Thesis,

on,

the Anatomy, Physiology and Pathology of the Arteries

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Preliminary remarks. A correct knowledge of the Anatomy, Physiology and Pathology of the Arteries is of the greatest importance, towards understanding the nature of their morbid conditions, and framing a true and correct Diagnosis of their diseases. Respecting the Symptoms and Diagnosis of diseases of these vessels, enough has been written to enable the Practitioner with tolerable certainty, to form a true notion, and in most cases to know the nature and extent of the lesion already existing, and indeed it may be said that this has arrived at a comparative degree of perfection. Considering that such perfect knowledge with regard to their Anatomy and Pathology is to be attained, and being aware that these diseases are treated indifferently, in consequence of not being fully conversant with their real pathology.

I presume that I am not far from being right in pursuing a series of observations on this branch of Medical Science, which must be of the greatest

utility

in applying the remedial measures. The term used for expressing the nature of their most common disease is so indefinite, especially as "Degeneration of the coats of the arteries," but I believe few Authors have been using it, in strict accordance with its Etymological import. The Anatomy of the coats of the arteries has been divided and subdivided to extreme minuteness; and indeed zealous Microscopists have manufactured coats to the arteries which cannot be said to exist, because proper investigations into the character and disposition of one of their elementary tissue will show that it is possible to reduce them into <u>two layers</u>.

Craving indulgence for the confident manner in which I opened the preceding opinions. I trust that any conclusions that I may arrive at will be leniently dealt with as I have pursued the path independent of all preconceived views, and have endeavoured to the best of my power to give an accurate and impartial description as far as the result of my observations with the aid of Oberhauser's Microscope. I shall pursue the present theme in the following order:-

I Anatomy
II Physiology
III Pathology

Anatomy:- Before entering into the details of my own researches on this part of the subject, I may here briefly notice the description given by others.

The immortal Hunter with comparatively rude instruments, after a series of experiments upon the arterial tunics of the living and dead subject, added to their Anatomy and Physiology very materially, by distinguishing in their coats an Elastic and Muscular structure arranged seperate of one another. The internal being composed of Muscular fibres interwoven with some Elastic tissue, and the external of Elastic alone which last decreases in quantity, according as the distance from the heart becomes greater - until at last they are composed entirely of Muscular tissue. I believe that he had approximated a true and correct description, if he had stated the reverse of their arrangement from within outwards, which will stand I think further investigations, and be proved to be true in the after part of this theme.

Henle having the powerful aid of the Microscope was more capable of undertaking a satisfactory and conclusive series of observations on the subject, more especially with regard to the arrangement of their tissues, which he has almost exhausted.

He by Microscopical examinations ascertained that the ~~arteries~~ arteries are composed of five distinct strata differing from each other in texture, therefore, reckoned as so many seperate tunics, Viz.

1 Epithelium; 2. Perforated Membrane; 3. Non Voluntary fibres; and Yellow tissue; 4. Elastic tissue; 5. White fibrous tissue.-

With regard to the preceding arrangement of the Arterial tunics of Henle, I have been induced from numerous and careful observations to draw different conclusions; respecting the structure of the "perforated membrane and Epithelial tunic"; consequently different arrangements; Although Henle is a high authority and acute observer on the present subject, at the same time I may claim from you forbearance to enhance my own observations.

The Epithelial layer:- Having scraped and peeled off the internal surface of healthy arteries on many occassions, and not having succeeded on any of these to witness ~~simulating~~ anything simulating those cellular structures as described by Henle; Therefore I have naturally been lead to conclude that they donot exist. Besides I think no physiological evidences show as far as the function of this structure is understood in other parts of the body, that we could conjecture the necessity of its existence in the vascular system; whether this will be considered authentic by you is what I cannot control.

The perforated membrane,- as I shall presently consider this tunic seperately it needs here no further remarks only I think, that it has no real existence, or at least needs no seperate name; nor indeed the two last requires a seperate notice which I shall again discuss more at length.

Having noticed the arrangement of the arterial structures as detailed by Hunter and Hewson. I shall now proceed to define the result of my own observations

It is a well ascertained fact, that the arteries are tubular canals destined to convey pabulum to different textures, and organs of the body: although found empty soon after death; hence the origin of their name from the notion formerly held that they during life contained air. Their internal surface present a whitish yellow colour like Cartilage, with irregular longitudinal corrugations, and entirely wanting in any appearance of vascularity; although the imbibition of Haematine which is altogether a post mortem process may strongly resemble the state in which blood may be said to circulate; indeed it has been figured by some authors as inflamation. This is disproved because it can be produced artificially by inserting an artery in blood.

The arterial tunics are fabricated out of two kinds of elementary tissues, namely, the yellow tissue, and what seems to be a peculiar modification of it*: (because it exhibit similar characters) and also the non voluntary fibres. The third ~~truly~~ ~~formed~~ element truly forms so small a part of the constitution of the coats, and of the same kind of texture that it may be more judiciously described and arranged with the Sheath of the arteries. *I may here remark that this variety, lines the internal surface of the arteries.

Basing my future arrangement of the structure of the coats of the arteries, upon what I have already advanced with regard to their most minute sub-divisions. Therefore I think their structure may be conveniently and correctly described as

1.st The Elastic layer or Internal layer.
2.nd The Muscular layer.
3.rd The Sheath.

Elastic layer.— On examining a large artery of a large animal, this layer may be found easily separable and presents comparatively loose connection with the muscular layer. It possesses considerable degree of elasticity, and strength transversely, and longitudinally, but more so in the former than the latter direction, because it may be made to extend in either direction, but less longitudinally, which restores itself with a marked resiliency to its normal length.

This layer presents internally the appearance previously described. By a further dissection of this tunic with Needles and Forceps &c. one will be easily satisfied that it consists of many layers having comparatively loose connections; more especially those on the inside. where one or more layers may be peeled off readily in the long axis of the artery. These films are extremely thin, translucent and form a continuous membrane which will readily give way when extended. The deeper lamina are much more matted together, and offer much

greater

greater resistance to be seperated into layers as compared with the preceding. The latter laminae present a yellowish appearance thicker and more ragged surface, which show more adherent connection of their laminae, than the superficial layers. These are furnished by a high degree of strength and elasticity, and have a greater tendency to peel off in a circular direction than in a longitudenal. They form much the larger part of this tunic. The following shows well the disposition of these laminae to seperate in a particular direction when the deeper laminae are peeled off while the superficial layers are in situ; the latter corrugate and split longitudinally the former tear and seperate easily circularly around the tube.

Microscopic anatomy of the Internal coat:- According to Henle the perforated membrane forms a great part of this tunic: having succeeded in procuring a proper piece for microscopical examination from the inside of an artery, and examined it first with a low magnifying power: that is 300 dia: The field presents a view resembling what Henle described as the perforated membrane, that is consisting of rather dark fibrous streaks which gives off branches that anastomose freely with one another. These overlay almost a colourless ground, but diffused rather irregularly between those fibres are enclosed spaces resembling "Holes", Hence its name. By gradually making use of a higher power, that is from 300 to 500 dia-

We may observe two kinds of appearances, viz. one representing what Hoole described as the amorphous membrane: the other representing those fibres that overlays the membrane which have a different focus, - and arrangement. The membranes consists of extremely fine and pale fibrous sheaths almost as clear as water. These are sinuous or waving fibres and may be observed to branch, and anastomose with one another. They are arranged rather regularly respecting one another, and cross the overlaying fibres at a right angle: therefore these take a circular direction as the former are known to take the opposite. This fibrous expansion is very brittle indeed so much so that we may consider ourselves fortunate to obtain an isolated piece. On addition of acetic acid I observed no change in its structure. I believe that one or more lamina of this fine fibrous expansion ~~membranous~~ line the internal of the arteries to their minutest subdivision. They form but a small part of the thickness of the arterial tubes and appear to be quite superficial. When the stage of Microscope is moved with the same power used in bring into distinct focus - those fibres overlaying the preceding fine fibro membranous expansion, between which we observe those Holes or what may be more properly considered as inter fibrous spaces: because they are produced by a-

particular arrangement of this tunic. These layers of fibres consist of a greenish yellow colour with a tolerable well defined double contour. They run side by side in a longitudinal direction following somewhat a bending course, and terminate by an abrupt and curling end: as they proceed they divide into branches which join and anastomose with one another in several ways; some of which dont anastomose; they curl and form a semicircular rings &c.

By the various modes of curling and anastomosing of these branches, indeed in some instance we may observe short fibres interposing the preceding, which form complete rings; in others they are imperfect. Between these fibres are distributed irregular spaces of various sizes and shapes, which are surrounded by a well marked borders: in some of these spaces this outline is incomplete so forming a kind of crescent, produced by incomplete curling of a fibre, - within which in a good specimen by varying the focus, we may see the fine fibres previously described.

How are these spaces or holes formed?

Henle says from want of texture at different points of a structureless membrane. These as previously described are irregular in size and form, and present no typical configuration, that is they do not exhibit symmetrical arrangement, which would be expected if due to a law of development of these parts; indeed they undergo all kinds of modifications in shape & size.

Therefore I think we are compelled to seek for another explanation of a simpler kind, and devoid of speculation; and I believe a more correct description of the presenting appearances. By observing and tracing the dark outlines of those spaces, I have satisfied myself occasionally that they are due to the fibres last described; in fact we observe analogous arrangement of structure in the porous tubes of Botanists; I believe the existence of these spaces are due to similar arrangement of the branches of the longitudinal fibres; indeed we may observe it, in the deeper layers of the internal coat where no membrane exists. Considering such to be their mode of production they may be rightly considered as interfibrous spaces. The deeper lamina form the greater part of the internal tunic. They consist of fibres running circularly, among the vessels and present similar appearances to the fibres last described, with the exception that they approach more closely the true yellow tissue; if the preceding description be true and correct it is quite evident that the internal tunic needs no sub-arrangements of its texture; although it presents different arrangement and appearances at different part of it, and it may be rightly considered to be composed of elastic tissue with some variety of it, joining one or more layers on the internal surface of the arterial tubes, as all present similar appearances, elastic properties, and not acted on by acetic acid. I cannot be far from being right in affixing the term (to all of which conjoined) the <u>Elastic coat.</u>

2. The muscular coat.—

Forming this tunic are two kinds of elementary structures, namely, Non voluntary fibres, and Yellow tissue. It has been stated that distributed between those or in their substance, are some perforated membranes. These as previously pronounced are but modified arrangements of yellow tissue. This tunic may be dessected into separate lamina which peel off most readily in a circular direction. they are more closely connected, less elastic, softer and of a more tawny aspect, than those of the internal layer. The non voluntary fibres present flattened, translucent, soft fibres, bearing at regular intervals distinct nucleiform particles, with intermediate dark granular portions: these are bounded by a comparatively well defined outline. They measure according to Sharpey from $\frac{1}{3000}$ to $\frac{1}{5000}$ of an inch in breath. They form a kind of short bars with their long axis in the transverse direction of the larger arteries,—that is each fibre does not completely surround them. There is no doubt that great bulk of which run circularly in the larger arteries: towards the distal termination of the arterial system, they undergo modification in arrangement, and configuration; here they consist more of nucleiform particles arranged both transversely and circularly, which have been called transverse and longitudinal layers.

The yellow fibres form comparatively but a small part of this tunic; they are distributed between, and

and among the preceding element; they course principally a transverse direction the same as the preceding fibres.

They approach very closely the appearance of what is commonly called true kind of yellow tissue; indeed so much so that they require no separate description. The two elements conjoined form about half the thickness of the larger arteries. The non voluntary fibres increase in relation with the capacity of the arteries, towards their distal termination. The yellow tissue of this tunic increases considerably towards the outer surface of the vessels, which has been considered by Henle as a separate layer of the external coat; but I have invariably been able to observe some non voluntary fibres interspersed between them in the ~~same axis~~, ~~namely the longitudi~~ transverse axis of the vessel. There is no doubt that this element forms an elastic layer on the outer surface of the arteries, but mixed with few muscular elements: it is so exceedingly thin and individually form so insignificant a part of the coat, and blended so closely with the muscular structure, that the separation of it into a distinct layer cannot be correct: for as I have previously stated both elements are interwoven together ~~and~~ with this only difference, that the muscular tissue have relatively decreased in quantity, but they have the same anatomical disposition, (circularly around.) Besides the convenience derived from few subdivisions of a similar texture must be a great advantage, under all circumstances.

The Sheath.- The arteries of the extremities are enclosed by a more or less dense sheath; the abdominal are much less so, which is often mixed with fat; It is altogether absent in the Cranial arteries.

These are connected by a similar texture, to the areolar tissue which surrounds the arteries pretty closely, and in it the vessels may be observed to subdivide before entering the arterial coat; When this layer is examined microscopically we may distinctly observe the irregular structure of areolar tissue by proceeding downward almost on the arterial coat: here procure a suitable specimen, it presents pale wavy fibres which run parallel with one another, in transverse direction; when acted on by acetic acid they disappear.

I may observe that this layer of white fibres is extremely thin and difficult in most cases to demonstrate, for it readily passes into the irregular arranged areolar tissue; therefore, the fifth layer of Hewlet's division may be, and should be ~~futilely~~ considered as a regular arranged part of the sheath, - as the fascia are regular arrangement of areolar tissue; and thereby may give an additional support to the arterial coat. If all what I have attempted to prove is a true observation and be proved to be established fact, - we are thrown back on the arrangement formerly made by Hunter, only reverse the arrangement from within outward. - The Elastic internally, Muscular Elastic externally

Nutrition of arteries:— The arterial coats are supplied by nourishment from plasma circulating within the arteries, and capillary arrangement in the muscular tunic. Small branches generally emerge from a vessel that arises from the artery: or branches may proceed from an artery in the immediate vicinity, which enter their areolar tissue, or the loose part of the sheath that closely surrounds them: where the nutritive arteries subdivide into innumerable branches as in periosteum, &c. before entering the canals of bone. This loose areolar tunic serves as a kind of vascular matrix for the ramification of their vessels prior to entering the muscular tunic.

I think we have good reason to suggest ~~has similar distribution~~ that the nutritive vessels in the muscular tunic of the artery, have similar distributions, to nutrient vessels in tubular structures generally, as Nerves Muscles &c viz, - that they run circularly around the artery and parallel with its muscular fibres with occassional cross bar. These as proved by fine injections only extend to the muscular coat, and in corroboration of which we have its general character:

therefore the elastic layer is non vascular according to acceptation of the term; and its nutrition must be performed through another medium, which is the liquor sanguinis in the arteries. (I must confess that I am sorry that I have been unable to verified the preceding statement)

Here I beg to be allowed to digress a little from the pro=
=per path of the subject in making few statements
in support of the independency of nutrition on capillary
circulation; because they bear importance on the present
and future part of the theme. It has been fully granted
that the capillaries are but the channels by which
pabulum is brought in close proximity to dif=
=ferent textures, and organs of the body, and from
which they appropriate to themselves as much
as they require, to maintain a normal state after
the performance of a function, which may be called
normal nutrition. The same remarks may be made
with regard to the agency by which abnormal nut=
=rition of different kind is effected. The injured textures absorb
into their interstices more plasma than is requisite
for maintaining the natural state of parts; which is
stamped with the peculiar form of the individuated
texture, whereby it tends to restore the original textures
by forming a new similar texture to that primary
involved: if that be the true state of things normal
and abnormal nutrition are but different in degree.
That they assumed state of the vessels from whatever
cause or the plasma within them have the power of
producing abnormal nutrition or exudation unless
a preexisting cause influenced the surrounding textures
(for instance traumatic injuries gouty and rheumatic
diathesis &c) perviously is well disposed in the case

of Blushing: here the vessels will be fully distended in almost a moments time which will disappear without leaving a vestige of abnormal plasma, consequently I believe that normal and abnormal nutrition are truly an inherent property peculiar to organised textures, that may be called vital or organic property, quite independent of changes in the capacity of the capillaries during abnormal nutrition: in fact the textures have their own choice with regard to nutrition, and the changes in the area of the capillaries, whether diminished or increased depend on the textures being stimulated, or being in a state of rest as either influence predominate the capacities of the smaller arteries and capillaries will either increase or diminish. Returning to the more particular bearings of the subject we may rightly conclude that normal and abnormal nutrition are independent of capillary arrangement: founding my reasons on those ideas, I suppose that the elastic layer is partly nourished by the liquor sanguinis circulating in the artery, and the vasa vasorum of the muscular tunic. as I understand it is only necessary that the plasma should be brought to the immediate vicinity of the textures, as in cartilage &c and I consider that the elastic layer is as susceptible of abnormal nutrition as any other texture well supplied with capillaries provided an exciting influence is applied..

II. Physiology of the arterial tunics.-

Entering into the constitution of the arterial tunics are two elements, endowed with distinct properties which conjointly are well arranged and adapted for the performance of their allotted functions as far as they are understood. On the present occasion I shall not enter on the nature of pulses and their modification, but merely treat of the arterial coats.

The following appear to be their chief functions:-

1st. Undoubtedly they tend to modify the capacity of the arteries, which is most marked in the smaller, according to the amount of blood they contain, whether plethoric or anaemic, whereby they accomodate themselves to their contents. 2nd. Maintain a tonic state. 3rd. Equalization of current of the blood. 4th. Maintain a fixed state most marked in the larger arteries. The two former are principally performed by the muscular, the two latter by the elastic element.

Muscular element.- It has been fully proved by a well devised experiment of Hunter and others that they are endowed with irritability when stimulated by any agent. The function of this element specially is difficult to analize and to form a correct theory of at the same time I think the present with respect to the function of this element is truely fallacious. It is generally admitted that the smaller arteries, where the effect of this structure is most marked have the

power

power of determining and regulating the necessary amount of blood for particular ~~for~~ secretion and nutrition; through the medium of the Muscular tunic modifying the calibre of the arteries of its own accord, that is when secretion and nutrition are actively performed the muscular structure of the arteries leading into an active part relax, consequently dilatation of the tube thereby permitting an increased flow of blood into a texture or a secreting organ; in fact that it governs the process of nutrition and secretion by changing the capacity of the smaller arteries. I think the varying capacities of the nutrient and secreting arteries can be explained as easily and more satisfactorily by granting that the textures generally exert a kind of attracting influence on the blood at their ultimate distributions: and in support of which we might adduce several phenomena.

There is no doubt that the capacity of the arteries leading into and in a part increase where its secretion and nutrition are actively performed; for we observe increased vascularity as in Hypertrophy &c with the reversed state while active functions are in abeyance. The harmony that undoubtedly exist between the textures and circulating system may be explained and illustrated by the following fact: Suppose many yielding tubes were supplied by a one common trunk or an injecting organ as Heart: and place one of the tubes conveying a fluid in a vesicid medium from which necessarily there will be increased exhalation from the surface of the tube in obeyance of

the

of the law of Endmosis and determination of the fluid with corresponding physical dilatation of the tube: in this instance the attraction that is exerted on fluid within the tube, by the viscid fluid that surrounds it at the point overcomes the normal area of the tube. Let the tube be removed from the viscid fluid or part, if elastic the normal capacity of the tube will be restored in virtue of its elasticity by simply overcoming the attracting influence of the surrounding medium.

Let similar observation be carried into the circulating system. There is no doubt that during secretion and nutrition that there is increased exhalation at the points they take place, through the medium of cells in the former, and some analogous process in the latter, which is not well understood. In both we have transudation of fluid from the capillaries in the form of a peculiar secretion or nutrition, consequently during this period of activity of function the textures must exert a kind of physical attraction followed by determination of blood which will dilate the normal capacity of the arteries, or in other words overcome their middle state; and when the process of nutrition and secretion is at rest the natural tonicity of the vessels overcomes that attracting power of the textures and they will resume their normal capacity. From the preceding reasonings, it appears to me to be quite evident that the modifications in the calibre of the smaller arteries depend on an active or inactive state of the texture of the vessels, and purely a property of the textures

2. This element serves to maintain a tonic or tonic state of the arteries. I believe that those short bands of muscular fibres are in continual state of contraction encircling them in the transverse direction. It is easy to understand that a tonic state of the arteries materially assists the onward progress of the blood; for a flaccid tube would very considerably interfere with the force (velocity) of the blood, by neutralizing its force. Probably the tonic state of the arteries tends to oppose too great a dilatation of the tube and subserves to the equalization of the stream of blood.

The Elastic Element:— This element forms a great part and performs an important purpose in the constitution of the arteries. The blood is projected in jets by the ventricle and the great purpose of this element is to convert these pulsatile jets into one uniform and continuous stream, under the following circumstances as:- the circulation consists of successions of jets varying in velocity the preceding jets of blood act as a partial interruption to the succeeding, so each in turn are caused to impinge sideways which dilate the vessels circumferentially. The arteries yield readily to the force whereby the sudden jets is partially destroyed: the column of blood during the act of dilating the arteries suspends considerably it force. but though the elasticity of this tissue is restored to an equal amount, for it permits extension to a limited amount when it reacts on its content and returns to its quiet state. by which it restores

gradually

gradually the already suspended force:- it is quite evident that during the act of recoiling it tends very materially to the conversion of those pulsatile movement of the blood into a uniform flow - or what may be called equalization of the current of blood. This element performs another equal important office, that of maintaining a fixed caliber which is most marked in the larger arteries. It is quite evident that the dilatation and restoration of the arteries to their quiet state is limited to certain extent, and the equality and precision with which they are performed are due to the elastic tunic principally. But it is considerably assisted by the muscular structure. In the arterial coat, the elastic tissue possesses a limited range of property, - 1st Fixed state: 2nd Dilated state. In the former the tissue recoils to certain extent which it maintains of its own accord, and preserves thereby through its strength, and this peculiar property, the arteries pervious: at the same time it tends to oppose the occluding tendency of the muscular textures. 2. Dilated state. The elastic tissue will permit extension or dilatation to certain extent and being fully extended circumferentially it grows tense and resists further distension - it recoils and resumes its fixed state. I may be allowed to observe here the partial loss of both of these forces in the formation of an Aneurism from arthromatous deposit.

Fatty matter as we shall presently see is situated between the layers of the Elastic tunic, where its presence must evidently materially derange its normal nutrition, and

mechanically interfere with its property: consequently they permit an undue degree of extension, from want of stamina to resist the dilating influence of the column of blood: but the force injuriously involved in the present condition is the inability to resume the former state: ~~which~~ ~~exists~~ every dilatation will have a marked effect in expanding the tube circularly: when this morbid condition is of any extent, because they are almost reduced to a passive condition: by which we cannot be surprised at the frequent occurrence of more or less dilatation of the larger arteries by considering the frequency of fatty deposit in the elastic layer, especially in those who have any active circulation and are of a full plethoric habits.

III Pathology of the arteries.

The arteries are not liable to many kind of organic diseases as compared with other organs of the body; yet they are not exempt from lesions that influence and cause many grave diseases e.g. Aneurism, Gangrena senilis &c. I believe all their diseases can be reduce to two origin, viz, - Abnormal nutrition or exudation of an Inflamatory and Rheumatic kinds, derived from the liquor sanguini circulating in the diseased artery. The fatty and calcareous deposits appear to me from reasons to be discussed hereafter to be only retrograding stages of transformation of a Rheumatic exudation. These two kinds of exudations have a marked difference in organic land formation; hence both are considered distinct exudations.

This

point I shall consider more at length in the after part of the present theme. I shall attempt in the succeeding part to discuss the subject of fatty and calcareous deposit by making 1st few preliminary remarks: 2.nd Character: 3. situation: 4. Structure, and origin of fatty and calcareous matter. 1.st Preliminary remarks.— Fatty and calcareous deposit in the arterial coat are always conjoined and are exceedingly common diseases so much so that it is difficult to meet with a perfectly healthy specimens in the Post mortem rooms. Besides their universality it appears that they possess this peculiarity of only involving the arteries of the human system and entirely limited to them. for, I understand there are one instances of fatty deposit in veins &c. The arteries may be affected throughout their whole length, or ~~only in patches~~ when but in isolated patches they generally occur in the larger trunks at the vicinity of bifurcations, or at the origin of a large arterial branch: in fact their distributions show greater tendency to involve the larger than the smaller arteries for the deposits generally decrease towards the circumference of the arterial system, or in them altogether absent, when the central vessels are fully impregnated with fat and mineral matter. I think it may be said with some degree of truth that their distributions in the arterial trunks are on par with the elastic tunic— therefore, it is very probable that they depend on its mode of nourishment, and anatomical arrangement.

Biot ascertained that the period of life of male existence most susceptible to fatty or Albuminous deposit is between the age of thirty and fourty: he has further established that women are less subject to this lesion of structure; hence the rarity in females of Apoplexy, Aneurism, &c. It is said that calcareous deposit seldom occurs to any great extent before the age of sixty, at which time different textures undergo similar transformations, as Tracheal rings and cartilages. - It appears to me that the concurrent ossified state of the arteries and Tracheal rings are but casual concomitant circumstances, for we may observe the arteries more especially in young people ossified to very great extent, with the tracheal rings perfectly pliable and vice versa in old persons. therefore from the want of complete concurrency of the two diseases it cannot be granted as a fact or law that ossification of the arterial tubes depend on natural transformation of the texture; similar to the calcification of those structures, and due to a constitutional cause. I think fatty and calcareous deposit are local diseases depending on a local cause. Fatty and calcareous deposit in the arteries are common concomitants of similar matters in the valves of the Heart, and effect of pericarditis. - By considering the age, sex. and their concomitant diseases. I think you will agree with me that they indicate very strongly: it is due to rheumatic exudation

Character of fatty deposit.

I suppose that the exudation that gives occasion to these deposits passes through various stages of chemical transformations and in support of which we have patches of different colours presenting certain anatomical differences; therefore they may be described as 1st Fatty stage 2nd Intermediate: 3. Calcareous.

Fatty stage:— The superficial layers over and around the involved portion of the artery are generally extremely softened, and have lower connections than normal lamina, for they may be peeled off readily with the point of the finger, as if they were undermined and their connections desirated through the intervention of some pervading fluid. This peculiarity is most marked on the surface. In these modified arterial tunics are generally to be seen small, pearl coloured specks of a marble white and comparatively of a soft consistence; or what is as common mode of its arrangement is by the formation of a longitudinal streak. These form streaks and lines of various sizes. This kind of deposit present similar appearances in the deeper layers only; in larger masses, which give to the surface a boggy and irregular aspect.

Intermediate stage.— It is characterised by difference of colour from the preceding masses and anatomical structures to be hereafter considered. When the preceding specks and linear deposits are of some standing they become variegated by reddish yellow pigment. In an artery greatly

transformed

transformed they form isolated patches of variable dimensions and forms; their surface are generally open and irregular, which is called Ulceration of the arteries, but we may meet with this deposit in the deeper layers with the tunics entire. They are of a soft consistence and invariably mixed with small white gritty masses like chalk.

Calcareous stage:- The mineral matter arranges itself in the form of plates of different sizes and shapes; sometimes they form complete rings most marked at generally at the bifurcation of an artery. These plates have an elevated margin with a cupped shaped centres; and they are placed invariably quite on the surface of the arterial coats. opposite these diseased points. the muscular tunic is greatly reduced in thickness. When the calcification of the arterial tunic has advanced to a great extent, it present an earthy appearance with its dry and shrivelled aspect; sometimes torn, shrivelled and raggedly projecting surface, from the result of the preceding superficial mode of examination of the stages of transformation of the deposit evidently shows similitude to other exudations undergoing chemical transformation, as Tubercle, Encephaloma, &c. The characters of the preceding conventional stages of the transformation of the rheumatic exudation are often obscure for all are sometimes blended together in one patch. which show them the more likely to be due to the same matter.

Structure of fatty and calcareous deposit.

It appears that Gulliver was the first to make out and demonstrate clearly the real structure of these deposits. Their structure are different according to the stage in which we examine it in. It is stated by Henle that they arise from a degeneration of a fibrous lamina which he calls "Tunica adventitia" situated between the perforated membranes. I sincerely confess that I have on several occassions searched for this tunic microscopically and on all failed, and I have consequently been induced to doubt its existence upon the following grounds:- In an artery slightly involved by the first kind of deposit, which we may isolate very readily, in most instances, we have a fair opportunity of examining its real nature: after several of these examinations I am convinced that it presents no organisms, as remnants of pus cells, or the element of white fibrous tissue in progress of development, not after the addition of acetic acid: as generally preceded fatty deposit in other parts.

1st Fatty stage:- When one of the white specks or shine are examined microscopically. They present intermixtures of fat globules and plates of Cholestrine. but the former form their chief constituents. These globules are perfectly round particles with a well marked dark shaded border and a clear central space. They are of variable sizes from the smallest specks to the dimension of a large pus cells. The smallest generally aggregate together in clusters. while the

largest are free; in fact, they have similar appearance to milk and yelk globules, or what might be produced artificially by by mixing together oil and albumen; hence such granules are called "oleoalbuminous". The plates present a transparent crystalline rhomboidal tabular plates of a pearly aspect, presenting one corner as if cut off. They are of variable magnitude, and constitute but a small part of the mass. They are not acted on by caustic potash or acetic but are soluble in ether. 2.nd Stage. This may be considered an intermediate Stage between the fatty and mineral ~~stage~~. When those reddish yellow spots are examined they present oleoalbuminous granules, few plates of cholestrine, mingled with a nebulous ground which when minutely examined consists of dark, irregular, specks, with angular margins, and neither affected by water, ether or alkalies; therefore they are probably of a mineral nature. This kind evidently shows some close connection respecting their origin for here we have the chief constituent of the ~~arteries~~ kingdom one. 3. Calcareous Stage - This exhibit no bony structure as once supposed; When scraped and mixed with water, they present amorphe particles similar to those described above with few oleoalbuminous granules, and sometimes plates of cholestrine.

Situation of fatty and calcareous deposits. When the internal surface of an artery is fully studded over with calcareous and fatty matter, the muscular layer presents comparatively much of it normal appearance to the unaided sight only at those calcareous points when

when of some standing, it is much reduced in thickness and more or less altered in appearance, probably from the influence of their pressure; but when examined microscopically it generally exhibits oleo albuminous granules, imbedding the fibres; others along their course deserving their structure as if undergoing degeneration themselves; but in most examples we are able to assure the fatty deposit along with the elastic layers lying behind the muscular layer normal, by which it appears that its peculiar site is the Elastic tunic. Fatty matter which afterwards becomes mineral deposit is deposited at variable depths of its substance, but the most common position in which we find it is near the surface of the vessel, but when the lesion is extensive we have it also between its deeper layers; sometimes it appears to be on the surface but when they are placed in water it does not float loose and I have been able by means of needles to seperate from its surface a thin fibrous film without removing the deposit:- from dissecting those spots and streaks I have satisfied myself that great part of them are situated between the superficial and deep layers of the Elastic Tunic and between the layers of the former (for as we previously described the elastic layer consists of superimposed lamina) because I have been able to isolate the deposit from its surrounding connections, by removing its superimposed layers. The larger masses are placed between the deep layers. They are generally more closely connected

with their surrounding lamina.

Calcareous matter:- As previously stated it forms plates and rings on the surface of the arteries. The superficial of which might be taken as argument against its albuminous origin; this I think would be wrong for we can trace and explain their mode of appearance on the surface. The fatty matter between the lamina hardens and tends to petrify which during this transformation must succeed successive pressure, thereby destroying probably the ill nourished superimposed layers; and as there are no vessels nor lymphatics for removing the matter it is left on the surface to undergo chemical transformation similar to the primary exudation; and in support of which there are generally covering a hard calcareous plates when of a recent date a redish yellow covering which presents the structure of the second kind of deposit. This indicates to me clearly that it is of a more recent origin and due to the original texture complicated.

The origin of fatty and calcareous.

Informations on the origin of morbid deposition of fat in different organs of the body are few and generally at variance with one another; probably, from want of a better knowledge respecting the chemical transformation during the formation of "Adipose cirs," from albuminous substances. In the present theme I shall not enter on fatty deposits generally: but I shall, to simplify the present subject

with organs similarly affected. Respecting the origin of it in the ar-
=teries two theories are upheld 1. Perverted nutrition
as Galliers's. 2. Abnormal nutrition. as Hales.

The first doctrine holds that the textures appropriate
for their nutrition at middle age the fatty con-
=stituent of the blood under some obscure diseased con-
=dition of the arterial coats; while in old age under
the same perverted conditions they absorb the mineral
part of the blood. This theory is supported by the
chemical fact that the blood contains relatively
more fatty and mineral elements at those periods of human
existence. That the superabundance of one element in
the blood can modify the process of nutrition is whol-
=ly denied from what is known of that organic property
but that it may modify the products of disease there
is no doubt;- and as we shall presently see the increased
amount of salts in blood towards old age serves to ex-
=plain the difference in the termination of abnormal nu-
=trition. If what I have attempted to describe be cor-
=rect regarding normal nutrition, namely, That they ap-
=propriate and assimilate pabulum as nicely and as par-
=ticular of the constitution of their food as the Hepatic cells, and
those of the Kidney &c. Respecting these there are no in-
=stance where their functions are materially perver-
=ted in any way: Therefore I think we have good rea-
=son to ~~conclude~~ believe that the process of nutrition never
becomes perverted only increased, as in Inflammation

Fatty deposit in the lungs, Brain, and Kidneys are
from the investigations of Rheinhardt on the the form-
=ation of compound granular cells. Professor Bennett on
softening of the Brain and Gardiner on the Kidney.
appears settled that this sucessive appearance of fat
in their structures are of albuminous origin, which have
undergone chemical transformations; but fatty deposit
in the liver is truly a result of perverted nutri-
=tion: here it cannot be considered an anomaly in pro-
=cess of nutrition by reflecting on its function for
liberating fatty compounds from the blood by which it is
not difficult to understand that it may accumulate
under a morbid law: besides if it depended on morbid
nutrition we should expect to find all parts of the
body similarly involved to this. I can answer nega-
tively that their is no direct relation with regard to mor-
=bid deposition of fat in different organs of the body
for I examined the voluntary muscle, liver, and
kidneys, in many instances of confirmed atheroma-
=tous arteries and I found that the greatest num-
=ber of them presented their normal appearance: the
heart indeed in almost all presented ill shaped mus-
=cular fibrilla. These facts and the preceding reasoning
have convinced me that it is not a constitutional disease
and must be due to some local peculiarity of texture.
On the plea of the preceding objections I am compelled to seek
for another theory to explain the origin of fatty and

and calcareous matter, and I think we are in possession of one quite consistent with known facts; viz.
Abnormal nutrition of a rheumatic kind. I have adverted in the former part of the present theme to the concurrent existence of fatty and calcareous matter in the arterial coat, with other lesions of a known origin, as those of the heart and pericardium &c; and the resemblance it bears in structure to other ~~diseases known~~ exudations in state of transformation, as Cancerous; &c, which are known to be of albuminous constitution. Besides these they happen at ~~happen~~ an age most susceptible of being affected by the exciting cause of rheumatism. There is no hesitation that these facts countenances greatly its albuminous origin. It appears to be produced in the following manner.—

The exciting cause of rheumatic exudation stimulates the fibrous structures lining the internal surface of the arteries to abnormal nutrition. These textures obeying the effect of the irritant from the nature of their structure, as it is now fully proved, that fibrous tissues of all are most susceptible of effecting rheumatic exudation. They as an effect of the pre-existing exudation or irritation absorb into their interstices abnormal amount of liquor sanguinis from the blood circulating in the artery and in consequence of the elastic tunic being now vascular it is retained between its lamina to undergo fatty and calcareous changes. when

so large an amount is suddenly elaborated. But a part of it may come as well from the "vasa vasorum" especially that between the deeper layers the most part of it there is no doubt comes from the fluid within the vessels as its effects are more abundant near the surface and decrease towards the deeper layers of the elastic tunic. The aplasticity of fatty deposit in the arterial coat in all its stages of transformation may be urged against this theoretical explanation; and in some minds sufficient to deny its albuminous origin:- I think this is too close reasoning, for there are degrees of plasticity in different exudations varying in organic power or capability of organic transformations, as into nucleated and fibrous layers; from that of dropsical to cancerous exudation, and the line of demarcation between the different kinds is imperceptible: but the strongest argument against such idea we can possibly have and of value in favour of the stated doctrine is that rheumatic exudation in certain situations as joints and endocardium seldom or ever undergoes cellular or fibrous transformations. upon the preceding facts, and the fibroid nature of structures here involved I ground my reasons in considering fatty & calcareous deposit in the arteries to be due to rheumatic exudation: respecting which before concluding I shall make few remarks.

I have already stated that fatty and calcareous deposits in the arteries are the results of a chemical transformation

of abnormal exudation, the mode and stages it pass=
=es through has not excited the attention of chemists
to this important subject; that must at some future
period prove of the utmost value, when fully explain=
consequently I am debarred from entering on this
interesting subject, at the same time the fact is
fully established by the observations of Professors
Bennett, Dr Gairdner, & Rainhardt that an exu=
=dation may be transformed 1.st into fat. 2.nd cal=
careous matter. Respecting the latter deposit in the
arteries I beg to make few remarks. There is no
doubt that those arteries fully implicated with mineral
matter contain more than chemical analizes could
possible account for as the residuum of a previous
exudation, and the decay of the textures involved
compared with calcareous remains of an albuminous
exudation in other parts; hence have originated the
idea of perverted nutrition respecting this theory
similar objections might be adduced against it as those
of fatty & nutrition. I think we are possessed of a
chemical phenomena that will explain the superadd=
=ition of mineral matter to the remains of the primary constituent of
the textures and exudation, without having recours
to do ambiguous an explanation. When nutritive laws are
almost in abeyance in those greatly involved by
fatty matter they are reduced to a passive condition
and permit the occurrence of endosmose & chemical
attraction,

of the mineral constituent of the blood, similar to what happens in the formation of Raphides & petrifaction of some plants. These are formed probably under probably under two conditions, viz, an acid is elaborated within the cells of the parenchyma in which they are found, which attract through the fine intervening membrane from the fluid that pervades the plant a radical base which combine and crystalizes within the cells, and a change in the viscidity of the tissue that determines the endosmoses. Returning to the subject of calcification of the arteries, and applying the same law of endosmoses & chemical attraction of the mineral matter of the blood, we can easily explain the presence of an abnormal amount of it. The exudation as previously described is placed between the lamina of the internal tunic where it undergoes changes in viscidity, and a chemical constitution of the following nature at least we have good reasons to suppose such. The Phosphorus and Sulphur are oxidized which form acids that attract bases (probably most common lime) through the intervening membranes, and is assisted by the viscidity of the part, along with this there passes with ale probability a similar homologous substance (Phosphate of lime) from the mass of the blood I am inclined to believe that this process of endosmoses and chemical attraction continues till all the exudation, and the surrounding texture are thoroughly

calcified. The whole explanation I confess is very theoretical but not inconsistent with known chemical laws, and serves to explain the difference in the calcification of the arteries in the young and old. It has been established as a fact that liquor sanguinis at the latter period of human existence from some cause contains more salts from which we may lead that the fluid is more concentrated consequently there results a more thorough calcification of the arteries. I may conclude the present subject by stating that there is no doubt that the superaddition of mineral matter to the residuum of the primary exudation comes from the blood through the agency of some chemical phenomena; but how, it is difficult to explain.

In closing the subject of this theme, I must confess that I have been unable to carry out my first views. The pathology of inflamatory exudation of the arteries I have not noticed, being unable to procure specimens where I could make my own observations. I have endeavoured to unshackle myself of opinions imposed upon us by previous authors, and lay before you the mere results of my own researches, trusting it will be more appreciated by you as such and not a compilation of already expended thoughts and opinions of others on the subject. I should have been happy to give few illustrations with the different parts for the purpose of assisting the description I have

given but I did not feel myself competent to the under=
=taking. I hope to meet your indulgence with all imper=
fections which may be apparent to your, and if
I merit in any degree your approbation I shall
myself well recompended.