Thesis,
on,
the Anatomy, Physiology and Pathology
of the Arteries
by John Robert Angus.
Preliminary remark. — 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 practitioners 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 the Anatomy and Pathology is to be attained, and being aware that their 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 supressing the nature of their most common disease is 'indefinite, especially as 'Degeneration of the coats of the arteries' but I believe few authors have been using it, in strict with its etymological import. The Anatomy of the coats of the arteries has been divided and subdivided to such a minute extent, and indeed realcal Microscopes 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 into two layers. Craving indulgence for the confident manner in which I arrived the preceding opinions, I trust that any conclusions that I may arrive at will leniently dealt with, and 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 Observer's Microscopes. 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 have briefly notice the description given by And
The immortal Hunter with comparatively rude instruments, after a series of experiments upon the arterial tunics of the living and dead subject, added to our anatomy and physiology very materially, by distinguishing in their coats an elastic and muscular structure, arranged separate of one another. The internal being composed of muscular fibres intermixed with elastic tissue, and the external of elastic alone which last decreases in quantity, according to 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 years of this theme.

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

Dr. by Microscopical examination ascertained that the arterial arteries are composed of five distinct shaded differing from each other in texture, therefore, reckoned as so many separate tunics. E.G.

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

The epithelial layer—Having scraped and peeled off the internal surface of healthy arteries on many occasions, and not having succeeded on any of these to witness demarkating anything dimating those cellular structures as described by Hinde; therefore I have naturally been lead to conclude that they do not exist. Besides, I think no physiological evidence shew as far as the function of this structure is understood in other parts of the body, we could conceive 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 separately it needs here no fur-
ther notice only I think, that it has an essential existence, or at least needs no separate name; nor indeed the two last require a separate notice which I shall again discuss more at length.
Having noticed the arrangement of the arterial tissue as described by Hunter and Hume, 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 sapubium to different tissues and organs of the body, although found simply soon after death. Hence, the origin of their name, from the notion formerly held that they during life contained air. Their internal surface presents a whitish yellow colour, like cartilage, with irregular longitudinal constrictions, and entirely wanting in any appearance of vascularity. Although the embolization of Haematuria 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 inflammation. This is deeper because it can be produced artificially by warming an artery in blood.

The arterial tunics are fabricated of two kinds of elementary tissues, namely, the yellow tissue, and what seems to be a peculiar modification of it. (Proceeds, as the vitellus, similar characters) and non voluntary fibres. The third truly found element truly formed to some a part of the constitution of the coat, and of the same kind of textures that it may be more judiciously described and arranged with the coats of the arteries. I may here remark that this variety lines the internal surface of the arteries.
Reading my former arrangement of the structure of the coats of the arteries, upon what I have already advanced with regard to their most minute subdivisions. Therefore I think these structures may be conveniently and correctly described as 1st. The Elastic layer or Internal layer.
2nd. The Muscular layer.
3rd. The Sheath.

Elastic layer.—On examining a large artery of a large animal, this layer may be found easily to be separable and presents comparatively loose connections 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 readily to its normal length.

This layer presents internally the appearance previously described. By a further dissection of the tunica with a flat and forceps, 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 assistance to be derived into layers, as compared with the preceding. The latter laminae present a light-colored appearance thicker, and more ragged surface, which shows 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 tenacity to peel off in a circular direction than in a longitudinal. They form much the larger part of the tunic. The following shows well the disposition of these laminae to separate in a particular direction when the deeper laminae are peeled off while the superficial layers are in situ; the latter corrugate and split longitudinally; ally the former tear and separate easily circularly or around the tube.

Microscopic anatomy of the internal coat. According to Hsueh, the perforated membrane forms a great part of the tunic; having succeeded in procuring a proper piece for microscopic examination from the inside of an artery, and examined it first with a low magnifying power, that is 500 dia. The field presents resembling what Hsueh described as the perforated membrane, that is consisting of rather dark grayish streaks which give off branches that anastomose freely with one another. They overlay almost a colorless ground, but diffused rather irregularly between these fibers are enclosed spaces resembling "Holes," hence its name. By gradually magnifying use of a higher power 2000 to 3000 dia.
We may observe two kinds of appearance, viz. one representing what is described as the amorphous membrane: the other present to have a different form, and arrangement. This membrane consists of fine, thin, and pale fibrous threads, almost clear and wavy. These are unusual or waving fibres and may be observed to branch and anastomose with one another. They are arranged in an irregularly intersecting one another, and cross the overlapping fibres at a right angle; thus their plane becomes circular, as shown at the former are known to take the opposite. This fibril expansion is very brittle, indeed, so weakly so that it may cause considerable force to obtain an isolated piece. An addition of acetic acid or absolute mechnap, in its tendency, I believe, that one or more laminae of the fibril membrane have 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 microscopy is mixed with the same power used for bringing into distinct focus, their fibril overlapping the preceding fine fibril membrane expansion, between which we observe those held or what may be more properly considered as intersitial spaces. Because they are produced by a
particular arrangement of this tissue. These layers of fiber 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 various ways, some of which do not anastomose; they curl and form semicircular rings.

By the various modes of curling and anastomosing of these branches, indeed in some instance we may observe short fibers intercutting the preceding, which form complete rings; in other they are imperfect. Between these fibers are distributed slender spaces of various sizes and shapes, which are surrounded by a well marked border; in some of these spaces this outline is incomplete to forming a kind of crescent, produced by incomplete curling of the fiber, within which is a good division by varying the focal; we may see the fine fiber previously described.

How are these spaces or holes formed?

This arises from want of structure at different points of a structurally 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 shapes and
Therefore I think we are compelled to seek for an-
other explanation of a simpler kind, and devoid of
speculation; and I believe, a more correct description
of the present appearances. By observing and tracing
the dark outlines of their shaded, I have satisfied myself
occasionally that they are due to the fibres last described
in fact we observe analogous arrangement of structures
in the preceding tubes of Botanists; I believe the suc-
tence
ence of these shaded are due to similar arrangement of the
branch of the longitudinal fibres; indeed we may observe
it, in the deeper layers of the intimal coat where no mem-
brane exists. Considering such to be their mode of production
they may be rightly considered as intimal fibres. The deep-
ern layer form the greater part of the intimal tunic. They con-
sist of fibres running circularly. The vessels and present
similar appearances to the fibres last described, with the su-
ception that they approach more closely the true yellow tis-
ue; if the preceding description be true and correct it is
quite evident that the intimal tunic needs no sub-
arrangements of its structure; although it presents different
arrangement and appearances at part of it, and it may
be rightly considered to be composed of elastic tissue with
some variety of it, one or more layers on the intimal surface
of the arterial tube, as all present, similar appearances,
elastic properties, and not acted on by acetic acid
I cannot be far from being weight in affecting the
form (to all of which conjoined) the elastic coat.
The muscular coat.

Forming this tissue are two kinds of elementary structure, 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 arrangement of yellow tissue. This tissue may be described into separate lamina which pull off most readily in a circular direction. They are more closely connected, less elastic, softer and of a more lauvar aspect, than those of the external layer. The own voluntary fibres present flat, lamellated, translucent, soft fibres, bearing at angular interspals distinct nucleiform particles, with intermediate dark granular portions: these are bordered by a comparatively well defined outline. They measure according to Sherrington from two to ten microns in breadth. 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 connect 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 the tissue; they are distributed between and
and among the preceding elements, there course principally in a transverse direction the same as the preceding fibres.

They approach very closely the appearance of what is commonly called true bundle of yellow matter, so much so that they require no separate description. The two elements conjointly 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. They yellow tissue of this tunic increases considerably towards the outer surface of the vessel, which had been considered by Riolan as a separate layer of the external coat; but I have invariably been to observe none. Non-voluntary fibres intervened between them in the same manner as the longitudinal transverse axis of the vessel. There is no doubt that this element forms an elastic layer on the outer surface of the artery, but mixed with few muscular elements; it is so exceedingly thin and individually form so insignificant a part of the coat, and blended closely with the muscular structures, that the separation of it into a distinct layer—can not be discerned for as I have previously stated—both elements are interwoven together with the only difference, that the muscular tissue has relatively decreased in quantity, but they have the same anatomical disposition, (circularly around.) Besides the connective tissue derived from few subdivisions of a similar nature must in great advantage, under all circumstances.
The Sheath. — The arteries of the extremities are surrounded 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, 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 moist cases to demonstrate, for it readily passes into the irregular arranged areolar tissue, therefore, the fifth layer of Huxley's division may be, and should be properly considered as a regular arranged part of the sheath, as the fasciae are regular arrangement of areolar tissue, and this may give an additional support to the arterial coat. If all what I have attempted to is a true observation and be proved to be established facts, we are thrown back on the arrangement formerly made by Hunter, only reverse the arrangement from within outward. The elastic internally, Musculo 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 vessels that arise from the artery, or branches may proceed from an artery in the immediate vicinity, which enter their anelastic biles, or the loose part of the sheath that closely surrounds them: whereas the muscular arteries subdivide into innumerable branches as in pericardiectomy before entering the cancellous bone. The loose anelastic 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 that distribution that the nutrient vessels in the muscular tunic of the artery, have similar distribution to nutrient vessels in tubular structures generally, as those of muscles, &c., that they run circularly around the artery and parallel with its muscular fibres with occasional cross bar. Thus as proved by injections only extend to the muscular coat, and in corroboration of which we have its general character, therefore the elastic layer is even vascular according to acceptance of the terms, 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 verify the preceding statement.)
Hence I beg to be allowed to divert a little from the pro-
per path of the subject in making four statements
in support of the independency of nutrition on capillary
circulation; because their importance on the present
and future part of the theme. It has been fully granted
that the capillaries are but the channels by which
plasma is brought in close connexion to differ-
ent tissues, 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 nutri-
tion of different kinds. The injured tissue, absorbed
into these latter lies more plasma than is requisite
for maintaining the natural state of parts, which is
stamped with the peculiar form of the implicated
tissues, whereby it tends to restore the original tissues
by forming new similar tissues to that primary
involved; if that be the true state of things normal
and abnormal nutrition are but depressed degrees
that they assumed state of the vessels from whatever
cause or the plasma within them has the power of
producing abnormal nutrition or consumption unless
a perpetuating cause influenced the surrounding tissues
(for instance traumatic injuries, gouty and rheumatic
colic, etc.) previously is well disposed in the case
of distention; here the vessels will be fully distended in almost a moment's time, which will disappear without leaving a vestige of abnormal plasm; consequently I believe that normal and abnormal nutrition are truly an inherent power peculiar to organized 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 change in the area of the capillaries, whether diminished or increased, depend on the textures being stimulated, or being in a state of rest at either influence predominating the capacities of the smaller 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 these ideas, I suppose that the elastic layer is partly nourished by the liquor Sampiniae circulating in the artery, and the pala basarum of the Muscular tissue, as I understand it is only necessary that the plasm should be brought to the immediate vicinity of the textures, as in Cartilage for and I consider that the elastic layer is as susceptible of abnormal nutrition as any other tissue, still supplied with capillaries provided an exciting influence is applied.
II. Physiology of the Arterial Tunics.

Intimacy 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 pulsus and their mode of life, but merely treat of the arterial coats.

The following appear to be their chief functions:
1. Undoubtedly they tend to modify the capacity of the arterics, which is most marked in the smaller, according to the amount of blood they contain, whether plethoric or anaemic, whereby they accommodate themselves to their contractions.
2. Maintain a tonic state. 3. Equalization of current of the blood. 4. Maintain a fixed state. 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 well devised experiments of Hunter and others that they are endowed with irritability, which is stimulated by any agent. The function of the element especially is difficult to analyze and to form a correct theory of at the same time I think the present with respect to the function of the element is entirely fallacious. It is generally admitted that the smaller arterics, when the effect of the structure is most marked have the...
power of determining and regulating the necessary amount of blood for particular purposes and nutrition; though the medium of the muscular-tissue modifying the calibers of the arteries of its own accord, that is when secretion and nutrition are actively per-
formed the muscular structure of the arteries leading into active part play, consequently dilatation of the tube, thereby permitting an increased flow of blood into a tissue 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 so easily and more satisfactorily by granting that the features generally express a kind of attracting influence on the blood at their ultimate distributions; and in fastness 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 act-
ively performed; for we observe increased vascularity at an hypertrophy with the reversed state while active functionality are in abeyance. The harmony that gradually exist between the tissues and circulating system may be explained and illustrated by the following fact: suppose many vessels tubes were supplied by a common trunk, or an insetting to heart; and place such the tubes conveying a fluid in a vessel medium from which needlessly there will be increase by

=halation from the surface of the tube in obedience of
of the law of Resometry 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 circulatory system. There is no doubt that during secretion and normal nutrition that there is increased hydration 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 motion, consequently during the period of activity of function the tissue meet such 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 at rest the natural tension of the walls overcomes that attracting power of the tissue and they will assume their normal capacity. From the preceding teachings it appears to me to be quite evident that the modifications in the calibers of the smaller arteries depend on an active or inactive state of matters, and purely a property of the tissues.
2. This element serves to maintain a tone or tonic state of the arteries. I believe that these short bands of muscular fibres are in continual state of contraction restraining them in the transverse direction. It is easy to understand that a tone of the arteries materially assists the onward progress of the blood; for a flaccid tube would very considerably interfere with the force of the blood, by neutralizing its force. Probably the tone state of the arteries tends to oppose too great 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 function in the constitution of the arteries. The blood is propelled 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 jet of blood acts as a partial interruption to the suc- ceding, so each in turn are caused to undulate sidewardly which dilate the vessel circumferentially. The arterial yield readily to the force whereby the sudden jet is partially destroyed; the column of blood during the act of dilating the arteries supplies considerably its force, but the ag- bency of the tonus the arteries to equal account, for its pres- sure is limited amount when it react on its con- tent and returns to its quiet state by which it restore gradually.
gradually the already superseded force. It is quite evident that during the act of accreting it tends very materially to the conversion of their pulsatile movement of the blood into a uniform—or what may be called equalization of the current of blood. This element performs another equal important office, that of maintaining a pulsatile 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 tissue principally. But it is conversely affected by the muscular structure. In the arterial coat, the elastic tissue possesses a limited range of property. 1. Tense state. 2. Dilated state. In the former the tissue recoils to certain extent which it maintains of its own accord, and presses firmly through its strong fibres and peculiar flexibility, the arterial vessel at the same time tends to discharge the occluding tendency of the muscular fibres. 2. Dilated state. The elastic tissue will permit extension or dilatation to certain extent and having being fully extended cannot, essentially it grows tense and resists further dilatation; it recoils and assumes its former state. I may be allowed to observe how the partial loss of both of these forces in the formation of an aneurysm from atherosomatous disease. Yell, another at we shall presently see is situated between the layer of the elastic tissue, where the pressure must evidently materially alter its normal situation, and
mechanically interferes with its propery, consequently, they permit an undue degree of retention, from want of stamina to resist the dilating influence of the column of blood; but the force vigorously involved in the present condition is the inability to resume the former state, which least every dilatation will have a marked effect in expanding the tube circularly; when this mortified condition is of any extent, because they are almost reduced to a flaccid 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 active circulatory habit.

III Pathology of the arteries.

The arteries are not liable to many kind of organic disease as compared with other organs of the body; yet they are not exempt from lesions that influence and cause many gross diseases e.g. Aneurysm, gangrene similar to — I believe all their diseases can be reduced to two origin, viz. Abnormal irritation or sedimentation of the inflammatory and Thumatic kind, derived from the liquor sanguiine circulating the diseased artery. The fatty and calcaeous deposit appear to me from reason to descrited herin as to be only real — a grading stage of transformation of a Thumatic sedimentation. These two kinds of sedimentation have a marked difference in organic transformation; hence both are considered distinct sedimentation.
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. Preliminary remarks: 2nd. Character: 3rd. Situation: 4th. Structure, and Origin. Fatty and Calcareous matter. 1st. Preliminary remarks: Fatty and calcareous deposits 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 specimen in the post mortem room. Besides their universality it appears that they possess the peculiarity of only involving the arteries of the human system and entirely limited to them, for I understand there are instances of fatty deposit in vessels. The arteries may be affected throughout the 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 distribution show greater tendency to involve the larger than the smaller arteries. For the deposits generally decrease to the walls, 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 distribution in the arterial tubes, on par with the elastic layer- therefore, it is very probable that they depend on its mode of nourishment, and anatomical arrangement.
just ascertained that the period of life of small animals most susceptible to fatty, or albuminous, deposits begins by the age of thirty and forty. He had further established that women are less subject to this lesion of structures; hence the rarity on females of cholecystitis, ascites, &c. It is said, that calcareous deposit seldom occurs to any great extent before the age of sixty, at which time a different kind undergo similar transformations, as tracheal rings, cartilage, &c. It appears to me that the current allied state of the arteries and tracheal rings are but casual concomitant circumstances, for we may observe the arteries more especially in young people, subjected to very great output, with the tracheal rings perfectly indurated and more or less in old persons. Therefore, from the want of complete concurrence of the two diseases, it cannot be granted as a fact or law, that calcification of the arterial tubes depend on natural transformation of the tissue, similar to the calcification of those structures, and due to a constitutional cause. I think fatty and calcareous deposit are local débris depending on a local cause. Fatty and calcareous deposition 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 inflammation.
Character of fatty deposit.

I suppose that the emulsion that gives occasion to these deposits passes through various stages of chemical transformations and in support of which we have patches of different colour presenting certain anatomical differences, therefore they may be described as 1. Fatty stage. 2. Intermediate. 3. Calcarcous.

Fatty stage.—The superficial layer less and around the involved portion of the tissue are generally extremely defined, and have looser connections than normal laminae, so they may be peeled off readily with the point of the finger, as if they were, undermined, and their connections dissolved through the intervention of some parading fluid. This peculiarity is most marked on the surface. In these modified arterial tunics are generally to be seen small, prominent specks of a marble white and comparatively of a soft consistence, or what is as common made of its arrangement is by the formation of a longitudinal al lining. These form dots of various sizes. This kind of deposit presents similar appearances in the deeper layers only, in larger masses, which give to the surface a baggy and irregular aspect.

Intermediate stage.—It is characterized by difference of colour from the preceding mass 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 appearance glistening transformed.
transformed, they form isolated patches, of variable dimensions, and forms: their surface are generally uneven and irregular, which is called ulceration of the arteries, but we may meet with deposit in the deeper layers with the tunics externae. They, 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 generally at the periphery of an artery. These plates have an elevated margin with a cupped-shaped centre, and they are placed invariably quite on the surface of the arterial coats. opposite these elevated points, the muscular tunic is greatly reduced in thickness.

When the calcification of the arterial tunic has advanced to a great extent, it presents an earthy appearance with its dry and shrivelled aspect; sometimes torn, shrivelled, and raggedly projecting surface, from the preceding superficial mode of examination of the stages of transformation of the deposit solidified. Should similarity to other simulacra undergoing chemical transformation, as Lyceum, Euphaloma, &c. The character of the preceding conventional stage of the transformation of the rheumatic simulacra 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 Gallon was the first to make out and demonstrate clearly the real structure of these deposits. Their structure is different according to the stage in its examination. It is stated by Béné that they arise from degeneration of a false laminae which he calls "lamina adventitiae" situated between the perforated membrane. I sincerely confess that I have on several occasions searched for this tunic microscopically and on all fail, and I have consequently been induced to doubt its existence upon the following grounds: - in an army slightly involved by the first kind of deposit, which we may designate 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 remains of pus cells, or the element of white fibrous tissue in processes of disorganization, after the addition of acetic acid; as generally possesses fatty deposit in other parts.

1st. Fatty Stage - When one of the white specks, or these are examined microscopically, they present intermixture of fat globules and plates of cholesterine. The former form their constituents. These globules are perfectly round particles with a well marked dark hollowed 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 with globules, or what might be produced artificially by mixing together oil and albumen; hence such granules are called oleoalbuminoids. The plates present a transparent crystalline, rhomboidal, tabular plates of a pearl aspect, representing one corner as if cut off. They are variable magnitude, and constitute but a small part of the mass. They are not acted on by caustic acids or acetic but are soluble in ether.

2. Mass. This may be considered an intermediate stage between the fatty and mineral stage, when those reddish yellow spots are examined. They present oleoalbuminoid granules, few plates of cholesterol, mingled with a calcosolous ground which when minutely examined consists of dark, irregular, specs, 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 kidney and bone.

3. Calcareous Stage. This exhibits in bony structure as once supposed. When scraped and mixed with water, they present amorphous particles similar to those described above with few oleoalbuminoid granules and sometimes plate of cholesterol.

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 complete loss much of its normal appearance in the unaided eye only at those calcareous spots when.
When in some standing, it is much reduced in thickness and more or less in appearance, probably from the influence of its pressure, but when examined microscopically it generally exhibits irregularly arranged granules, intermixed with others along their course, giving them a structure as if undergoing degeneration themselves. But in most specimens we are able to observe the salt deposit along with the elastic layers, coming behind the muscular layers, normal, by which it appears that its peculiar life is in the elastic tunic. Lastly when afterwards becomes mineral deposit is deposited at variable depth of its substance, but the most position in which we find it is near the surface of the vessel, but when the lesion is extensive we have it between the deep layers, sometimes it appears to be near the surface but when they are placed in water it does not float unless and I have been able by means of. needed to separate from its surface a thin gelatinous film without removing the deposit, from dissecting these spots and stricate I have satisfied myself that great of them are situated between the superficial and deep layers of the elastic tunic and between the layer of the former which are previously described the elastic layer consists of superimposed laminae because I have been able to isolate the deposit from its surrounding connections, by removing its superficial layers. The larger masses are placed between the deep layers. They are generally more closely connected
with their surrounding laminae.
Calcareous matter.—As previously stated it forms plates and rings on the surface of the arteries. The superficial
layer, which might be taken as argument against its al-
luminous 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 laminae hardens
and tends to infiltrate which during this transformation
must succeed successive periods, thereby destroying par-
fall, the ill-nourished superimposed layers; and then
are no vessels and lymphatics for removing the mat-
for it is left on the surface to undergo chemical trans-
formation similar to the primary calcination, and in
support of which there are generally covering a hard

calcareous plates when a recent state a reddish yellow
covering which presents the structure of the second kind of
deposit. This indicates to me clearly that it is of a
recent origin and due to the original structure of the

The origin of fatty and calcareous.
Informations on the origin of morbid depositions of
fat in different organs of the body are few and general
at variance with one another, probably from want
of a better knowledge respecting the chemical trans-
formation during the formation of "A deposits" from
albuminous substances. In the present theme I shall not

entrue to deposit generally, but I shall the present subject
with organs similarly affected. Respecting the shift in the art
sice 1700 theories are upheld. 1. Distended nutrition
at Gallie's. 2. Abnormal Nutrition, as Arule.
The first doctrine holds that the textures appropriate for the
nutrition at middle age, the fatty con-
dition of the blood under some obscure deceased con-
dition of the arterial coat, while in old age under the
same parent 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
existence. That the superabundance of one element in
the blood can modify the process of nutrition is what
seems to be known of that organic property;
but that it may modify the product, of disease there
is no doubt; and as we shall presently see,
amount of salt in blood towards old age, arises to ex-
plain the difference in the termination of abnormal nut-
rition. If what I have attempted to describe is cor-
rect regarding normal nutrition, namely, that they are
appropriately and accumulate prelalbum as nicely and at par-
icular, constitution of their food at the hepatic cells, and
those of the kidney, etc. Respecting these there are no in-
stance where their functions are materially permi-
ted in any way; therefore I think we have good rea
To consider barley that the process of mutation must
become persisted and inveterate, as in inflammation


Fatty deposit in the lungs, brain, and kidneys arise from the investigations of Rheinhardt on the formation of compound granular cells. Professor Bennett on softening of the brain and Gardner on the kidney, appear settled that the succinate appearance of fat in their structures are albuminous origin, which have undergone chemical transformations; but fatty deposit in the liver is rarely a result of persistent nutrition.

Now, here, it cannot be considered an anomaly, in process 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 depend on morbid nutrition we should suspect to find all part of the body similarly involved to this. I can answer negatively that it is no direct relation with regard to morbid deposition of fat in different organs of the body for I examined the voluntary muscle, liver, and kidneys, in many instances of confirmed althoroma -ous actus and I found that the greater number of them presented their normal appearance; the heart indeed in almost all presented ill shaped muscular trabeculae. Their fact and the preceding reasoning have convince me that it is not a constitutional defect and must be due to some local peculiarity of structure.

On the plea of the preceding objections, I am compelled for another theory to explain the origin of fatty and
and calcareous matter, and I think wax in polypus.

You quite consistent with known fact: viz. Abnormal nutriment of a rheumatic kind. I have advanced in the former part of the present theme both 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 well-known lesions in state of transformation, as Canon says, which are known tabs of albuminous constitution. Besides these they happen at happen an age most susceptible of being affected by the exciting cause of abnormalisation. There is no hesitation that these facts countenance greatly its albuminous origin. It appears to be produced in the following manner.

The exciting cause of rheumatic supuration stimulates the fibrous structures lining the internal surface of the arteries to abnormal nutriment. These continue to produce the effect of the incident from the nature of their structure. As it is now fully proved, that fibrous tissue of all are most susceptible of effecting rheumatic suppuration. They at an effect of the preceding infection or irritation absorb into their interstitial abnormal amount of liquor daunyinis from the blood circulating in the arteries and in consequence of the elastic tissue being now vascular, it is retained between its lamina to undergo fatty and calcareous changes. when
so large, amount is suddenly elaborated. But a part of it may come as well from the "vasa vasorum" especially that between the deeper layers. The mast part of it, I think, doubt comes from the fluid within the vessel as its particles are more abundant near the surface and decrease towards the deeper layers of elastic tissue. The fact 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 altaminous origin. I think this is too loose reasoning, for this are degrees of plasticity in different substances varying in organic power or capability of organic transformation as into red cells and fibrillar layers, from that of diastolic to cancerous condition, 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 latter doctrine is that rhumatic satisfactory in certain situations as joints and endocardium seldom or ever undergoes cellular or fibrillar transformations, upon the preceding facts, and the fibrillar nature of structures, here involved I ground my belief in considering fatty atherosomal deposit in the arteries to be due to rhumatic syndation. Respecting which before concluding I shall make few remarks.

I have already stated that fatty and calcarea deposit in the arterial walls are the results of a chemical transformation
of abnormally exudation, the mode and stages it pas-
se through, had not excited the attention of chemists to this important subject, that must at some future
period prove of the utmost value, when fully explained
consequently, I am debarred from entering on this
interesting subject; at the same time the fact is
fully established by the observations of Professor
Bennett, Dr. Gau-dier, & Reimhard, that an exu-
dation may be transformed 1. into fat, 2. cal-
cearous matter. Respecting the latter deposit in the
arteries, I beg to make a few remarks. There is no
doubt that these arteries, fully impregnated with mineral
matter, contain more than chemical analysis could
possibly account for as the medium of a previous
exudation, and the decay of the tissue involved
compared with calcareous remains of an albuminous
exudation in other part; hence have originated the
idea of perverted nutrition respecting this theory
similar objections might be adduced against it all
of fatty nutrition. I think we are possessed of a
chemical phenomena that will explain the supersed-
tion of mineral matter to the primary constituent of
the tissue and exudation, without having recourse
to so 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 endothelial & chemical
attraction.
of the mineral constituent of the blood, similar to what happens in the formation of Raphide, the crystallisation of some plants. These are formed probably under possibly under two conditions, viz., an acid is elaborated within the cells of the parenchyma in which they are found, which attracts through the fine interveining membrane from the fluid that pervades the plant a radical base, which combine and crystallize within the cells, and a change in the viscosity of the tissue that the endosmosis. Returning to the subject of calcification of the arteries, and applying the same law of endosmosis I chemical attraction of the mineral matters of the blood, we can easily explain the presence of an abnormal amount of the endosmosis as previously described is placed between the laminae of the internal lamina where it undergoes change in viscosity, and chemical constitution of the following order: at least we have good reasons to suppose such. The phosphorus and sulphur are oxidised, which form acids that attract bases (probably most common lime) through the interveining membrane, and is arrested by the viscosity of the fluid, along with the other matters, with all probability a similar homologous substance (Phosphate of lime) from the mass of the blood. I am inclined to believe that this process of endosmosis and chemical attraction continues till all the endosmoses, and the surrounding tissue, are thoroughly
calcified. The whole explanation I confess is very theoretical but not inconsistent with known chemical laws, and serve to explain the difference in the calcification of the arteries in the young and old. It has been established as a fact that blood containing, that is, one per cent of human resistance 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 sub-addition of mineral matter to the blood of the primary addition 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 inflammatory suppuration of the blood I have not noticed, being unable to procure specimens when I could make my observations. I have indeed vowed to unshackle myself of opinions imposed upon me by previous authors; and lay before you the new results of my own research, trusting it will be more appreciated by you at such a time and out a compilation of already suspended thoughts and opinions on the subject. I should have been happy to give few illustrations with the different parts for the purpose of adding the description I have.
given but I did not feel myself competent to undertake your taking. I hope to meet indulgently with all imperfections which may be apparent to you, and if I merit in any degree your approbation I shall myself well accomplished.