly. the state of diffusion will depend upon the proportion of the bulk in which the two liquors are put together, this easy to observe that diffusion must be for the most part limited and the probability is from every experiment that diffused matters are not reduced, as in the case of Solution and mixture, to their minimum, they will still retain a certain bulk, and accordingly we find that diffused matters will not pass thro' our filters, in dissolved matters, wherever the Menstruum can pass, there they can pass, whereas diffused matters can be separated by Strainers and filters, which shows that there is a limit, With regard to the degree of diffusion, what is that limit is impossible to say, but since it has its limits it will be with this effect, that the diffused matter will go no farther, will not escape from Vessels where it would be duly acted upon, therefore such matters will be confined to the red Vessels, Where the action

necessary

necessary to this diffusion take place, now agreeable to this I say
Hence —— Vessels, all our Vessels from the largest to the smallest
are dilatable, and indeed the power being given, to what degree
is not easy to say, probably it is considerable, and so even the red
Globules will pass by the Arteries thro certain Diuretories without
any rupture. Dr Haller indeed is of opinion, that there is not
such a thing as an error loci, but we allow that it is possible
but we say that under the ordinary impetus of the heart and
Arteries, they are strictly confined to certain Vessels —— farther,
I am by no means ascertaining exactly the fact in this respect
and I cannot refuse that in certain of the Serous Arteries, these
immediately going off from the red Arteries, that the force of the
heart and Arteries does extend to keep up the motion of the fluids,
and maintain a diffusion of a certain portion of Gluten going
there, but we cannot understand how the diffused Gluten can be
carried much farther, and there are morbid appearances, in which
the diffused Gluten is carried farther, and evidently preter
naturally as in that case it produces a disease, but what I
have said is enough to show that the red Globules for certain
and the diffused Gluten with great probability is only carried
to certain Vessels, and that this serves —— filled, while there is
such a resistance in the smaller Vessels as is sufficient to prevent
any unusual dilatation from the ordinary Impetus of the blood

we

we have no difficulty in understanding this, that there is some difficulty to the transmission of the blood beyond the Extremities of the red arteries, and that therefore the dilatation of the Vessels,— or what we call the pulse takes place, which is a certain mark of the distension that we speak of, but tho' there are thus confined we admit that the other, and by much the greater portion of our fluids runs off by the several outlets that are open, I say, but—— Circulate, the consequence has been apprehended often and has been much urged by the Pathologists, who supposed in consequence of this a lentor prevailing in the blood, but we think that that lentor is obviated in this way. This —— whole this is obvious, for we do not see a Spontaneous Concretion of the blood, but it does in every case entangle a considerable proportion of Serum, and in many cases much the largest proportion of it, nay from the experiments of Mr Swank it would appear that if you let blood fall immediately upon being drawn into Water it will entangle three times its weight of it, that ℥VI of blood will entangle in its pores ℥XVIII of Water, and we have reason to believe that in the proper Serum, the Serosity is in large proportion. But if you Coagulate it by heat, the whole is uniformly Coagulated together, and if we mix that Serosity with a quantity of Water it will even take in a large proportion of that fluid by the application of heat. It is upon this

this fooling that we suppose that the effects of this rescidity takes place in the living animal, and I could easily show that its an inconcewably small portion of the Serosity that is separated at the Extremities of the Vessels to go by the proper Excretories I- said formerly that to account for the most considerable exerction of Urine that we are acquainted with to the length of 12 Lbs. in a day, there need not be above a gram weight separated from the blood in one transmission, for taking 60 pulses in a minute, this will amount to above 11 Lb weight, and when we come to consider the pathology we will find some beautiful applications of this, and we observe further that such is the nature of the Animal Oeconomy, that wherever there is any danger of uncommon Spissitude taking place, Thirst is excited to supply the necessary dilution, and when the fluidity is increased the Exhalants are laid open to pour out a part of it, and wherever any accident has refused the ordinary supply of meat and particularly of drink, the consequence is that immediately the whole Secretion are suspended, and the fluid parts of the blood preserved, but these I only shortly suggest, however, but this has been too little attended to either in Physiology or Pathology, the manner in which our Vessels are kept distended, and in what manner the due consistence of the blood is preserved.

Another circumstance connected with the consistence of the

Blood

blood is this -

262. The heat of the Human body —— solved, I shall certainly Conclude in this very Conclusion, but at the same time in our enquiry after it we shall meet with facts that are proper to be attended to, and we shall be able to reject erroneous opinions that have prevailed not only in Physiology, but that have affected our Pathology, and practice, and therefore the problem is necessary to be considered, this paragraph contains nothing particular, but this fact which is to be attended to, that the heat of the human body is supported by powers within itself, if there are any variety of bodies placed in one and the same Medium, they may from different causes be in different degrees of heat. but if they are allowed to remain for some time at rest, in this common Medium they all assume precisely one and the same temperature, and if we find a body, which is with a great many others, in the same Medium of an uniform temperature, and an uniform application, show a greater heat, we suppose that there is some particular secret power applied to it, that there is something within that body which has a power of generating heat, and this applies to our body, in this Climate we are exposed to a temperature, that is below the temperature of the human body, and while a piece of wood

of

or Stone takes ~~place~~ the temperature of the air and keeps it exactly. the human Body is generally of a temperature that is much higher, there is a dispute at present with regard to the precise temperature; we put it at 98 d of Farenheits Thermometer, which we say is the ordinary temperature of Men in health, and this under great vicissitudes, is very steady and constant, and what is surprising in the whole number of persons here present, this takes place, and this gives a proof that there is a power in Animal Bodies supporting this heat, some power belonging to the oeconomy itself, it is as you know a Circumstance upon which a great deal depends in the State of the Oeconomy, and probably any variations its capable of are of considerable effect, therefore the nature of this generating power in Animal Bodies deserves to be particularly enquired into, but as the Solutions that have been offered are very numerous, I must consider them only per Capita, as reduced to a few general heads, and I say first that.

263. The —— analogy, some have supposed that it was the fluids in the primæ viæ, which was the Sylvian doctrine who supposed that the pancreatic juice and Bile effervescing with one another, was the source of heat, others have found out Acids in one place, and Alkalies in another, and the common

mony

mon opinion has been that Acescent fluids taken in & mixed with Alcaline fluids already prepared gave occasion to this heat, but I say these are purely hypothetical, and I can see neither an acescency in the bile, nor an Alcalescency that is sufficient to unite with Acids, and give the Animal heat, they are equally hypothetical, with regard to the place the mixture is made, some suppose that it is made in the primæ viæ, others that it is made in consequence of the Chyles entering the Subclavian vein, in its course to the heart, and in its passage thro' the Lungs, but there are no facts to show that a greater heat takes place here, and I say, to prevent much discussion, that the whole is ill supported by any analogy. Heat may be generated by mixture, but it is constantly with this effect, that the heat produced is only during the time of mixture, which is only a short space of time, the heat does not immediately go on or continue, that mixture immediately assumes the temperature of every surrounding body, in short its not permanent unless you are constantly adding new materials, and even here in very few instances is any considerable heat produced, unless considerable Masses are mixed, now if the Chyles being poured into the blood produces heat, it is in so small quantity, and there is not a constant effusion, for in a few hours after ealing the whole of the Chyle does pass into the lacteals and we find those vessels collapsed till the next meal, and they would be entirely so were it not for the Lymph which is constantly passing on

on to them so that there is no proper analogy to support any hypothesis, with regard to mixture that has been offered, I say

264. More —— bodies, we allow all this which has been the foundation of the hypothesis, but notwithstanding we say that the opinion is extremely doubtful from these Considerations, First, The —— ascertained, why I acknowledge at present it is disputed by some, if putrefaction in any Case produces heat, for laying aside for a little the putrefaction of Vegetable Substances, in Animal Substances they refuse it, and I believe it is very true, in all such cases we would expect it to be remarkable in proportion to the size of the mass, Now we have seen the largest Mass of Animal Substances, as the bulk of a large Whale laid out and exposed to the Air, and going on to putrefaction, so as to affect the Neighbourhood with its intolerable fator, and yet from the persons handling such Masses no sensible heat is to be observed, therefore what is the heat generated by Animal Substances is very uncertain, and the degree of it is exceedingly small, however I must say, that there are some facts that I cannot question, which show that there are Animal Substances that under certain circumstances will show a generation of heat, a certain Physiologist Swammard (or some such name) says that a heap of Birds laid together will go on to putrefaction, with a sensible degree of heat, but if they are stripped of their feathers, this will not happen, for I have seen Wool, and particularly Woolen rags, that when laid in a heap and undergo a further putrefaction, and sensible generation of heat accompanying it, but it is not very clear that there is not some circumstances in this, as that these soft and fibrous parts

heave

have air more intimately mixed with them, which gives an opportunity for a more speedy action, but it was the putrefaction of Vegetable substances that especially gave occasion to this supposition, as in a Mass of green hay, if it is too humid, it will conceive a degree of heat, so as even to break out into an actual flame, or at least it will produce a considerable degree of putrefaction in the Mass, but there are persons that even refuse this, as it is probable that every Vegetable substance passes first thro' the previous Stages of the Vinous and Acetous fermentations. Thus in Bordyes experiments, he says, that it is only while the Vegetable is in the Vinous or Acetous fermentations that any heat is generated, and that when the marks of putrefaction appeer the heat ceases; which leeves the matter doubtful, and gives occasion for us to say that the effect —— ascertained. But only to bring the matter neerer to our purpose I say, It —— there I heve said that it is true that there is some approach towards this putrefaction in animal bodies, but there are no experiments that say that in that precise progress towards putrefaction, which takes place in animal bodies, any heat is produced, and we know well from what happens in human bodies, that when a body is kept by the Anatomists till its putrefaction is are very considerable, we never find that it ever afterwards shows the least sensible generation of heat, and if the heat was connected with the putrefaction, it would be in proportion to that, but there is no experiment to show this, and therefore much more strongly will we conclude that the approach to putrefaction which takes place in animal bodies is not capable of producing the heat that appeers there, And Lastly I say whatever —— contrary, we consider the fever, as a putrid disease, or if we take the lesser cases of putrefaction, there of Gangrene and Mortification the heat of the body in these cases may be greater, but it is no greater than the increased

frequency

frequency of the Pulse is in these bodies, nay in the case of particular Morbid
cations instead of the heat appearing increased, we find the contrary that the
heat is taken away, and in the case of fevers, which is carrying on the body
very fast to putrefaction we have an opportunity of observing this, but the
heat never rises to a greater degree, than it does in fevers of the Inflamma
tory kind, nay there are observations, which show that in proportion to
the marks of putrefaction, the heat is diminished, happily for me I have
not been frequently present in such cases, but Boerhaeve alledges that the
heat in these cases is rather diminished as he found by applying the
Thermometer, so that there is little foundation for the supposition of
putrefaction being the cause of animal heat, but I say.

265. The —— blood, Its true it may be supposed that the tendency
to putrefaction, the approach I speak of is very often in proportion to
the greater or less motion in the blood that might be supposed, but I
would argue that in fact the putrefaction is not found to be exactly
corresponding while every circumstance in the variety of motion ——
seems to shew a connection with the production of heat for ——
established. This arises from an observation that has been made on
the Incubation of Eggs, tis now known that the effect of Incubation
is to operate by heat, for we now know that an Artificial heat will pro:
duce the same effects, as the heat of the Mother, and the exciting of heat in
the Chick is especially necessary to life, accordingly the Mother is more
constant in her sitting upon her eggs as the Animal is younger, or at
the beginning than she is afterwards, when the Eggs acquire a degree
of heat which they retain longer than a body of the same bulk exposed
to the Atmosphere does, so that there is evidently a generating power
going on to the end of Incubation, when the Mother may be absent
much longer than before. —

Lect: 65

Lect. 65.

We have begun to Consider the very curious, and I wou'd say im-
portant problem, concerning the production of Animal heat, We
do not expect to solve the problem; but it is necessary to Consider
upon what footing it has been attempted, and to what length we
may proceed. I have said that the several opinions may be reduced
to Mixture, a certain degree of putrefaction, and to a third opinion
which supposes it to depend upon the motion of the blood. I have
given my reasons for doubting of the two first, and a principal
reason is that while we cannot perceive the reality of the mixture
or degree of putrefaction connected with this mixture, it is manifest that
it does depend upon another cause, i.e. the motion of the blood, I
was giving the proofs of its depending in general upon the motion
of the blood, for —— established I must explain this matter a
little more clearly. A Hen must sit upon her eggs, in order to bring
out Chickens for 21 days, during the first week she is constantly sitting
upon her Eggs, she hardly will quite them so long as is necessary, as
our Poet says, to pick a Scanty meal, and where there is a Mono-
gamy the Male brings her food, but during the second Week she can
be longer absent, and during the third still much longer, and after
the Chick comes out of the egg still the heat of the Mother is useful
in rearing it, for tho' the Animal has now acquired a considerable

power of

power of generating heat in itself, still if the External heat were withdrawn this power would be overpowered, but as that is increased its capable of resisting the External Cold. This is what I meaun by saying, That the power ——— established, as we trace the appearance of the Embryo or Chick, we observe that the action of the heart soon takes place, but that the Circulation extends only a small way, we judge of it by the portion of the body filled, which is the Aorta only, and its only by degrees that it extends farther and farther, and with regard to the Circulation of the blood thro the Lungs it does not take place till the animal is brought into the air, therefore its not without reason I say that the power of generating heat is perfect, and the Animal does not any longer need the Mother, when the motion of the blood is compleatly established, but that is not so much a proof of our proposition, as its connected with it, and I thought it a matter of Curiosity, and I say, when the ——— blood, its certain that by bodily exercise we increase the frequency of the pulse, we increase the velocity of the blood's motion, and at the same time we considerably increase the Temperature or heat of the body, We observe that in several instances the heat of Animals is a little more or less in proportion to the Exercise the Animal is employed in, and there are several other Causes that increase the velocity of the blood ~

and I

and there is no Case where that takes place, but we find in some proportion the heat always increased, and in dying Animals, the heat grows less, and the motion of the blood grows less, of these we have some experiments, which render it sufficiently evident but particularly it appears, when we consider the motion of the blood, as it is gradually declining at length coming to cease altogether at death, it declines first in these parts, that are most distant from the heart, and these parts in proportion become Cold, and we judge of the approach of death by this feeling of the Extremities, and when a part is diseased so as to affect the motion of the blood in that part, we find that the heat is more or less there in proportion, and if but a very temporary Deliquium happens, it is attended with an evident diminution of heat, which is only recovered in proportion to the bloods motion, and we have by way of experiment tied the large Arteries of certain Animals, and where we are obliged to tie large Arteries of the human body, in both cases by interrupting the motion of the blood the part becomes Cold, as when for the operation of an Aneurism the largest portion of the brachial artery is tied, the Arm becomes Cold, we know however that in consequence of anastomoses that go off above our ligature, the Circulation can be restored, and the heat of the part is also restored, and the

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One in proportion to the other, and in short there is little doubt of the following fact applied to this subject, In —— acquired, bodies acquiring heat either by Communication, or by some of the ways of generation, as soon as either of these Causes cease the body returns to the temperature of the surrounding Air, but in different bodies it is in different times according to their bulk, so with regard to the human body from a very gross view, we can conclude that the most part of Animal Bodies lose their heat as soon as other bodies heated to the same degree of 98 or 100 would lose it in a given temperature of the Air — De Haen has made many observations upon this Subject of Animal heat, and there are several of them that are difficultly reconciled to any one Theory, and he had an instance where the heat of the body increased after death, or indeed remained much longer warm than usual, but that is a single Observation, and does not disturb the general Conclusion, that the human body loses it as I have said, and that the heat before was truely connected with the motion of the blood, there may be other circumstances, which may take place in one body more than in another, and so may disturb the general law, but will not prevent our saying that the motion of the blood has a principal share in this matter, In short

Obs

266, Thus —— proved. There have been some persons attached to other Hypotheses, who have thought of reconciling this to putrefaction being the cause, and therefore they say that tho' the heat is in some measure owing to the motion of the blood, that the putrefaction is in some measure in proportion to this, but I would refute the fact, what is the effect of motion will cease when that motion ceases, but what is the effect of putrefaction will not immediately cease, when the putrefaction is increased, and it's the nature of putrefaction to go on increasing, therefore if by exercise we increase the heat of the body, the putrefaction would run on much faster than usual and show itself in a higher degree, but tho a Man every day has such exercise as for the time increases the heat of the body, notwithstanding there is no observation to lead us to suspect that in such the putrefaction goes on faster, at least in our labouring people, and in a running footman the putrefaction is not hurried on in proportion to that frequent increase of heat, therefore I say, it depends upon the motion because it ceases with that motion, and the favourers of putrefaction must still allow that the motion is a necessary circumstance I say it's very well proved, and —— heat, this is the difficult part of our problem to explain in any Animal body how the increased Motion of the blood increases the heat, and

267.

267. On ——— move, and having rejected putrefaction as a cause of heat, and also mixture, I know no other means, but such as are Mechanical, by the motion of the particles of the blood, and these can only act three ways, by Attrition, percussion and Collision, the two last of these we have no view of applying here, and therefore it must be by attrition or friction, and if we make use of any Analogy, we find that two bodies of a certain consistence and Texture, of a certain degree of firmness and Elasticity, if rubbed with a certain degree of Velocity, may occasion any degree of heat, even to a red heat, or to that of Inflammation, as we have occasion to observe in the case of the Wheels of Coaches &c. it has been therefore the universal resource to suppose that motion generates heat by some attrition, and there have been two suppositions offered with regard to this, one of them is that it is owing to the motion of the particles upon one another, Or, secondly, of these upon the sides of their Containing Vessels, But I say we cannot ——— Supposition, and 1st I say no experiment shews, that by the motion of the parts of a fluid upon one another, where the Contact of Surface is inconsiderable, there is no instance I say of such motion of fluids producing heat, there are several instances of fluids heating by Motion

tion, but this universally, where such motion produces a certain fermentation, as in the Churning of Milk, now here is a fermentation, a resolution goes on, and new productions are formed, and therefore it remains a question whether that heat is owing to that change of mixture, or to the Motion, and in no other part of nature is there any appearance of heat being generated without such an appearance, except in Quicksilver, it is certain that it by being agitated does shew a generation of heat to a certain degree, and therefore there is an instance of the agitation of a fluid producing heat, but tho' this be true the difference is so great between the density and fluidity of the particles of Mercury, and these of the blood, that it would be a very slender analogy, but I have not need to rest my objection upon that ground, for I say that there is no instance of heat being produced in this way, but where a portion of the Mercury is at the same time converted into a powder, probably into a dry and angular body, and you can hardly subject Mercury to any Motion, if it is pure, but more or less of this powder will be produced, thus if you shut it up in a Vial and let it stand in any building in this City, in a short time the agitation communicated to our houses from the Wind and Carriages going along the Streets will convert a portion,

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tion of it into a black powder, and in making Mercurial ∞
Phosphorus, by including a quantity of Mercury in a hollow
ball of glass, with a certain quantity of air in a certain
condition, the agitation will produce light, and very quickly
it produces this black powder, and when so it is more fit
for the generation of heat, and becomes less fit for the
generation of light, now as that is the case that there is
always here the production of a dry body, I am at liberty
to say that the generation of heat is owing to the attri
tion of a dry body, and with regard to Water, which some
have alledged by a certain degree of Velocity can be made
to generate heat, we say, it is not true, there are instances
of Water moving in certain Cataracts in America &c ~
with a Velocity that is vastly greater than that of our
blood, and yet the water at the bottom is found to continue
in its former degree of Coldness, but it has been the com-
mon opinion that some fluids are more fit to be acted ~
upon in this way than others, but there is no instance of
any one fluid having been so affected, and therefore to sup-
pose it from Theory is not admissible, There is a certain
portion of matter which is inflammable, and we are of
opinion that that is either a peculiar Element in bodies

or /

or a Mixture of one certain kind, and it has been common to supp-
pose that that matter is more fit to conceive heat than other
bodies, and we are ready to think of the Phlogiston as the
matter of Inflammability and of heat. I must not stay to
show the falseness of this supposition, it is enough to say that
it appears in no experiment, if we take for example a quan-
tity of Water and Oil, and Spirit of Wine, and try them by a
communicated heat, we will find that one of them will heat
sooner than another, but one of them will not heat to the smallest
degree more than another, and in many cases the Inflam-
mable matter will heat slower, and there is in the Commu
nication, and in the retention of heat no evidence of Phlo:
gistic inflammable Bodies having a greater tendency this
way than others, and that of heat must be a matter that
is in common to all Bodies in nature, and is communi
cated to every one, and therefore cannot be a matter pecu
liar to any one body, the subject of heat, I say, is a matter
in common to all nature, and does not form the Constitu-
ent parts of any one Mixt, and I say that the particles of
the blood are not more capable of generating heat, than
pure Water is. with regard to the other supposition it is as ill
supported by analogy, in the friction that arises from the
Cataracts

Cataracts I mentioned, there is no evidence of heat being gene-
rated by the attrition of a fluid upon a Solid I know of none;
there is the case of the Mercury I syphoned off, but this can be ex
plained by a dry powder rubbing upon the Solid glass, There
has been another supposition that a gun ball moving
thro' the air does acquire heat, but the fact is not proved,
the ball had acquired a heat, and probably it acquires a heat
from the attrition in passing out of the Cannon, and there
is no experiment that shows that it has more heat after
some miles than when it was flying out of the Cannon,
and till the experiment is made, till we contrive to stop
the bullet soon after it has gone out of the mouth of
the Cannon, and examine its degree of heat, and again
after a greater progress if it is found to have a greater de-
gree of heat, it will apply, but till that is done we cannot
admit of it, and supposing that it should come out that by
moving with a great velocity thro' the air, it should acquire
a very great heat it will be difficult to apply it to a fluid
moving with a prodigious less Velocity, there will be a dif-
ference in moving a Solid body in a very elastic fluid, and
in the motion of our fluids that are without any sensible

Elasticity

Elasticity in its parts, or where there is no such elasticity in the Vessels as we should suppose to operate here, we know upon the contrary that wherever the Attrition of two Solid bodies would generate heat, we can prevent it by the interposition of fluids, and such is the nature of fluids consisting of Spherical particles that operate like fruction wheels, and being interposed prevent the generation of heat, further in all cases where heat is generated one of the bodies must be in some measure fixed, so as that the Undulation may be returned to the body that is fixed as in the case of Iron and file, where the heat returns to the Iron, but fluids easily give way, and we have no such Elasticity in the Vessels as is sufficient to return the motion into the mass, therefore I say it is difficult to support this supposition from analogy, and I add, The attempt ——— facts, you probably all know that a very ingenious Gentleman Dr George Martin has taken a great deal of pains upon this subject, to shew that the Attrition of the Blood upon the sides of the Vessels is very nearly the same in different parts of the System, and as the generating power would appear to be so, it accounts for the equal destribution

of

of heat. Its remarkable the uniformity of heat in animal bodies, in different parts of the body, if you apply a Thermometer to the surface you will not find the same heat expressed, as if its immersed in the bowels, but by guarding against the Cold of the external Air, even the surface when covered shows nearly the same heat as we observe by immersing it into the bowels, and and hitherto no experiment has shown that there is any difference; and the Abdominal region and the Thorax, what ever may be said with regard to the power of the heart, the Centre of motion, or of the function of the lungs. Now there is some difficulty in explaining this, and Dr Martins solution would be perfectly satisfying, but it proceeds upon doubtful principles, for not to go back to our former consideration of the Attrition of a fluid upon a Solid, its not being fit to generate heat, he says that the heat will be in proportion to the Velocity and surface, by which the bodies are applied to one another, I call this a very doubtful principle, take two rulers, as my hands, apply them by their broad sides to one another, and give a certain velocity, you will by the attrition produce heat, but it requires a much greater velocity than when they are applied by their two edges, which would in Wood produce actual inflammation and the Velocity being given

nothing

nothing depends upon the Surface applied, the heat will be produced providing the Velocity is sufficient, and even such a Velocity as will not operate upon the broad, will operate upon the smaller surface more remarkably, and the Tremor that is to be excited and returned into the body is perhaps better done in the smaller application, than in the larger, and therefore the general principle that the Velocity will be compensated by the Surface is not true the velocity of 120 feet in a minute is but a small Velocity in soft bodies, this however is constantly diminishing as the blood recedes from the heart, and one principal cause of this, is the Increased surface of the Arteries, from the branches being larger than the trunks, and in this way Dr Martin has endeavoured to find out that the Ramification is always in one and the same proportion, so as to give an increase of Surface in proportion to the diminution of Velocity, and this is supported by measure from the Injected Vessels of Dr Keils, where there is indeed some probability of the measure being near to the truth, tho' from the inequality of the Vessels at their Ramifications &c this proportion as I said before is not easily ascertained, but he has also taken these measures from Eustachius's plates, where the painter certainly meant no more than to give a view of the destribution, and to preserve in some measure the proportion,

and

and how should he, when they did not know to inject by Solid — matters, but moreover he has taken measures from plates that were merely intended for Diagrams, and which had no meaning or intention of giving the real size of the Vessels, as these of Dr Nicols, but allowing that an increase of Surface will compensate for a diminution of Velocity, and that the diminution is much as he supposes, but not only in every Ramification a certain proportion is necessary, but one continued Series of diminishing Vessels should take place in the System, thus the Aorta is divided into the Iliacs, into two branches in some measure as it should be according to this plan, but if there is a Vessel going off from the Aorta itself, that is precisely of the same size, with a Vessel that is found in the foot, the Velocity in these two Vessels is considerably different, and consequently the heat should be different also, but there is no proof of this taking place in fact, and in short if you enter into the Consideration you will find that the whole is founded on doubtful principles and mistaken facts. But in consequence of our renouncing this Solution it is necessary to say how we can otherwise account for the equality of the heat here, and I say

268, The ——— only. I have taken a supposition that the generating power may be confined to certain parts only, but allowing

allowing that to be the Case, as that it is chiefly in the Lungs, if it were so the heat would be still pretty equal, tho' there were no generation of it elsewhere, because it would be retained in the larger Vessels passing from it, and as these are almost every where interposed, the bulk of the blood would not sensibly lose its heat, for by this communication of the blood from any one part to every other, the heat thus generated might be preserved, it is not easy to say how soon the blood passes back again into the Lungs, but from a gross estimate, by taking the size of the heart, at the lowest we may suppose that at each Systole two ounces of blood pass out of it, and supposing that there are only 60 such in a minute, or at a Medium about 4000 in an hour, the whole Mass of blood must have finished its Circulation in a very short space of time, so that the passage of the blood from any one part to another must be in so short a time that it cannot possibly have lost the heat it had acquired in any particular part of the body so soon

Lect: 66

Lect: 66.—

On this Subject of Animal heat, Gentlemen, I would say that its pretty certain, to me very evident that the generation of heat is connected with the motion of the blood, but how this motion acts in producing this heat, is a matter of more difficulty. It was Analogy that was to be supposed to lead us to that, and the most obvious supposition was that it was by Mechanical means by attrition, and particularly by the attrition of the Globules, upon the sides of the containing Vessels, and this has been commonly received, but it cannot be received without some doubt, as there is no Analogy in Nature of any such thing generating heat in any instance. To support this hypothesis or Theory there has been a particular attempt made by a very ingenious Man Dr George Martin, to show that the equality of the heat is best accounted for upon this very supposition, and if his Theory was quite satisfying it would go back and prove the fundamental proposition, that it depends upon attrition, but I have moved several objections to his Theory, I say that his principal proposition that the increased Surface will compensate for the diminution of the Velocity is not true, but not to insist upon this, I say, that this increase of Surface for the

loss

loss of Velocity, is not uniform and that he proves it from figures that are not admissible, But granting all this that constantly the branches taken together keeps a certain proportion to the trunk, it will not apply to the purpose, I was pointing out in what manner, but perhaps not very clearly, take it in this simple light, take one of the Intercostal Arteries, and an Artery precisely of the same size any where towards the Extremities, in these two arteries, the Surface by which the blood is applied to the sides of the Vessels is certainly the same, but the Velocity is considerably different, for in the Intercostal the Velocity is considerably greater than in any such Artery of the same size in the Extremities, the heat therefore in the Intercostal should be upon that account remarkably greater, but that is not supported in fact and indeed its easy to show that if his Theory were to apply a very different destribution of the blood Vessels must take place. But I say tho the equality of the heat requires that the generating power be generally diffused over the whole, it does not require that it should be equal in every part, but supposing it greatest in the largest Vessels, these are carried to some distance and are destributed not far from most parts of the body, and bodies when heated require a certain time to lose that by Communication, what time it would require in any one portion of the body is not to be measured, but the speedy Communication will at least probably take

take place, before much of the heat can be lost by such Commu-
nication, the blood in any portion of the Arterial System soon
passes into the Veins, while other blood of the due temperature
is pouring into it, I have observed this, because I think it applies
to some questions in Pathology, but I am not to make this use
of it, to take up the hypothesis of any particular focus in which
the heat is generated e. g. the hypothesis of Dr Robert Douglas
who supposes the heat especially generated in the Capillary Vessels
that are only fit to transmit a single red Globule at a time -
from the Artery, embracing more closely that Globule, and
if the attrition upon a great extent of Surface had much
effect, there would be some ingenuity in the supposition, but
it does not give us any relief with regard to the general Theory,
it is liable to all the objections, that lye against attrition in
general. Another supposition, and the only one that requires
to be taken notice of, is that which supposes, that the heat is
generated in the Lungs, it is very true that the blood passes,
thro' the small Vessels of the Lungs with greater Velocity than
in any other part of the body, but let us observe that with all
this while the same quantity of blood passes thro' the Lungs -
that does thro' the whole of the rest of the body, and therefore

they

the Velocity of the whole must be as much greater as the capacity of the whole blood Vessels of the Lungs, is less than the capacity of the Aorta, but I say in the Aorta, and pulmonary Artery, the Velocity is exactly the same, for it is a matter of demonstration, that the quantity of blood thrown out, from each Ventricle is nearly the same, otherwise there would soon be a considerable accumulation of blood in the System of the Aorta, to the destruction of the System,† if therefore the quantity from the Ventricles is the same, and the Systole of each is equally frequent it is evident that the Calculation with regard to the Velocity of the blood in the Aorta will apply to the pulmonary Artery, and here too the branches are greater than their Trunks, and therefore I would say, that even the Velocity in the Lungs, is not very well suited to produce or generate heat, I say therefore, that it gives us no particular relief with regard to the general Theory, and it is not supported by any particular evidence, one would readily believe that, if the heat was only generated in the Lungs, and was lost by the motion of the blood in the Aorta, we should find a sensible difference between the heat of one part and of another, notwithstanding of what we said with regard to the Communication of heat, by applying Thermometers of great Sensibility, and with

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a Minute Scale; but the heat of the blood as appearing from a Thermometer applied to the left Ventricle of the heart, is not sensibly greater, than when it is applied to the most distant parts of the System, nay we must suppose that the blood returning by the Vena Cava every where must have lost a considerable portion of the heat it had acquired, and that we should observe a sensible difference in the heat of the Right and Left Ventricle, but experiments that have been made with this view have pointed out no such difference, the only argument is that breathing animals are universally the warmer animals, These Animals that breath in consequence of the alternate respiration, the Mamalia and Aves, they are nearly of the same heat, and the Species belonging to this Class are of this same heat, which is greatly more, than it is in the Amphibia and fishes, the Serpentia and Repentia are breathing animals, but they can interrupt their breathing for a considerable length of time, however the difference of heat is at the same time so great as to give a suspicion that it was not entirely connected with breathing, but the air is for the most part in this Climate a good deal Colder than the Temperature of these Warm Animals, and people have alledged

that

that tis for this purpose, to temper the extraordinary heat gene-
rated in the Lungs that Cool Air is necessary, but I have pointed
out other uses, that it serves, for example to carry off certain matter
that are constantly exhaling from the Lungs, and that would
be pernicious, if retained, to the System, and with regard to the
cooling effects of the air, they are not near so much as has been
imagined, the Air entering is certainly Cooler, but you will ob-
serve two things, that take place here, tis but a small portion
of the air that is thus alternately renewed and expelled the Lungs
holding always a much greater quantity of Air; and the Air
is a body that is heated the most quickly of any known in
nature, and it will take the heat of a body that is applied to
it, without any great effect upon the body, so that it may
be heated in the Lungs, without diminishing much of the Tem-
perature of the body, and that the breathing animals are warmer
because they — Warmer, the heat giving occasion to that
change that produces the Mephitic air, therefore if a certain
Warmth is necessary in the Oeconomy of certain animals
and this heat requires an exhalation of such matter, the use
of this Cool air will be evident, and there is nothing peculiar
in the Lungs, whereby they are fitted for generating heat there
more than there is in other places, so far I have been only
considering

Considering the operation of the motion of the blood for producing heat, but with regard to its absolute dependence upon the motion of the blood, or how the matter is modified, I say

269. With ——— difficulties for example It ——— exactly the same, if we were to examine every person here, we should not find the heat of our bodies very sensibly different, tis a question just now, what is the exact and precise temperature, — and tis agreed that it was formerly put too low at 96° and that it may be put at 98, and from some of De Haens experiments we might suppose that it goes nearer to a hundred, but there is a difference in our age, size of body, temperament, and frequency of our pulse, and therefore one should suppose a considerable difference in the velocity and motion of the blood, at least it will be difficult to show how these are to be so reconciled as to make no difference in the heat, With regard to the Age, we learn from De Haen that in many different persons taken at different periods of life the difference of their heats is hardly sensible, upon comparing a few different persons we may find it a degree more or less, but taking perhaps a hundred of old and young persons the medium of the whole is very exactly the same, and we may take young persons when their pulse is about 120, and old

many

Men whose pulse at a Medium we may put at 60, now here is a double frequency of pulse, and the other Circumstances being given, the Velocity of the blood will be as the Systole of the heart, here then is a double velocity, and the heat precisely the same, Now there has not been the least conjecture offered to remove this, but that of Dr Martins, that the surface by which the blood is applied and the attrition are the same, but it is not easy to shew that the enlargement of Surface, with the diminution of Velocity will have that effect. And here is a case of more difficulty the same person has the frequency of their pulse at 60, and the heat of their blood at 98, and they are attacked with a fever, and that raises their pulse to 120, and the heat of their body to 108. which is among the highest now here is the same person where the surface is always the same and the heat is increased 1/10, but if it depended upon Velocity and Surface it would be increased to a greater degree, as the Velocity is now double, So that Physiologists now suppose that something further is requisite, and I say that it will be difficult to shew ——— the same, or, upon the other hand to shew ——— heat. There is an opinion, that the heat of fishes is not of any determined degree, but depends upon the surrounding Medium, but with regard to the Amphibia, which we have an opportunity of examining more easily, their heat is most steady, not varying from the Air they live in, or the Water they swim in, but taking the heat as-

Cowp

low as you please, it only increases the difficulty to shew how the Velo:
city of, or Surface to which the blood is applied is any way correspon:
dent to the pulsation of their heart, and the heat of a frog for ex:
ample should be nearer to warm blooded Animals, than it truely
is, And with regard to fishes we may say the same, and there is a
particular Consideration here that Haller adds, the prodigious Ve:
locity with which the bodies of some fishes move, and that with
a constancy and steedyness which is astonishing, as they have not
the same intervals of sleep and watching which we have, thus
we are told of a Shark, that was known from a certain wound
that followed a Ships under a great degree of velocity for more
than 10 days together, and there is no doubt to be entertained that
the motion of the body does increase its heat, and Animals capable
of such prodigious exercise should have their heat raised to a very
great degree, but there is no experiment to shew that they have
any considerable increase of heat, but taking the circumstance
of Warm Animals of different sizes, now these should be constantly
of the same heat, and that in other Animals where the motion is
not so much diminished, as the heat is, is there not reason for
seeking for some other Cause than the motion of the blood, and
there is a fact that I have hitherto reserved to this place it is not
many years ago since it was observed, in this Climate we are

exposed

exposed to a surrounding Atmosphere that is greatly colder than the temperature of the human body, but at the same time there are many persons that are surrounded by an Atmosphere that is hotter than their ordinary temperature, where the degree of heat is higher than 108d. which is the highest we have experienced in fevers, and the heat of the human body does not increase in proportion, the generating power may be supposed to remain the same, and when less heat is lost by Communication with the Atmosphere or rather none at all is lost in this way, we might suppose that the heat of the human body would be increased, but when a Thermometer is hung in the air and expresses such a high degree of heat, and then is put into the mouth of a Man, it falls considerably, and the heat of the human body continues to be a good deal less, and that occasions a very great difficulty in any theory that has been offered, and it leads to this, that there is in the Vital principle of Animal Bodies some circumstance perhaps inherent in their Nervous System, no matter of what kind it is, we say that this is different in different Animals, and under a great similarity of circumstances as in the Amphibia, this very Vital principle is equally vigorous, and remarkably more tenacious, as it still appears remaining inherent in their Nerves, after the Ordinary means of its support is destroyed, whereas in the warm blooded Animals the proofs of the presence of a Vital power

sooner

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sooner disappear, to find these parts irritable in them for a few hours is a very extraordinary accident, whereas in the Tortoise, Lizard &c it will continue for days, it is well known that they retain their irritability in parts that are detached from the rest of the System, and I could allege that in Animals of the same Class, Genus and Species, where the uniformity is more exact, under very considerable inequalities, in Age size and Temperament, the heat is remarkably the same, there is a difference in the warm blooded Animals, whether Quadrupedes or Birds, but this difference runs thro the whole Genera and Species, and there is a surprising uniformity in that respect, only the Vital principle is different, and it may be supposed to be connected with that, and that there is therefore somewhat in each Species, that is pretty exactly the same, and which only can account for the heat, it would be too nice and subtile a Theory to apply this, to speak of the nature of the Nervous power, and Vital principle, but we may get more light with regard to that, when we are more united in our opinions, it is the peculiarity of this power, that we find it to be supported by heat, and it is certainly connected with this matter of heat and probably we shall find such a solution of the matter as I here hint at. May — circumstances, The velocity of the blood may be the same in a frog

or

or in a Mouse, tho' they are not very different, yet in consequence of the different Vital principle, the heat produced may be different and on the contrary from a likeness in the circumstances of the Vital principle the heat may be the same, tho' the motion may be different I have said enough in regard to this Subject, but it's a curious one, and it would be of the utmost consequence to arrive at something determined with regard to it, I go on to say farther what is peculiar to the Animal fluids in other respects

270. In ——— ground, so far as I can perceive there is ground to suspect that there is a diversity of matter, but what it is, has rested upon Conjecture only, It ——— females, you must be acquainted, if you have touched the Subject at all, that this has been a frequent supposition, but I say there ——— for, if you take all the several accounts that we have had of Chyle having been found upon the Surface of extravasated blood, you will see that they are loose and undetermined, and that they often mistake gluten floating separately for Chyle, as being somewhat of a whitish matter, and the Arguments ——— difficulties, you see the inaccuracy and fallacy of these observations from hence that if it was a fact that the Chyle for sometime did float separately on the blood in the manner alledged, it would occur every day, but the experiment has been made particularly with a view to the observation of the Lacteals, Animals have been

been opened, when filled with food, and when a considerable portion of it had passed into the Mass of blood, and yet not a particle of any such thing is observed in the blood, it must therefore be diffused and covered with a red fluid as it passes on with the blood from the Subclavian, otherwise it would appear there very frequently, and its appearing upon a few occasions would not conclude with regard to what was the ordinary manage ment of the oeconomy, and the appearance can be accounted for otherwise; here I must refer to the ingenious Mr Hewson who has given some instances of white Serum, but he at the same time alledges, that it is a Serum that has acquired this whitish colour, and he imputes it to reabsorbed Oil, that is not yet perfectly blended and mixed with the other parts of the blood, and in consequence of the Inflammation of particular Viscera, as of the Lungs, we find their surface covered with a thick gelatinous fluid, and a preternatural quantity of Serum very often of a considerable milky appearance, it is however nothing less than Chyle or Milk, it is nothing but a quantity of gluten that has exuded, and is more or less diffused, and is not at the same time readily separable from the Serum that is poured out, and we very often find it with portions of it concreting and of a fibrous appearance, this appearance therefore may be produced

by

by reabsorbed Oil, but it may likewise be occasioned by a portion of Gluten that is in a diffused State, and that is ready to Concrete by it self, but it is alledged that the milk resembling the Chyle, is found to be separated most copiously from the blood in consequence of recent aliment taken in, and therefore that it passes to the mam. ma Muliebris almost unchanged, now if Milk was the same — with Chyle, the Argument would be strong, but there is no proof of it, but you will consider further that it is embarrassed with several difficulties, it is said that Milk is only secreted from the blood in 12 hours, now tho' it might be alledged that the Chyle escapes an accumulation in passing once thro the lungs, it cannot be supposed to do so during twelve times allowing that it all passes once thro' the Lungs in the space of an hour. —

Lect 67.

Lect. 67.

We are now enquiring Gentlemen, after what matters may be contained in the Mass of blood, besides these of the red Globules Gluten and Serosity, and I say, That the Chyle remains circulating with the common Mass of blood, in the same form and with the same qualities, that it had at its entrance is improbable, that the reports of Chyles appearing, upon the extravasated blood, has proceeded from inaccuracy of observation. There are instances of a White Serum appearing, but that is accounted for another way, and two such Solutions I have mentioned, it may be either a quantity of Oil recently reabsorbed, or a quantity of Gluten that is diffused and in a condition that perhaps we do not understand, but in which it is not disposed to separate and Concrete as usual, but passing from this, the other most probable Argument, for the Chyles subsisting in the Mass of blood, is the Secretion of Milk, it is alledged that the Chyle, and the Milk resemble one another very exactly, and it is pretty probable that milk is only secreted copiously, after the taking in of fresh aliment, and from the resemblance of the two fluids they have advanced the Argument, that they are the same but with regard to the resemblance, I would observe that they

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are both liquors of a Consistence, and of a Colour that are pretty much the same, but how far they are otherwise alike has not been ascertained by any proper experiments, and while that is the case, I would say farther that the fact is improbable, for tho' we might suppose that the Chyle in passing once through the Lungs is not perfectly assimilated, that might do, if we cou'd find the Chyle immediately converged to the Mammæ but it is probable that the Secretion of Milk is upon the footing of other Secretions that there is only an inconsiderable quantity separated from the Mass of blood at one time, and that it will require many repeated Circulations before the whole of such a matter can be drawn out, and therefore I say that tho' we might suppose that in one passage thro' the Lungs the Chyle might retain its form, yet that it should do so during the whole time that it circulates before it enters the Mammæ is impossible that in so many repeated Circulations for 12 hours it should retain its form as before, but the great difficulty is behind, the Milk shews a matter that I cannot believe to be in the Chyle, an evolved Sugar, now take what System you please with regard to digestion, I have alledged that a Saccharine Substance is a nutritious part of our fluids, and of the Mass of blood of the Gluten, but that Sugar undergoes

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a fermentation, that goes the length of the Acetous, and itis in an Acetous state that it forms with our other fluids the Chyle, and there is no foundation for imagining, that this is again changed into a Sugar, when this appears only in one portion of our fluids, therefore the probability is that milk is produced by Secretion, and when we again Consider the wondrous powers of Secretion in producing new fluids out of others we will rather impute the Milk to the power of Secretion, than to this, that the matters have remained in the Mass of blood, now I think all these Considerations will allow me to Conclude that this opinion is embarrassed with many difficulties. I go on to enquire what other Substances we may find in the Mass of blood, and for the chief foundation of a diversity I have said in the next paragraph.—

271. Itis——Mass, supposing that there is one portion of the common Mass that may be called properly the Animal fluid, I observe with regard to it, for example the Gluten, that it has been produced in a great measure in the way of fermentation, and that itis in a constant progress of fermentation, towards that stage of it we call putrefaction, Itis an universal proposition with regard to all fermentative fluids, that, as I allledge of the Animal fluids they are in a constant progress, and are not Stationary, I will show with what difficulty, uncommon Care and pains that Fermentation is stopped from going on very rapidly, in the case of our

our Wines &c and after all we find Wine proceeding on to Vinegar, and the Vinegar advancing to putrefaction, and that once begun, proceeding fast to its ultimate Stage; itis with good reason therefore that I suppose that our Mass of blood is in such a progress, and that itis hardly for a moment ——— Mass, ——— putrefaction, we can thus perhaps distinguish the two Extremes, the one which is — nearest to the Chyle, which we say is assimilated very quickly, the other the nearest to the excrementitious fluids, and therefore immediately passing out of the body, I would allow the Milk to approach nearer to the first, than perhaps any other portion of our fluids, and itis evident that the Serosity and its Contents, which furnish the Urine, and probably the perspiration[t] is again in a State the nearest to putrefaction, and are ready to rush into its last Stages, but between these ——— Experiments, When you take a Matter of a blue Colour, and the matter of a red, and blend these so, as to give a purple, you can make the purple more inclined to the one than the other, and in this way you may perhaps establish an innumerable diversity, but itis difficult to distinguish any two proximate ones, or to say sometimes when the one prevails, or when the other, or in what gradation the different shades are, and we may in general acknowledge that there is such a diversity, and we may allege that one is fitter to be one Secretion, and another to be another, but we cannot distinguish them as they lie

ly in the Mass of blood, and to me this is the only Idea that can be given of the diversity of fluids in the Mass of blood, but —

272. Besides —— it I am not to go back upon the opinions of Physiologists, at a time when their notions with regard to this subject were very imperfect, I am only to Consider the opinions of the later Physiologists, and such as are of Credit and authority, and among these is the opinion of a Mucous matter —— Vegetables such an opinion I say has been entertained by Dr Haller Dr Gambius, and Mr Senac, who are all sufficiently respectable Physiologists but the Mucorum ductile & filatrahens of Gambius and Haller are manifestly these parts, which we can draw out from extravasated blood, before it is Concreted, but they have not obtained from the Mass of blood a Mucous matter, which resembles the Mucous of Vegetables, that does not Concrete Spontaneously, nor by any other means, but that of exhaling its more fluid parts, that does not concrete, I say by the application of Acids, of alcohol, or a certain degree of heat, without exhaling its more fluid parts, and therefore the existence of such a Mucous matter is not admissible, but they infer it from the plentiful Secretion of a Mucous matter in so many different parts of the body, there is not an Internal surface where Acid matter

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are to pass, that is not defended by such a Mucous exuding from numerous follicles that are lodged in their Internal Membrane, and that the Secretion of Mucous is copious is evident, but I say it is different from the glutten of the blood, and also I say it is different from the Mucous of Vegetables, and in short the question can only be with Mr Senac who alledges that the Mucus is formally existent in the Mass of blood, why to every other person there is no foundation for that, it is the principal Secretion, if not the only one, that is poured out after a Stagnation in a Cavity, in what is called a follicul: crypto Mucosæ, and the different appearance we impute to that Stagnation, With regard to its coming from the Mass of blood in the same circumstances is very improbable, for from the tenuity of the Vessels, these would admit only of fluids extremely dilute and as it is directly poured from the Extremities of the Vessels it is extremely dilute, nothing is more common than to meet with a Coryza, a destilation of a watery fluid from the Nose, and it is generally of a very sensible Acrimony, and we have no doubt that that is in consequence of an Irritation of the Mucous Membrane of the Nose, which occasions the pouring out of the fluid before it has time to stagnate, and whither you take this account of it, or that there is an increased determination to the Mucous Membrane, or if you take the State of the tears which

are poured out from the Lachrymal gland, these are fit to wash off every thing adhering to the Eye, but afterwards it passes by the Lachrymal Duct into a Sac in the Nose, where it acquires the same form as the matter from the follicles of the Mucous Membrane, but as itis secreted by the Lachrymal gland, we see the State in which itis poured out, and in which it existed in the Mass of blood, without being under the least temptation, to suppose that it had its form as flowing in the Vessels, but he gives another proof of it, he says, that the internal surface of the Stomach, as every body knows, is full of these Mucous follicles, which pour out mucus in a viscid form, as itis commonly rejected in Vo: miting, and he made a particular experiment, he took the Sto: mach of an Animal recently dead, and he found that he cou'd express from the Mucous follicles a considerable quantity, as by taking an ivory folding Stick, by which he drew out a prodi: gious quantity of Mucus, such a quantity as he supposes cou'd not be contained in the follicles, but must have been immediately drawn from the extremities of the Vessels, but I think his Conclusion is not just, because he cannot have any measure, or form any supposition, with regard to the quantity contained in the follicles, and itis to me much more probable that whatever the quantity is the follicles are really sufficient

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v under any Management it is probable that the Fluids are formed from the Blood.

to contain it, rather than that it comes out of the Vessels in its mucous and viscid state, and therefore I say that the supposition is founded on mistaken facts, and false reasonings, and there is no proof that a Mucous matter like that of Vegetables, or that the Mucus as secreted did formally praeexist in the blood Vessels. Another matter that has been supposed present in the blood is a gelatinous Mass like ——— animals, this has been supposed by Senac, but there is no experiment, that can directly extract it from the blood, and therefore that a Matter similar to what they consist of is present there, but the gelatinous matter into which we resolve the Solids, is not the same matter that they were formed of, it appears from Geofroys Experiments, that when we take any portion of Animal Substance and treat it by decoction, we do not make a Solution of it into Integrant parts, that extraction which we obtain is by a resolution, it costs a great deal of labour and repeated Decoctions, in order to dispolve any such portion of our Solids, and if you examine the first and last Decoctions, you find them exceedingly different, and when you have proceeded a certain length, if you analize the matter still remaining, and compare it with the Analysis of it before it was so treated, you find it different, and at length it comes to be a pure unspid Earth, so that this is truely a resolu-

tion

tion of a Mixed, and therefore tho I allege that there is certainly a rameness between the matter of our Solids and fluids, yet I say there is no such thing, as that matter present in the Mass of blood, it does not resemble any thing that we find in the Mass of blood, take a Jelly thus extracted, it does not Coagulate by heat, and only in consequence of an exhalation of the thinner parts, and if you try it with acids, or alcohol, it shows no marks of its resembling the gluten of the blood, and this and the Solid parts of the body are very nearly of the same nature for if you treat the portion of gluten from a quantity of blood, as you treat the Solids, you get the same substance from both, but it is in consequence of a resolution. Therefore I say that there is no evidence of either of these substances being formally present —— reasonings, except that diversity of fluids explained in 271. there is yet no evidence of any other matters, but the red Globules, Gluten, and Serosity, but such as may arise from the progress of our fluids from one state of fermentation to another, I would by no means however push this matter too great a length, all I would conclude is, that yet there is no proof, evidence, or presumption of any other matter, But, while I thus determine, and limit the Matters that

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are thus the common and Constituent parts of the Mass of blood

273. It —— Vessels. I need not say how many Substances, as mistaken food, and more commonly Medicines and poisons have been introduced into our Mass of blood, besides these that are in every Sense extraneous, and that many —— Vessels, — There may therefore, tho' not constantly or Naturally, be accidentally or occasionally a prodigious variety of Matters present in the Mass of blood, and it may be necessary to determine, whether they do enter into its mixture and affect its ordinary Composition, or if they still float separately in the Mass, or what is their effects upon the ordinary constituent parts, but —— fluid I conclude so, because it is so seldom in the innumerable instances of their presence, that we can perceive any change in the qualities, and mixture of the ordinary Constituent parts, and indeed I would allledge with regard to many of them considered as Medicines that they can have but very little effect upon the state of our Natural fluids from the quantity in which they can be present, thus Cantharides have been supposed to act upon the Mass of blood, and to dissolve it, why Cantharides are taken in and do exert there remarkable effects * but that they can have any effect upon the consistence of our fluids I cannot conceive they are in such small proportion, a gram will excite Strangury,

and

and perhaps this is the limit of what we can admit, as if it is taken in, in greater quantity it must occasion Inflammation which may prove Mortal, and in the way of Mixture, there is no instance of a small quantity having any sensible effect upon the general Mass, it must be in the way of fermentation, that a small matter can have any great effects, upon a greater, but in the way of Mixture, it is not analogous, to any experiment in Chemistry, therefore I say it is probable, that hardly any of them enter into the mixture of the Animal fluid, but I add only that it is probable, as it was necessary to leave room for the supposition that they may, and when they are of a considerable proportion, and can readily join with it as suppose Vegetable Acids, that are not of a common part of our food, but that are taken in, in considerable quantity, and may therefore enter into the Composition, and in proportion to the quantity taken in may have effect, and certain Saline matters that are near akin to these that impregnate the Serosity may increase the Solvent power of the Serosity by impregnating it further and give a much greater fluidity to our Mass of blood which we suspect is the case in the Scurvy, but leaving room for such singular occurrences, I say that they are —— outlets,

thus

thus we find that every sort of saline matter which especially diversifies the most part of the matters taken in, is thrown out by the alimentary Canal &c, and we have instances of these foreign matters being ~~for~~ only found in the Excretories of certain glands, and we shall find reason for believing that their effects are almost only upon particular excretories, and that they very seldom do affect the Mass of blood, the strongest instance is, when the Internal fluids are again reassumed in considerable quantity upon the mass of blood, as the bile; what is the quantity of bile usually secreted I dare not determine, it is not necessary to do so, it may be considerable, but the ordinary course of it into the Duodenum is in some cases entirely stopped and passes by absorption or Regurgitation into the Mass of blood, and we have it diffused over the whole skin and passing off very copiously by the urine, Now here is a matter formed from the Mass of blood and may be supposed akin to it, and therefore it might be supposed to have considerable effects upon the state of the blood, but there are instances of Jaundice subsisting for months I knew an instance where it subsisted a year, yet there was no such effects perceived, we could only see a degree of sluggishness and Torpor produced, but it in noways disturbed the functions in any other respect, after the period of twelve months the passage

into

into the common ducts being Cleared, and the Jaundice thereby Cured, there was very little alteration found in the state of the System, and it appears to me that the bile may be present in the Mass of blood in considerable quantity, but the presumption is that it does not operate upon the Mass of blood, at the same time long continued Jaundice may prove a fatal disease, when the obstruction of the Biliary ducts is insuperable, but it is not by changing the nature of the blood, and I can see otherways for accounting for its effects, especially as in so many other instances it has not this effect, There are Arguments for the extraneous matters, only being in the Serosity and it is evident that when the Acconomy cannot guard against their admission, it has provided for their ready Evacuation by the various outlets, I add however as a limitation upon this subject that the Oil of the —— fluid, I should have added which certainly enters &c. With regard to these two, I need not mention the proofs of it, if we see that the Adipose Membrane is just now filled, and that very soon after, the whole of its Oil is consumed by an actual reabsorption, it must enter into the Composition of the blood, and every consideration leads us to think so, the Oil thus secreted evidently answers several purposes, as the facilitating the motion of the several parts upon one another, for keeping the bones in a certain degree of Ductility &c, but upon any unusual Acrimony or Tendency

dency to putrefaction taking place in the System, it is reab-
sorbed again, in order to be blended with the Mass of blood, and
to prevent this Acrimony and putrefaction from proving
pernicious, With regard to the Lymph, when you consider
how carefully it is poured back again and applied to the new
Chyle, there is little doubt, that it is for forming the new Com-
pound that gives the animal fluid, but these are the only reab-
sorbed matters that certainly enter again into the mixture of the
animal fluid, I have been just now speaking with regard to
the bile, and I have given my reasons, why I think that it does
not enter again into this mixture, the same reasoning will
apply with regard to the Urine, and for any thing that we can
see to the perspiration also, It is not to be supposed, that what
Nature intends as an excrementitious matter, is any way fit
to enter into the Mixture of the animal fluid, I have seen a
number of instances of an Ischuria Renalis, where they were
exactly sealed I cannot determine, but it was in consequence
of it's being stopped in passing by the Pelvis, or into the bladder,
taken up into the Mass of blood, but we still see it remaining
in its peculiar State, we have instances of its being poured
out by Vomiting, Stool, and Sweat, retaining its peculiar

odour

Odour &c; and we find that it is poured out in considerable quantity in particular places, and there exerts its peculiar effects, — we have found the persons dying of a Coma or Lethargy, by its being poured out upon the brain, and in one instance it produced in the space of 10 days the most violent degree of putrefaction, that I have seen in a living body, so that these fluids may be returned into the mass of blood, but it is improbable that they anyways enter into the mixture of our fluids —

But

Lect: 68. —

We have now as well as we can enquired into the several parts and the nature of the Mass of blood, and after thus Considering the parts of the Mass contained in the red Vessels, and its by that which we determine the Common Mass we must

next

neat Consider the several fluids which appear in the other parts of the body —

276. all ——— interrupted. This we mentioned before, but here the reasons are more distinctly summed up, from the Continuation of the red Vessels into every Secretory and Excretory of the body, and from the ceasing of every Secretion, in consequence of the passage of the blood from the common Mass being interrupted, which are sufficient proofs, that they are somehow or other derived from this common Mass of blood, and —

277 The ——— pass. I shall say presently that we cannot perceive them in any Shape in the red Vessels or common Mass, and therefore whether in the way of Separation or otherwise, we conclude that they are the effect of certain circumstances in the extremities of the Vessels, in these which we suppose are Secretory Vessels, and which after the fluids have passed they appear different from the common Mass, and which therefore we say have a share in producing or determining their Nature or quality, I insinuate that this may be in consequence of a certain Structure; in what manner the Structure may be supposed to influence this we shall say immediately I have added here what may appear a Mystery, with perhaps some other condition in the Extreme Vessels thro' which the

fluids.

fluids pass, as the Structure, so far as we know it, is insufficient to account for this change, we may suspect, that there is some other condition, as the Physiologists indeed have all along supposed, as that certain ferments are lodged in the Secretory Organs, that the several Secretory Organs are endued with a fluid, that will admit of fluids of no other kind, and that a certain Modification of Capillary Attraction has a share in this matter &c. I say there may be certain conditions that are somewhat different from all of these, but we may abstain from such hypothesis at present, and I only say, that there is probably a certain Structure —— Secretion the most obvious notion is that the several secreted fluids were existent in the common Mass of Blood, and in a diffused State, and that these glands, like Strainers, by the size of their Apertures, may be fit to secrete, and form these fluids, and from this most obvious Idea, the functions have been called a Secretion, but we by no means admit that the Idea of a Secretion must be limited in this manner, for if there are any other circumstances that change the Mixture of any part of the fluids, that will not be termed properly a Secretion, I say a part having such a Structure is called a Gland, or Secretory Organ, the term Gland was

firstly

first imposed by anatomists, from a certain view of the Ha
bit of certain parts, from their observing certain parts, in
cluded in common Membranes by themselves, to any such
distinct Mass they gave this name, but they observed diffe:
rent States or conditions of these, and divided them into the Con
globate and Conglomerate glands, and this a question, whether
any excretion takes place in one of these, and we find in cer.
tain parts of the body, that there is a Secretion without any
certain portion of Membrane wrapping up any Congeries of
these glands, this therefore being a loose term, we choose rather
the other term of Secretory Organ, without restraining it to
any particular Idea, with regard to the Habit or Structure,
but from the Idea of the Structure, that has been commonly
received, it is this that we should first enquire into, and we say

278. The —— unknown, I am sorry that in so many
parts of our Physiology, I am obliged to set out in this man.
ner, that the function is hardly yet explained, but I believe
that every Physiologist will agree with me here, and from our
not knowing the Structure of the Organ, you will not expect
that I am to enter into any particular Anatomical discussion
With regard to the Structure of the Secretory Organs, they are
divided into two kinds, one is where a certain Series of Secre.
tory Vessels pour their fluids into a hollow Cavity in which
there

there may be a particular fermentation going on, or there may be only a certain absorption, abstracting the Watery, or other peculiar parts, so that the fluid is now changed by its Stagnation now in this hollow Cavity, These now in the common language of the Anatomists are called Glandulæ veræ, as Dr Haller does in his 203 par: because the Structure was transferred to every Secretory Organ at the time of the celebrated Malpighi, but from the labours of Ruysch the Anatomist we have found that the intervention of such follicles does not every where take place, Dr Haller says, Glandulæ veræ —— persistiat, and in his 199th par. Dr Haller discusses the matter more particularly, his conclusion is in the next Par: and I leave you to Consider this subject there, as the matter is very nearly at present compromised, while every Anatomist enters into the opinion of Dr Haller in this respect, We can have some idea of the Glandulæ veræ with regard to the determining the nature of the fluid, if it is merely in consequence of absorption, but with regard to the other Secretory Organs, that consist merely of a separation of Vessels, we are at a very great loss to find what Structure can have any influence there, and I can't show that better than by giving the opinion of such an able Anatomist as Dr Haller, when I say that the Structure of the Organ —— unknown he, having mentioned the many different Circumstances that take place

with

with respect to the different size of their Arteries, their several flexures, that occur before they arrive at the proper Secretory Organ, the different angles that they make with their respective trunks, he introduces the 219 par: in this manner Nonnihil —— interjicit, he goes on to prove that the Branches and Angles are considerably diversified, and that the different states of the Angles will have an effect upon the fluids, Facile —— experiemur, and observe as necessary to our Conclusion, Arbusculas —— efficient, There are all these differences in the Conformation of the Vessels in these Secretory Organs, and he concludes, non —— est, we may readily admit it, but we must also admit what follows, Nondum —— relies, that I trust to him, who was as able an Anatomist as any whatever, but I would chiefly observe what follows, ad —— diversitates, as we observe the same Structure in the Arteries and Veins, it will be doubtful how far this diversity of Structure is designed for determining the nature of the Secreted fluids, but I am founded in saying that the Structure —— unknown, the one equally as the other, at —— function, at least no Physiologist has said, why the Vessels are distributed in the manner they are in the different parts of the Body, as in the form of a painters brush in the Spleen &c, no Body has applied this particular

particular diversity, except that the difference of Aperture and Angle may give a difference of Velocity, and that may favour a particular purpose, but what appears to be the chief difference is the different size of the Secretory Vessels, &c.

279. If —— Secretion, a merely different size of Strainer for separating diffused fluids, but —— Blood. I am still more particular. We —— Organs. I have lately spoke with regard to the Milk, and also with regard to the existence of Mucus, and I have rendered it improbable, that either of them do exist in the same form in the Mass of blood, and I formerly spoke sufficiently upon the Subject of Oils, yet the first and last, the Milk and Oil are the fluids that are most commonly supposed present, and with the greatest probability, but with regard to the last in particular it is a matter of demonstration, that it is not present as we can examine it every day by a variety of trials, in short there is a power of Secretion that we do not understand, and therefore we will not allow any Theory to lead back to the Supposition of what might be the foundation for it. Dr Haller supposes that the Oil in the Cellular Membrane is secreted by a mere exsudation, which infers that the Oil was previously existent, but I will not allow it to be such a proof, especially when we have so many strong reasons for refusing it, with regard to

to the other fluids, all they have said is, that there are fluids present in the Mass of blood that are somewhat akin to such as are secreted from it, as that one fluid is Coagulable by acids, Alcohol &c, and therefore it is a presumption that it is derived from the Gluten, but because I find a Coagulable part in the Bile or milk, or in some others of the secreted fluids, I do not find it previously existing in the common Mass, because I find a particular portion of it so, and the bile for example differs from the Gluten, as much as any other fluid in nature, it is not enough therefore from a little viscidity in the Mucus, to suppose that it is from the Gluten, I could render it highly probable, I think Dr George Fordyce has done so, that there is a Coagulable part in the Mucus, but how it is blended with other matters, we are not a bit the nearer of knowing, and I say there is not the least proof, that the least particle of bile is present there we know that it will become very evident there, when in consequence of a secretion it has been produced, but when any cause as a Stirrosity of the liver, interrupts the Secretion, no appearance of bile is ever found in the common Mass, and where will you find any foundation, for supposing that the Semen Virile was previously existing in the Mass of blood, a fluid which is distinguished by certain living portions of it

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I may say, which we call the Animalculi, which are a particular ingredient of that fluid, and are no doubt there for a particular important purpose, and it is absurd from any Chemical apparatus to pretend to find out the analogy of the Semen Virile, with the Mass of blood, and there are no experiments, that point out this analogy in whole or in part, and Physiologists indeed have not alledged that these peculiar fluids are present in their proper form, but they think that they go a certain length, when they show that the different parts of which they suppose these fluids to consist are present, as when they suppose that the omentum supplies an Oil to the liver, and that a Saline matter is procured from the Intestines, and from this Saline matter and Oil they make their Sapo of Bile, but it would be ridiculous to follow their hypothesis, that are not supported with any probability of reasoning, and nothing is more evident, than that there is a very singular power in the Oeconomy for producing fluids, that are very different from there out of which they are formed, and it is better to suppose this, and leave it where it is, than to prosecute it, with such vague Conjectures as has been done.

280. This —— attention, we cannot apply Secretion, where the Circumstances that favour it do not exist, and there is but

one

one Circumstance that we suppose can favour it, for I pass from following Dr Haller, where you may find the matter fully detailed, he speaks of the distance from the heart, giving a diminished Velocity of the blood, or a distance from the heart in consequence of a singular tour in the Circulation, as in the Liver, and of the Velocity as being influenced by the state of Ramifications, which may give a more considerable retardation, also the various flexures, angles &c all which circumstances can only be applied in consequence of the fluids having been previously existing in the Mass of blood, and they have gone no length in accounting for any one fluid of the body, the only circumstance that can have effect, is the apertures, but —— Separation I would allege, that it is a case of simple separation by which the Halitus is poured out into the several Cavities of the body, and which is again absorbed, and returned to the Circulation by the Lymphatics, for we observe that in consequence of these Vessels being dilated from a force within, or from a relaxation in consequence of an affection of their Moving fibres, the Exhalation can be considerably increased, but how the conditions of it are modified we do not know, in like manner in the case of the Separation of the Urine from the Serum, we can't understand the Secretion from a Subdivision of Vessels—

Thely

that will not admit of any Secretion of the Gluten, and we have particular proofs that a different State in the Apertures in the Kidneys does produce a different State of the Urine, both in quantity and quality, thus in the Diabetes, we have evident marks of a relaxation, and in the Diabetes Hysterica, we have as evident marks of a Constriction; for just now perhaps it is going on in its usual way, but by various accidents operating upon the Nervous System what we call an Hysteric paroxysm is brought on, whereby the Secretion of Urine is very singularly changed, it flows in an unusual quantity, but at the same time that it does so, it loses its ordinary quality, it becomes a pure alimentary Water, and that happens in the space of a few minutes perhaps, and Matters are perhaps restored again as suddenly to their usual State, Now we don't see what happens here, but it is presumed that the Hysteric paroxysm produces a Constriction in the Secretory Vessels of the Kidneys, and at the same time forces the Fluids into them; which two circumstances combined will explain the Phaenomena, and I think the same circumstances from certain Phenomena of diseases, will apply to other Secretions, as we may have occasion to point out afterwards, but except this in such Cases, wherein we can suppose such a simple separation of the several parts of the common Mass, In ——— Misture, a new Fluid is produced

thereby

that is of a different Mixture from any thing that we see in the Mass of blood, as the bile for instance, I say there is nothing resembling it in any part of the System, but something with regard to the Coagulation, I presume therefore, that there is a change of Mixture, but ——— them, and there I must still leave the matter, and I believe that more light cannot be thrown upon it by any thing yet said, by Physiologists, I pass therefore from explaining the nature of Secretion, but I think it is to our purpose to observe certain circumstances that belong to it, and that are often of Application in our Pathology, how the state of the organ does affect the Secretion I cannot tell, but its of consequence to know that it does affect it, and till. —

281. We perceive the precise changes that are made, or the manner in which the Causes do it more clearly ——— Blood In all these Cases where a change in the Nervous System produces a change in the state of the Secretion, we will I think conclude that the operation is upon the Moving fibres of the Organ, and in fact in such Cases, we do not perceive any difference in the state of the blood, or that even the motion of the blood is any how affected, and much less can we suppose that in that instantaneous change that is produced upon the Secretory Organ, that in the same time any change is produced in the whole Mass of it

of blood, if you will not think me a great Epicure, I will mention this fact, as I know it best in my self, that at the sight of a delicious morsel, my Saliva is poured out all of a sudden, now here the imagination is operating upon the secretion of Saliva, and it will be hardly conceived that at the same time the imagination has any effect upon the Circulation, or different condition of the Mass of blood, and Physiologists are full of such examples, of powers that seem only operate upon the Nervous System, producing changes upon the several Secretions, as upon that of the Urine which I just now mentioned, but the matter is now so universally known that it is not necessary to give a fuller proof of it, and I say.

282. If ——— arteries, These are increased by the exercise that increases the frequency of the hearts Systole, and the Velocity and Impetus of the blood in the whole System, that these Secretions are increased is sufficiently evident, and that no others are thus sensibly increased appeers from observation, as we have not an instance of any other increased in exercise, or what is more in fever, this indeed but that certain † Secretions are increased in consequence of fevers, because fevers tho' considered as general affections, have a peculiar determination to other parts of the System, but we have a thousand in

stances

stances where this does not take place, and I think it is a proposi-
tion of some consequence that —— Organs, and negatively not
by any Change in the Circulation, or in the Mass of blood, and
These —— Vessels, that all Secretions whose Excretories we
have acess to, can be increased, and in some measure changed
in their natures, by Stimulants applied to their Excretories
is sufficiently known, Thus the Volatile parts of an Onion
ocasions a Secretion from the Lachrymal Gland, and Acids
applied to the Intestines will increase their Secretion, and
Dr Haller gives us an extremely curious instance of this kind
of a person who was liable to a prolapsus Ani, where on
application of Jalap produced from the parts acopious Ex
sudation of fluids, but —

Lect: 69

If I was to argue against the Theory of Physic, and to urge the imperfections, Errors or general fallacies of it, I would lay an Argument in this manner, I would say that the body, is for the most part consisting of fluids, or of other parts formed of these fluids, and it is more than probable that the functions, the sound or morbid state of the body, will depend very much upon the State and Condition of these fluids, but if that is the case, the Theory of Physic must be upon a very bad foundation, for it is pretty certain, that we have at least but a very imperfect knowledge of the nature of the fluids in general, and this must appear from our knowing so little of the manner in which a great part of these fluids is produced, and therefore little of the doctrine of Secretion, we neither know the subject matter in the mass of blood, with sufficient exactness, nor in what manner they can form new Substances, and even when these are produced, our knowledge of them is still very uncompleat, I will not say just now how well such an Argument would be laid against certain Theories that have been advanced, nor how the Conclusion may be obviated, with regard to the doctrine of general principles we propose to deliver, but it must apply so far, and I cannot

perceive

"There is one Secretion, that of Perspiration & Sweat, that is very much connected with the general State of the Circulation —

perceive that any Physiologist has yet presented us with a doctrine of Secretion, that is of any application, I have therefore passed over most of the Theories, that have been offered upon this Subject very slightly, but I must say, that tho' we cannot discern the nature of Secretion, there are some circumstances with regard to it, that are of importance to be Considered particularly those which determine them to be more or less, and which perhaps determine them to be in different cases of a different quality and the first proposition that I have laid down is, That the action of the Vessels —— Blood, I have mentioned enough of instances of this, by shewing that in consequence of the application of matters, which act upon the Secretory Organs, both the quantity and quality seem to be changed, and that with very little change in the general state of the Circulation, or the different conditions of the Mass of Blood, With regard to the general state of the Circulation, but we cannot perceive that the other Secretions are, And on the other hand, I say that most Organs, These Stimulants I say may be —— Vessels. I was yesterday entering into a detail with regard to the effect of Stimulants applied externally to the Excretory Vessels and I say that we can perceive it in a variety of Instances, and tho'

tho' in several Internal Secretions, we have not an opportunity of pointing out the application to the Excretories, yet there are several Cases, that we cannot interprete any other way, There is a Language I hold with regard to this Subject, that I may explain here, the emulging the Excretory Vessels by applications to them, whereby the fluids may be drawn out, I take my example from the Secretion of Milk from the breests of females, if we can believe the histories we have with regard to this subject in many writings, we must believe that tho' this depends upon a particular connection with the Uterus for ordinary, yet there are instances, in which it has been drawn into the breasts of Males, merely by the sucking the Papilla, and there are instances of its being so drawn forth by applying to the Nipples of Women, who had never been pregnant, and these histories I think upon the whole are not to be refused, but even from what happens to every female, tho' it at first depends upon the Uterus, yet afterwards it depends upon the means of emulging them for no female will continue to give Milk unless it is regularly drawn forth. I have seen instances where some accidental Circumstances irritating or titulating the papilla, has immediately occasioned its turgescence, and

a[illegible]

a flow of milk, and the want of this effectually suppreses the Excretion, if the application is not made to draw forth that milk, the flow either does not take place at all or soon ceases, now we have circumstances that we can explain in no other way, as when Emetics or purgatives draw off a considerable quantity of bile, which is only done by the action of the Intestines being increased, and thereby emulging the Excretory Ducts of the biliary secretion, as the bile discovers itself from its Colour, we have a frequent opportunity of observing this, and while bile is thus thrown up we observe that it is in consequence of the repetition of vomiting, and the more violent the Emetic is, it occasions this appearance of bile the more certainly, and that especially towards the last Vomiting, it is possible indeed that the action occasioning Vomiting, does also act in pressing the Gall bladder, but it will not account for the quantity that is frequently poured out, if we do not suppose that the action of Vomiting does act upon the Biliary Ducts and draws off a considerable quantity of bile by the Ductus hepaticus from the liver, now had we the same means of distinguishing the Pancreatic juice, that is mixed with the other other fluids and thrown up, we would see the same thing take place. I have said all this with regard to such Stimulants as

are

are applied externally, but I have added applied externally or Internally to the Excretory, what Medicines thrown into the Mass of blood can again reach the several Excretories is difficult to say, whether as has been alledged a purgative Medicine thrown into the blood Vessels, appears again upon the Intestines, which is a thing that appears doubtful, but there are other substances, for example some have explained the operation of Diuretics, as operating upon the Mass of blood, and occasioning a greater quantity of fluid parts, but its evident that they are determined to pass off with the Serosity, and by Stimulating the Excretories they promote that Excretion, and Diuretics, e.g. Cantharides are evidently determined to that particular Secretion, and act especially as a Stimulus upon the neck of the bladder, with regard to the case of Salivation by the power of Quicksilver, and that alone, I must not enter into the Consideration of all that has been said, with regard to its being fitted to pass by the Salivary glands, or to change the Consistence of the fluids, but I say this is evident, that it never does operate by Salivation, but when it has arrived at the Excretories, and can Stimulate them, and we find that the application of the Mercury

is

is more effectual than when it comes there by the ordinary Course of blood, I conclude therefore that this too is an instance of the same, that it's especially by operating upon the Excretory Vessels, that it produces the increased Secretion and Excretion another means by which Stimulants increase the Secretion, is when they are such as are —— Secretion, when I spoke of the Imagination affecting the Saliva, or of an hysteric a paroxysm affecting the urinary Secretion, these are instances of Stimulant powers, applied to the Sensorium, with regard to these that are applied to distant parts of the Nervous System which by —— Secretion as that a certain operation upon the Stomach, will emulge the Salivary glands, when it has not arrived to a Topical application, which is frequently the effect of a Vomit, whether the effect of a fracture of y^e^ Skull in producing an increased exertion of the bile is to be referred to a general operation of the Sensorium, or to a consent between the head and Liver, I will not determine, but the Connection between the Mammæ and uterus, may be referred to this, The explanation of the Secretion of Milk, being produced chiefly upon the birth of the Infant has been variously accounted for; it has been explained by a change of the destribution of the blood by a very trifling anastomosis between the Epigastric and

and Mammary Arteries, I wish show that such explanations are very unsatisfying, and imperfect, for I say that the circumstance of the determination should have taken place before the birth, more than afterwards x. and that there is a particular consent between the two as parts of the Nervous System is very evident, I take only one proof of it, that is certain and Conclusive independent of any Change in the destribution of the blood, or in its qualities and condition, there is a constant connection between the Uterus I say and mammæ, there is a Connection I say between the Clytoris of females and the papillæ and the Mammarum, insomuch that the titillation of the papillæ, will excite the erection of the Clytoris, & c contrario, (These Gentlemen to Philosophers should be very grave matters, perhaps you are not arrived to that length in Philosophy, and I excuse you if are not - but its absolutely necessary to the illustration of this same matter) so that Exertions may be acted upon by Stimulants applied to distant parts of the nervous System and that the milk will flow, by such applications to the Uterus I have reason to beleive, and upon the whole I have thus pointed out what is of considerable influence in the Pathology

thesy

that the several Secretions are more affected by the state of the Secretory Organ itself, than by the general state of the Oeconomy, for I say that these Stimulants —— blood, In the case of purgatives, there are certain of them, of such an Acrid nature, as to stimulate any one part of the body as Jallap, which applied externally to the Skin will produce a blister, now the general Stimulus may be transferred to the System, and we may have fever occasioned by certain purgatives, and that may have some influence upon particular Excretions, but without supposing that the increase of the Circulation has any share, we have instances of purgatives, that will produce very copious evacuations, without our perceiving the smallest change in the state of the pulse or destribution of the blood, so with regard to other Excretions, they have their effects, without affecting the Circulation, and if this is affected, it is rather as a consequence than as a necessary part of the operation, as if the Operation of Mercury upon the Salivary glands, is attended with a degree of fever, it is connected with the Inflammation of the Mouth and fauces, but the Secretion goes on to a certain length, without any perceptible difference in the state of the Circulation, so much then with regard to the Connection between the state of Secretion and the general state of the Circulation of the blood.

283—

y will promote the whole Excretions, & the diminishing
the Quantity of Fluids;

283. With —— Secretion, nothing is indeed more obvious, or more probable, we see that there is a certain resistance in all the Secretory Vessels, and if they were extremely pervious and patulent, there is no doubt that the whole fluids of the body would soon run off, but it requires a certain force of the heart and larger Arteries in order to force these and to promote the Excretions, and the action of the heart and Arteries is very much in proportion to the mass of fluids, and the fulness and Tension thereby produced, and therefore a larger proportion of fluids, does dimmish all the Secretions, but notwithstanding of this, I still return to my former position that the State of most of the Secretions, depends upon a particular circumstance of the condition of the Secretory Organs, but the effects —— Milk, perhaps it is because these are the only excretions that fall under our observation, but we can see particular reasons for it, as from the circumstances of perspiration, its being most connected with the general state of the Circulation, we see how its quantity follows the quantity of fluids in the body, and if the Urine chiefly consists of Water, for the Contents are in small proportion to the Elementary water, the quantity will be constantly connected with a larger proportion of aqueous parts that therefore the quantity of these should increase the quantity of Urine is obvious, so

with

with regard to Milk, as an animal is fed more or less, Cæteris paribus, in proportion is the Secretion of milk at the same time I say, that we do not know more than this in general, and we have no Experiments to show how it influences the Bile, Pancreatic juice, Saliva, Mucus &c We do not see such changes in consequence of the fulness or emptiness of the System take place, With regard to these, as with regard to the three Excretions I have mentioned, With regard to the qualities of the common Mass I say that they may ——— Secretions, certainly it may be presumed — therefore I cannot say, what matter in the common Mass is especially fitted for the Secretion of Bile or Saliva, the presumption still lies that there is a certain condition of the whole blood that is fitter for supplying these Secretions, than another Condition and very possibly there is such a condition as determines a greater Secretion of Saliva independent of the application to their Excretories, and with regard to these last I might condescend upon facts, — I say therefore, but the effect ——— Milk in these which we can perceive it more clearly, With regard to the Perspiration and Urine they are constantly going on and depend upon the state of Digestion taking place, and we can perceive, that as our Aliment is of a more or less putrescent kind, or as other Causes have more or less tendency to favour putrefaction, these Secretions within proportion

proportion be increased, with regard to Milk, tho' we have said that it is not derived from Chyle, the presumption is that it is derived from recent Aliment, and tho' it is alledged that a Vegetable Aliment supplies a greater proportion of Milk, than Animal food does, I am not at all certain of the fact, and our choosing to feed our Nurses, upon Vegetable rather than Animal food, is rather in consequence of the quality, than the proportion of the Milk, I have no doubt however that the very contrary may take place, i. e that a Nurse fed upon Animal food, will not only give us much more of it, but that the milk will be much more impregnated with the Nutritive ingredients that are contained in Milk, and if the Vegetable food seems particularly to increase the Milk, it does it more especially because it carrys along with it a greater proportion of liquid, and I say, even ——— Mass, i. e it returns again to the effect of the quantity of fluid, and more to the effect of Water, than of any other particular matter in the Mass, and with ——— Organ I suppose and I believe that there is a condition of the Blood in which it is fitter to supply a copious Secretion of bile, but what that condition is, or what sort of Matter it produces we are perfectly ignorant, and therefore we must be very Cautious in admitting

admitting the Theories that have pretended to determine this matter, as in the case of Salivation, and the Operation of Diuretics, which are things that are by no means yet determined, while they are evidently such matters, as stimulate the Secretory Organs, ~ another Observation with regard to this, is this

284. The —— Vice versa. that the perspiration and urine mutually affect, and, I may say compensate one another, is evident to how many other Secretions it does extend we do not know, the Excretion of Mucus is increased by a diminution of perspiration, and the same Secretions of Mucus is by the same means probably increased in the Internal Canal, With regard to the Cause I say, This —— Nervous System in three several ways, the mutual effect of the Secretions may be explained by a change in the determination of the Blood, upon the suppression of perspiration from the Surface, and less blood being sent into these parts, more will be determined to the Internal and produce different effects, and we may impute to this the increase of Urine, from the diminishing of the perspiration, as it happens in Winter, in the first place, or upon a change —— Mass, if less is drawn off by perspiration more of the fluid parts will be retained in the common Mass, and in this way likewise, may the increase of the Secretion of Urine be accounted for, or, perhaps, upon —— Nervous System if the determination to the Mammæ, and the Secretion ~

of

of Milk depends upon a connection with the Uterus, so that we find that while the Secretion of Milk goes on, the Menstrual Evacuation is suppressed, that may be explained from a Change in the determination of the blood, but I think from the Circumstance I mentioned, itis more properly tobe referred to a certain Connection between the several Organs of Secretion as parts of the Nervous System, and itis probable that the same does operate in other instances as that there is a Connection between the Vessels of the Surface of the body, and these of the Kidneys, so that certain operations upon the External surface can produce the Excretion of Urine is pretty well known, a Coldness of the feet, itmay be accounted for in part by the change of the determination, but its effects are often so immediate, that itis more probably by a Connection —— Nervous System and except —— blood, for the most part I say, the diminution or increase of Secretions mutually affecting one another, are tobe explained upon the three heads just now mentioned, and seldom upon the difference of matter that is produced. e.g. if we see an increased Secretion of bile, in consequence of a suppressed perspiration itwill be difficult toshow, that itis the matter of perspiration that is passing this way, and perhaps we cannot be certain of this, but in the very case of the perspiration and Urine, and these we presume

presume, do evacuate the very same kind of matter, but I am afraid in being rash in laying down this as a general proposition, as perhaps the perspiration will pass by other Secretions as well as that of the Urine, and that appears in consequence of the nature of the matter which has particular effects, Thus if it is certain that the Excretion of Mucus in the fauces, Bronchia, Intestines, and perhaps in other parts is increased by a suppressed perspiration, and I could render it probable that the matter in perspiration is determined to the fauces more copiously by this Secretion of Mucus, that there is a particular matter here, we may Judge from the considerable irritation it produces in the parts throw which it now passes, but except in the case of the matter of perspiration, we do not know any other Secretion the Suppression of which does increase the matter of other Secretions. Now Gentlemen I have finished what I have to say, upon the subject of Secretion, I own that we would wish.

285. After ——— fluids, I would wish not to rest in the general determination, with regard to the Imperfection of the Theories of Secretion, considering how much, Physiologists have attempted in explaining particular Secretions, and it would be incumbent to show that they do not do it with propriety, and to Consider the particular nature of secreted fluids, but ——— said, and the imperfection of the particular Theories, with regard to the bile, Saliva, Urine, &c is sufficiently evident, and we have not ——— it, I will not take up your time.

time, in shewing you how little we know with accuracy, and precision with regard to any one of them; we know more with regard to Urine than any other, and some useful inferences may be drawn from it, but with regard to the Bile, Saliva, Pancreatic juice, and many others, the whole doctrine is imperfect, and the Experiments are for the most part more or less contradictory, and daily new Contradictions are arising to old opinions, Last Season I should have been in danger of misleading you with regard to the Bile, look into the Experiments of the ingenious Dr McLurg, and you will find that he either gives us a very different view from what we had before, or he shows, at least we are under a great difficulty what to determine with regard to it, I believe he will not say that he has yet prosecuted his experiments far enough to come to any Conclusion that will amount to a general principle, with regard to the Bile, I think it sufficient therefore to leave you to pick up with regard to this subject what you can find from Authors, that are in your hands, and to which I have nothing to add, and I proceed to our next Section which treats of

Nutrition.—

Nutrition

Nutrition I say.

286. Under —— Supplied, Nutrition is the means by which the Matter of the body is acquired and is constantly supported, and that acquisition of Matter, both with regard to fluid and Solid, and the constant support of it is especially with regard to the fluid matter and under this —— supplied, but —— repaired, That the Body acquires a considerable addition of such matter is sufficiently evident. There have been questions with regard to the quantity of this matter, while some have taken a great deal of pains to show that even in the Adult state the quantity is extremely inconsiderable, I cou'd say that the reasonings are not sound, and that the Solid matter is much more than they wou'd allow, and I am certain that it is true, that there is a considerable acquisition to the Solid parts. There have been other disputes with regard to the occasional Waste, while some alledge that the Solids once formed are hardly liable to any occasional Waste, but we have frequent occasion to see the contrary of this in the loss of Substance from Wounds, and there too we see how soon the Waste is again supplied.

Lect. 70

Lect: 70.

I am now to enter upon the Subject of Nutrition in many parts a dark and difficult Subject, in several parts of it, we will not be able to rise above Conjecture, in this I am never Confident, and much less in this am I disposed to disparage the opinions of other persons, here I shall tell you my opinion, and give the arguments in favours of that, but I do not enter much into Controversy, I have told you how we are to limit the Subject, and in what manner the Solid parts obtain their increase of Matter, I say.—

287. There —— Solid, These are the three heads, to which our whole present disquisions are to be referred; With regard to the first Question

288. We —— asserting, as indeed has been admitted by Physiologists, that —— Chick, it is always provided in considerable proportion in the Egg, and it is gradually diminished and exhausted as the animal proceeds in its growth, and that joined to the resemblance betwixt this and the Solids of animal bodies sufficiently confirm this, and if we are thus led to perceive the nature of the Nutritious fluid in Oviparous Animals, we do presume —— growth, since its the same kind of Solids that are formed, and we think —— Oviparous. I am of opinion that the Analogy might be extended further, but while there might be some difficulty in this, we do not think it necessary, but as the human Solids are the same with these of the bird

kind

kind, there is no room to doubt, that if we can find a fluid that is nearly the same in the human body we presume that such is properly the nutritious fluid, and I say.

289 This —— matter. the only difference that appears between the Gluten and albumen I have marked before, and I have said that there is a very strict and strong resemblance, and that the only difference is in respect to its Concreting, when it is allowed to remain at rest and exposed to a certain degree of Cold, how to reconcile this may be a little difficult, but tho' the Gluten is not diffusible in Water, yet if it is in a diffused State, by mixing a certain proportion of Water with it, you will keep it diffused, There is one experiment of Dr Butts, that I might here make use of, tho' I before asserted the contrary, I said that the Gluten itself did not seem to be further diffusible, but he says that the Gluten triturated with Water may be very sensibly diffused in it, and that the whole may be reduced to a dissolved State, and he adds further, that when thus mixed with the Water, the whole is entangled in its pores, and forms a sort of Jelly, but there is certainly a limit to this, and if you add a greater proportion of Water, then the Concretion does not appear, but the whole of the Gluten can be thus kept perfectly diffused, I am therefore perswaded that the difference I mentioned does not certainly establish any difference between the Gluten, and the albumen, for in a dissolved State the resemblance is exact, the albumen is Coagulated in like manner by Acid, Alcohol, and Heat, therefore I say. This —— blood, only

only properly —— matter, which as we take it from the vessels of a living animal it is hardly posible to obtain, a portion of the saline matter is still retained in the glutinous part of the serum, when Coagulated by art, the albumen again is a substance of a perfect blandness, but if we can account for the proper dilution, we have little difficulty in supposing that by secretion, it can be freed from the saline matter, therefore allow it to be the Nutritious fluid, and we have thus determined the first question, what part of our fluids is employed in nourishing the solids, the next question is by what Channels the nourishment is conveyed, and I say

290. To —— formed. If it shall appear that there are some parts of the solids, that appear to be present at all times of the animals duration, and that every thing else is an Accretion made upon them we say that these are fundamental solids, and undoubtedly in the first beginnings of the animal, the nourishment must be conveyed by these fundamental solids, I say

291. It —— texture, only of —— parts. this you must be acquainted with, that of late years particularly much pains have been taken to establish the Cellular texture of every part, when I was upon the subject of the Simple solid, I said enough with regard to that and there indeed I likewise supposed that there was another portion that might be separated from it, but because our doctrine applied

to

to either supposition, it was not necessary to be more particular here I say, and —— kind, if there are fibres in every part of the body, they are on many occasions of a great deal of subtility and minuteness, and for the most part there is an interposition of Cellular Texture which is most remarkable and evident in the Muscles, in the Tendons, where the fibres are brought in to a smaller bulk, that Cellular Texture is not so obvious, but by a little Maceration it appears equally there, only it is of a closer texture, and some of the most solid parts is resolved into the same, and the greatest bulk of the Vessels is Cellular Texture, thus take the Arteries, where they have no proper investing Membrane externally, and you find only a Cellular texture; that is more rare as it is more exterior and grows more dense towards the interior parts and what is called the Tunica Nervea, and which seems to be more compact, and formed into a Membrane, by blowing, and especially by Maceration, it is demonstated to be a Cellular Texture, and in the Alimentary Canal, and wherever we have Vessels that we can examine the same thing is evident, therefore it is with propriety enough that we say that the Structure of the greatest part of the Solids is evidently of a Cellular Texture. But —— body, accompanying this Cellular Texture, thus it —— Nerves, the brains of most Animals particularly of fishes, by being Coagulated by heat, we get the fibrous appearance very distinctly, and admit of the Separation into certain

Cylindrical

Cylindrical Substances of a considerable length, With regard to their breadth, and the same thing appears in the Nerves, both from the like Experiments, and further it will be presumed, in so far as it is admitted that the Nerves have a Medullary Substance in them, which is a continuation of the Medullary Substance of the Brain" In the Muscles and Tendons" that is a piece of Anatomy, that no body at present questions, I say farther" in the Arteries" in so far as they are of size sufficient to be examined properly, With regard to the parts that follow- "in the Excretories of the glands" and "in the Lymphatic Vessels" we cannot say that every where the fibrous Structure can be demonstrated, but in so far as these parts are irritable, we say that that Irritability belongs to Muscular fibres, and in the Arteries not only the irritability but a Muscular Coat is to be demonstrated" in the Alimentary Canal" they are sufficiently obvious" In the uterus," in the gravid uterus particularly they are every where intermixed, the Muscular fibres are every where interposed, not to speak of the proof of the Irritability" and Bladder of Urine", here too it is both ways demonstrated, as also "in the Ligaments" "in most Membranes" there indeed arises the first doubt, the membranes of the body, those most strictly so called the Dura and Pia Mater, the pleura, peritonæum &c: but as the Animal is nearer to its origin, this fibrous Structure can be more distinctly observed. Baglivi gave occasion to a dispute with regard to the Dura Mater, and Dr Haller who is otherwise such an Advocate for the Cellular Texture

Texture, acknowledges that fibres are to be observed in the Dura Mater and he does admit it in the other Membranes, the Pleura Peritonæum &c in the same manner I might have added to these the Periosteum - and these are indeed the principal parts that are called Membranous - and when I am saying that to a little attention, by Maceration, the fibres appear in all the several Membranes, I wou'd observe that these appear the more readily as the Animal is nearer to its origin, there is interposed a Cellular Texture, which by time acquires a considerable density, and which does in a great measure obliterate the former appearance of fibres, but the Modern Anatomists have pushed one of their Arguments in favour of a Cellular Texture too far, when they say that in consequence of a Maceration of the Dura Mater, - peritonæum &c the whole appears without a fibrous Structure, but it is not right to Conclude from hence that the fibres did not exist, - for in like manner, the whole substance of the Aorta can, by Maceration, be made to put on the appearance of Cellular Texture, and that no Anatomist refuses, that there is a Muscular Coat there, or at least that there is a manifest arrangement of fibres resembling that so that Maceration is not a sure proof that fibres did not at the same time really exist, and I have only to add that the fibrous structure is to be seen in these Membranes, whether you allow them to be Periosteum or not, which are afterwards changed into bones, the whole Writers on the Anthropogenea have allowed that both in the long

and

and flat bones, while they are Membranous or Cartilaginous, as-
they approach to bones, they are manifestly arranged into distinct
fibres, or in some of the flat bones, they are like rays of a Circle -
proceeding from a Centre to a Circumference, and now.

292. From —— Bodies, and perceiving that it is Cellular Texture
that forms the increased bulk of these, which —— Solids, as they are
especially observable in the beginning state of animals, and do sub-
sist distinctly during the whole of their existence, and if they are in
some parts obliterated, as in Membranes, I have explained in what
manner, we suppose that to take place, and I shall consider the
bony Structure afterwards, and if they are the fundamental part
of the Solids, I say they are —— Bodies, It is one of the most difficult
questions concerning nature that does occur, to explain the forma-
-tion of an Organized body. I need not say what different opinions
are held with regard to this, or enter into a discussion of them at
present, I adopt the opinion maintained by the greater part of
Physiologists, and by Dr Haller especially, and which is the more
remarkable because he was formerly of a different opinion; he is
now convinced from Bonnay, that there are original Stamina
see particularly his treatise sur la Cœur organizé) and that the
increase of the Body is from the growth of Cellular Texture formed
upon them and we will have equal reason to Conclude* that
they

that they are primordial parts, and in this regard to the whole being Cellular Texture, and being so diversified, as to take on the different appearances that we observe it will be a matter of the most difficult Conception and the probability is that there are primordial Staminal parts, and that the Cellular Texture is —— fibres, the matter however has not been prosecuted with this view in Animal bodies, tho' it has in the case of Vegetables, and therefore I add here The —— opinion, I must not enter into a full detail of this subject, in giving the more minute anatomy of Vegetables, and in giving you all the proofs that might be brought of Vegetables consisting of Solid fibres, and a Cellular texture that is formed upon them. If you take the leaf of a plant, with its pedicle or petiolus or stalk of the leaf, you observe that it is continued upon one side of the leaf to its further extremity, and as it runs along it is ramified and divided like the vessels of animals, and it was not a difficult notion to suppose, that this was a vascular distribution, but in no part of them are they hollow vessels, they are each of them subdivisible into a distinct number of fibres parallel fibres, and there is a continuation of the like bundle in the Stalk, and some kind of it appears every where in the other parts of the plant; and I should have added, that all the other substance interposed is evidently a Cellular Texture, and can by maceration be reduced to such, and separated from the Staminal fibres which may be still preserved in their original form, and if you take the Bark of plants that accompanies them and makes a Consi-

derable

derable part of their whole substance, you will find that it is of the appearance of a Membrane, but it is resolved into an infinite number of parallel fibres, that have no manifest communication with one another; the proof of this you may know very well, as it is from this part in our bark, that our whole Cordage, or flax and hemp is produced, and that we obtain it merely by a Maceration, which separates a Cellular texture, that is adhering to it, from this it appears indeed that the whole of Vegetables consist of this appearance of fibrous Structure at least, and Cellular texture, and that these fibres are not Vascular is at present alledged, there is a dissertation that was published in the year 1755 at Hale entitled Specimen Physiologiæ Plantarum, where the Author has endeavoured to prove at great length, by many different Arguments, that these are in some measure to be called Solid fibres, that filtrate a fluid along their substance, and are not to be entitled to the appellation of Vessels, and it is evident, that if they are Vascular, they do not consist of a trunk and branches, as the other Vessels do, but are simple fibres, continues for a great length in single distinct fibres, without any appearance of a communication, so as to communicate fluids in the manner of Vessels in animal bodies and if you prosecute the matter a little further, you will find that the whole growth of the solid parts is constantly made out of these fibres, that are upon the internal surface of the bark, the juices of the plant are moving in considerable quantity in this interior surface of the Bark especially, and it appears that in proportion to this going

on

ow, the distinct fibrous nature of these parts, becomes more obvious, and that upon the surface of these fibres, there is a Cellular texture pushed forth, and there is by degrees accumulated a juice which afterwards hardens, and gives a layer, which is gradually converted into a layer of Wood, Thus we have an Idea from Vegetables of the fibrous structure producing a Cellular Texture, and laying a foundation for a different Organization. Du Hamel has given us the anatomy of a pear, he observes, that it consists of a Cortical part and an Anterior, and the Seed Vessel, which is a continuation of the fibrous part of the Stalk, as is also the exterior, which forms the Cortical part of the fruit, while the other forms the Seed Vessel— and the growth of the fruit, tho' to every considerable size, is only a considerable bulk of Cellular texture between the external Cortical part and the Seed Vessel within, and this is gradually formed and expanded in proportion to the progress of the Juice; first next to the Seed Vessel, and is still more expanded till it reduces the Cortical part to a great degree of tenuity, and every day in opening a Lemon, we judge of the maturity of the fruit by the diminution of the exterior Cortical part as the fruit is more ripe that constantly diminishing and filling with Juice, but in its first beginnings it is only a Cellular Texture without any appearance of fibres or Vessels in it. Thus from the Consideration of the growth of Vegetables, we have such an illustration and confirmation of the opinion that I employ with regard to Animals, that the fibrous parts are the primordial ——— fibres, that the after growth is merely an extension of these fibrous parts in their length, and an Accretion of Cellular Texture on their Surface, under a

mechanism

Mechanism that we are not in a condition to explain, I proceed to a more particular Conclusion, I say.

293. At —— Nervous System. the Brain and Nerves is evidently the Nervous System itself, and with regard to the Muscles, I have given my arguments, for their being a Continuation of the same; With regard to the Tendons, there is a dispute among the Anatomists, whether they are a Continuation of the belly of the Muscle, there are great names on both sides, I have the Authority of the late Dr Albinus, and I shall say further, that while the matter from observation is a little fallacious, the probability is very strong from a certain consideration that weighs with me, that in consequence of a certain progress in the living Animal, a portion of every Muscular fibre is converted into a Tendon, and you must know that the opinion has been maintained by many Anatomists, tis a question, whether the tendinous part does increase at all, but I say if this last fact be made out it amounts to a demonstration, that the Tendons are a Continuation of the Muscles, With regard to the Arteries, Excretories &c, the proof of their being fibrous rests upon their being Irritable, and if Muscular fibres ~~be~~ are a Continuation of the Nerves, these part are so too, in the Ligaments, and in most Membranes, I allow that there is no proof of their Irritability and therefore no proof of their being Muscular fibres, but while we observe it in so many of the other fibres, and while there is no consistent account of the Nourishment being any other ways conveyed, but by the supposition of their being a Continuation of the Nervous System, I am disposed to believe that probably they might be originally Nervous Sensible fibres, and that in consequence of the growth of Cellular Texture, their appearance as fibrous, and their nature as

Nervous

Nervous fibres is obliterated, as I suppose happens in the case of Muscular fibres being Converted into Tendons, where tis with a manifest change in the state of their Cellular Texture, ale this taken by itself however amounts to a probability only, but I add another Consideration that carries it a little farther, that is while they are thus parts of the Nervous System from ——— Nerves. I said just now that the probability is in that the rudiments of the animal structure its most complex organization is however delineated in the original stamina, tis true that a Heart, Lungs, Stomach, and other Viscera do really exist in the first Rudiments of the Embryo, but with regard to the growth we see that to be more properly the Nervous System, the Brain, Cerebellum Medulla oblongata & Spinalis, are the parts that are first obvious and, that are evolved to the greatest growth, the presumption therefore arises, that they were necessary to the further Evolution or growth, I have had occasion to say that tis necessary to suppose that the severed Organs, which I acknowledge to be delineated, must be Nervous fibres, must have a Communication with the Nervous System for their Irritability, and tis very probable that Nature has made the means of conveying the growth and the Irritability the same, Therefore the presumption arises that ale the fibres are a continuation of the Nervous System, in every different part of the body, and it will be difficult to suppose that there are fibres independent of it, or to suppose how the growth is carried on before the Vessels are evolved, and the proofs of this doctrine do not rest upon any single Argument, but upon the whole taken together, giving this presumption that I form here that the fundamental Solid is first formed, and appears manifestly fibrous and probably

of

to be Nervous, and that the formation of the body proceed in this order and this again will lead to the Conclusion —— Nerves, there will be no doubt of it, in the Embryo, and the probability will remain that it continues to be so in the Adult state, but I mean to abstract from the formation of the bones, which are not supplied entirely from Matter conveyed by the Nerves, the growth of their fibres is so produced, but in consequence of a Cellular Texture formed upon their Surface, there is a space prepared for the deposition of a fluid from the Arteries which Concretes into a bony matter, I therefore say only that the Nourishment —— Nerves, and when we say so, necessarily.

294. This —— System, I say what is otherwise probable, for that I refer to Dr Boerhaave, who by many Arguments proves that there is a Secretory apparatus in the Brain, and that there is no other Excretory but the Medullary substance of the Nerves, he indeed has carried it ale the length that is necessary, it was the System of Dr Boerhaave in all its extent, only he supposes that the secreted fluid was otherwise employed then in nourishing the body —

But

Lect: 71 —

Lect: 71.

I have told you that we are now engaged in a difficult Subject, I give you what appears to me most probable, but I give no demonstration, nor do I pretend to obviate every difficulty with regard to it, I give what I think is a System upon it, consisting of various parts mutually supporting one another, and the whole is only to be understood by taking the whole of these particulars together into consideration, I have given my reasons for thinking, that in general the Nutritious fluid is conveyed and applied to the several Solid parts of the body by means of the Nerves. I have not said a word of any facts in direct proof of this, when the opinion has been formerly maintained, they thought they had some facts in proof of it, as the remarkable Atrophia or shrinking that appears in paralytic members, and very often that is owing to an affection of the Nerves, and it may be such an affection as renders them unfit for conveying Nutrition, but I dare not apply this, for it cannot be proved, that a paralytic limb has lost any part of its Solid matter, or that it has not acquired the growth that it otherwise would have done, and I suppose that the fact should appear, as in the case of some young persons, where the part never acquires the same size, as the other parts of the body, or as the like parts in other persons of the same age, there it would appear that the Member has not acquired that increase of bulk of the Solid parts, that it otherwise would, but this may depend upon another cause; the bulk of most part of the body depends upon the fluids by which their Vessels are filled, and I shall say by and by

that

that tho' the Nutritious fluid is conveyed by the Nerves, the application of it and growth of the part depends probably upon the Circulation of the blood, upon a certain extension given to the Arteries, and every other fibre of the body, and therefore this may be no more than an affection of the Arteries, and may partly proceed from their own Muscles being paralytic, and therefore the argument drawn from the consideration of Palsy, I own does not support my opinion, nor do I know any fact that very distinctly proves that Nutrition is made by the Nerves, for suppose it has been said that the tying of a Nerve does prevent the further growth of a part, the same reason will apply here, that I applied in the case of Palsy, and the only fact that would answer our purpose, is in the case of the growth and healing of Wounds, where a loss of Substance is to be supplied, that is chiefly done by a new growth of Cellular texture, but the Vessels are also extended very much in the same form as before in new Ramifications, and therefore it appears, that the ordinary means of Nutrition are indeed applied, and we can perceive that this growth does proceed with a manifest increase of the extent of the Arteries, with some degree of Inflammation necessarily subsisting in the growing flesh, and this with an uncommon degree of Sensibility, and the parts are granulating, the parts are of an exquisite Sensibility, and the Nerves are stretched out, and under a particular influence, and this looks like that the Nerves are concerned in this Nutrition, That is all I had to supply with regard to my general Conclusion of the Nerves being the Channels of Nutrition, and consistency absolutely requires, that we should add.

294

294. This ——— System that the brain is a Secretory Organ is other wise proved, and I refer you for this to the Arguments of Dr Boerhaeve, and I leave them to sustain themselves by their own weight, and upon the whole, this some of his arguments are not very conclusive, he renders the matter sufficiently probable, and as we cannot perceive in the blood Vessels, the matter that is immediately fit for being applied in Nutrition, the Gluten is there, but it is either in a diffused state only, and not fit to reach the last parts of the System, or it is in a dissolved State, but that is by means of a Saline fluid, which is intimately united with it, and as therefore it is evident that a farther preparation is necessary to the Nutritious fluid, there is none more probable than that it is thus prepared in the brain, and this is especially confirmed from the other Arguments that we can produce for Nutrition being made by the Nerves, Dr Boerhaeve was of this opinion, but as he did not see how, as conveyed by the Nerves, it is applied to every Solid part, he admitted that every evanescent Artery drew such a size of Vessel &c as was analogous to the cortical part of the brain, and therefore was fit to distribute this nutritious fluid, but that is supported by no Analogy in Anatomy, and does not relieve us from any difficulty, and if we do reject this, we must have recourse to the brain, for the purpose of preparing the Nutritious fluid. Now when all these matters are considered it supports the probability of our opinion, and what I have said further is a necessary consequence I have shown that the gluten requires to be in the state of the Albumen Ovi, to be in a certain state of dilution, and if a Secretion thro' the Nerves as Secretories is necessary, we say it is

powers

powred upon the Medullary Substance of the Brain, which is the begin-
ning of the Nerves, and we suppose that itis filtrated —— System, how
fluids may be thus filtrated along with very simple fibres, we have en-
deavoured to explain from the Analogy of Vegetables and it was the opi
nion long ago, particularly of Sir Isaac Newton that they were in this
condition, not hollow tubes, but solid Capillamenta, as he expresses him-
self, Now I say this supposition is a necessary part of our System, to ren-
der the whole consistent, but there are difficulties with regard to it, that
we must obviate. Dr Boerhaave who maintains the System of Secretion
of the brain, and that the Nerves are the Channels of Nutrition, he
does suppose that it answers all the several purposes, for which the
Nerves are calculated, that itis the means of Sense and Motion as well as
of Nutrition, now we have given a different Idea upon this subject, and
I only here repeat it, We —— Nerves, we call it Solid in opposition
to fluid, tho' sufficiently porous, and fit to filter the fluid, is —— Motion,
I have explained my self more clearly here, than in any other part of
my Text, where I left the nature of the fluid undetermined, but from several
paragraphs. I gave reasons for suspecting that it might be an elastic
fluid, that it must be a Subtile fluid is evident from the velocity of Motion
that it admits of, and that itis constantly adherent, I gave reasons for
beleiving that itis not a matter that can be produced from a Secretion,
when I argued against Sleep and Watching, depending upon a Secretion,
I only add farther here that the presence of this is probably also the means

—— Extremities

—— Extremities my late Collegue Dr Whytt, was in the Boerhaavian opinion, that a fluid secreted in the Brain was conveyed along the Nerves, to their Extremities, both for Sense and Motion, as well as for Nutrition, he had found difficulty however in understanding how the Motion of this fluid could be carried on, and very justly, if it is moving in hollow Tubes, tho his Calculation has no effect, yet from every Consideration, it is evident it cannot be moved by the force of the heart and Arteries thro such slender Canals and of such considerable length, therefore he had recourse, for the sake of the Nerves particularly, to the Capillary attraction which he supposes to take place, With regard to the other parts, as, I said — I see no occasion for the supposition, and it is embarrassed with many difficulties, but if an aqueous and melastic fluid of some rigidity does proceed from their Origin to their Extremities, there is no other means probable, but that it is moved by a Capillary attraction, and here we are guided especially by the analogy of Vegetables, we see that their juices moves along their fibres, or Vessels against its gravity, by the power of heat, and it is probable, that it is by operating upon a subtile elastic fluid which is present in living Vegetables, as well as in living Animals, for they are the subjects of Irritability, the chief proof that we have of it in Animals, I think, that the term of Sensibility cannot with propriety be applied to them, but the term of Irritability may be applied to them in common with Animals, and by the application of the Electric fluid in larger quantity merely by a communication of it

it from an Electric matter, we see that the motion of the fluids in Vegetables is very much promoted, in so much, that such an application of it, renders their growth very sensible; and I might have recourse I believe to some other electrical Experiments to show in what manner the Electrical fluid being applied, has the power of promoting the fluids in certain Capillary tubes, where with the assistance of the gravity of the fluid, it does not run out, but by the Communication of the Electrical fluid it flows very freely. All these Considerations serve to illustrate an Idea that I have upon the Subject, that it is by means of the constant presence of heat and its action or influence upon what we call more particularly the Nervous power that the Nutritious fluid, is carried along from its Origin towards its extremities. Now I have given my System, so far as I can explain it or render it probable, but in what manner ——— explain. I could offer conjectures, but they are such as are not to myself any ways clear, and I therefore do not attempt to say any thing upon the Subject, but I think I may say, that neither can ——— Nutrition. The only other notion with regard to Nutrition, that we would take notice of is that the Nutritious fluid is conveyed by the Arteries, that it is some how conveyed by the Arteries, and applied to the growth of the Solids, I leave you to consider that System more at your leisure, I don't choose to go into Controversy, but I say you will find very many difficulties attending that

that System partly of Dr Boerhaeve and which may be that of others, who maintain that this nutrition is conveyed by the Arteries, that it is prepared in the Extremities of the Arteries, and from thence applied to the growth of the Solids, it will not be easy to prove, that there are Extremities of Arteries, thus to be applied to the Solid matter, however that supposition is further attended with the difficulty that I mentioned before, the supposing such a Secretion every where in the System, so far as we know the extremities of the Arteries, we find them terminating in Veins, Secretories or Exhalants, of one kind or other, and these least the Exhalants are the only ones, that can be supposed to serve this purpose, and how these, by pouring out their fluids into the Cellular texture can occasion the extension of the Solid parts is not very obvious, in short the difficulties that attend the employing the evanescent Arteries for this purpose are so great that our present Physiologists have taken another System, and they suppose that the nutritious fluid is applied in the course of the Arteries by a kind of exudation, Now not to say, that there are experiments in contradiction to this, and that such an exudation only takes place in dead animals, it supposes that the nutritious fluid is already prepared, and flowing with the common Mass, but supposing it was that the exudation will make the necessary application does not appear probable they take a particular illustration of it from hence that any

two

two surfaces of Contiguous parts naturally kept separate, by a fluid or Halitus interposed, if they are closely applied, as that portion of the pleura, which is extended over the Lungs, and the same portion lining the Internal surface of the ribs, they are glued together, and we find the appearance of a Cellular texture interposed between them, I might urge some difficulties, here in point of fact, that indeed this Cellular Texture is not the same with the Cellular Texture in other parts of the body, or however analogous it may be, I cannot find that it will apply to the ordinary case of the Vessels, if an Artery consisted merely of the Internal Membrane, it might be admitted, that such an exsudation thro' the Internal Membrane might be suited to conform into the form of a Cellular texture, but every where this exsudation now meets with a Muscular structure, certainly with a fibrile structure now the same matter fitted to form a Cellular texture should soon occupy the Interstices of these fibres, and entirely obliterate them, but how it should form their fibrous Structure, and then the Cellular texture, and that too of such different density, in the different Layers and Coats, as we observe it does, is difficult to Conceive, In short any other supposition on this Subject is embarrassed, with equal if not greater difficulties, and particularly no more does explain how a nervous fibre is extended by the application of any matter by the Arteries, or how the Cellular Texture is formed by a fluid poured out from the Extremities of the Arteries, or exsuding from them in their course, and with

thus

this I leave you to compare the two Systems, its not of very great consequence which of them you adopt, and therefore time enough has been spent upon it. And I go on to another matter, upon which we will be able perhaps to throw more light.—

295 ——— Vegetables. I have given a hint that Vegetables are entirely a nervous System, that is consisting of fibres, that are entirely the same from one extremity to the other, and its highly probable that the Nutrition proceeds in consequence of a filtration along these solid fibres, but how the Cellular Texture is there modified in several parts, and comes to form the various utriculi, are Mysteries that are not yet developed, but I conclude that the first part of the Animal growth proceeds in the same manner, because till Vessels are evolved, till they are some how or other filled with fluids, and the powers for moving them are evolved, till in short their Nervous System is animated, or vivified, there can be no action of the Heart and Arteries to move the fluids, as we find they do afterwards, therefore the first beginning of the growth must be purely in the manner of Vegetables by such a filtration as I speak of, There is a fact that Dr Haller gives, that I cannot find in the original Author, he gives it from Mr Lione who has wrote a Quarto Volume upon a Caterpillar, he plainly perceived that the growth was for some time entirely in the manner of Vegetables, without the appearance of any power moving fluids in hollow Vessels, But ——— place, the Vegetable Oeconomy differs

in

in this from the Animal, that while they have both for their foundation a Nervous System, an Irritable System, the Animal has the further addition of a Vascular System thro' which fluids are kept in Motion, and which is provided with especial powers, for maintaining it, but there is nothing analogous to the heart to be found in Vegetables, — at a certain period of the growth of Animals, the motion of the fluids, by the chief mover the heart does certainly take place, and the progress of the growth does depend. —

159. That the blood is thus destributed by the powers of the heart and arteries themselves, I need not now repeat, and that it is destributed by Vessels in a distended state, I have said before, at the same time it may be supposed, or we are led to suppose — body. that I likewise endeavoured to prove before, while at the same time I said, that the arteries themselves, are constantly in a state of Tension, and it is by this means that every Solid part of a living body shews an Elasticity, and gives a proof of an extended state, and the Arteries, in the oeconomy of Nature, are evidently destributed with this view, that their extension might give a tension to every other fibre of the System, and if this may be supposed that this tension is given, we presume that by the Extension —— Surface in consequence of the growth of the fibre itself, in what manner it operates, it seems difficult to explain, by extending a fibre, you move its particles at some

Lillie's

little distance, and give an opportunity for a fluid to insinuate itself which is fit to accrete and encrease its substance; but however this may be it is evident that the gradual Evolution of the several parts does depend upon this Motion of blood, and this extension of the Arteries, for we can perceive, that the growth is in proportion to the blood being brought into them, and we observe that in a fœtus the upper parts are in a larger proportion, compared with the Inferior extremities, and we find a considerable difference in the proportion of the ascending trunk of the Aorta, and its inferior branches, the Carotid and Subclavian Arteries are larger in proportion to the Iliacs, than they are in Adults, and the growth of these parts proportionally take place first, so that the head is more than 1/4 sometimes 1/3 part of the body, and in the Newborn Infant it is very often a fifth, whereas without this acquiring in itself any very considerable increase of bulk the body is extended downwards to such a size that the fine proportion of a Man, in these Countries which produce such, is that the head is only 1/10, and in this Country, where we are less elegantly formed 1/8 is a low proportion, and 1/9 is more common and we can perceive at what period this takes place when the Umbilical Arteries are tied, and the blood is prevented from going any more that way, immediately the Iliacs are enlarged from having so much blood determined into them, and which passed formerly by the Umbilical Artery. Some other illustrations of this might, but it is at present sufficiently admitted that an extension of the Arterial System has a considerable share not only in the Evolution of the System, but that it must at the same time

give

give an opportunity to the farther growth of the Solid part, and this is a step to the general doctrine of Nutrition depending upon the extension of the Arteries. It may be said that this is in favours of the doctrine of Nutritions being conveyed by the Arteries, for the doctrine will apply this way, that the parts grow in proportion to the quantity of the blood poured into them, but considering what a small increase is made to the former Vessels, enough may be poured in to supply that from the Nerves. But I go on now to supply one other part of the System of Nutrition, I spoke of the Nerves being the Channels of Nutrition, and I said they were the Channels by which the Nutritious fluids were conveyed to the soft and homogeneous parts, here I supply what I imagine is a necessary explanation with regard to the formation of the bones, I say, perhaps —— body, this respects the density of Membranes themselves, it respects the formation of Cartilages, and of bones, With regard to the two first I can't speak very explicitely, With regard to the bones, I think the matter is a little more clear. I might have mentioned a particular in illustration of the growth by the Arteries, as some may think we find bones grow in proportion to a certain force of the Circulation Dr Haller in his treatise De formatione Pulli &c which you have in his Opuscula Minora, observes that in the long bones, there is no formation of them that is remarkable, till there is a Circle of Arteries, and these Arteries while they form a Circle round the Extremity of the parts to be ossified do send out streight branches every way, and no Membrane appears without this first taking place) and in the flat bones, where the process of Ossification proceeds towards the Centre) in like manner till

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an Arterial spot seemingly a sort of Circle of Arteries is formed in the Centre and is extended by branching out every way, No Ossification is observed to take place; this I might have taken as an illustration of the general Idea of the Arteries, being necessarily here, but it likewise operates in another manner, by this Evolution a new Secretion is produced, which is fitted to pour out a Matter in different circumstances fit to acquire more or less density, thus the Bones, are formed by what may be called a Bonny Matter, and poured into the Meshes or Cells of the Cellular Texture; it is there Concreted, till every separate Cell is thus united together, and the whole forms a consistent Compact bonny Substance, I take this Idea from an Author, whose Authority you will not lay much stress on perhaps. i.e Du Hamel, I own that his opinion, with regard to formation of Bones is embarrassed with some difficulty, but still the general parts of his System appear to me highly probable.

Lect: 72

On the Subject of Nutrition, I have endeavoured to ascertain the Nutritious fluid, and to determine in what manner it is conveyed to the several solid parts that are formed of it, and so far we have supposed a Nutrition taking place in Animals analogous to that of Vegetables, but there is little doubt, that the addition of a Vascular System in Animals thro' which fluids are moved with a considerable force, that this is concerned in the growth of the Animal, and a Vascular System must be evolved by fluids propelled into it, and it is probable that while this propulsion of fluids gives them their proper size, that the application of the Nutritious fluid to form the Solid parts is in some measure in proportion To explain this I have shown that the Vascular System of Animals is constantly distended, and that this gives a preternatural distension to every solid fibre of the System, while they remain in any degree in a flexible State, and that it does give an opportunity to the application of Nutritious matter to the extension of every fibre, and to the formation of Cellular Texture, but this only accounts for the formation of the soft and homogeneous parts, I have mentioned that the bones are a heterogeneous substance, they were originally in a soft State, and in the progress of life a matter is further added, that is fit to Concrete into a bony substance, and we do not suppose that this matter is derived from the Nerves, we believe that this is derived from a peculiar Secretion that takes place in proportion to a certain extension of the Vessels by the expulsion

of

of the blood in the arteries, I pointed out the observations of Dr Haller with regard to this matter, and I conceive that the Membrane of the bones has at least for a considerable part of it a Cellular Texture, that thus receives a matter that is fit to harden into bones, and thereby at length it puts on the appearance of entire bone; which I conclude from the Experiments of Du Hamel, but whether it is an original Membrane that is thus formed into bones, or if there is a periosteum, from layers of which it is formed as in the bark of Trees, it is not very necessary to determine, tho to me the System of Du Hamel appears very probable) but whether it is Periosteum, or a Membrane that is no part of the Periosteum; I suppose that the bonny matter, is poured into the several Mashes of the Cellular texture; and taking a bone new formed, he found that it is not in the whole a bonny Mass, but in part still flexible and Membranous, while the bonny matter is deposited in its Cells or Mashes, and we can Elucidate these grumes of bonny particles, that have hardly yet acquired their solid consistence, but by degrees every Cell is formed into a bonny Mass, and these uniting they obliterate the Net work that was formerly interposed, this then finishes what we have to say towards giving a general Idea of the formation of all the parts of the body, and I go on to Consider a little the successive extension of it, I say.

296. By ——— it, that the growth of the body is connected with such an Evolution, I gave you one general view before in mentioning the Successive formation of the upper parts, of the head more particularly, and of the lower Extremities, which are evolved in proportion to the

extensions

extension of the Vessels, and the Vessels of the lower Extremities, which were of a small size, have now a greater quantity of blood poured into them, and that is evidently connected with a quicker increase of the whole parts, and if you look into Dr Hallers very curious observations upon the formatio pulli, you will find that there is no other red particle, but the heart itself that is observable, but this appearance gradually extends itself to some length in the contiguous Vessels, gradually proceeding further and further, and in proportion to this do the several parts of the body come to be sensible to our Eye sight, and gradually acquire a certain bulk, with some different circumstances, in the different parts, but in all of them, it is in proportion to this mark of Evolution, thus you will easily see how the Abdominal Viscera acquire their greater bulk than the lungs in the fœtus — while almost the whole of the blood returning from different parts is determined by the foramen Ovale, or Ductus arteriosus, to pass into the Aorta, while a very small portion passes into the Lungs, only so much as is necessary to fit them for the reception of air, in order to their further Dilatation, this is the general Idea that I think every body adopts with regard to the Evolution I speak of, the growth will be determined I say, "As by the Constitution of the original Stamina" being of more or less density, and so more fitted to yield or resist, and not only from this difference of density, but according to the Rudiments of the Vessels being made of different sizes, so as to be put into the condition of 177, 8. the original Stamina in some measure determining the Impetus or quantity of blood distributed into each part, I have also marked some "after Occurrences" such as the tying of the umbilical Artery which determines

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the blood into the Iliacs, and I have mentioned the situation of the Lungs, their being dilated afterwards by air, and you will readily understand from the singular course of the Venous blood in the Fœtus to the Vessels of the Liver, why that has such a proportion in the Fœtus, to what it is in Adults, but we must add that as —— parts, I go upon a supposition in some measure, but which I have endeavoured to render probable, that in proportion to the Evolution will the application of the Nutritious fluid be, as it consists of glutinous parts, which will concrete into a Solid, where there is some provision for abstracting a portion of the more fluid parts, in consequence of which the Solids will acquire a greater proportion of Solid matter with regard to the Water. Thus if you take a portion of the gelatina obtained from Animal Substances in Decoction, you have it in a fluid state, but by evaporation, you bring it into a very solid Mass, to that of our ordinary Jelly, and if you take a certain portion of that fluid, you can only get a certain quantity from it, but if as the Evaporation goes on, I am adding fresh Decoction, I can acquire still more and more of the Solid, and we may suppose that somewhat of the same kind takes place in the application of the Nutritious Juice, and that the Solid parts do in fact acquire a greater portion of Solid matter, is evident, if we compare the fluid state of this matter in the Embryo, and the gelatinous state of the Fœtus, with the rigid state that takes place in old bodies they —— Evolved. This is an obvious and easy enough consequence that if it depends upon the force of the heart, that they are evolved —

and I

and receive their nourishment, the sooner that is done, the sooner they will acquire their Solid matter, the extension will be in proportion to the propelling force and the resistance of the fibres, and as they grow they will resist more and more, thus if just now the Vessels of the head have acquired a faster growth, they will be going on to diminish in proportion, and in fact we see, how small a proportion the head in Adult persons has, compared to that of Infants, and the blood will now be determined in greater quantity to the lower Extremities, and this may first take place in the very head strictly so called, as the Nervous System was first evolved, and this resistance will first take place, in the Carotid and Vertebral Arteries, and then in the Subclavian and Brachial, and as this goes on the blood will be determined more powerfully into the descending Aorta, there perhaps the Viscera are first formed, and these will also determine the blood more powerfully into the Vessels that belong to the limbs, we cannot indeed condescend upon the particulars, but the general progress we clearly understand, and by this means the whole ——other, with the forces to which they are severally exposed; suppose it were otherwise, if any one Vessel has a greater quantity of blood poured into it than another, because its resistance is less, that must increase its, or suppose its poured into one of a greater rigidity, its growth must stop, till the whole comes to be in ballance, at least in proportion to the forces to which they are severally exposed. There are some particulars that may be mentioned here, that we have not yet mentioned, because we cannot ascertain the circumstances, it appears from the Ex-

periments

periments of Dr now Sir Caston Wintringham, that in proportion to their size, the force of the Vessels is greater as you recede from the heart, and their resistance will be proportionally so, and for bringing the whole into the due ballance, the larger Arteries nearer the heart are exposed to a greater proportion of blood, and they will therefore get more solid matter, but its evident that they become more in ballance with the Extreme Vessels, otherwise these would be Ossified before the System was perfectly evolved, but I shall have occasion to touch this in another part, and I say.

297. The——— further, I now add, from——Veins, if the blood flowed in the several parts of the System, with the same velocity, its plain that there would be no such pulsation, as we observe to take place, and we explain the pulse from this resistance in the Veins, its in this way that the Arterial System is kept constantly extended, and its to be observed that besides, these resistances formerly mentioned, there must be a resistance in the Veins, for——Veins, I have said that the red Globules do not pass beyond a certain size of Vessels, and probably a certain quantity of Gluten is confined to these, but these do pass into the Veins entirely, and if the resistance there was none at all the Arteries would not be so stretched, but there is a resistance in the Veins, in consequence of their distance from the heart, the Viscidity of the blood, the friction of adhesion &c, these all continue to operate, but further these by——them, now we again return to say.

298. While——before, here is one of the greatest difficulties that occurred in the business of Nutrition, as long as the heart continues

to beat, and the pulsation is observed, at every such Systole is the Arterial System extended in width and length why therefore should not the growth continuedly proceed? That necessarily lead to a supposition that I have thrown in here, that a certain extension is necessary, and tho' the Arteries continue still to be extended, yet we say that that extension is probably not enough to admit of the proper application of the Nutritious matter, and how this is precisely we have not perceived, but the supposition is almost unavoidable, that it is not every extension made by the Systole of the heart but that which subsists during both the Systole and Diastole, that is necessary to the growth, there is another way of explaining it in part, that the length of the body is certainly determined by the growth of the bones, the limits of stature certainly depend upon their growth, and I have said that the growth of the bones, depends upon a progress of Arterial Substance, and as the Animal grows that is less and less, and when it finishes in the bones and Epiphuses, which are different, we find the limitation of the growth of bones, and of the growth of the length of the body, for as these bones extend, a prodigious number of fibres, this probably is a part of the extension that is necessary to the growth, and no longer acting proves a limitation of it, but whether you take this from the extension made by bones, or as depending upon an extension made by Arteries, and to be sure in many of the soft parts the extension depends upon the Arteries alone, there is a state of extension which in lax parts gives an opportunity to the application of Nutrition, but that is limited, and therefore perhaps

perhaps it is, that the more —— slowly, as it becomes more rigid its in proportion to this extended less by the same powers, this is a fact that every observation shows, so from the beginning to the adult state, the increase is prodigious, but in acquiring that prodigious proportion of growth it is gradually slower, from the smallest beginnings in the Chick from the first appearance of the Germ of the first day to the 21, which is the time that it remains in Ova, it has acquired some Millions of times its first bulk, and it can be traced that the second months growth is less than the first, and in like manner in Viviparous animals, the growth is constantly diminishing more and more, in so much that a Child of 3 years old has not half the stature that it afterwards acquires, but we must now observe further that unless —— farther, I say if the Solids are constantly increasing in their resistance, unless the extending powers, are increasing in proportion there will be a period in which they will ballance one another, taking in the supposition, that without a certain extension this cannot proceed, But —— other, we say the blood is propelled into the Extreme Vessels by the joint action of the heart and Arteries, but the action of the Arteries, is in proportion to the action of the heart, we have only to enquire therefore whether its powers increase in proportion to the increasing resistance of the Solid parts, we have no means of determining this, but by comparing the bulk and weight of the heart, and that does not at all increase in proportion, Dr Haller says that the heart of an Adult is 8 times less, or in a foetus that it is 8 times greater,

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in proportion to the bulk of the System, than it is in Adults, and there will be a proportional diminution of the quantity of blood that is thrown into the System at every Systole of the heart, and the extending powers therefore are not only not increasing in the same proportion, but are diminishing, and therefore it is evident that these two powers will —— other. here I have considered only the resistance of the Solids in proportion to the growth of the heart, but there is further the particular resistance in the Veins, I say

299. But —— Vessels, if there are two sets of Vessels, or two portions of the same Vessels, thus communicating, the resistance of the one will be in proportion to their respective densities or firmness for we may abstract here from Muscular power, which may be allowed to be in the one and not in the other, and the force of the heart will dilate the Arteries, or force the blood into the Veins, in proportion to the density of these two sets of Vessels. But —— Old, I refer you to him for the particular Experiments, for the proof of the fact, and tho' they have not been repeated, they have not been refused by any Physiologist, and they are made with an appearance of great attention and accuracy, and we have the more reason to trust them, in that they are supported by every kind of reasoning, he made his Experiments on the Aorta, and Vena Cava, in the Lower animal, and he found that the resistance in the Vena Cava was greater than that of the Aorta, requiring a greater force to burst it, but that

that we are not so much concerned with; but when he compares the same vessels in the adult, he finds now that the force of the arteries is greater, than of the corresponding veins, as in the Aorta and Vena Cava, and, where he made the experiments more exactly in the emulgent artery and vein, and Iliac artery and vein, in taking a lamb, and an adult ram, or sheep, and then it appears that during —— time we would expect this from the arteries being nearer to the heart, for as it is an extension that is constantly encreasing the density of parts — the parts nearest to the heart must increase in the greatest proportion and therefore —— diminishing, and a necessary consequence is that —— extended, it is obvious, that if during the Systole of the heart as much blood passed from the Extremities of the arteries as issued out of the heart, there would be no pulsation, but as there is a dilatation of the arteries, we can perceive that in proportion to the resistance of the Veins admitting more, less at the same time will be confined in the Arteries, and their dilatation will be less, and Lastly —— powers, The yielding of the Veins, and the receptition of more blood into them, may retard the encreasing rigidity of the Arteries, but as it constantly operates in occasioning some extension, it will bring them at length, to be in a ballance with the extending powers, I should not have said, will the sooner bring &c but it will at length bring the increasing Rigidity of —— growth, upon the principles I have before explained, this particular change with regard to the destribution

of

of the blood in the System, especially with respect to the blood in the Arteries and Veins, as it has a considerable effect in many respects I thought it worth while to point out this, and I say. —

300. This —— old. The Anatomists who are occupied in Dissection and Injections are entirely of this opinion, and we may judge of it from what appears upon the surface of the body, that while the whole surface is kept distended, and has the red Colour that it derives from the Arteries, the Veins are less in their size, and in the colour they communicate to the Skin, while in an old person the Shriveled parts have very little Colour, the Veins are distended & it is their Colour approaching to the livid line, that is to be perceived, and there is another Consideration that —— persons, by accident they may occur at any period of Life, but in nine cases often Arterial Haemorrhages occur before the person arrives to his Acme, you know that a Haemoptoe may be considered as an Arterial Haemorrhagy, and that it is a very frequent foundation of a Phthisis Pulmonalis, and so long ago as the time of Hippocrates, this disease was limited to the age of 35, and it hardly occurs before the age of 16, when the Arteries are acquiring their most considerable distension, and at the same time are increasing in their resistance, which shows how much that haemorrhagy is connected with this destribution of the blood, and I would say that of the Haemoptoes that occur 9/10 of them occur between 16 & 25 for one that occurs from 25 to 35, and we need not say, that the haemorrhagy from the Nose is confined to the age of puberty, but upon the whole that this is

they

the fact will be acknowledged by every person, and on the contrary that Congestions —— Age, the most considerable Haemorrhagies that are called Venous, tho' I am not certain with regard to the propriety of the term, but tho the effusion may be said to be from Arteries, its upon a different principle but often it only tends to give an increased Exhalation and Effusion; and I need not say how often these depend upon Congestions of the Veins, or that these occur most frequently in old Age, when the ballance is thrown upon the Veins, and here we wou'd expect that the Congestions shou'd be in the Vena portarum, where the Venous blood is so readily collected, and moves with the least force, and in fact we have many diseases that depend upon this, as the effusions from the Haemorrhoidal Vessels, which may arise from various Causes, but which especially proceeds from the varicose state of the Venous System

But. ——

Lect: 73.

For two days past, I have been engaging you in a Speculation that is extremely curious, and I believe extremely important too, the consideration of the ballance between the several parts of the Sanguiferous System, I have said it is obvious that for the most part the growth of Animal bodies consists of an Evolution of their Vascular System, and it is probable that the Accretion of Solid matter to their several parts goes on by certain causes in the same proportion with this Evolution of their Vascular System, but this depends upon the force of the blood propelled into these Vessels, and if so the Evolution, and growth in every respect must go on in proportion to the flexibility of the parts to be extended, and the powers applied to extend them. In this respect it appears that in the first beginnings of Life, the parts of the Vascular System are extremely flexible, and the distending powers large and strong in proportion to them, and therefore a certain growth goes on with a surprising rapidity, but these very effects must have also an effect in retarding the further progress, and at length in putting an entire period to it. i.e. by the growth there is an Accretion of matter from whence the Vessels acquire more rigidity, and less flexibility, and that the growth should proceed as before, the extending power should be in the same proportion increasing, but it is very certain in fact, that the chief extending power, the power of the heart does not increase in the same

proportion

proportion, with the resistances in the Vascular System, and upon this account, these two powers must at a certain period be in ballance with one another, and therefore the growth depending upon this difference no longer proceed.

In considering this matter, we took occasion to observe that this is modified in different parts of the System, this somewhat different from the Constitution of the Original Stamina, and from after occurrences in life, whereby certain parts, are more exposed to the Impetus, or quantity of blood poured into them, but again with regard to the whole, when we speak of the ballance between the resistances and the power of the heart, we comprehend the whole System of Arteries and Veins, but this again may be modified by a different ballance, between the different parts of the Vascular System, there is probably some peculiar ballance between the different parts of the Arteries and Veins, as they are at a greater or less distance from the heart, this would appear from Sir Clifton Wintringhams experiments, but as the facts here are not so clearly established, I do not chuse at present to found any thing upon it, but there is another ballance between the several portions of Sanguiferous System, that we perceive very clearly, and that is the particular ballance between the Arteries and Veins, it is evident that the Veins are of a much greater proportion, with regard to density in Young than in Old persons, whereas on

they

Contrary the arteries are acquiring a density and rigidity much faster than the Veins, therefore the power of the heart remaining the same, the Veins will receive a greater quantity of blood, and less will remain to distend the Arterial System, and this with the general increase of resistance will for some time retard, but will at length concur to bring the whole to a ballance between the two Systems of blood Vessels at different periods of life, such a difference of Ballance appear also from various Phaenomena of the System, thus it is evident that Haemorrhages, which must arise in proportion to the fulness of the Vessels in which they occur, and the application of powers filling and distending them, and it is certain that the Arteries are more liable, to Haemorrhages in young people than in Old, and that Congestions in the Veins, and their consequences do in fact appear more in old persons, than in young, I was beginning to point out, that in general there is the appearance of more fulness in the Arteries in the time of youth, and that they are of a larger size in proportion to the Veins, and that the contrary of this takes place in old Age, when the Veins receive a greater proportion of blood, and that Congestions in the Veins and effusions then more readily take place, and I was going on to point out in what parts of the System particularly they arise, and I observed that they were no where more remarkable than in the System of the Vena portarum, so that we frequently find the liver and Spleen enlarged, and the diseases that arise in consequence of this, and in this way we see that in consequence of the resistance given to the branches of the Vena Portarum operating upon its depending parts and producing the Haemorrhoidal

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flux, this may arise from a variety of Causes, and at different periods of Life but so far as it depends upon the state of the System, this only at the decline of Life that they occur, Another part of the System in which they occur is the Venous System of the Brain, I formerly pointed out the Conformation of these, in so far as that small Veins, are all directly poured into large and lax sinuses, and the return of the Blood from these is by their Structure not the most facile, perhaps it was necessary to retard the Blood, as its poured into the Jugular Veins, because their depending situation would return it too quickly to the heart, and prevent such a quantity of it from being retained in the brain, as is necessary to keep up a certain tension in the brain, but for the same reasons that its thus retarded, Congestions will more readily occur, and accordingly Apoplexy, and Palsy, and the other set of Comatose diseases do occur then; and its evident that they do depend upon an accumulation of the blood in the Vessels of the brain, and frequently upon effusions of blood in consequence of that and still more frequently in consequence of effusions of Serum, how this is occasioned its not my business to explain, and its every day explained in our common Systems. - Having taken this occasion to mention this curious part of the ballance of the System, I go on to observe, by what means this Machine of ours, has its final period, and becomes unfit to perform its functions, but I first throw in, by what means the event is retarded, that we would otherwise expect to occur from the resistance gradually increasing, and the power of the heart diminishing

nishing, we would expect that this would soon put an end to the power of the heart with regard to the System: But.

301. It —— Blood, tho' the power of the Heart is diminishing, if the capacity of the System, at the same time, it may still be equal, and we have only to explain, in what manner the Capacity of the whole System, is diminished, and the heart now propelling the blood into the Vessels with less, and as the application of any two parts of the living body, pressed upon one another, is sufficient to form an Adhesion, and obliterate the capacity of the Vessels, therefore, if powers of Compression are externally applied this Adhesion will take place, and such Compression in fact does take place; and that first from the larger Vessels, which are exposed to a more considerable distension, this is greater in proportion to the nearness of the heart, and many small Vessels are laid in the Membranes of the larger, and in the Cellular Texture, to which these large Vessels are contiguous, and next the action of the Muscles how it happens, with regard to the Vessels distributed among the Muscular fibres, we do not understand, but we know, that the Muscles when exerted acquires a considerable degree of hardness, and do Compress all the Vessels in their neighbourhood, and thereby they have their noted effect, in accelerating the motion of the blood towards the heart, and the various action of the bones and Joints, their friction and extension must have effect at the same time; and we cannot be exercised in Motion but in a resisting

the Medium

Medium, and we perform few exercises, but in acting upon other bodies, and we frequently sustain the action of other bodies upon us, and supposing the System to remain in its ordinary force, the length of time must indeed Squeeze together several parts of this lax System of ours, however this I say is sufficient to retain the total destruction of the Machine, as the diminishing force of the heart, has thus less power to exert, and this accounts for the Stationary condition of human life, for some length of time, perhaps till the human body has arrived at 30 it has not got its compleat size, and from 50 years, it is in a manifest decay in all its several parts and functions, and from 30 to 50 it is remarkably Stationary, perhaps there is a Meridien of life as Dr Cheyne has put it at 35, but no body puts old age before 50, when the further decline of it is more remarkable, but still this is limited, for while the resistances ——— diminishing, that the irritability of the Moving fibres, is diminishing, we know from every Circumstance with regard to the strength of the body, at least from 35, the strength of every Muscular fibre is diminishing, whether that depends upon the change in the state of the Muscular fibre itself we would not determine, but it may depend upon a Vis insita, a power of Irritability in consequence of its own form, but it also may be in consequence of a certain power from the brain which takes place in every motion, in these not called Voluntary, it is less evident, but I gave many proofs of their motion depending upon a certain Energy of the brain, and

and if it appear that these powers are constantly diminishing, the power of the heart —— ensue: how it exactly proceeds, — With regard to the several portions of the System, is not very clear, but it at length falls upon the power of the heart, in propelling the blood thro' the Lungs, whether that is partly owing to the power of the heart, and partly to the weakness of the Organs of Respiration in dilating the Lungs, I will not determine, but this the left Ventricle, that first ceases to act, next the left Auricle, and these both cease before the right Ventricle, which next ceases to act, and last of all the right Auricle shews some palpitation till the motion ceases, nothing is more evident than that death proceeds in this manner by this ceasing of the action of the heart.

302. The —— life. I am doubtful but the proposition in this paragraph may be considered as very much the same, as that in the last, that viz the diminished irritability, and diminished energy of the brain that occasions the Cessation of the hearts motion, but I added it in view of the Supposition of a Vis Insita entirely independent of the brain, Dr Haller would explain it merely from the extinction of the Vis Insita, the ceasing of the Irritability of the moving fibre, but there are causes of Debility and weakness that may be understood to be in the whole of the Nervous System and perhaps more especially in the Energy of the brain, than in the irritability of particular fibres, and the total extinction of the vital power there does

does arise too independent of the Circulation perhaps that cannot be absolutely put, as this Energy and the Circulation are certainly so connected as to proceed together, but independent of the Circulation more entirely this takes place, and this not in the first instance that the brain loses its Energy, by the taking away the force of the heart in propelling the blood into its Vessels, therefore to say that the heart ceases first, and the functions of the brain afterwards seems to me not so proper, and I take it that the order is inverted, that the energy of the brain first ceases, and that in consequence of that the heart ceases to act, the Energy of the brain does decay from certain causes operating upon the Nervous System, and we must suppose this to take place in consequence of the progress of life, and I say that it follows the progress of life seems to be proved ——— period. it is beyond the period that I before assigned, it is from the period of 50 years onwards, that Sense becomes less acute, the Imperfection of our Organs depend upon different causes, upon a change of the Conformation of the Organ itself, and in the Eye, for example, we might suppose that the Retina is in the same condition as before, and that indistinct vision proceeds from some fault in the Organ of the Eye, but in many Cases while the Conformation continues the same, and the limits of distinct vision being given as depending upon the Convexity of the Cornea or Chrystalline Lens, manifestly the Retina is less sensible, and requires a greater quantity of light to make the same Impression, so in the case of the Ear where we can't ascertain the

change

change of Conformation of what is called the External Organ, the Sensibility manifestly diminishes, one certain proof to me is that it is happened with a decline in the power of Memory, the imperfection of this as I hinted before depends upon various Circumstances, but it certainly depends upon this among the rest, the Vividity of the Impressions that are made from the Sensations arising from the various objects, that our memory retains them longer, now we observe that Old persons retain a very distinct memory of old occurrences, they retain the most part of these towards the decline of Life very exactly, but these of yesterday are more difficultly retained, and here I may say with the Poet " I thought so once, but now I know it," the Impressions last made are the worst retained, and that is owing to their making less deepth, according to the common language, or less lively impressions, and that memory declines both with regard to recent and old impressions is sufficiently known, and that our Intellect is also upon the decline, our Intellect is employed in Comparing the relations of bodies, and by Memory we must call up all the relations of things that are under Consideration, and therefore memory may subsist without Judgment, but no Judgment can subsist without memory and there may be an increasing accuracy of Judgment in consequence of frequently considering the same relations, and in that respect our Judgment for a great length of time goes on improving, but with regard to many of these parts, the original Impressions are obliterated, and the memory is more slow in running thro the whole

many

train of Associations, and in consequence of this our Judgment becomes more imperfect, and this must be purely and entirely referred to the brain, as I have proved this to be the proper Sensorium Commune, but further we may take in the decay of Irritability as a part of the general decay of the Nervous System, how far this depends upon the Conformation of the particular Muscular fibre I will not say, but the Concurrence of the brain is necessary, and we can perceive the Irritability of the brain to be less, not only in consequence of the Sensibility being diminished, but as the Sensation and Volition being given, we do not exert the same vigour in action, so the same Sensation being given, it does not exert the same vigour and force as in young persons, and therefore a total extinction of the Excitement or vital power of the Nervous System does at length take place, and that in consequence of the progress of life, but there I can go no farther, we know too little of the Constitution and its peculiarities to go farther, we can see that Excitement produces Collapse, and therefore that the alternation of rest. With regard to these functions that depend upon the exertion of the brain, is so constantly necessary, and as it thus operates by the day, some what of the same kind may be supposed to be operating in the progress of life, and that the repeated exercise takes away from the vigour of the Excitement that is produced, so that at length it may come to be extinguished altogether, but I engage upon a melancholy subject, if not to you at least to myself, and here let me say Mors ultima Linea rerum; I here take an opportunity of finishing what I have to say upon my

I said it might be divided into 7 Sect: the 4 first of these I have Considered, and I have only to say, why I do not think it necessary to consider the three others. My Intention is chiefly to consider the more general System, and the more general functions that have a share in the explanation of diseases that affect the same more generally, and which to be sure, therefore are the most important object of our Consideration, but with regard to these functions as modified by the particular Organs, I do not think it necessary to Consider them, as the understanding of them is inseparable from the Anatomy, or from the assistance of some other parts of Science which are here to be called in, but which must be acquired elsewhere, thus whoever understands the Conformation of the Eye, and has a moderate knowledge of Optics, he may at least by a little application come to understand that Organ; and therefore our fifth Sect: which was to treat of —— functions. I think no ways necessary to be considered here, we have considered what relates to Sensation in general, and also what relates to the motion and action of moving fibres in general, as they are employed in performing the several general or particular motions of the body, And with regard to them I say, that a few principles taken from Mr Winslow with regard to the judging of the effect of the Contraction of Muscles applied to the knowledge of their situation and dependencies from anatomy, will lead you to understand the particular motions of the body, particularly these that are called the

voluntary

Voluntary, and therefore that part of the Physiology is not necessary to be insisted upon now. With regard to the last Sect: we might find there indeed some general Laws relating to the System, but I should have very little to deliver, but what we learn from Anatomy, With regard to the more general Laws of the System, it's one of the Mysteries of Nature, the most dark and intricate of any we know, and it would be losing your time, to give the various Conjectures that are to be made with regard to it, there are indeed some parts of the functions, with regard to the Sexes, that are proper to be Considered, as the doctrine of female Menstruation, this may be understood in some measure from what I have been last explaining with regard to the ballance of the System, and will come to be considered to better purpose than we could do here in the Pathology under the title of the Sexus feminae Symptomata, and upon the whole you will excuse me for finishing the Physiology in this manner, and will allow me a day to turn my thoughts to our new Subject of the Pathology, Upon Thursday morning therefore, you will bring Copies of Dr Gaubius's Pathology along with you.

I have a few words to add with regard to some students in the Course of practice you will join with me I dare say in my

in thinking that the University has sustained a very great loss by the Death of my very worthy Colleague Dr Gregory. The Gentlemen particularly who have been his pupils this Season, will especially regrate the loss, The University are very anxious that your loss may be made up, and I am desired to intimate to you that Mr James Gregory is to carry on his ffathers work for this Season on Monday next, I know that he has very sufficient materials, in his hands, for this purpose, in so far as he has his Fathers papers, pretty fully wrote out; and he, as you know is a young Gentleman of most excellent parts, and has made a considerable progress in the Study of Physic, and he is better acquainted than any body else with his fathers System. Therefore I hope that you will have the Course carried on very much to your satisfaction.