| Chapter I     | Preliminary on the metamorphosis of the blood corpuscles and their contents as observed in obliterated vessels & intercoagulations, according to the special organs & tissues in which they occur. Notes, illustrative cases & observations. |
| Chapter II    | On the chemical nature of the changes which the contents of the blood-corpuscles undergo in their transformation into the various forms of granules, crystalline & amorphous pigment.                            |
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Introduction

I was induced to direct any attention to the question which I have chosen as the subject of the following pages by the considerations which suggested themselves inquiring into the arguments which are brought forward by Prof. Köhler in his well-known article on the Spleen in Mr. Todd's Encyclopaedia, in support of his doctrine of the function of that organ. In reference to this investigation, the subject has at least some importance, and I think grotesque in itself, more than sufficient interest to make it worthy of all the labour which I have been able to bestow upon it.

While my attempts have fallen far short of the success which my self-confidence had led me to anticipate, and while I am fully aware that this is unworthy, not of the author, but of the occasion, yet I continue to hope that the novelty of the subject as well as the consideration that the whole of its literature is to be found in a language with which I deeply regret that I am not more familiar, will be accepted as in some measure a palliation, if not an apology.

Thos. Sanderson
Chapter I

Preliminary.

I. General Sources of Colour in the Living Organisms.

Without taking into consideration those forms of pigments or other substances which are included among the normal constituents of certain tissues, such as the pigment nucleus of the eye, the colloid in which they are unconnected with our present subject, colour may be said to have its origin in the living organism to one of three causes. Either it may be due to the presence of fatty granules, which though they appear colourless when viewed individually, by transmitted light, communicate a specific tint to any tissue through which they are infiltrated, in any quantity, as in the case of the corpus luteum (the richest of the ovaries, the form of glandular softening of the breast, etc.; or, on the other hand, they may be their origin to more or less attenuated bile, or biliary, which is by far the most frequent source of abnormal colour, to blood tissue in its original condition or radically changed.

With respect to the first two of these, as they are unconnected with our subject, their considerations will be overlooked, etc.
Except in so far as to enquire whether or not they may possibly depend to a certain extent on the fact of the source of colour mentioned above. It is believed by many, indeed, that the coloring matter of the bile is derived from that of the blood. The grounds however upon which this theory is founded, which will be carried into detail are not very satisfactory.

On this subject numerous theories have been held at different periods. In former times it was supposed that the corpuscles being the nutritive constituents of the blood, applied themselves to the walls of the capillaries and so disappeared in the surrounding Parenchyma. This was founded on observations which have been long proved to be fallacious.

Widely advanced the view that the corpuscles were thrown off by the liver and thus conducted directly to the formation of bile. More recently Pasteur has maintained that the spleen performs the same office. The consideration of the phenomena on which he grounds this theory will fall under a later section.

If we examine a specimen of healthy blood taken directly from the circulation of a living adult animal, we see as much as a drop to point out, from any peculiar characters which they present, these corpuscles which have fulfilled their functions and are on the point of dissolution, as those which have only recently originated and have not perhaps arrived at their full development. When we add water however, or any dilute acetic acid, we at once recognize different ah. we before inappreciable aiding from the various degrees
The same occurs onesting insects of all kinds. I asked, "Does the word mean to refer from one plant to another even of different ages?" Is it said that the insects attack every cell?"
of susceptibility possessed by individual corpuscles to the action
of these reagents, some being acted on and disappearing at
once, others not at all, or not till after a considerable period
has elapsed. As to the magnification of these differences, it is
rather difficult to form a precise opinion. It must in the first
place be remembered that the apparent disappearance of a corpuscle
when subjected to the action of water must not be considered
as equivalent to its solution; there is no reason to suppose that
the very transparent enveloping membrane is necessarily attacked.
The action of water on the corpuscles is of two kinds. In the first
place it produces a swelling up or enlargement to a greater or less
certain extent (in which respect I am not aware that any difference
in the susceptibility of different individual corpuscles is observable),
and secondly, it dissolves the colouring matter, and it is to differences
in the solubility of this constituent at different periods of the
development of the corpuscle, that the peculiarities above referred
to in the action of water are attributable. This explanation is con-
formed by what we observe in encapsulated bodies, in which
the first change accomplishes consists in a gradual diminution
in the solubility of the haematin, which diminution may,
with some probability, be supposed to arise in both cases
from a coagulation of the contents of the corpuscle consequent on the loss of its vitality.

With respect to the actual mode of disappearance of the blood
corpuscle, although no satisfactory observation can be made

It is difficult to understand how the oval nucleus of the large blood corpuscles, shown by Bums, the round appearance of the lymph cells, in the same animal—Stib.
in the higher animals, yet I think it possible and especially
in the Frog some results sufficient to throw some light on
the subject may be obtained. Thus Brown tells that in what
he calls the "zoo-graded development" of the embryo of the Frog
the following facts are observable. The corpuscle first loses its color
while the nucleus becomes more apparent and assumes a gela-
nae aspect. The cell-membrane becomes wrinkled and quivering
at its margin, disappears or nearly becomes cheese and cheese
is at first only to appear as a pale shadow. Finally the
nucleus only remains and is indistinguishable from a lymph-
corpuscle.

In first few days there appeared the appearances assumed by the
fetal blood-corpuscles at the 12th day of incubation when undergoing
a process of dissolving away, perhaps analogous to that above
described. The three corpuscles, when no respect was added, I could
almost observe the color gradually fading under the eye
and think it very probable that the phenomena was not neces-
sarily accidental, as it was repeatedly observed, but a really
normal. It is unnecessary to say, however, that all such observations
are entirely vague and uncertain, and that the great importance
is to be attached to them. If may be correct. The mode of disappearance
of the blood-cell may be considered as analogous to most other cases
in which the membrane becomes altered and dissolved, before
any change take place in the contents.

In whatever mode the blood-corpuscles become dissolved a disappear
The paper "In the Osmoning Matter of the Blood and Bile"

Annales de Chimie appliquée a la Medicine 1846 p.253
It is probable that the coloring matter becomes diffused in the surrounding tissue in a nearly unaltered condition, probably communicating to it that brown colour, which is characteristic of it. Does this coloring matter become subject to chemical change and, as such, disappear, or does it, as some suppose, retaining the character of pigment, become bleached into the coloring matters of the livers of vertebrates? For the determination of this question we must consider, first, the mode in which these coloring matters can be ascertained by observation to originate and, secondly, the points of correspondence, if any exist, between them and the coloring matter of the blood.

On the subject of the convertibility of the pigment of the blood into that of bile, various opinions have been held and observations detailed. Thus, it is maintained by Prieur that the destructive property of the coloring matter common to the blood, bile, and urine is that it is rendered yellow by reduction, red by oxidation, and that as the red blood-colour becoming less oxidized in the liver and kidney, it is converted in to the yellow. This characterizes the secretion of those organs. This theory he founds principally on a number of experiments in which he endeavored to show that reducing agents turned the colored composites yellow, while oxidizing agents turned the bile red. This theory seems to be based on his slender foundations, mere worthy of much confidence. Various chemists who have investigated the question of the bile.
of the constituents of bile in healthy bodies, have concluded that
the biliary coloring matter found in that fluid had qualities
akin to that of blood itself. Thus Denys selected such a coloring matter
as a constant constituent of healthy liquor gastricus. Under
this head it is maintained by Simon that a marked distinction
exists between the two, which is especially indicated by the different
action of salicylic and on each.

As to the mode of origin of the coloring matter of the bile we
know nothing. Acquaintance have no proof that it is formed entirely
after birth; for the appearance of the opposite of yellow granules
occupying these cells, upon which much stress has been laid by
some authors, is an abnormal fact and cannot be an indication
of the first step in the establishment of the condition of jaundice
resultant on obstruction, namely, the intense state of the psyche
itself. The coloring matter being thrown back upon the cells
and absorbed in a continuous way a general fact of which
we shall have other illustrations in the sequel.

Thus is just one other observation which seems worth
mentioning, as tending to confirm the doctrine of the change
in color of the blood-pigment into that of the bile. In the three
higher classes of vertebrate animals, the bile attains a brown
color a bright yellow color — while in birds and reptiles it
presents some shade of green. In connection with this it not a little
improbable that the coloring matter of the blood in apes,
lesser apes in presence of true attention, in their tribes of animals
always exactly corresponding with that of the bile.
General Phenomena observed during the changes which take place in stagnant or embrocated blood.

[3] Preliminary Changes directly consequent on Embrocation or Inversion. After fluid blood has undergone extravasations into the tissue of any organ, or into any of the cavities of the body, or has become stagnant in a vessel artificially or otherwise, the first change which it undergoes is that of the consolidation of the fibrin. This process set in process within the living organism, though essentially identical with this corresponding one, tends to take place in blood which has been removed by pretreatment or otherwise, is considerably modified by the existing circumstances by which it is surrounded.

On maintaining a recent acoagulative clot in the tissue or elsewhere, the whole clot is found to consist of a soft and, in many cases, almost diffluent homogeneous mass, in fact assuming the form of a sheet. The clot of healthy blood, when formed extrinsically within the body, is known from observation that the framework of the clot is formed extrinsically within the body. It is known from observation that the framework of the clot is formed extrinsically within the body.
Circumstances which in a recent extravasation clot, caused it to assume a very soft consistence, consists in the large quantity of serous fluid which it involves in its meshes at the period of its formation, which, however, rapidly undergoes absorption. In most cases both these causes are probably present and operate at different periods, the first being dependent on the infiltration which takes place after the clotting along with the serum into the surrounding tissues, while the serous clot becomes as by a filter.

During the period immediately subsequent to extravasation and before the commencement of the changes imparted to the organization of the clot, it undergoes no further alteration except that dependent on the gradual contraction, and the disappearance of the serum. It will be perfectly necessary before entering on our immediate subject, namely the metamorphosis of the blood, impregnated which of course takes place after the period referred to, to consider the process of organization of which the two constituents become the subject, and in which the impregnated substances are involved. In describing the facts connected with these changes, they naturally divide themselves into three connected with the development first of fibres or fibrillar structures, secondly of celliform structures.

[17] Vital facts connected with the development of fibrillar tissue in organizing clots.

The process has been described by Divitry in his two memoirs "sur l'Organisation" and "sur la Metamorphose" of his Siemens.
Note.—I have been unable to obtain possession of either of these works, as they do not exist in any of the libraries in Edinburgh, and are only acquainted with their contents by the abstracts which have appeared in the German Journal and especially in the "Rationaler Pathologo" of Prof. Stahl.

See this work, p. 22.
of reticulum. Important observations have also been made on the same subject by Bock (Lehrbuch der Pathologischen Anatomie, 1847, p. 429) and by Bouch (The same, 1818, p. 112) to which we shall have opportunity of referring subsequently.

Preparatory to the commencement of organization, the substance of the coagulum, when microscopically examined, is observed to have lost that appearance of fibres running in various directions, which it invariably presents immediately after its formation. Its appearance is homogeneous and transparent, and its consistence has become—according to Bock—more fragile, softer than before. In the Thrombus in Arteria, according to Prouhet, towards the end of the second week after the application of the ligature, the development of permanent new structures in the form of nuclei commences. These when they first present themselves are generally small, of a round form, and tellurium provided with a nucleolus. Originally, they present no definite arrangement with reference to each other, but subsequently they arrange themselves in rows, and become elongated in the direction which is afterwards to be assumed by the fibres to which they give rise.

At this point a new element presents itself in the form of broad fibres, which can now be more or less distinctly defined, and which the nuclei above described have a peculiar relation. The appearances of these are various according to their stage of development. Predominantly nucleated cells (kerngezellen) which are perfectly round in form and only similar in other respects, which had elongated in both directions,
Brisk and flat frict are seen, which become more and more dis- 
eted towards the end of the fracture line (in the Femur, with 
all their observations refer) - and, being here and there provided 
with nuclei, present an appearance similar to the undisposed 
muscular fibre. About the 7th or 8th week, these fibres have split 
into filaments and have become wavy - they thenceover being con- 
verted into bundles of white fibrous tissue.

The foregoing series of facts may be considered as those charac-
teristics of the process when complete in all its parts. All other 
changes are however only completed under certain circum-
stances. They may as above stated be well seen in the common 
clot of ligatured arteries, in hemorrhagic edges in the brain, 
tissue generally, and in the corneal wound consequent upon 
fracture; they may also be admirably studied in sepsis in the 
brain and many other situations. The process cannot be observed 
to go beyond the preparatory stage if the development of nuclei 
and Nuclear fibres or even not so far.

It is to be remarked that the metamorphosis which the corneum 
of Stapp's book undergoes is the same as every structure with the 
of which it composes. Biondition is the subject under similar cir-
sumstances, not only as regards the development of fibres, but 
as will be seen hereafter, in other changes.

[6] Several facts connected with the development of celliform 
structures in organizing corneum

In almost every extravasation if not be of different age, it will
he found that while in the peripheral portion of the resulting
computation, the changes described in the last section are to be observed
in process of time, in the more central parts other structures and
which present very different characteristics. The changes which were then
described as preliminary to organization grow in the same
manner, and at the same time, but varying to extent which
we cannot very easily define. The superficial portion gives
rise to filaments that more removed from the influence
of the surrounding tissues gives rise to cells by a process of conglutination
with its assuming a fluid form.

Now again in this fluid we have to observe two main changes
at once with which we are acquainted in that of an evolu-
tion, each giving rise to forms essentially identical. Since in de-
scribing the evolution of these forms, we are only describing facts
and phenomena with which we are familiar under other
circumstances. It is true that some cell-like bodies referred to
are much altered in their appearance by the presence of foods
capable either unchanged or in a more or less metamorphosis
condition. But this circumstances is perfectly unimportant as
regards their identity. Nature or her conglutinating to form into
the conditions of their origin.

With regard to the physical characters of these bodies
we cannot call them cells in the strict sense, although surrounded
by an apparent membrane) as they present themselves in anoma-
less form, a short time after acceleration has taken place,
They are at all times the same, namely, those presented by what has been called by some writers, the "granulate corpuscles" by that the "compound granular cell" etc., and which differ in several important particulars from those of every other cellular form body with which we are acquainted as existing in the organism, whether healthy or mortally. They are distinguished by consisting of a spherical or spheroidal aggregation of the albuminous granules or other bodies, which appear to be surrounded in many cases by a distinct membrane; differing however from all other proper cell membranes in being insoluble when acted on by water or dilute acetic acid. Many of them contain a basilar, transparent, nucleus, which may be either central or peripheral in its position. In their mode of development, as will be shown in the sequel, they are also peculiar, the contents becoming collected together into a spheroidal mass before the formation of the cell-membrane, or rather of the structure which appears to be such. The proof of this lies in the fact that undigested blood-corpuscles are found among the contents of these bodies, which of course cannot be supposed to have originated subsequently, or to have been developed in the position in which they are found.

These "granulate corpuscles" I use a term which has, I think been applied to them with more propriety than any other by Mr. West, occur under various circumstances. They were first described by Lunge in inflammatory eruptions under the name of occurring
Are the studies done referred to the same as those which conclude blood experiments. I am inclined to think not, although it having been shown that a menstruum may form from blood particles, secondarily, analogy is in favor of a menstruum also being capable of forming sound approximations if properly prepared. I therefore it is maintained that this is the only, may even the common means I sometimes in the compound known body, I am satisfied the opinion is incorrect
along with pus globules under the name of inflammation globules (Entzündungskugeln). In healthy lung, however, they are usually entirely absent, or occur only occasionally. They may be best seen in pneumonic exudation or in the fluid which may be squeezed from pneumonic lung. That are the exclusions conditions of their production or the precise nature of the meningitic-like structure, which appears to surround them well, though unconnected, with our immediate subject, almost unavoidably fall under our consideration in a future section.

[6] General facts connected with the metamorphosis of the blood-corpuscules and their constituents in ulcerated or stagnant blood.

Almost from after blood becomes stagnant, whether it be a clot within the walls of a blood-vessel or not, the blood-corpuscules undergo one of two changes. Either they become colourless and almost invisible and finally disappear altogether, as a consequence of the dissolution of the haematinic in the surrounding medicine, or returning to a greater or less extent their original, become gradually incapable of being acted upon by water and acids and subsequently shrink and lose their previous form, with their smooth contour and transparency, their contents undergoing various changes in the course of its transformation into granular pigment. The first of these forms of alteration, that in which the blood-corpuscules become decoloured, affects in
Every case, the greater proportion of those, and in consequence the surrounding fluid becomes deeply tinged of a reddish or brownish colour, as for example is observed in certain apoplectic conditions of the brain, in which this condition is often present to a marked extent. In consequence of this process, the blood-vessels become almost entirely invisible owing to the great transparency and slightly refractive property of the mucous membrane, in contrast with that of lens or water. It is quite unnecessary to suppose that in disappearing they undergo immediate destruction or indeed that they are at all altered. Eventually, however, like all other organized structures they no doubt break down and undergo absorption.

In the other case — that, namely, in which the colouring matter undergoes its transformation into granular pigment, while it still remains included in the walls of the capillaries, various modifications are observed. First, a form of pigmentation frequent occurrence is described by Forthou as occurring in various situations in soft and imperfect organs, which have become more or less completely broken down into a dark red diffusible mass, to recur in the various parts of the apoplectic cells in the brain and other organs as well as in the fluids of various apoplectic disorders, as in anaesthesis. This is distinguished by the following characteristics. The margins of the apoplectic corpuscles are more distinct and refractive than in the ordinary condition, while their diameter is much diminished, but they are observed to contain at this
...or more rarely in later centuries. Sexual minute granules which are characterized by presenting dark Margins with transparent centres. These bodies, when acted on by dilute acids and acid permanganates, but are dissolved by the same reagent undiluted. They are not attacked by water. But soluble in strong solutions of acid or alkali. The further changes which they undergo consist in their gradual disintegration in size and the dissolution, first, of the granules and subsequently of the membrane which surrounds them. Beullé has described similarly altered corporules in large aphrodisiac cysts in the Perineum and Coke (Countets Schoelch'sdick 1841/1842) in extravasated blood in the inguinal glands.

Secondly, for the most frequent kind of transformation which these corporules undergo under similar circumstances, present some what different characters. They gradually, as above mentioned, become indelible to the action of water and acetic acid, as well as of saline solutions. Their contents assume a shining yellow or brownish red or even black colour. After this, the disk form and the smooth Margin is gradually lost, the whole corporule becoming wrinkled and gradually diminishing in size, until at last they form only dark spots.

Finally another very remarkable form, but one which is not very often seen is that in which the colouring matter assumes a crystalline form in the centre of the corporule. Several instances of this phenomenon have been recorded by Alliacher; the only one in which he observed it in the intumescence of the testes as follows. In a dog...
Whole spleen surrounded by desolating blood-globules. The blood of the spleen is distinguished itself by a very great quantity of colourless blood-corpules, almost all of which contain numerous nuclei, and often had a deception resemblance to egg-globules. In the blood of the liver were found a great quantity of altogether different blood-globules. There were swollen or almost colourless, but contained from one to five thousand or thicker small tube of dark yellow colour. But these differed in size length, the blood-globules, but were shorter. Not like found in two instances similar bodies in the spleen blood of fishes.

In very many of the cases in which the corpuscles undergo the second form of transformation described above, the appearance which they present during the changes are remarkably modified by the additional circumstance of their aggregation into spherical masses, and then becoming surrounded by a membrane, as has been already mentioned in the preceding section. This may take place either shortly after development, in which case the appearance of cells containing blood-corpules (the so-called blood-corpules developing cells as seen in the spleen of the shark) is observed, or the formation of these structures may not take place until a later period, when the blood-corpules have become more or less attenuated. This seems to occur in the metamorphosis of the Thœarchus according to Tschudy, and probably in many other situations.

At what a period however, the formation of these cell-like bodies take place, the ultimate result is the same, that they present
The appearance of pigment cells, which communicate to the tissue, throughout which they are diffuse, or to the mass of arterial blood, which they contribute to form, varies shades of colour according to the amount of change which they have undergone. They derive from pepsin cells and not always disappearing after an indefinite period, and their constant drain in general little liable to absorption. Thus, I have found them in the steady atrophy of the corneal vessels after the brain, the result of an acute lesion which must have occurred many months if not years before, and Sowerby has observed them in a Thrombus of 12 years duration, apparently altogether unaltered. In most cases, however, they break up after a certain time, yet clasp, nothing being left but granular pigment and the more subluminescent granules, all are usually associated with it.

III. General Facts relating to the formation and mode of origin of red pigment.

It was stated above that, whenever stagnation of blood occurred, the greater part of the corporcles became entirely decolorized. The principal proportion of the removed colouring matter becomes chemically changed and absorbed by the veins or lymphatics. Another fact is involved to a greater or less extent in the formation of very peculiar crystalline bodies of a black-red or dark brown tone, which whenever they seem to be distinctly traceable to arterial blood. As far as my observations go, they only are seen in arterial blood, after some time's life, being absent in diffused extravasations. A cork, in no doubt, owing to the substance which forms their basis ending in a more concentrated form in the former than in the latter situation.
May 4th 1979

Chaa - 8 April 1978

Czech - Polish bilingual materials - Charles University, Prague.
Their effects have been investigated by several authors with results somewhat contradictory—especially with reference to their chemical composition. In this account there is considerable difficulty in arriving at a definite conclusion as to the conditions on which their formation depends. We shall return to this subject in a future section.

Chapter II

On the Metamorphosis of the Blood-corpuscles and their contact as observed in blooded cells and extravasations, according to the special organs or tissues in which they occur—both clinical Cases & Observations.

Section 8: Observations of Twiskey on the metamorphosis of the corpuscles in the Thrombus of arteries.

In the following facts I am indebted to an abstract of Twiskey's results in a paper by Paul Broch, in Inflammation-plates, as well as to the notice previously referred to in Prof. Heule's Pathology. Twiskey's observations on the Thrombus extended both to the live animals and the human subject—and the changes were recorded day by day as they occurred. The general results agreed in most respects with those which are to be obtained relative to the phlebitic changes in the basis—their sequel to be subsequently detailed.

In accordance with the general observations contained in previous sections (sect. 6) Twiskey found that the corpuscles & their
contents became charged in their distinct modes. A proportion of them—by far the most numerously—disappeared without leaving any visible trace, a circumstance which is attended by a gradual diminution in the size of the clot itself, along with an alteration of its colour, which between the second and fourth week was observed to fade gradually from red-brown to a yellowish white. By this time most of the corpuscles had dissoloved, and about the fifth week, but few were to be found. It is not easy to determine whether, during this process, the membrane burst, allowing the escape and subsequent dissolusion of the contents, or whether the corpuscles, without bursting gradually became clean as after the action of water.

The state and less considerable proportion of the corpuscles undergo a chemical alteration of the membrane and contents. They become insensible to the action of water, acetic acid, and being in characteristic form, are finally converted into red-brown granules just as described in Section 6, as the second mode of transformation mentioned.

In their arrangements with respect to each other, these altering corpuscles presented some peculiarities. They formed clouds, parts of the clot, which had in consequence assumed a brownish, white, or blood or matter of pigmentary granules which were however not surrounded by a membrane, and in most of them very transitory. Having entirely disappeared after the fifth or sixth week, a few being however traceable in a state of disintegration.
These bodies may, in all probability, be considered analogies to the more developed cell-like bodies which we shall find occur in organizing clots under other circumstances.


Under this head will be included the facts connected with the metamorphosis and formation of hemorrhagic cysts or apoplectic cysts in whatever tissue they occur, as well as the consideration of certain cystiform structures which arise from circumscribed accumulations, in which blood-corporcles are accidentally present. We know from accumulated observation that a cyst consisting of a well-defined wall, lined by a structure which approaches more or less to an epithelium, may arise in any tissue which presents the requisite mechanical conditions, entirely as a new formation morphologically independent of any previously existing. This doctrine is well illustrated by the history of those Kansas cysts which are known to originate from large or small granulations in the substance of the brain, and it will be seen from the following details, that when such an extravasation takes place into a loosely connected, and consequently, non-resistant tissue, it invariably undergoes these changes, these will finally result if not interfered with by accidental circumstances, in the formation of such a cyst.

In accordance with the above observations.
Vitreous or firm nodules may be associated with a cystiform structure. May be developed, so as to constitute an abnormal growth. Thus, it may take place by an evagination into a previously existing structure of the tissue, budding into a stromal vessel, into a mucous or salivary follicle, or into the dilated capsular termination of a ductule tube. Secondly, an effused mass of evagination, as the gelatinous evagination into the cells of the Thymus gland, or Bronchus cells, may, often centrally and eventually, give rise to a well-developed cyst. Thirdly, the encapsulated evagination may take place in any case tissue (as in the formation of colloid cyst in the loose cellular tissue of the choroid) with the same result. Lastly, a cyst will arise from an extravasation into a tissue which presents the same mechanical condition, as in the apoplectic cysts of the brain above referred to.

If the contents of these cysts, from which do not arise in the first instance from extravasation, blood is frequently found to be a constituent, while the cysticules undergo the same change as in those of apoplectic origin, in accordance with the observation which was made above, that the melanosphere of an evagination or extravasation is, under cellular circumstances, precisely the same.

(a) Apoplectic Cysts of the Brain

An extravasation, which will result in the formation of an apoplectic cyst may take place in the brain in various ways.
In some cases a number of capillaries or minute arteries over a limited space give way, producing in the first instance the appearance of what is called "capillary aquaplecy". One or two or a greater number of these minute extravasations enlarging and breaking down the tissue immediately surrounding them may coalesce to as to form a larger more or less spherical dot, with ill-defined margins. In other instances the result is produced somewhat differently. A single blood vessel gives way and the blood continues to escape from it, breaking down the surrounding tissue and gradually enlarges. The dot which is produced presents much the same appearance as in either case, except that in the first it is not so well defined and spherical as in the second, and contains mixed up with the blood which constitutes it, a larger proportion of broken down tissue.

The first change which the extravasated blood undergoes in the process of coagulation. In the greater number of cases, the clotted blood forms a dark red homogeneous mass which fills out the cavity and assumes its form. Occasionally, however, according to Bosteanouky, part of the fibrin separates into a colourless central or peripheral portion, an occurrence which he describes as having an important influence in retarding the process of absorption.

In the more common cases, the clot mass, which consists of the Blood corpuscles is likewise involved in the process of the coagulated fibrin, undergoes rapid absorption, — in the first instance
owing to the disappearance of the cloud fluid and intensity
of the greater part of the corporalized / fluid. While
these changes are progressing an exudation of liquor langu-
our from the surrounding tissues takes place. This con-\ntrus
s with the former of the superficial part of the clot itself; to form a similar
ary, which completely surrounds it, and is lined by an inner layer
of material undergoes organization of another kind, consisting of
the development of cell-like bodies or conglomcrates, which include blood
granules in various stages of their metamorphosis into granular seg-
ments of large intercellulars, the mass of blood corporalized and fibrinated
not concerned in any well marked process of organization. The
latter undergoes that process of softening, the is preparatory to further
change but no nucleus or other structures are developed until while
the former becomes decolorized and disappered or without losing their
colour, simply shrinks up into little irregularly shaped bodies.

In a large aphthous cyst, which was removed from the anterior face
of the hemisphere of the brain of an and the duration of which
was about
on microscopic examination, I found the follow-
ing structures to be present:

The cyst, which had unfortunately been for some time immersed in
alcohol, measured about 3 inches across. It was well defined externally
and of firm consistence. The contents consisted of a light pulp of broken
blood globules, which had undergone the changes above referred to, and
were most of them in state of disintegration preparatory to absorption—along
with cholesterolic crystals and flakes of broken down fibrin. The cyst.
Fig. 3 Explanation
itself, consisting of an external former portion about the line indicated,
which was perfectly colorless, and an internal soft and more
friable layer of a pale yellowish pink colour. The internal layer
was found to consist of smooth bands of fibrillar substance, running
more or less parallel with each other, in which were embedded many
minute granules but no pigment. These did not present the ap-
ppearance of fully formed fibroblastic tissue, nor did they show any
nuclei or localized nuclear fibers. They seem rather to be the direct
result of the "spilling up" process described by Hance & others in organ-
izing fibrin, which may and does take place without the intervention
of nuclei. The internal layer present under the microscope, a ho-
mogeneous fibrillar looking substance without apprecia-
ble structure, and in which also numerous fine granules were en-
bedded. Besides these a considerable number of angio-mesangia of various
colors (from 1/1000th to 1/5000th of an inch) were observed, which consist of yellow granules dispersed through the surrounding
membrane, so that they could only be considered attempts at the more
destinct form found under similar conditions in other situations.

With reference to the changes undergone by fibrillar corpuscles forming
the soft central mass, Prof. Hinde has stated that in an aplas-
icotic cat which he examined of 6 months duration, he found
the blood corpuscles smaller and more distinct than in the fully
condition, rounded and bordered with small dark points. They re-
semble blood corpuscles which had been treated with a concentrated
formic solution and subsequently caused to swell out by the


action of water, the result of which is that the colouring matter, instead of being equally distributed over the corpuscle, appears in little masses at the periphery.

After the fluid contents of a cerebral abscess have been removed to the condition above described, their absorption takes place without their being subject to further change, and finally if the healing process proceeds favorably, they will altogether disappear giving rise to a bivouc accreta, consisting of an internal fibrous portion, which may be observed in general, including a more or less granular, highly colored centre. The remains of the internal or segmentary type of the cyst, in some cases the cavity may close but the fluid becoming gradually clearer, a clearer, the opaque at last remains at the condition of a true second cyst, in which it may remain for an indefinite period.

(b) Abscesses in the Brain Tissue.

In accordance with the general facts referred to at the beginning of the section, circumscribed hemorrhages in the brain tissue give rise to lesions similar in every respect to similar hemorrhages in the substance of the brain, and result in cysts even more fully organized than those that occur in the brain. The special facts connected with their history will be best illustrated by the following observations.

Case I. In removing the scalp for the purpose of examining the brain of a pig, dotted, embedded in the surrounding loose cellular tissue, and connected with it, a tumor about the size
The general relations of the tumour to the surrounding cellular tissue are shown in PL 17, Fig. 1, being magnified about 80 diameters.
of a mirror LCD, and of tolerably firm consistence. On incising
and examining this tumour, I found it to possess the following
structure. It consisted of two parts. The external portion or cyst was
of a dull yellowish colour and resistant texture. Under the microscope
it presented the structure of fully developed, waxy white spherules,
with a very few of the external bodies left intact. The internal
portion or nucleus was of softer consistence and of a dark
damp green colour. It presented the following elements, i.e., oval-like
bodies. These were of a round, oval, or occasionally irregular form.
They presented the appearance of a distinct membrane and well
defined mass glued and mixed from 1-200th to 1-100th of an inch
diam. 2. In almost all of the spherules, a nucleus was visible,
inside which they contained a highly refractive, clear, round, granular
apparatus. Perfectly spherical and colorless of varying sizes of
amorphous granules of various sizes and of a yellow green colour.
These granules seemed to form the true contents of the smaller spherules.
cells, or Coloured Crystals. These crystals not only occurred
within the cells, but in great number in a free state. They were
of a deep lemon-yel colour of a rhombohedral form. The
depthwise angles formed by their sides, as far as I was enabled to
measure them, 130° and 120° respectively. They were remarkably regular in
their form and it was remarked that while the thinner spherules fre-
quently bore of the yellow tinge, in the thicker, the red was more obvi-
ous. Lastly, All the above described bodies were also found
in large quantity in the free state.
Lo B. Fig. 5. Epl. 3. Pl. IV Fig. 30-4
Transitional stages between the cell-form and the fibre have been observed at that part of the tumour where the cellular and internal portions of the tumour blended together. These occurred in the forming fibre cells, which, while they contained the green granules, received in their central portion, had split into fibres at their ends. This circumstance would seem to point not only to a similarity in mode of origin in the two forms of structure, but probably a similarity in chemical composition between the fibre and the material forming the apparent wall of the cell.

Old. 1. In a frog which had been kept for three months without food, found in opening the abdomen--stomach of about the same size as the one last described, occupying the body subcutaneous cellular tissue of the mesogastrium. It was of an oval form and consisted of a fibrous layer enclosing semi-solid contents. The latter, when microscopically examined, presented a finely granular material of a distinctly greenish yellow colour, excess which were dispersed numerous spherical fatty granules which possessed the same colour and were of very various diameters. Some of these appeared to be enclosed in cells. They were unaffected by Acetic Acid, Sulphuric Acid & Lot of Lead Nitrate. They were entirely decolorized by Strong Nitric Acid.

The cellular portion of this layer consisted of well-developed white fibrous tissue but it was lined by an inner layer, which presented the following remarkable elements, namely, cell-like bodies each of which contained an irregularly, spherical, or mulberry-shaped
Carl Parson, Zur Entwicklungsgeschichte der pathologischen Cystenbildungen. Zeitschrift für innere Medizin. 1891
Central mass of pigment. This mass presented a granular appearance and was of a dark brown colour at centre of a lighter yellowish brown externally. It was surrounded by a distinct membranous structure which, under the microscope, displayed faint concentric lines, but it was composed of several layers. On adding acetic acid (deuterium) the membrane was unaffected, but it was dissolved by nitric acid when undisturbed. Sulphuric acid in solution and nitric acid produced no effect on the membrane, but the latter converted the brown colour of the pigment any matter into bright yellow.

Although in the two examples which we have been considering there is no distinct proof that the appearances described originated from extravasation of blood either into previously existing cysts, or, as is more probable, into the acinar tissue within which they were found, there can be little doubt that such was the case. In the first place they agree in all essential points of structure with formations which we know to originate in that manner, and secondly we should come to the same opinion by analogy in a similar case it is impossible to eradicate any other mode of origin except that of the cysts in a patient.

The following case of developmental tumour in which there was also a cephalic alteration of the testicle, I have extracted from the paper of Dr. Bums on "Pathological Cyst-Formations."

Three months before the patient's death he had received a blow in his left testicle, which was attended with much pain and swelling. At post mortem examination the testicle and epididymis
in that side were found to be healthy. The tissue 

albuginea was 

unaffected, but between it and the tissue 

periercolated, there was 

found, in contact with the former and preceding bone what upon 

it, a clot of the size of a nut by a brownish red colour, with 

a yellowish firm peripheral portion, and a pulpily broken down cen- 

tre. The former displayed a concentric arrangement of lamina 

and was about a line in thickness, blending externally with 

the surrounding loose cellular tissue. Besides this large and 

a framework was found, which resembled it altogether, except in con- 

taining yellowish serum. Microscopic examination shows 

that the central portion, which was of very friable consistency 

was formed of a loose network of fibrinous material along with 

numerous blood corpuscles - nuclei - round masses of granules, masses 

of yellow pigment & clumps like bodies as large as fusiformales, 

the were rounded masses but not dissolved by acetic acid. Many 

of the blood corpuscles had become insoluble to the action of acetic 

acid and were at stage of transformation between them and pigment 

granules were seen. The fibre displayed, less and less organiza- 

tion, as you passed in examining it from the peripheral to the 

mere central and fluid parts which consisted of almost blood 

corpuscles only. The external portion on the contrary consisted only 

of concentric layers of tissue of the blood-corpuscles having disapp- 

ared. The most internal displayed homogeneous, but simply 

a network of flattened fibres, while these most external and 

consequently most developed possessed long small nuclei, and
distinct variations in the character of this blended indubitably into two other normal tissue of the gland.

The cyst above described is an example of a structure atypical analogous to those just alluded to the origin of which from an entama bizarre to no more certain and definite; and its appearance of the entame cyst which occurred along with it affords an illustration of the ultimate condition of such a structure with inro- 

cale abdomen. That, namely, of second bag.

The following observations (also extracted from the same author) offer an example of a similar formation containing fluid, but originating in a manner somewhat different.

Obs. 13. In a young man no above thin were tubercular masses at the apices of both lungs, and in above the Thyroid gland was enormously enlarged. That organ presented, on examina- 

nation after death, the following appearances. The right lobe seemed to consist of several lobules each of which was large as Easter eggs. The left was similarly divided and contained at one

part an earthy concretion as large as a bean, while at another a colloid cyst not less than a goose egg projectia. In some part the gland appeared quite normal in texture, showing the semi-

transparency and orange tinge of the parenchyma, which, at the 

fever when it was dissected divided into yellowish white. From

the lobes which presented a normal appearance could be squeezed abundance of the fat globules and (radial) structures which are

usually found in this organ. The characteristic vessels of this organ.
could also be detected, either embedded in the parenchyma.

On making a section of the portion where the cyst was obtained, these were found, besides the larger cyst, several smaller ones, which were filled with an opaque yellow gummy fluid, in which floated resembling flakes of spongy colour. These consisted, as shown by the microscope, of clumps of Blood-corpuscles connected together, which were partly deprived of colour and had swollen out or lost their shape, were partly confluent, forming large or small groups of a deep red colour, along with which were numerous free Blood-corpuscles, granules, Nuclei, and cell-fragments such as are observed in the normal parenchyma, and isolated gelatinous looking small masses.

In other cysts in the neighborhood, a similar honey-like material, like softened parenchyma matter, which contained, besides the above mentioned elements, 'heaps of granules of a yellow colour, which included large, dark yellow shining angular corpuscles, and very probably consist entirely of agglomerated blood corpuscles.' Many of these bodies possessed a dead margin which disappeared when treated with acetic acid.

As the mode of formation of these cysts, it would appear from their being surrounded by tissue, in which a gelatinous exudation had taken place into the gland substance, and from the fact that the smaller cysts more possessed a distinct membrane, but were only surrounded by the parenchyma adherent by this exudation, that they were originally fierce cystic.
Müßermale Zeitschrift für Rål Ped. 192 Butter
produced by softening, of which had become subsequently firm and covered with a distinct membrane, and into which a punctated leakage had taken place. In the large cyst which formed under the left lobe of the gland, a clear yellowish second fluid was found, and it was provided with a smooth lining membrane.

The following case is distinguished from Peritoneal disease by the formation of cystic tumors, in which the illustration of the same fact is recorded by Adolf Mnichmam in Schles. Zeitschrift for 1847.

Elisabeth Dietrich, aged 93. Cheese-maker, was first seen on the 14th of Jan. 1846, when she suffered from want of appetite, weakness, and nausea. In the course of four months, irregular menstruation had occurred, along with weakness in the limbs and in the abdomen. There was no evident pain in the pelvis. Leeches were applied to the abdomen, which was followed by mercurial injection, which was continued till cachexia was produced. A mixture with digitatin and tincture of potash was ordered.

Jan. 21st. As increase in quantity of urine but profound sweating has come on. Pulse much augmented. Various other remedies were tried with no better effect up to Feb. 21st, when peritoneal suture was performed. The trochar was introduced halfway between the umbilicus and the iliac crest, and the umbilicus. No fluid escaped from the cavity. The trochar was again introduced in every region of the abdomen, with the result of a full bladder of blood.
The blood was of natural appearance, except that it presented a slight buffy coat. In a time she was much relieved, but towards the middle of March the abdominal swelling was again considerable. On the 15th the pain became very severe, and the patient appeared much emaciated, and was feverish. By her own description, theREATINUSIS was repeated with the same result as before. After this she sank fast, the countenance became hypostatic, pulse rapid & feeble, death following on the 9th of April.

LECTUS ORTHANUS. The cavity of the abdomen was filled with blood, which, though it appeared putrid, did not coagulate within the same period. Various parts of the Putridal Surface were beset with numerous tumours. Along the smaller curvature of the stomach and on both aspects of the great curvature, they existed larger in number, but for the most part of inconsiderable size. The largest were found in the lower covering of the intestines and in the mesentery. In size the tumours varied from that of a pea-head, to that of a goose's egg. In form they were generally round. In all the attachment was narrower than the width of the tumour, and some were pedunculated, the peduncle being occasionally more slender and not less than an inch in length. Many of the larger ones numerous smaller ones were attached to them. The whole resembled a bunch of grapes. The colour, especially of the smaller ones, was light reddish, while the larger were generally darker, more like masses of blood clots. The tumours were described by Dr. Hulse with the following words:
The small tumours on the surface of the scutum were found to
be covered by the peritoneal investment, and those which
bulged in the scutum were between its layers. They appeared
to consist simply of extravasations. The large tumours all possessed
an incipientous investment, which was continuous with the
peritoneum, which it appeared to have carried before it in its
growth. The structure of this covering was however different from
that of the peritoneum. It consisted of newly formed fibrous
and contained properly developed fibrous tissue. Proceed-
ing the incision the contents were seen to consist of a soft
or even partly fermented pulp, through which a network of
stems of fine fibres was seen to ramify. These fibres then remained
were formed to the delicate blood vessels, about \(1/10\) inch
in diameter, which were characterized by no cells nuclei scattered throughout
their walls. It was easy to demonstrate their numerous branching
and anastomoses by washing a little of the pulp with water.

The last consisted in the large tumours for the most part of
blood corpuscles, which had aggregated into large round or oval
globules resembling inflammation-globules. The largest of these
measured \(1/2\) in diameter. Among these were numerous tumescent con-
globules.

Some of the tumours were filled with freshly congealed
blood and had dark. These probably had given rise to the
hemorrhage into the peritoneal cavity. Some of the lamellar
tumours had become firm and yellow at certain points.
Throughout the whole substance, tissue had become concreted into round, thick-walled, spheroids, as large as peas, of elastic consistency. The yellow spots always at roughly four in a large and small globules which at some points, while the cortex was bulging, were mixed in quantity with cholesteroline. In like part the globules containing blood-corpuscles displayed a remarkable attraction, being assumed a bright yellow color, and broken down into fine grains distinguished by their equal size and regular sharp contours.

A tumor in large or medium was found, under the peritoneum occupying the space behind the root of the mesentery, which had a very different structure. It was lobulated and while part of it presented a fibrous structure, another part was of cheesy consistence like tubercle. The fibrous portion consisted of the well-known stuff, filamentous fibers peculiar to cancerous growth, along with masses of undulation, corpuscles and cancer cells.

The cheesy portion consisted entirely of cancerous cells today separated from each other.

In this story very interesting was, which although found quiet at some length, is much contradicted from this original, we have an excellent illustration of the facts obtained in the various stages of the transformation of blood-corpuscles generally.

In the first place, in the smaller tumors, etc., simply the altered corpuscles of extravasated blood. Secondly, in the larger examples, we have the fabric of vesicles tuberculous became organized at the periphery to form a well-marked
Vascular cyst, and in the central portion being transformed into a stroma, also containing blood-vessels, while the capillaries forming the great plexus of the central pulp, have aggregated into conglomerates of various sizes as a preparatory step to their metaporphosis into granular segments. Thirdly, in one of the other tumours described, we have a deposition of fatty granules and cholesteatous epithelium forming a fatty degeneration of the newly formed tissue, a process most strikingly illustrated of what later place normally in the transformation which the blood enters data into the granulose cells undergoing and which results in the formation of the corpus luteum in the human subject.

With reference to the special conditions in which the lungs the pathological results above described as having apparently originated in the subserous tissue of the pleurae, were to be considered dependent, it is more difficult to form an opinion. It presents some points of resemblance to the peculiar method growth, as is well known as the mucus cysts, but here the cysts themselves were extravasated blood instead of serous fluid.

From the fact that the smaller of the tumours, in the case before us, were in general evidently the most recent, it would appear that the process of extravasation must have been a gradual one, or, to put it in other terms, it must have been repeated at longer or shorter intervals. This suggests...
Having noticed, by the facts, the tumour, which was found attached first and which was the source of the haemorrhage, and the pelvic neural cavity was not a recent one, but had itself undergone considerable organisation.

As regards the indirect cause of the whole disease, then it is considered that the patient had not menstruated for a considerable period, although no observations were made during life, as the periods at which the various haemorrhages took place to justify such a supposition. On the contrary, the case might probably be considered to be one of obvious menstruation assuming the remarkable form.

The Corpus luteum

The changes which the blood, which is poured out into the cavity of the corpus luteum, have undergone, been very fully investigated by Leveley in his work "Le Corps luteum ovarii". I have been unable however either to obtain the work itself or to meet with any abstract of it in the Journal. I am therefore constrained to depend on the result of the few observations which have had the opportunity of making themselves on the subject, as I am not aware that any one except the above mentioned observers has inquired into it.

The corpus luteum as far as the bowels are concerned, especially in the cow and sheep, differs very considerably in general appearance and to a certain extent in structure, from what we observe.
in the human subject. In appearance the most obvious difference consists in the distinguishing both the central cavity as containing space with irregular wavy outline can be noticed in making a section through the corporal luteum of the human female. It is also considerably smaller and its external portion as more granular in appearance. In structure the human corporal luteum differs much less considerably and prominently that that of the cow or sheep. In the corpus luteum of the latter, owing to the much less complete development of fibrous tissue to the former, and in more considerable proportion to the cellular matter.

In the fully formed corpus luteum of the sheep, I found that the pearly yellow glandular-looking substance of which it was composed varies its colour to large cell-like bodies of ovoid form, which contained spherical, highly refractive, granules (fully granules) of bright yellow colour, which reflected very considerably in the form and men. These bodies were embedded in a fibrous tissue consisting of uniform fibro-cells all of which were provided with staff-shaped muscles. The history and mode of development of these fibre cells, as stated by Worsley has been already alluded to in Sections III.

Towards the centre of the corpus luteum in the sheep, it becomes instead of the general yellow colour, it assumes a more or less reddish tinge. This is perhaps best owing to diffused blood, and partly to the fact that at that part the cell-like bodies
See Fig. 1, Chap. **

*Plt, Fig. 1.
Continued, besides the above-described fatty granules, granular pigmentary matter of an orange or brownish colour. Besides these elements and blood-vessels, there were interstices between them, through which the corpuscles more or less completely extravasated into the fatty granules. Whether the above-mentioned cell-like bodies had originally contained undigested blood-corpuscles, or not, is uncertain, as well as whether they were of endogenous or exogenous origin to the fatty granules. However that be, we know that they are not at all necessary for the production of these last, as long as the human corpora lutinae, where the cell-like bodies are absent.

The Corpus lutenum in the human subject. In examining the body of a young female who had poisoned herself 3 weeks after her last menstruation, two corpora lutea were found in the ovary, forming. The one described below presented a section of a central and peripheral portion, which possessed the relation of form and size represented in the drawing. The central part was of a reddish colour, and glandular structure, and was easily separable from the rest. On microscopic examination it presented a substratum of fibrous matter, in which no trace of nuclei or fibre-cells could be detected. Embedded in this material the following elements were observed: viz. 1st, Hæmatoxylinized blood-corpuscles, radiating spherical or ovalish bodies with well-defined margins and very refractive, about 1,000 under medium, which were evidently blood-corpuscles partially transformed.
2. more reforms
into fragment granules, ridly Rhombohedral Crystals of very regular form and of the same colour (determined). The largest of these only measures 1-2200 inch in its longest diameter. Only true crystraline bodies of same tradition form between these two last. ridly, Rhombic granules of colored material one of which is figured (Plate 7). These display the same kind phenomena when viewed by transmitted daylight. If using as time part not the red colour which they possess generally but a blueish-green colour, which, however, does not seem to be exactly complementary to the original red.

On adding acetic acid no change was observed. On adding strong nitric acid, the fibrinous tissue was first converted into a reddish brown. On then adding caustic Potash in cold, effervescence was produced in the affected tissue and it was converted into a very bright orange yellow. A change etherion was produced in the crystals and altered blood corpuscles.

The peripheral or yellow portion of the corpus luteum indicates a somewhat different structure. It was separated from the interior portion by a distinct border and presented a yellowish tint, ridly a fibrinous substratum which toward the interior was becoming organized and showed nuclei which were beginning to arrange themselves in rows. Ridly, fatty granules of various sizes to which the colour was probably due, but which under the microscope, appeared to be crystals like the granules of the yolk which they very much resembled.
That is, no future actions are developed in it.
In comparing the foregoing histological facts with what we know of the history of the changes which the corpus vitreum undergoes in its appearance which it presents to the unaided sight, and the mode in which it originates as described in the researches of Dr. R. Petersen and others, it would appear that, as regards its more intimate structural relations, the nature of the process which results in the formation of that body may be supposed to the human subject to be of the following nature.

1st. Immediately after the rupture of the lens, vitreous, a corpus luteum, the result of the extravasation of blood at the point of the rupture, after an hour completely fills the cavity of the vitreous body, presenting the appearance of an homogeneous mass of firm consistence and of a red colour. (See Fig. 1 of Dr. Petersen Oct. 31.)

2ndly. At the same period an inelastic lamella intervene to the corpus luteum, and to the so-called "internal membrane" of the vitreous body.

3rdly. The corpus luteum gradually contracts in bulk, while retaining its original consistence, until about the 6th week, about presents the appearance (as I have figured PRI, F1) after which it softens and becomes absorbed, its place being occupied by the central cavity, which was found by Dr. Petersen to exist as early as the second month, and to contain a small quantity of clear fluid. During this period the corpus luteum does not undergo organization properly so called, while the blood-plates and their contents either become directly
The results of conversion into crystals or amorphous pigmentary material, as described above. That these last-mentioned changes in brain, improbable. It is more likely that, while the primary substance in which they are embedded becomes dissolved, that they remain unaltered and would be found in the fluid which subsequently fills the central cavity.

Lately, the concreted material became evident to the Tertiary period, forming a deposit in the Corpus Luteum shortly after the escape of the ovum, a narrow line of material, white at a very early period, assumes a bright yellow colour. In the course of the first few weeks, it gradually thickens, and at the same time, from the contraction of the surrounding tissue, as well as of the central clot, it becomes fleshy to as to present the jagged margins so characteristic of the fully developed corpus luteum. The intimate structural changes which it undergoes, are two-fold. First, in the fleshy layer, a substance which it originally contains, a deposition of fatty granules takes place by a process perfectly similar to that in which fatty granules become deformed (constituting “atheroma”), in a fibrous layer previously formed on the inner surface of the wall of arteries, to which their morbid condition is foreign. Indubitably undergoes a process of organization consisting in the development of nuclei of fibro-cells and finally of true fibrous tissue.

Although the corpus luteum in the human subject, differs considerably in some points of structure from those of the sheep or cow,
Is there any difference between the structure of compounds that are interconnected with synaptonemal complexes?
Such evidence of extravasation either in the form of albuminoid corpuscles in a free state or of more or less cell-like structures. Such containing albumin, blood corpuscles, or granular pigment, thus broken down in the blood or other parts like crystals, large or small, or pale yellow matter, which were considered insoluble by acids, but rendered more transparent by alimens.

Fecund bile and black-yellow globules from 0.12 to 0.22 inches.

These bodies were considered by Pirchow under the compound microscope as cylinders containing a yellow matter, later on found to be an insoluble albumin of granular or diffused nature, and oxide. So much so that membrane could be thrown to body and crystals for some effect. Also a mass of albumin was heated to remove on platinum foil, a red ash was left, which was found to contain iron.

In Pl. Fig. 1 have represented similar cell-like structures also derived from a large cyst occupying situated in the central substance of the kidney. There were also insoluble the action of balsam acid, a cello-sis acid, and present the same character of lumen described by Pirchow. They appeared to be much entitled to be considered as cells as any of the other cell-like bodies. Have fallen under our notice as developed in extravasating generally. They probably were originally formed around degeneration of blood, globules, the had subsequently become altered to produce this appearance presented in figure.
If then a time from death
Metamorphosis of the vessels corporated and their contents in diffused or infiltrated extravasations.

Diffused extravasations in the substance of the brain, in consequence with the circumstances under which it takes place, under two modifications. Either it may, occur in consequence of softening from whatever cause or of whatever nature, or independently, which case it may produce it. Under both of these modifications it must be remembered in taking into consideration the nature of the changes to which the extravasated blood undergoes that besides the blood, inflammation is also present and may modify the result.

In any case of extravasation, a large proportion of blood becomes diffused and infiltrated into the surrounding tissue, communicating to it a yellowish tinge, and a consistency softer than natural, which are sufficiently appreciable soon after the examination is made shortly after the occurrence of the lesion. In this state, the remarkable alterations which the brain vessels and their contents undergo under these circumstances come.

I shall advert to the following observations, which were suggested by reading the results of the following experiment by Prof. Kölliker in his paper "On the state of the blood-vessels in inflamed parts," he states that by bounding the hemisphere of the brain, he produced extravasation and laugnirous infiltration in the substance of the brain, that many of the so-called "inflammation globules," which were developed in the neighbourhood of the wound.
Continued, besides, these cellular constituents, undiluted blood-globules
with some of the purest, and assaying the future
histological tissues containing blood-corpuscles. I made the following
experiments. In a number of persons of different ages, I
commonly observed salve-rents through the upper part of the knee-
whereafter brain into a bin of producing extravasation. A fraction a
considerable proportion died for its effects of the injury. In these latter
the extravasation was produced, and in these no extrusion for
4 days after, only found the usual compact granular cell inter-
crating the presence of concussion in the brain of the wound.
Some time which lived a sufficient time, and in which other cir-
cumstances were favourable, I obtained the results detailed be-
low, namely,

First, Three to four days after the infliction of the injury it
was found that the substance of the brain in the immediate
neighborhood of the track of the wound had assumed a yellowish
green colour and somewhat stiff consistence. The track of the wound
itself being occupied by a clot. In the softened part, on mi-
croscopic examination, the following elements presented them-
severed. 1st., Cell-like bodies provided with a distinct membrane con-
taining freely granular matter and one or two olio-albuminous gran-
ules. Induly, similar bodies completely filled with olio-albuminous
granules (called Compound granular Corporules). Both of these
elements measured from 1-200ths to 1-1300ths an inch in diam.

PRESIDENT
Edm. Cullen containing both olio-albuminous granules and figure.
PLII. The outline of the surrounding membrane of the cells is represented. Though too strongly marked it was extremely delicate though perfectly distinct.
Blood corpuscles. Their size were very numerous, and some of them
were observed as large as 1/800th of an inch. The blood corpuscles
 contained in these excreted entirely those which were floating
free around them, and when water was added, it was ob-
derved that they were similarly acted upon, their nuclei
being displaced. The drawing which I have given was taken from
the brain of the first person successfully operated upon. It is con-
spared both the appearances observed in subsequent experiments
and corresponded exactly. I may add that Prof. Bennett was
kind enough to verify these results.

Secondly, from seven to eight days after the operation the
same inquiry, the following appearances were observed. In the
case to which the description refers, a slight ulcer ob-
dered as before in the track of the wound, which was only in-
dicated by a yellow softening. In the softened part were obser-
ved similar bodies to those last described, but which appeared
to have diminished some what from their original size, the
compared with those from the more recent lesion, their average
diameter being 1/1000th of an inch. They possessed well-defined
irregular and contain, black, bluish-green, greenish, and bluish-yellow
granules, besides occasionally attaining a con-
tact of blood-corpuscles. When submitted to the prolonged action
of acetic acid, they remained unaltered, and were quite
 unaffected by water. By adding solution of caustic potash,
the granular matter was converted into a rich reddish brown.
Thirdly, In a guinea whose brain was examined 4 days after the
infection of the brain injury, it was observed that the greater part of
the blood was generally diffused in the neighborhood of the base
of the wound, as indicated by the yellow coloration, while in
the spot a minute coagulum, not larger than a mustard seed,
could be distinguished. On microscopical examination the following
elements presented themselves. Generally diffused in the track of
the wound, were scattered bodies altogether similar to those
last described, containing clear-hyaline granules and a
bright yellow amorphous material. In some of these, the one con-
stituent preponderated, and in some the other. Their diameter
was about 1/400 of an inch, and they almost all presented
either at their centre or circumference, a spherical clear space
indicating a vesicular nucleus. Lastly, In the coagulum above
referred to, bodies of similar bodies of smaller diameter, as if con-
tracted, which contained almost nothing but the yellow amor-
phous matter, were observed. These differed from those above de-
scribed in not presenting the appearance of a smooth transpa-
rent membrane surrounding them, so that they as they resembled
masses of conglomerated amorphous matter than cells. Their
colour was not so bright as that formerly mentioned, rather being
of a rather than a gamboge-yellow.

The results of the above observations seem to be important in
two points of view. First, They go to prove that the so-called
"compound granular corpuscle" or
Bennett, "On Inflammation of the Nervous Centre." Vol. I

It is very difficult to see how this is ground in any way.

Said.
"Embolation corpuscles" as observed in the brain. "Uformd like all other primary cells, a nucleus being produced, from which a cell-wall arises," is a false one. Secondly, they illustrate and explain the mode in which the appearance of cells containing blood-corpuscles (blut-körperchen-haltende zellen) in which so much stress has been laid by Virchow and Schaffner, may be produced and afford the experimentum crucis in proof of the doctrine of Prof. Kölliker, that, under certain circumstances, the corpuscles in extravasated blood, become enclosed in an apparent membrane, before undergoing further change.

The same facts are illustrated by the post-mortem appearances which we observed in the following case.

Mr. W. Phinny, aged 32, was admitted into the Clinical Department of the Royal Infirmary on the 22nd of Dec., 1852.

On admission, he suffered from intense dyspepsia with cough and copious expectoration, along with other very urgent febrile symptoms, which were liable to occasional paroxysmal exacerbations. Under these, the continued to labour during the whole period of his stay in the house, but no suspicion was excited in the minds of those under whose care he was placed, as to the probable existence of any affection of the cerebral system. Unfortunately, no investigation was made into her history, and she died on the second of January. Subsequently, however, the following facts were elicited from her friends. Five years ago she had a paralytic attack affecting
For current history of this case see Pott's on Criminal Medicine, 1776.
her left side, from which she recovered perfectly in two or three months. Four months ago she had a similar attack
with loss of consciousness, and more complete paralysis of
the same side. The insensibility gradually disappeared during
the ensuing fortnight, but it is stated that she never entirely
recovered the use of her limbs and that there was a permanent
impairment of memory.

Eyes: Oedematous. There was dilatation of the left ven-
tricle with diminution of its thickness of its walls, and mi-
ral incompetence. Besides the usual appearances of Pericardia-
to both sides, the left lung was non-transparent throughout and
abnormally clear. Fluid oozed out on section of pressure, but the
base posteriorly, there was an extensive haemorrhage. The Ri-
thlung was also generally non-transparent, except at its anterior
margin when it was emphysematous.

Head. On removing the calvarium, the membranes presen-
ted the normal appearances. The Paries were moderately
filled with fluid, which on the left side was turbidly clear, but
in the right was very turbid, i.e., of a greyish color, indistinctly
under the microscope numerous dark-green granular corpuscles.

On making further examination, it was found that the foot of the
further to the right corpus-clearture at its outer border was en-
tirely soft, almost -diffused. On one part of the mass-diffused,
a few masses of inconsiderable size, in the peculiarly
firm consistence and a bright yellow colour were observed,
see Plate fig. 3

P. P. I regret extremely that, owing to the unfortunate inability to put up the first vessel, I was unable to examine this interesting claim to satisfaction as I could have wished. Wilkes, in op. cit. P. 784.
The left wing indicated to the medullary substance in the neigh-
borhood.

The center of the Medullae, a limited portion of the bone,
which softened, not exceeding a quadrant per cent in size was obser-
ved. It was situated a little to the right of the middle line and was of recent appearance.

Microscopic Examination: In the softening last-mentioned,
besides blood corpuscles, and the somewhat broken down element
of the normal structure of the part, consisting of fine granules-
like masses, large cell-like bodies of various diameters (from
1-220 to above 1-100th in). Some were contained apparently-
ly nothing but swelled blood-corpuscles and a transparent
fluid, the proportion of the one to the other varying considerably
in different instances. In others the corpuscles had become
more or less completely converted into granules, and to have ad-
yaed during this change an intense yellow colour.

These bodies were totally unacted on by water. Their membrane
was perfectly homogeneous and apparently structureless.

In some cases they assumed the appearance of flask-shaped
vessels, of minute vessels, alike of which they pro-
bably had originated. This reminded me of the circular
appearance, which Prof. Kötiker had described so carefully
as occurring in fishes. He found "cells containing blood-corpu-
scles and their metamorphoses included in round delicate-wall
vesicles which resemble coagulations or depositions of the sheath of
minute arteries."
see P. II. Fig. 1

It was found

?
In examining the creamy fluid obtained from the most delicate part of the lobules, corpuscles situated, found the following elements, namely, 1st, Compound granular corpuscles, varying from 1-1500 to 1-100, 000 in chick in diameter, and containing the abuminous granules of very various sizes. 2dly, Lumbar corpuscles containing, in addition, finely granular pigment of a bright yellow colour, diffused among the granules. 3dly, Lumbar corpuscles, containing besides both the above substances, pigment-grains spherical or spheroidal, in form and of a bright brick-red colour. These last appeared to be allied blood-corpuscles. 4thly, Fine ovo-abuminous granules & pigment. It was observed that the red pigment always assumed the form of the spheroidal grains, like contracta. Blood-corpuscles, when the yellow was always in the amorphous or finely granular condition. Both forms were unaffected by Acetic acid, Spirit of wine, or Spirit of alcohol.

In examining the yellow material of firm consistence above alluded to, consisted of a substance of transparent, pretty fine material, somewhat like coagulated fibres, to which were embedded the abuminous granules & pigmentary matter. It might profitably be considered as an indication of the former presence of an aphrodisiac, apt to the situation with which it occurred.

On making his above observations, there was a motion by a certain doctor on the similar facts in recorded.
Ehre: "Zur Genesis der Entzündungskegel"

Prof. Ether in a paper "On the genesis of Inflammation" describes the following case.

A 42-year-old white girl, who was attacked in the course of an epidemic of whooping cough, which prevailed at Boston in the winter of 1816. After two months duration of this disease, died with the symptoms of general Tuberculosis. On making a post-mortem examination, a softened portion, about the size of a dollar of a yellowish colour, was detected, which was flattened over with minute and bloody points. The microscope: elements met with in this portion were, besides the usually observed fragments of nerve-traces, \\


3. Cells which contained, besides a greater or less number of dark or yellowish granules, Blood-corpuscles. The cell membrane was remarkably distinct and the blood-corpuscles altogether undisturbed. The number of blood-corpuscles contained in a cell was various. A few contained only one, and had a diameter of 0.010 mm. Others which measured from 0.15 to 0.25 mm contained from 6 to 8 blood-corpuscles or even more. In dilute solution the surrounding membrane, which adhered closely to the contents was less distinct. It also made it difficult and was easy to satisfy oneself by rolling the globules, that the blood-corpuscles lay within a membrane. The most of the globules, the membrane, was unaltered by the prolonged action.
of water, while in others, it at last becomes indistinct. Lastly, heaps of similar granules in those occupying the cells above described, along with the blood-corpuscles, some of which were surrounded with a membrane others not.

They do not appear to have any influence from the fact that the liver cells undergo a change similar to that which the blood-corpuscles undergo when diffused through the substance of the brain, nor at all depend upon being enclosed in cells or cells-like bodies. In the first place, the preliminary alteration in their susceptibility to the action of bile and acetate acid, lasts longer when corpuscles which are free just as in those enclosed, and the same is very probably true of the late stages of the conversion into fragment. It is however impossible to decide whether the granular or amorphous yellow pigment in the leucorrhea resulting from extravasation may not always have arisen from broken down cell-like bodies. This is illustrated by the illustration which I made to an example of that in known to pathologists as Atrophia Regionis Lenticularis, Leon Cachet, Leic. 25 Aug. 1802, a latter in which the place of the grey matter seems to be occupied by a fibrinous material infilled with yellow colouring matter, and which seems to be the result of a former acute inflammation accompanied with extravasation. In the case in question, in which, according to what was known of the history of the lesion, must have been of considerable standing, it was found that the yellow coloration was still principally due to cells-like bodies which I have represented in fig. 5, and which contained finely
granular fragment of a dark yellow colour. These bodies had most
probably origination contained blood corpuscles, & had undergone
within them, some metamorphosis into pigment.

Diffused extravasations in the lungs. After changes which
the blood corpuscles undergo in pulmonary extravasations, Dr. Le
tti, as I have had no opportunity of making direct observations,
they probably have to be found to resemble those that we
have already seen in the brain, pretty exactly. It is stated by
Fischer that lung become congestion in the lungs into black gran-
ular pigment. This may sometimes be the case but does very doubt-
ful, and I do not find that Fischer made any observations to
prove it. In one case in the chronic pulmonary infarctions where
surrounded certain obsolete linings of a questionable character
in the lung of a man who died while at Infirmary of Dr. Le
tti. Infarction infiltration a considerable quantity of a pigmen-
tary material, which, in microscopic examination, was
found to consist of amorphous masses of bright yellow,
granular fragment, some granules being observed to be budding,
in the so-called emulsion corpuscles, which exist in consid-
erable numbers.

In many cases of extravasation into the substance of
the lung, the coloured contents of the corpuscles, becoming dis-
solved in the infiltrated serum or other fluid, afterwards re-
emerged the solid form of the so-called haematia corpuscles which
it first
have been described by various authors. Then it is not uncommon
Not only in the substance of this lung, but also in the sputum, in cases of Tuberculous Chronic Pneumonia.

[Diagnosis has rendered a case in which black specks were found in great numbers in the sputum of a tuberculous lung, and Aaroek has recorded the following case, which may be considered as an exemplification of one mode within the extenuated channels of the blood engendered in pulmonary tuberculosis. May become metamorphosed.]

Carl Engelie, laborer, 42, admitted into the Charite Hospital, Berlin, 3rd of October. For 12 weeks, during which he had worked in a damp situation, he had suffered from pains in his butteculences.郛syg dyspnea, there was edema of both lower butteculences and ascites. There was extremely Pelvisq. These symptoms continued till the 23rd when he became worse. There was profuse diarrhea and pain in the left hypochondrium. There was also much febrile pulse 100 beats, and great difficulty in expectoration at dyspnea. He got gradually worse till he succumbed 4th of November.

The Post mortem examination, it was found that the right pleural sack was half filled transparent sputum. The right lung being completely covered with serous exudate, which covered masses of obturator hilarise and a hepatic portion of the liver. The section, an ink-like fluid could be squeezed out. The bronchial mucous membrane was much reddened and somewhat edematous. Many of the branches of the bronchiae were blocked up with old clots of organized blood. The right lung was very euliphaginous, but otherwise present...
The same characters as the left... The tiny flocks above refer to contained black particles in quantity, both in the form of granules & amebae. The amebae consist of flattened oval objects, moveable tables with very sharp angles, so long in proportion to their thickness, as to make them almost spine-shaped. The length of the larger was from 0.08" to 0.16"—the breadth being 0.02".

From time to time, other considerable dimensions occurred in fragments, which did not exceed from 0.012" to 0.032" in length.

As was above remarked, there is no proof that in this case the black pigment whether in the granule or agglutination form was derived from the coloring matter of blood, as has seemed to be the case in some instances in the history of this case. But, e.g., in instances of cardiac disease, from which it might be deduced that extravasation to any extent had taken place, the metamorphosis of the blood corpuscles and their contents in the liver. Although in Droso & the Monarchia we have little or no evidence that the transformation of the blood corpuscles into granular pigment takes place, this does not mean great external or under any condition, whether normal or in this origin.

Deprived, we have abundant proof that such is the case in some of the lower animals, especially in the batrachian reptiles. In these last... indeed the process is carried on so regularly, and as it appears to me, advanced so much the characters of a physiological process, that it is surprising that Prof. Huxley and others who have fixed on the
breaking down of the blood-corpuscles as one of the first
of the spleen, have not allowed a space in this effect to the
livers, in the case of which, as far as the experimental
concerned, the evidences appear to much more conclusive, as I
think will appear from the following facts.

If you examine the liver of a Frog or Newt during the
Summer months, when the animal is obtaining abundance
of food, you will find that the live cells are more or less
filled with fatty granules. Towards the end of autumn, when
the period of what is not very correctly termed hibernation
is approaching, these fatty granules disappear to a great,
or less extent. The organ undergoes other changes of an inter-

ing nature. With respect to these, I have made the follow-
ing observations.

I have examined the liver of a Frog about a week after it had been
taken (in the last of November), among these elements of the normal
structure of the organ, I found vesicular bodies existing in pretty
considerable numbers, which contained in their interior other
considerable bodies, which presented the form and colour of blood
corpuscles, and on the nuclei could often be observed. These
I have represented in Plate Fig. 3. That they really were what they
appeared to be, and were in fact produced by an analogous
process to that by which we have seen similar structures or-
generate in the brain, I think there can be little doubt.
In this manner will be observed other similar phenomena.
bodies, containing granular pigment of a dark brown colour. These occur sparingly at all seasons in the liver of the frog, and are probably the remains of fleas which have former contained blood-corpuscles the previous season.

Indoors, the making similar examinations during the winter, somewhat different appearances present themselves. Thus, in a frog which was kept without food and water from the 22nd of June, the liver presented an appearance of accumulation, no perfect corpuscles. No living presenting the usual appearances were however to be observed, along with very numerous minute fatty granules. Besides these, the bodies which are represented in Plate Fig. 1 existed in very great numbers, so as to give a decidedly dark colour to the whole organ. These presented the following forms, viz. 1st, bodies with well-defined and sharp margins, not so transparent as those corporules, if of olive-green colour, and frequently containing a smaller nucleus-like body in their centre. 2nd, bodies similar to those but of a reddish-yellow or yellow-colour. 3rd, those containing brick-red or reddish brown pigment, arranged either in bodies or granules and either either peripherally or centrally, or occupying the whole as represented in fig. a. These most probably were altered blood-corpuscles and had originally been enclosed in an membrane, although latter no such membrane could be detected surrounding any of them.
A little helps the little live in the little hut. But the little helps the little live in the little hut. But the little helps the little live in the little hut.
From the foregoing facts, I am inclined to think it probable that in the frog and Newt, that the blood corpuscles undergo a process of progressive breaking down in the liver during hibernating months, in some cases becoming surrounded by an appearance of membrane, previously to their undergoing any change, estate in others this accessory phenomenon may be absent.

In spring when the animals again begin to feed, the process seems to be suspended, for at that period, as has been shown by Weber in a paper on the relation of the liver to the development of the blood-corpuscles, the organ undergoes a very remarkable change in appearances. From possessing a reddish brown colour, it is converted to a greenish yellow. This alteration is owing to the accumulation of yellow fatty granules in large quantity, which Weber supposes to be partly owing to a deposition from the circulating blood, which has been stored at that period, a quantity of the fatty matter secreted later in the lymphatic system during the winter, in conjunction with other sources, it is accorded to a considerable extent derived from the food, which is injected after the long winter's abstinence. During the hibernation, Weber observations tend to show that these granules gradually disappear, two other facts being at the same time set up, viz. on the one hand, the development of young blood-corpuscles, and the active formation of bile on the other. If this is the case it will afford an example of an organ in which, at different periods, the latter
"Due not this point to a chemical change in the fatty portion by means of which they were converted into pigment."

Date: [1815]
autopsies, processes of destruction and evolution of the blood-corporcles go on at different times.

The sequence of the destructive process in the living frog during winter is probably rather owing to the state of the blood, produced by the deprivation of food, than to any periodical influence of the season. Thus, in a frog which was taken last July and was kept without food until the 29th of September, when it was examined, the liver was of a dark colour, almost black, and, instead of presenting the vacuolation the normal cells containing oil-globules, it was found that these were completely broken down and that the colour was owing to the abundant dark brown fragment granules, which displayed an active molecular motion. These appearances were sufficient to indicate that a process analogous to that described above had taken place in the organ.

[Metamorphosis of the Blood-corporcles : their contents in the Spleen]

There is no organ in which the phenomena which form the subject of the present inquiry have attracted so much attention as in the spleen, or in which they have given rise to so much speculation. Although the various observations which have been made on the subject are most of them worthy of credit as being correct, yet unfortunately, such undue importance has been attached to certain particular facts
to the neglect of others, according to the theory which the
observes has happened to have in view, that it has be-
come extremely difficult to assign to all their proper
positions, and thus to arrive at correct conclusions. I hope
however, that by approaching the subject in the proper direction,
showing it in connection with analogous phenomena, the
questions connected with it will be reduced to a more
discriminating form, and that we shall have no difficulty unow-
ing that the characters which the organ presents, when in the
normal condition, furnishes no pretext whatever for consider-
it to directly, physiologically concerned, so the destruction
or breaking down, any more than in the formation of the
considered.

It will be necessary to notice shortly the researches of the
various observers, whose inquiries have been directed to the sub-
ject. In reference to the supposed physiological relation of
the spleen to the colored corpuscles, it is strictly necessary
to state that two opposite doctrines have been held by
different observers. According to the one of these, it is the function
of the organ to form, according to the other, to destroy those
corpuscles. The decision of the whole controversy depends on the
splification to be assigned to certain structures which often
was held before these opinions concern us, considering as
normal constituents. These we shall find to be analogous to
the cellular bodies containing unaltered blood corpuscles.
Cocker Festschrift für 1st Med. Br. Ltd.

which we have already seen to occur in such various situations. In the spleen they have attracted a much larger share of attention from their having been made the subject of other Köthe's, Fulcher, Schappee & others.

The fact mentioned above describes them as occurring in the spleen of the calf under the following forms.

1st. Cells about 1-100th of a mill. in diam. containing a single blood-corpuscle, the rest of the cell being either quite clear or finely granular. By adding water to these the cells burst and the corpuscles having escaped become clearer and soon disappear. Others somewhat larger contained two blood-corpuscles. Many of them also contained a granular nucleus, and these resembled the surrounding spleen cells. Lastly, large cells more than 1-100th of a mill. in diam. filled with streaked blood-globules, of an intense yellow colour and no longer altered by the action of water. Also among the free corpuscles many transitions occurred between the unaltered and the threshed condition.

Köhler represents the so-called "cells containing blood-corpuscles as originating not from a nucleus, but logically from a nucleus. Hence, found a break in aggregations of blood-corpuscles, in the same way as the inflammation globules of plague "converge-themselves into cells" or as the "smaller globules of fission of the yolk form themselves into cells." He however believes that nuclei, which either
originate principally to the process of aggregation or the
consequence of it are directly concerned in affording
the conditions necessary for the development of a cell-
membrane. In all animals Kölliker found that the blood-
globules contained in these bodies, disappeared and were
degenerated in a similar manner, and that ultimately
the cells themselves became colourless. The method in which
this takes place, differing according to the animals, varies.
He has succeeded in discovering cells containing unchan-
ged blood-corpuscles in man, the rabbit, the sheep,
calf and dog, in all which he found the number of inclu-
ded blood-globules from one to twelve, and by the strum-
ing together and falling to pieces of these, just as described
by Ehrlich, he believed that "granule cells" filled with green-
yellow or rusty-brownish-yellow contents were formed,
which by the further breaking down of the granules and
their gradual disappearance, because at last entirely inter-
mixed. In some animals he also observed that the meta-
 morphosis of the blood-globules took place, without any definite
indication of the formation of a cell-membrane around them.

Kölliker admits that in man and the sheep,
man, it is difficult to demonstrate the cells containing
definitely unaltered blood-corpuscles, though he states
that with cow and it is perfectly possible to satisfy one's
self of their existence, especially in the rabbit, calf, sheep
Lee P. T. fig. 5. Explanation.
and dog. This has made it's endeavours to do, but have few the latter stages repeatedly. In reptiles, and especially the naked amphibian, Helleke states that the cells containing blood-corpuscles are most distinct, and then change most easily. Although this is generally true, I have been unable to occupy the constant occurrence of these bodies in the spleen of the frog, or newt, as they are perfectly healthy. At least I may say, that the numerous examinations of the spleen of variously affected newts, I have found either the traces or very few of the appearances alluded to. In newts in a state of starvation however I have found them in considerable abundance, though not so abundant as in the liver.

In these last they presented the following forms, which have endeavoured to show in Plate 102 fig. 160. Corporal cells similar in size to the surrounding spleenic corpuscles, but resembling blood-corpuscles in colour, without their transparence (partially attune blood-corpuscles). Isid. Cell-like bodies containing one or more similarly altering blood-corpuscles, the last had often assumed an orange tinge. Isid. Larger cells which contain in their interior, besides altering blood-corpuscles, smaller secondary cells similar to the last. In almost all of these cells a vesicular nucleus (corpuscle) similar to that described by Helleke, and in many the clear fluid which they contained appeared to be deeply tinge
Throughout the pale yellow tone of the corpuscles. As trials of experiments instituted by Landis at the advice of Prof. Kollman, on no less than thirty rabbits, tend to conclude that the cells containing blood-corpuscles are normally formed in animals in great numbers, at a short period after feeding. In 15 where observed two or five or eight hours after eating, cells with unchanged blood-corpuscles were found in electri, while in the other five, which were examined 12, 24, 48 hours after, there were found many yellow or brown. The golden yellow granules only having taken their place. If ever happened that Landis obtained such remarkable results, I cannot conjecture, as I am quite certain that observations which I have made with the greatest care on animals similarly prepared, and as regards their periods of feeding, have not yielded similar ones.

Even admitting the importance of these experiments, Prof. Kollman at the same time admits that it is impossible to prove that the phenomena to which they refer are really normal. Until this is done, there can be no reason for assuming that such a doctrine is true, especially since, although it may seem to explain these facts, it is contradicted by many others.

On the other hand, we enter on the consideration of the same phenomena in a more direct direction. Seeing pathological they proceed from the first as pathological, be unite first place.
observe that, in as far as our limited acquaintance with the pathological anatomy of the spleen will allow us to judge, the most common lesions to which it is liable are those dependent on hemorrhage. Two distinct forms of hemorrhage exist, which may, I think, be noticed as existing in the spleen. The one of these constitutes the ordinary so-called "hemorrhagic infection" of the organ, which is so commonly obtained in some epidemics of Typhus fever. The second or slighter form, I am unable to find any description, though I cannot conceive that it is unknown to pathologists. It consists essentially of hemorrhage into or around the Malphighian Sacs. On making a smooth section of a spleen in which it exists, dark-red or reddish-black spots or similarly colored rings of about 1/8 line in diameter are often observed, which are spread over the whole surface of the organ at slight intervals. The centers of these rings are occupied by dull whitish looking material, and on further examination they are found to correspond to minute hemorrhages which take place at the circumference of the Malphighian Sacs; the central portion corresponding to the sacular contents. All the anatomical relations of the hemorrhage to the sacular membrane have not been able to satisfy myself. I am inclined now to believe that it takes place into the cavity of the sacs, that is, between the membrane and contents.

The appearances above described may probably originate...
In a healthy person from any unusual cause producing a certain amount of congestion of the organ. The form of the lesion is very satisfactorily accounted for from anatomical considerations. The uterine plexus into which come of the minute arteries which supply blood - one to each acinus, consists of capillaries which are, therefore, more minute than those which constitute any other part of the capillary system of the organ. In the examples which I have seen of this lesion in the pathological theatre here, some have occurred in its more recent condition, that after the extravasated blood had undergone more or less of change. In all the case of the organ appeared normal.

It is not uncommon to observe spleens which present a certain blackish or dark circumscribed spots or irregular outlines. On examination these are found to consist of concretions of black pigment-granules which are generally aggregated in amorphous or irregular masses but are sometimes included in cell-like bodies. These may probably be obsolete Malpighian corpuscles which have undergone the change described above.

With respect to the other more extensive lesion which was mentioned, i.e., the hemorrhagic infarction of the organ which occurs in typhus fever, in the more severe forms of intermittent, and in connection with certain other acute dyspeptic diseases, and in which the fibrous
tissues of the organ are often eventually destroyed, and the whole reduced to a fultaceous mass, in most cases from our only being them in their recent and acute stage. The changes which the blood-corpuscles undergo are not observed. In other cases, however, probably owing to the circumstance that frequently repeated congestions attended with hemorrhage have taken place, these may be seen without any difficulty. Thus in many cases after chronic tumors of the spleen to which is known as a consequence of fever, such indications may be expectorated unchanged as long such tumors in its acute stage has presented a hematohagic character.

These given in Dr. T. the microscopic appearances which such a spleen present.Díg numeros esferidas or spheroidal granules bodies, which consisted of pigment granules the yellow color held together apparently, by a transparent matrix. Some of these were surrounded by a distinct membrane, and their forms were curious. The pigmentary granules were evidently altered and broken down. Blood-corpuscles, with which some of these nearly corresponded in life.

The spleen from which these had been was found to be enlarged to about twelve in length, and present all the obvious characters of the febrile spleen.
See Pl. II Fig 6. Explanation.

Ecker in op. cit. 140.
The lymphatic glands are liable to congestion, haemorrhage, like the spleen, and when affected present the same obscure characters. On microscopic examination we also find that the lymph-corpuscles undergo finally similar changes, becoming aggregated into masses, in some cases surrounded by a membrane, while others remaining in their scattered condition, and afterwards being subject to those further transformations which have been already so frequently alluded to.

Metamorphoses be in the Thymus Gland

The changes in the lymphadectasis, which undergo in this organ have been studied by Prof. Eber. He describes the following case as illustrative of the results of many numerous observations: "In an almost apoplectic lymphadectasis in one side of the Thymus gland, which constituted a reddish brown fluid, there occurred yellow globules of from 0.125 to 0.50 mm. in diameter, which were composed of yellow granules. Many of these globules shone in the addition of Water a distinct membrane, and where the granules were not too numerous, a nucleus could also be detected. Between and among these yellow globules, numerous small yellow granules from 0.7 to 0.60 mm. in diameter were detected, which in long aspect resembled those contained in the globules. As these bodies floated about, it could determine that they were permanently connected, several one to the other, inasmuch as they did not alter their mutual relative position.
Über die Bildung körpereigenen aus zentrifugiertem Plasmatronenblut. Zeitschrift für klin. Med. 16.1140
They were often so arranged with reference to each other as to form a semicircle, and it could be frequently recognized especially, if they had been treated some time with water that a number of minute new connections by an extremely fine intermediate substance so as to form a corpuscle (the former blood-corpuscle). The granules themselves however were altogether neuter by water. The corpuscle is evidently the remains of a blood-corpuscle. The coloring matter probably diffuses into individual granules, while the rest of the substance of the blood corpuscle is dissolved, gradually, fully asunder. Among the above, clinical blood-corpuscles occurred which were unaffected by water, and certainly formed a transition stage from the former.

It is unnecessary to remark that the changes which are so carefully described by Schenck as above, are identical with those to which reference has already been made, as occurring in the brain (see section [67]).

[75] The following observations of Anni de Müller on the metamorphoses which the blood corpuscles had undergone in the mucous-blood in a case of irritation of the uterine mucosa from imperfect apparatus hymen, may serve as an illustration of what is generally to be observed in large local glandular accumulations in the various mucous membranes.

"In a young woman who from congenital imperfect apparatus hymen..."
had never menstruated, loose sounds of a brown fluid-like tea was evacuated by operation. Microscopic examination showed none, a few normal colored blood-corpuscles. Lastly, flattened + wrinkled blood-corpuscles, as they appeared after treatment with salt. Daily, at transition stage of discharging from their down to the edge of a pigment grain to which many of the corpuscles had the greatest resemblance, could be demonstrated, showing an active molecular motion. Concurrent with the discharging there was an attraction in their behavior when treated with water and acetic acid, these least-altered immediately declining but not disappearing, others only after prolonged action. Many on the other hand not appearing at all afer acetic acid. Dark, dark bodies of various size, much resembling the so-called inflammation globules, occurred in quantity, which were evidently conglomerates of the bodies above-described. Their external surface was sometimes crack, sometimes more or less smooth & rounded. Swallowed blood-corpuscles could not be detected in them.

In another case of the same nature, the evacuated blood presented, as regards the isolated corpuscles, similar characters. The conglomerates were, however, smaller in diameter, and displayed yellow masses somewhat more symmetrical. In one I believe I also observed a nucleus in the interior, but cannot speak decidedly what affixed or of the substance of a surrounding membrane.
Diffused Carcinomatosis in Cerebral Tissue

In the case of a man, Bernard Stevens, who died under the care of St. Luke's in the Royal Infirmary on the 14th of December 1836, affected with encephaloid disease in various organs and tissues, numerous carcinomatous masses of cancerous tissue were distributed through the substance of both lungs. The right lung much larger than the left (as large as two fingers), occupied the right-lateral region of the chest, involving both the right lung and pleura. The contractile portion of the lung, which appears here and there to be limited by a dense, white fibrous cyst, was of brain-like consistency and texture by fibrosation, the direction of the fibrosation being perpendicular to the surface. Towards the centre of the small ill-defined area, by a recent left cerebral abscess, the texture was more fusible, and surrounding the abscess there is a dense redish-yellow tinge, owing to the presence of diffused blood.

On microscopic examination of the central brain tissue, nothing was found but inanimate blood-corpuscles. In the left yellow encephaloid substance, which surrounded the left cerebral hemisphere, a number of nuclei were discovered with a blood-corpuscle nucleus, these cells were found, which contained granules of another kind, namely pigment of a bright golden yellow colour. These were spherical or spherical in form.
see Pl II Fig. 5

*This is not observable in the fig.*
and varied in diameter from 1-250 μ to 1-25 μ if at all.

They always possessed a surrounding membrane and sometimes presented the appearance of a distinct color-
less peripheral space. They contained besides pigment-
ary matter floating in a yellowish fluid, a greater or
lesser number of dark abnormally granules. The pigment
assumed different forms in different examples. In some
it consisted of grains of various sizes which seemed to
be either contractile blood-corporcles either isolated or in
different masses, while in others it had assumed the finely
granular form and was generally diffused throughout the
cell-cavity. In some of the cells blood-corporcles in a nearly
undeveloped condition were observed.

In reviewing the foregoing facts, the circumstances which
appear least applicable is that the cell-structures which
contain some blood-corporcles and the results of
their transformation were identical with the large
forms of cancer-cells (mother-cancer-cells) among which
they occurred, being of the same size and containing
the same dark abnormally granules with which many
of them were loaded. This seems to indicate that in true
instances at least (if not in all) we may be wrong in
calling these "mother-cells" and in supposing them
to exist exclusively in these cells or granules which
they include. Unless we make some such admission
Buch, über Entzündungskreis.
Ames, fahrung, III, Bd. 15.
must see how we can consistently explain such cells as the above.

And that Dr. Burch in his paper on inflammation-global formation, the above conclusion for similar facts. Speaking of granular embryos in cancerous growths, he says, "In the case studied after usual granular loops which have a pretty constant diameter, I observed very large ones, three or four times as broad as the other, which contained, instead of one, sometimes as many as sixteen nuclei. These large loops occurred both without membranes surrounding them, and with forming in the latter case extracellular cells filled with granules + nuclei. Among these forms, I found that are often called "cancer-mother-cells" that is, more or less transparent large vessels, which contained a number of nuclei + daughter-cells and between them and the granular cells alone described. These were all transitions from endogenous nuclei to endogenous cells in such a manner that the included granules became smaller and smaller, the more developed was the generation of endogenous cells (are endogenous "double") from the same facts, which, it must be admitted, are not very clearly related, and from these similar which concluded that the granular components without membranes are but early stages in the development of what, if the view is correct, are improperly termed

mother-cancer-cells."
Chapter III

On the chemical nature of the changes which the content of the blood-corpuscles undergo in their transformation into the various forms of granules, crystalline & amorphous pigment.

[17] Chemical properties of the contents after colored blood-corpuscles in relation to their transformation.

Of the two constituents which in solution participate in forming the contents of the colored blood-corpuscles, viz. Globulin & Hematinine, it has been taken for granted by almost all those who have investigated the subject that the latter is alone concerned in these transformations which we have been considering. The former being supposed in all cases to dissolve and disappear. While, inasmuch as the former not only has we have no sufficient ground for making such an assumption, but that there is in fact a surprising evidence in the opposite direction.

The substance which is known to chemists as Hematin is a material of a dark brown colour with a slight metallic lustre. It is without smell or taste and insoluble in water, Alcohol, Ether, fixed or volatile oils, in almost all of which properties it differs from what histologists are familiar with, as communicating the Beautiful pale-yellow tinge to the colored blood-corpuscles.
Schmaue, Lehrbuch der physiologischen Chemie
J. B.
The mode in which ammonium is obtained may be shortly the
lit described. Twelve pounds of Blood about 8 times the
quantity of sulphate of soda is added. The result is filtered
and washed as completely as possible, and then heated in a
kettle of Blood-corpuscles. These are next dissolved in water and co-
agulated by the application of heat. The coagulum having
been washed, then dried and finely powdered, is repeatedly
mixed with spirit of wine containing Sulphuric Acid
acting on the latter to colour it. On the addition of excess of
Ammonia, Sulphate of Ammonium is thrown down and
some globulin. The filtered liquor is then evaporated to dry
ness, and the residue, after being treated with alcohol,
then taken in again dissolved in an alcoholic amno-
moniacal solution, to get rid of the last traces of globulin.
There is undoubtedly the proof that the final result of the above
process is actually identical with the soluble coloring matter
of the unmixed Blood-corpuscle; it may therefore be con-
cluded that the one stands in the same relation to the
other as is coagulated to soluble albumen; yet we are equally
ly entitled to consider the ammonium as a completely
fused product, though as, although there is reason to be-
line that a distinct coloring matter did exist in the Blood-
globules in their natural condition, yet we are totally
has equanmitate with it. Except as in conjunction with
globulin, and inseparable from it, colour by totally al-
The principal character of haematin, in addition to those already admitted, are the following.

It is very soluble in alcohol which is slightly acridulated
into Sulfuric or Phosphoric Acid. The solution possesses a
brown colour is altered red by alkalis and is precipi-
tated by the addition of water.

It is also very soluble in water and alcoholic solutions
of caustic and carbonated alkalis. The solution resulting being
coloured green by heat and become red by the addition
of sulphuric acid.

It derives these characters from the presence of iron, with how-
ever it may be deprived without losing its essential pro-
erties. Its ultimate chemical composition differs considerably
from Rotuline, being represented, according to Miller by
the formula \( \text{C}_n \text{H}_{2m} \text{O}_r \text{N}_s \), &c.

Rotuline belongs to the class of so-called Protein con-

The trouble condition, and it

in a separate state
Note. According to Pake and Koeler, when hydatid cysts in the liver occur at a very considerable size, they may give rise to the dying or blood suicide, and on occasion, laceration of blood into the heart. Another patient relates that he has repeatedly seen evidences of such laceration in obsolete hydatid cysts. In the case from which the cysts referred to were obtained he states, that, "At one point in the occurrence of the cyst, where the gradual disappearance (Pake and Koeler) of the substance of the liver atrophied, by surgeons could be traced into case, an intensely Vermilion-colored mass which presented a rather remarkable surface, but in more ample as accumulation, was found to consist of very peculiar cystic by broad lines, which formed sometimes petalolate annular modeled, sometimes circinate and concentric figures. These lines consisted entirely of very large yellowish red crystals of pigment.
Experiments and Results of Fischers into Respect with Some Chemical Constitution of the Acid. Least he found that his crystals had a tendency to sublimate and that the substance of which the crystals in question consisted, on this ground that, although not altogether identical with the matter it was analogous to and in fact derived from.

The following are the results which he obtained from the chemical examination of crystals which were taken from an intestinal ulcer, building in an hydratide crypt of the liver.

(1) Apart of the crypte it occurred with some odorous fluid containing bile was dried on a glass plate, then digested with ether, no alteration was produced. The dried glass plate was then boiled with water and left suspended in a closed vessel for a week. No result.

(2) Another portion was treated with alcohol of 86% e. without being affected.

(3) Another portion was repeatedly heated, and then subjected to the prolonged action of Alcohol containing a small proof of Sulphuric Acid. No change resulted.

(4) The same experiment was performed, with the substitution of Oil of Turpentine. No result.

(5) Another portion submitted to the action of Chlorine Gas for three, was unaffected. Then however it was submitted
Unfortunately the identity of these lines could not be proved either with arteriolar blood-vessels, or with those of the gall-ducts, although in examination of the perfused one could not help suspecting them to one of these elements.
The action of caustic ammounia and acetic spirit, the crystals were reduced to a crumbling mass, but they were unaltered. On the addition of nitric acid they became brownish red, and by dissolusion in the course of time became various shades of colour such as intense green, blue and coeruleum, and finally dirty brownish red. (Dioctyl) pteron similarly prepared, were treated with sulphuric acid, and dissolved in water for half an hour. No effect was produced.

(7) Another portion was dried on a glass plate which was then thoroughly heated on a sand bath. The crystals were found to be blackened, but to retain their general form, though they had lost the sharpness of their angles. The plate was then broken over a grinded flower, when a strong smell of carbide was given out. The crystals were now found to be reduced to a white ash soluble in water.

(8) A similar portion was treated with a concentrated salt of carbonate of potash. After the interaction, chloroform became green, and the fluid assumed a slightly yellow tinge. Under the microscope was then apparent a gradual dissolution of the crystals from their edge, a yellowish margin however still remaining. In the state of which the yellow red colour was perpetual. After several days the colouring matter was entirely dispersed, and yellowish or yellow greenish plates could only be detected.
which possessed roundish irregular contours.

The supernatant fluid was then boiled and filtered. The

remains were then washed with dilute acid, to form a

more focally dispersed, forming a baffled yellow-coloured

fluid, which did not effervescence with acids.

9) Where solution of Cadmium Potassium was added to another

portion, if the action were not too violent, the crystals split

into numerous small plates, cleaving in a direction parallel
to their longer sides, while the colour changed to brow

red. Where, after the action of Potassium was continued for line

days, Sulphuric Acid was added, the crystals first be

came darker, then gradually assumed a violet tinge and

changed to deep-blue, until the whole disappeared without

undergoing further change. The final result being a more

greenish tinge. Nothing and produced a similar effect, the

crystals being first reddish violet, then rose colour, then blue

& bluish green.

10) By the direct addition of concentrated Sulphuric acid,

along with the destruction of the colouring matter, formation

of a yellowish red compound occurred. Each crystal was altered.

Most of the crystals were entirely destroyed, some however

remaining little or not at all altered.

11) Direct addition of nitric & Muriatic acids only produc

ed slight alterations of form & darkened the colour.
Note: Schmerzer (Phys. Chemie, 1872, p. 181) states that he has occasionally found the red crystals to be dissolved in the addition of Alcohol containing Sulphuric Acid or Ammonia.

Note: These crystals are regenerated after Reichert's (B. 1877)
From the above conducted view of the results of Donaldson, it will be apparent that they alone are insufficient to warrant any very definite conclusions. The attempt was made to ascertain that the crystals are constituents of Formaldehyde in true form, most of the experiments are conducted with a view to a comparison with the sublimate. The result is that effervescence differences are found to exist especially in regard to the solubility of the so-called Formaldehyde in alkaline solutions and in alcohol, being latterly into Sulphuric Acid.

[19] Researches of Reecht

The following results, which are contained in a paper (Electro-lytic Decomposition Substances in Crystalline form) by J. E. Reecht in Micles' Archiv for 1829, appear to the too of great importance in relation to the present inquiry.

The crystals on which Reecht's observations were made, were obtained from the surface of the Placenta and membranes of an almost mature fetus of the Ausia Bogge, as well as the adjoining membranes and membrane of the uterine. The urine contained L-failure and contained with the urine, appearances presented themselves in all the above mentioned surfaces being coated with a material of a dark colour resembling black blood. This material when examined microscopically was found to consist of Tetrahedral crystals, more or less intermixed with mucous epithelial
The crystals possessed being regular forms (tetrahedral), the inclination of their sides to each other being 70° 31’ 43” and of the edge opposite the angles 54° 66’ 57” Tho. Their edges were in the length of the axis being from 1-600 to 1-154 of this.

Their colour was a dark brown red, varying however considerably in different crystals in intensity. In general, the larger they were the more intense was the colour. The smallest only possessed a slight tinge. In some cases however the colour became intense Henry difference to life and this to a considerable extent, a circumstance which seemed to indicate that they derived their colour from some material foreign to the substance of the crystal itself.

In substance they were elastic being capable of returning their original form and size after being subjected to the action of the compression.

On examining them chemically it was found that when subjected to the prototypic action of concentrated nitric acid or when boiled in a saturated salt of Potash, they were dissolved. They were also soluble in water at a high temperature. The immediate effect of the action of concentrated nitric acid was to convert the crystals, barbitone and being decomposed into a substance, (Barbituric acid, Water) which by treatment with Potash or Alumunum acid became an intense orange colour. This circumstance was...
above sufficient to sit at rest the question of the crystalline nature of the crystals at the extraction applied. It could only take place when an protein compound was concerned. Then treated with spirit acid, the crystals were enlarged, without losing their form or being altered as to their general appearance. The Bunsen's acids produce a similar effect accompanied with a change of colour, varying according to the acid employed. Solution of salisilic alcoho also caused the crystals to enlarge and to assume a yellow brown colour.

If the facts related by Birkbeck are correct, and if this be considered their unmistakable nature, no matter little seems to doubt. (in other words it can be shown that an ammonium compound bitter which is capable of assuming the crystalline form) it is evident that they must have an important bearing on the present inquiry. Although the crystals above described, differ in completely in form from all we have hitherto considered in building in agriculture, yet we cannot doubt the similarity of their mode of origin, nor the probability of a corresponding similarity in chemical composition. I think of the home to known protein compounds the crystallizable material of Birkbeck most closely approximated, we have often mean of determining. They is not be wrong in the inconsiderable probability, as much and is essentially as intimately united with duration, late some medi-
alone sufficient to set at rest the question of the chemical nature of the crystals at the time involved. But it could only take place when an protein-compound was concerned. Thus heated into acetic acid, the crystals were enlarged, without losing their form or being altered as to their general appearance. The Prunair acids produced a similar effect accompanied with a change of colour, varying according to the acid employed. Solution of acetic bitallic also caused the crystals to change and to assume another brown colour.

If the facts related by Recher are correct, and if they be considered under an unmistakable nature, there seems little room to doubt; (if we except those of them) that an albumin, compound acetic acid in capable of assuming the crystalline form.) it is evident that they must have an important bearing on the general inquiry. Although the crystals above described differ in completeness of form, from all we have hitherto considered or existing in latticelizations, yet we cannot doubt the identity of their mode of origin, nor the probability of their corresponding similarity in chemical composition. In what of the hitherto-known protein compounds, the acetylic after material of Recher—most closely approximated, we have otherwise no means of determining. They are not the enmixture into indiscernible elements, but as much as it is evident to be intimately united with hyaline, but some medi-


location of the albuminous constituent of the content of the
blood-globules viz. the Globuline.

[20] Researches of Lewicky

The work of Lewicky, as quoted, gives his work on the perfect
exhaustion by Virchow, once obtained from the chemical exami-
nation of crystals which were found in the corpora lutea
of pigs, cows & goats. They are however remarkably, as because
like those reader of other authors and are entirely wanting
in that clearing, as according to Virchow characterize
the rest of the work. He distinguishes two kinds of crystals.

1st. Small yellow or chisel-shaped (the rare) crystals, produced

in form

indily "Red 4 for the most part" square plates (p. 30); reddish
large or lanceolate crystals, plates (p. 16); bug red, platy nearly
of square or angular form (p. 16); small crystals into acute angles
which more frequently constitute slabs.

On examining these chemically, it was found that they
were all rendered colorless by alkaline baths. The brown
crystals were found quite soluble in water. In another place
it is shown that the crystals are unaffected by Alcohol Ether,
Black Acetate and Phosphates & Nitric Acids, while on the other
hand concentrated sulphuric acid, in slight-true color
Their blue and finally convert them into irregular black
glowels" This is compared with the reaction of sulphuric acid
on fluids fat which is colorless kept "just green three blue"
and finally, appear to be dissolved.

These introduced these results of Tiwshy's principally with a view of showing that all crystals which I have called coating, and are found in connection with the so-called hemorrhagic crystals of Virchow, and with the similar crystals which I have described as occurring in the corpus luteum. This seems good reason to believe that some at least of the crystals described by Tiwshy were in reality fatty in their nature, and it is evident that they were found not in the central clot but in the yellow portion of the clot. If so they were probably composed of cholesterin (or of some kindred substance, and formed in the same manner) which always exists but is abundantly in fat which are undergoing a process similar to that by which the yellow material of the corpus luteum is formed. For example in the atheromatous deposit in arteries. There is no reason for believing that fatty crystals may not be formed by hematomas in the same manner as it has been already shown that albuminous crystals may and the probability of such a supposition becomes the more evident when we consider a fact which is related by Virchow. But the ease of a man who died after amputation of the forearm, he found that the adipose tissue on the inner surface of the flap had assumed
Krohow, m. op. Suppl. 1895

A peculiar reddish-yellow colour. The microscopic examination, it was found that the fat cells displayed, when surfaces the well-known appearance of stars, diverging from a point supposed to be owing to a commencing crystallization of the contents. They presented however a very remarkable peculiarity in that a haematical cap was very uniformly placed at the point of divergence of the star, in the direction of which a light red, gradually fading tinge of colour gradually extended towards the circumference.

There also exists that for the case of vomiting after a few hours resembling fluid was obtained in which occurred fat-globules (Fett-Kugeln, fat-cells), the most of which contained at their centre, a compact structure, with small reddish-yellow rhombohedral crystals, which were considered to be crystals of the fat in the fat cells. That both these crystals and those described by Frosch were really fatty in their nature can, I think, hardly be doubted; and that they were their colour to haematical is from the position in which they occurred, more than probable.
[21. General conclusions as to the chemical relations of the various modifications of pigment which have been described in the foregoing pages.

These modifications may be substantially divided into the following:

I. Red Crystals (Albuninuous)
   - Tetrahedral
   - Rhombohedral
   - Crystals contained in cell-like structures. See P. 25

II. Granular Contents of Blood-corpuscles (Kälber)
   - Spherical or spherical bodies somewhat similar to red corpuscles (altered blood-corpuscles) (Pb. 3 Fe + Pb 3 Fe)
   - Fine Granular Pigment
     - Yellow, chestnut or brown, occurring in the brain, lung, liver, spleen, kidneys, ovaries, etc.
     - Black, Green, Brown, etc.

III. Fatty Pigments
   - Red or yellow crystals of various forms
     - Corpus luteum (Swick), Cellular tissue, (Schick)
     - Adipose tissue (Pirsch)
   - Fatty granules
     - Lipemia. In extravasation-cyste in Birds/Pellets
     - Yellow. Corpus luteum. Extravasation cyste in Muller.
Note. It may be proved experimentally that various kinds of crystals, if formed out of a liquid that contains much tannin in solution will assume a deep red colour. Hence it may be considered perfectly possible that some of the red crystals described by authors are in fact salts of tannin, condensed in rain streams.

See PL IV Fig. 4.
It has already been shown that an albuminous corpuscle exists which, under certain circumstances, may arise in the organism, is capable of assuming a crystalline form, and that the resulting crystals may have a deep red colour, communicating to them, from the presence of haeminic.

The simplest condition in which we can observe the crystallization of the contents of the blood-corpuscles, is that under which it has been described by Holikke, namely, when a red crystal is formed within the membrane of an actual corpuscle. This crystal can scarcely be doubted, when its size is taken into consideration, to be constituted of the whole original vital contents of the blood-corpuscle, or in other words, to be an albuminous crystal, coloured by haeminic.

In the corpuscles between these observed, as detailed in a previous section, all gradations of forms between the red spherical body, which is the simple result of coagulation of the contents of the blood-corpuscle, and the similarly coloured crystals, as if the material which in one case remained in the amorphous condition had in other made variously successful attempts to assume the crystalline form. This conclusion, be correct, we may suppose that these crystals, like those of hæmice, will similarly descend formed for the clear contents of the blood corpuscles.

The difficulties experienced in every attempt—
to determine with precision the chemical constitution of the crystals, we have been considering are very great. The most accurate of all tests for the presence of compounds that, usually, are recommended by Wielon, of the employment of the solution of the acid of mercuric is obviously applicable from the fact that the reaction obtained consists in the production of an intense red-colour, which of course could not be distinguished from the original colour of the crystals themselves. The same is true with regard to the otherwise sufficiently characteristic purple colour, produced by Muriatic acid. The best test of all as being most readily applicable in such a manner that the results may be observed under the microscope is that recommended by Rieche, namely, the employment of Nitric Acid, followed by Solution of Chlor?Potash. The bright orange colour produced is quite unmistakable.

Of the chemical composition of the true granules, I am inclined to assert that they have been made into its nature, or a compound, by the complete breaking down of the blood corpuscles, and is always characterized by a colour between yellow and brown, such that granules possessing an opaqueness and lack of outline, which distinguish them, are obviously from the material from which they are derived. It probably differs in chemical composition from any constituent of the
This statement is arguable, at variance with a larger W. J. according to John.

This sentence is very contradictory.
unaltered blood-corpuscles and perhaps approaches in its character to the physiological pigments. This must always however be very difficult to decide, as it always exist only in small quantities together and is most intimately intertwined with other tissues.

There seems to be no evidence to prove that a black pigment identical with the true melanotic is consistently derived from altered blood, with less that all black pigments whether normal or abnormal owe their origin in some way or other to transformed haematin, as is supposed by many. The only circumstance of importance favouring such a conclusion is probably the remarkable point of identity with which all such pigments present to haematin in the large proportions of how bleeds they contain in iemorrhages in the pigmentations organs, etc. It is certainly unusual to find black pigment arising from as the result of the transformations it have been considering, both in the human subject, however and still more abundantly in that of fishes. It occurs very frequently in the extravasations. See Pl. V. Figs. 1 & 2.
Jurg. Pathological Anatomy - Trausl. 9. P.

Bruch. Untersuchungen über das König’s Pigment, 1824, p. 58.
Conclusion

I shall arrange the results to be obtained from the facts detailed in the preceding pages in the form of some general propositions, the truth of which appears to be more or less clearly established.

[a] The transformation of the contents of blood corpuscles into the usual form of pigment occurs to place and be completed without the intervention of any cell-surface structure.

As the relation which pigment bears in the result of the transformation of fluid, holds to the cell-structures into which it is so frequently associated, the following are the views held by authors, etc.,

Let it be believed that recently ordinary cells take up by their metabolic power pigment granules as content. Indeed, Bence on the other hand maintains that the pigment granules originate before the cells, the membrane being formed "wie den gängigen Inhalts". Inflammation-globules are first formed by the union of Elementary granules into

Rothausky - Allg. path. Anat. pag. 301

De Virchow uop. cit. p. 382

The conclusion here is very indefinite...
Peculiar heaps, which become infiltrated into the nervous tissue from phloem-cells, a nucleus being finally formed and a surrounding membrae.

Boyle. They maintain that granules agglomerate around from a blackish brown Bryostatella which subsequently become surrounded by a membrae.

Likely. Rokitansky believe that nucleated cells about black pigment, which subsequently their contents assume the granular form.

Likely. The theory of Kiely and Eche where we now know to apply to carrier to truth has already been sufficiently detailed.

All the stages in the production of the granular form of pigment are observed in situations where no cell-like elements exist. Thus we have the constant occurrence: living aperistatic cysts in the brain, while although we can without difficulty make out attempts at the development of the structures referred to in the form of conglomerates, yet a great proportion of the segmentary material is in a perfect free condition. Here it presents the same colour and other characteristics peculiarities which it possesses in these situations.

The term *inflammation* plate has only been used by Flures and is now unknown in science. As far as the case, it has not been found that these bodies were always formed in the manner that is described. The author has taken as witness of the current proof in this case.

This term is also abandoned.

On the contrary, they are extraneous different bodies.
Ecker, Bougie, Engel & others are evidently in their theory of origin, functions with the so-called inflammation globules.

That the cell-like bodies containing blood-corpuscles which have been described in a former chapter as occurring in extravasations in the brain, are essentially identical with the Sandulovski corpuscles observed in the same organ is evident from the fact that they are produced simultaneously by the same cause, and that they merge indistinguishably into each other. The unusual form represented in Plate Fig. 3 may perhaps be thought not to admit of the same explanation. Yet they, however, must be admitted to correspond to the others in every really important characteristic. The same analogy is also to be observed in other situations, but nowhere, probably in the brain.

[The above mentioned structures always originate in the previous aggregation of their contents into a spherical or spherical mass, which subsequently becomes surrounded by an apparent membrane.

The evidence in support of this conclusion are too derived from recent sources. Yet, the fact that in a late blood-corpuscles are found to be included within the apparent-membrane and that these cannot be by any possibility supposed in many of the situations in
This is a different group acting than the cells under viroid plants, being the muting by other of presumably writing molecules.
which they occur to be developed in that position, is itself quite sufficient to let the question at rest.

Finally, Dr. Bichat's evidence may also be derived from such cases as that recorded by Deulé & Bichat (Coll. I.) in which a series of aortic, intimal evaginations had taken place into the substance of the brain, the resulting lesions, as seen after death, displaying all the various stages of the formation of the bodies in question.

In these considerations may be added the fact that conglomerates occur as the result of the physiological process of the healing of the yolk in animals, and that their mode of formation during it corresponds to the above definition. In certain parasites worms according to Kühne, the formation of each new cell as observed during this process is preceded by the aggregation of the granular material, in relation to a central vacuolar nucleus, the surrounding membrane being subsequently formed.

[47] They possess certain definable characters by some of which they may be recognized as distinct from true cells and are not destined to undergo any further development.

1st. Their membrane remains altogether unattached when treated with water and a little alcohol, alcohol, although by concentrated acetic acid and the prolonged action of
water is dissolved. Lastly, in their primary condition as conglomerates, the elements composing them are held together by a gelatinous-looking transparent structureless intermediary substance. At a later period this substance seems to project as to form a distinctly visible transparent margin, especially when water is added, which causes it to bubble out. Finally, this margin assumes the character of a distinct membrane, from the internal surface of which the content becomes degenerated in free, as it shows when the globules are caused to rise by moving the cover-glass upon the slice. This must be owing to a softening of the cellular or first-formed intermediary substances as might be expected to occur when we consider that the whole structure eventually disappears by a softening or breaking down of the same kind. The first change through the pigment derived from blood undergoes in to become destarched and absorbed. This may, while while it is yet included in a cell membrane, as occurs according to Kotzebue in the spleen, or, as happens by far more frequently, after that membrane has disappeared.

From the onset of its formation, the membrane sometimes presents a lamellated appearance, a number of strata or membranes indicating the successively formed layers of substance of which it is constituted being visible.
Die Rezension, insbesondere, über die Entwicklung der Market-
theorie, 1923.
[C] They have no influence on the changes which their contents undergo. This proposition is illustrated by the fact already alluded to, by that the conversion of the contents of the blood-corpuscles into granular pigment progresses, precisely similarly, whether they be surrounded by a membrane or not. Again, in vascular exudations, the blue-albuminous granules which are such constant constituents of the conglomeration and exudation corpuscles, which occur here to be formed, are to disappear without reference to them and according to allow applying to febrile exudations in general in various situations, whereby they undergo a process similar to the fatty degeneration of muscular fibre or of the tunica adventitia of arteries.

[1] They are not necessarily the result of exudation. Among other proofs of this fact may be mentioned their occurrence in stagnant blood in contracted veins and it is also strikingly illustrated by the occurrence of the so-called "Plat-celled" in the fevers, who are nothing more nor less than large congested-cells, such as we are customarily containing blood-corpuscles. They consist of agglomerations of blood-corpuscles surrounded by a clear and smooth membrane, and have been supposed by some who have described them to be "mother blood-cells." They occur about the third day of incubation in the chick
The area of the chick and are owing to particular situations occurring of the condition which we knew nothing.

It may be generally stated that the liquor in question, when subjected to the same changes as lumbar fluid, then placed under similar circumstances. Thus we have certain evidences indicating a dual nature giving rise to organizations not only of the same general form, but altogether analogous in every respect, and similarly we have diffused extravasations and accumulations producing appearances perfectly identical, except as regards the presence or absence of blood corpuscles.

All the conditions which are necessary for the development of that form of organization which we have been considering and which we may call the conglomerate cell, we can form no definite conclusion. We observe in the process of the formation of spongolitic corpuscles that, while the peripheral portion of the mass of congested fibrin becomes highly organized and often forms true basophilic fibers, as it is beautiful shown in extravasations into the arachnoid, the central portion shows no signs of basophilization at all, being out of the reach of the influence of the surrounding tissues. Between these, however, there is an intermediate layer in which conglomerates are developed, the whole arrangement suggesting to indicate that these form the lozenge in the ascending chain of pathological cellular forms. Structures, in influence, which had to be born out by their history as observed in other situations.
Appendix I

As supplementary to the illustrations which arose given in Chapter II. the effects of diffused circulation into the substance of the brain, I append here the accounts of two cases, the one of which is quoted from Dr. Stuke, while the other refers to patient who fell under my own observation. The first of these which is recorded by Dr. Stuke as follows was also separately observed by C. S. and is described by him in his work on granular segments.

From the history of the case it would appear that the patient had three successive apoplectic attacks of which the first occurred a year, the second 4 months, the third only one hour before the fatal event. The most recent and distinctly fatal apoplectic in the left hemisphere of the brain, contained coagulated blood with unclotted blood-corporcles or fibrine fibrilla. But inflammation developed. On the coagulum nor in the surrounding softened brain substance. In the second case coagulum in the middle lobe of the left cerebral hemispher, which was firm and less dark-red, many few unclotted blood-corporcles were visible. The great mass cont
of those corpuscles which were somewhat larger than in their normal or round form, and rest with subtle dark spots. These accumulate into corpuscles which have been first caused to shrink up by treatment with strong saline solutions, and then caused to swell out by adding water, in which case the coloring matter does not in general become again equally diffused, but accumulates in isolation always at the periphery among these corpuscles and also in the yellowish-red and red blood-subs.
be otherwise produced as they also occur in embolism which contain no blood-corpuscles with speaking. That the peculiar tinge of colour of the softened brain substance coming to these globules may be attributed in part to the fact that the yellow and brown and more brownish black. These occurred also colored inflammation globules, which principally followed the course of the vessels with true nucleated fragment cells, and blackish brown fragment-corpuscles.”

In that case D'Herelle concludes that the “embolus corpuscle” was the result of the transformation of the blood-plasma alone, and that there was no trace of the presence of embolus. Although the latter part of her conclusion may not have been fully at least strictly true, the former is tolerably evident. In the near case however, in many respects truly analogous, the accuracy of which can be with some more apparent.

George Crofton, Oct 28. Driven admitted to the Royal In
germary Jan 4th 1837. It appears that 2 weeks after ad-
mission he was troubled with pain in the head, which from that
time gradually increased in intensity until the Monday
preceding his admission when he was seized, while atting
ing to his business, with vertigo and dizziness. He died
not however lose his consciousness, but walked home without assistance. On Tuesday he discovered that the use of his left arm was impeded, and on Friday the day of his admission, his left leg also began to be affected, the loss of power in the arm having now become complete. From this period, he gradually sunk into coma, along with occasional convulsive twitching which increased until he died on the 10th of Sept.

Necropsy, Sept. 17th. On removing the brain, it was observed that the convolutions were much flattened, and on opening the lateral ventricles they were found to be occupied by about 130 c.c. of serpiginous humour. The lining membrane was perfectly healthy. On lifting out the brain, a semi-transparent or opalescent flocculent exudation of a greyish colour, was observed which corresponded in position to the anterior subarachnoid space, but extended forwards to the Sylvian fissure involving the bodies of the caudate, putamen and the second and third nerves. It also extended considerably backwards on each side of the corpus callosum. Immediately behind the commissure line of the optic nerves, the exudation was 1-3 cm. thick, and possessed of semicelluloseous consistence and passed back filling out the lateral ventricles, until it became continuous with a sti

...
Grass of about 1-3rd of an inch in thickness, which corre-

pended to the posterior perforated space, and exten-

sly filled up the cavity in front of the anterior-

margin of the Root Vasci, besides incrusting on the

substance of the brain.

In making a section in the middle line, and then closing

the optic thalami, it was found that a clot of about

the size of a pea existed in the substance of that body

about its middle or posterior third, which was surouni-

ned by a sufficient portion of brain substance forming the

lateral third ventricle, and a capillary apoplexy

which extended principally posteriorly.

By microscope examination the coraculium was found

to consist of the following elements, viz. 1st Blood corpuscles

of the normal appearance or slightly necrosed, 2nd

Portions of fibre tube, 3rdly, Irregular shaped bodies intercalate

the culture, consisting of the white substance + axial-cylinder

forced out of the fibre tubes. 4thly, Finely-granular matter.

5thly, Spherical or ovoidal bodies about 1-200th of an

inch in diameter, which contained finely granular matter.

No irregular shaped bodies above described, and especially

blood-corpuscles, but here and often other ovo-ellipsoic minors,

which so commonly occur in the meningeal cavitation or

epidermis of the brain. They were sometimes surrounded by a delicate membrane, lying

in the interstices in the neighborhood of

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found but fragments of tubers, the same irregular shaped bodies, and fine reticular matter. In some pieces however brownish tinge was perceptible, cellular bodies like histoplasms but containing yellowish brown granular pigment. These bodies were never surrounded by a membrane. They seemed to indicate the traces of former extravasations.

The circumstances in the appearance presented in the above case, which oblige me to indicate most distinctly, that the extravasation corpuscles which were found were in reality dependent for their origin on extravasation and not upon laceration, consists in these having occurred not in tufted brain-tissue surrounding the vessel but in the connective itself, whereas on an opposite supposition but little or what we might have expected. On comparing the foregoing fact with the history of the case, it seems probable that previous to this Monday before admission, when the head fit began with giddiness the condition of capillary aphasia had alone existed, but that, subsequently to that period the larger clot had begun gradually to form giving rise to the succeeding train of symptoms. That the clot was in reality none gradually, that is by the coalescence of several previously existing small ones which had gradually enlarged, seems indicated by the large proportion of broken down nervous tissue which it presented throughout its substance.
Appendix II

The subject of cells containing blood-corpuscles may be approached in another and a different point of view. It has been already shown that their occurrence in a tissue or organ cannot be considered as any indication—much less proof of the physiological connection of such organ, with the normal breaking down of the coloured blood-corpuscles, and that in fact, if the account which has been given of their mode of origin and history be accepted, they cannot be considered as normal structures. Another set of observers have, however, assigned to them a totally different designation and have founded upon them most opposite results. They have considered them as indications rather of an eliminative than of a disintegrative metamorphosis, of an act of new formation, not of decay. Among them may be mentioned two German observers, Dr. Duplanchâtre and Schaffner, and Mr. Wharton Jones of London. These endeavours to prove that the doctrine has
Geschicktes Handbuch der Gewebekunde. S. 217

Zeitschrift für innere Med. VII, 1875,

Schaffner, Zur Kenntnis der Malpighi'schen Körnchen der Milz und ihrer Inhalts. (Vom same 7, 1875.)
Blood corpuscles are developed within previously existing cells as a false one, and at the same time to communicate some result which I have been able to come to, as to the mode in which these bodies really originate.

Dr. Verlauch admits that he finds in the Mafiguean sacculi of healthy spleen blood corpuscles contained in cells which develop them. According to him although these cells exist only sparsely at a time, they are of very constant occurrence. He further believes that the sacculi are connected with the lymphatics of the spleen, and that the blood corpuscles, as soon as formed, are thrown by these vessels into the circulation.

These observations, although contradicted by every other anatomist, have been confirmed by Dr. Laënnec. He states that in the Mafiguean sacculi of the sheep and cow, he found large cells of about 1/100th of a line in diameter, which contained yellowish-green granules and a certain number of perfect blood corpuscles. He also made similar observations in some reptiles.

These facts, containing blood corpuscles were in identical tissue alluded to formerly as being described by Prof. Kolichev, may be concluded from two circumstances.
Baumzüchtung, Bestätigungen über die Herren und das Blut. Freiburg, 1830.
yet, if they had been, it is scarcely conceivable that
the invariably accompanying pigmented cells, and
other indications of extravasation blood could have been
overlooked. Lastly, they cells in question had a different
anatomical position from those of Kottke. Think
it more probable that the appearances were fallacious,
by interpreted, and that their real nature was as
follows. Cells, much larger than the rest, often seen in
the alveoli of lung, which from the smoothness of
their outline and their considerable power of reflecting
light, remind the observer at once of blood globules,
being of course easily diagnosed by the use of reagents.
As to the colour, it is a characteristic which is extremely diffi-
cult to judge of unless it be well pronounced, and
thus liable to lead to faulty, or almost any,
conclusion in the body, is capable of assuming a blood
tinge from mere insufficiency, as occurs very frequent-
ly in the spleen.

I shall next proceed directly to detail the facts
connected with the history of the development of the
blood-corpuscles from the earliest period, in which I
shall include all the other observations leading to prove
that the bodies in question originate within cells.

According to Kallmann's, the earliest
blood-corpuscles consist in the form of aggregations
Schultz, System der Circulation, 335-36.

Im Richert - Entwicklung Leben im Holzbett, 1871.
- Bischoff - Entwicklung der Säugetiere, 1875.
- Fort - Annalen der Zoologie, 1876, An. P. 207.
of yolk granules, without any vesicular membrane. These gradually disappear until, about the 12th day, a perfectly transparent ring is seen round the globular nucleus, the reddish colour becoming perceptible. A line the series of changes is described by Schultzy, the most observer of any importance, consisting in the transformation of an embryonic cell containing numerous granules, by the gradual melting away of its contents into the oval nucleus, into blood corpuscles. The nucleus being formed by the persistence of one or more of the larger granules, the smaller ones either blending into it or, by and by, disappearing. In the chick, on the other hand, according to the same observer, the nuclei originate first, in the form of transparent, homogeneous-looking yolk globules. Around these, in the course of development, a membrane is formed, within which granules are deposited. After this, the resulting cell gradually enlarges and assumes the oval form, and characteristic colour, the granules having completely disappeared. The whole of this process according to Schultzy is not completed until a late period of embryonic life.

All the more recent observers agree with Schultzy and Bauerngärtner in maintaining that the blow corpuscle is originally identical with the embryonic cell (Roter-Text (Reichert) Forschung-Text).
They differ however materially in other respects.

The question which has been most disputed in relation to the early development of the blood-corpuscles is that of their connection with the first formation of the capillaries. It is maintained by Schwaner, Pflicke, Dechesnoff, Rückert and others that this takes place by the juncture and uniting together of branching cells, while Rückert maintains that the first capillaries are mere intercellular spaces. The principal consideration of this question will be almost unavoidably included in the following remarks.

Among the more recent of the recent investigations in the early stages of fetal life, Pless and Dumas, describe the first origin of the blood corpuscles as follows. According to them the vascular area, or, as they term it, "hemopoietic area" of the germinal membrane, is constituted towards the end of the 12th day.; before, of course, any blood vessels or corpuscles are formed, of two layers (corresponding to the prae- and second) composed at this time of globules (globules hemoplastiques) which are described as varying in diameter from 1 to 4 to 1-2.5 to 5 to 6.5. Between the layers which bore globules from, the new blood vessels are developed, to which they supply the globules themselves afford the material for the development of corpuscles between them. These last do not appear until
Kölzer, Uber die Blutkörperchen uned menschenähnlichen Echsen und die Entwickelung der Blutkörperchen bei Saugethiere.

Zeitschrift für ent.-Phy.
IV. Bd. 1892.
At the end of the 12th day, being gradually formed, the homogeneous fluid at this time existing in the young vesicles.

Gay Lussac gives the following as the result of his researches with reference to this subject: "The vesicles which are just formed, even when they are not divided in number by the future capillaries, are not vesicles with a simple thin-walled membrane. They are all originally solid masses like the heart, and are not divided by any lines from the surrounding parenchyma, which is formed of cellular embryonic cells. Gradually, however, the margins become distinct and at the same time or even sooner, their interior becomes fluid, in disguise of which the cellular cells become loosened and become free. These form the first bone-corpuscles, which therefore agree with the vesicles and are thereby more than cellular colorless cells of the originally solid vesicles (Dejaï's corpuscles).

The most full and complete view of the whole subject equally valuable from the author's original researches are in including all the results of the more recent observations is contained in the first part of Remarks great work on development, now a prospect of publication.

According to him, not very many hours after
The commencement of incubation, the germinal membrane consists of two layers: each of which consists of platelets from 1-100μ to 1-100μ of a line in diameter, those of the lower layer being rather larger than those of the upper. In process of development, these platelets in both layers become metamorphosed into smaller bodies, presenting the anatomical peculiarities of cells. Subsequently, this change the lower layer splits into two, namely, a thicker superior and a thinner inferior lamina, distinguishable from each other by structural peculiarities. Shortly after this, the well-known shield-shaped thickening of the germinal membrane & the primitive trace begins to be visible. The cells above-mentioned are observed to have undergone important changes; both in the upper & middle layer. They have gradually become larger & smaller & smaller by successive division and at last untraceable.

At a later period, namely, during the last quarter of the first day, it was observed that the earliest traces of the blood-vessels were visible in the middle layer. These first appear as opaque cylinders from 1-00μ to 1-00μ of a line in diameter, and possess a radiculate arrangement. On more careful examination they are seen to consist of granular nucleated cells.
from 1-300th to 1-2000th of a line in diam. "Here and there isolated cells occurred of large dimensions with large transparent nuclei, and dense granular contents surrounding them, like those cells which at a later period make their appearance as colourless granular blood-cells in the first circulation."

The walls of the more developed of these vessels were consist of a single layer of cells, which project considerably into the central cavity. In those which are situated in the vascular area, towards the end of the 1st day, even before any trace of the heart has shown itself, numerous forcibly colourless, partly coloured, granular cells (Blood-cells) are visible, which, on the addition of acetic acid display single or double nucleoli. Now these first blood-cells originate, observes Remak. I cannot speak decidedly; I can only conclude that they owe their origin to cells which lie in the vessel-layers.

At the period at which the action of the heart commenced, that is about the 36th hour, a considerable number of corpuscles already exist in the vessels, both colourless or coloured. The former in general contain numerous granules and are more or less spherical. The corpuscles although many of them are also spherical, are for the most part oval or low sausage-shaped.
In the researches of Remak above detailed, my account of which I have shortened to the utmost extent consistent with clearness, we have probably the best and most accurate account of the phenomena under our consideration. It will be observed that they are in the main confirmatory of the previous results, as of Böckeler, as of Prevost and Dumas.

During last summer and autumn, I make numerous attempts to demonstrate these facts to my own satisfaction, and succeeded in as far as relates to the essential part of the process. If I was not to succeed half as I might have been, this is, in some measure accounted for by the great difficulty which attends the successful dissection of the embryonic structures, even as late as the 12th day.

From my investigations during the period referred to (during which alone the primary development of the blood corpuscles in the embryonic cells can be studied, as after this it gradually ceases) I arrived at the following results.

Let the spherule cells which are destined to constitute the globules, as observed during the 12th day, are identical with the embryonic cells which form the tissues or organs which are laid down at the same time in the same position, that is, the heart and vessels. Thus e.g., the heart in its earliest condition consists
was

See Plate VIII, Fig. 1
of cells entirely the same as those destined to form blood-globules.

I am unable to trace any earlier stage in the development of the cells referred to, than that of transparent, perfectly homogeneous-looking vesicles. As these enlarge, they become distinguishable into a central nuclear portion and a surrounding membrane, the former appearing as if rising from the surface of the latter.

Whether it is from the first vesicle,

... During the course of development, the whole becomes elongated and assumes the following characters, as it does on the third day. The cell-membrane is smooth and homogeneous, but is much swollen and renders almost invisible when water is added. The colour being destroyed. The contents are pretty deeply-coloured and contain a few granules of varying size and number floating in a transparent fluid. The nucleus is visible and often contains one or two granules. At one period in its history, on the addition of water it displays a very remarkable structure, which is represented in Plate Fig. 8. Instead of presenting a simple vesicle, a delicate membrane is seen rising from it on one side, which differs from the membrane of the nucleus, being itself, in not being so refractive. No such structure is
while before the addition of water. As to its signification it is difficult to express an opinion, unless it be connected with the mode of multiplication of the corpuscles to be described immediately.

I have lately had an opportunity of seeing the very detailed results of Mr. McLord on the primary development of the blood-corpuscles. As however his observations did not commence until the third day of incubation, and as the development in question is in progress daily in the second day, they can scarcely be considered as referring to the same series of changes as those which have been hitherto under our notice. The first stages in the process according to Mr. McLord may be described as follows.

The blood-corpuscles originate in the form of a small granule which enlarges and becomes clearer in the centre. Subsequently this enlargement state going on, the central clear part becomes dark and finally distinctly granular, the border being well-defined, smooth and transparent, the whole retaining its original spherical form.

With respect to the appearance above described I cannot say that I have not seen them and cannot help thinking it possible that they may have arisen from other bodies besides blood corpuscles intermixed with them in the ascertainment sequence. The succeeding stages are however as described by Mr. One Lord and others in accordance with what I have detailed above.
of my own observations. He says, "The central part gradually becomes less opaque and ceases to appear granular, the internal portion separating at the same time in some degree from the central part (nucleus). He further states that the corpuscle becomes coloured and at the same time flattens in form, becoming perfectly circular. After this it gradually elongates in both directions and assumes the general character of complete development.

At a period between the third and fourth day of incubation, and from that time to about the tenth or twelfth, a different mode of formation of new blood corpuscles, much more easy to trace and consequently ascertainable, with more certainty begins to be observable. This consists in a multiplication by division which goes on very actively during the 4th, 5th, and 6th days and ceases gradually to diminish in activity after that time, till at last it can no longer be detected. The appearance first noticed by the eye, when this process is in its greatest activity, have given in Fig. 1. When a blood-corpuscle is about to divide, it with its flagellum assumes an unusually elongated form, its constituent parts gradually becoming transparent until separation takes place. And secondly, the membrane becomes gradually central and across the short diameter, till it forms an hour glass form, the contained part gradually becoming bar-
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Ler also Ausstatt. Jahres bericht for 1841
to the narrower outlet separation occurs. In result is that two new corpusescles are given rise to, which although they at first possess a spherical form, subsequently assume all the characters of the original from which they were derived. The behaviour of the nucleus during the processes was not to be constant. It sometime appears to divide previous to the commencement of the constitution; at other times it does not do so, a new corpuscle seeming to be developed in one of the newly formed corpusescles.

When I first observed the foregoing facts, I thought they had been undescribed. I find, however, that they are noticed by Remak in his work Before alluded to, and it also appears that he had detailed similar observations in some previous researches on the blood-corpusescles of an embryo frog. Prof. Römer also in the paper above cited, in alluding to Remak's first observations, expresses himself decidedly in favour of a mode of multiplication consisting of the conversion of a blood-corpusescle as it becomes larger into 2-4 new corpusescles, according to the number of the nuclei leaving it undecided whether this multiplication takes place by division of the cell or by endogenous development. The structure of the corpusescles towards the end of the period during which they are observed to multiply by division, differs considerably from that which they present at their first appearance. The walls of the on
See Pl. VI. Fig 2 in which the appearances induced by the change occurring in different degrees are shown.
flattened lenses to be divided into two layers. The cuticle is perfectly transparent, colourless, and homogeneous. The internal, much less resistant than the cuticle, is in intimate contact with the colourless fluid inside. It reminds me strongly of the inner membrane of the plant-cell (primordial atricle), which has a similar relation. That two membranes meet is evident from several circumstances, e.g., when the corpuscles are subjected to a fluid whose density is above that of the interior, the inner membrane, which lies up, the outer remaining at first unattacked. Secondly, a luminal effect is produced too much gas in the degree by certain agents, a clear space being formed all round the inner membrane and between it and the cell. Thirdly, when a corpuscle is extended in the direction of its long axis, the internal membrane, as often seen, still chink, like a bridge, more or less twisted often — between the distal portions of the internal membrane. Similarly, it is observed that if any part of this structure escapes by a rupture of the inner membrane, it assumes a sphaerical form and becomes free in the surrounding humour, extremely resembling a blood-corpuscle.

The nucleus is a colourless space in the centre of the corpuscle of a spherical form, and consists essentially of a delicate vesicle containing a fluid, in which a few granules of outcome fine dust float. This the only part of the
Cell which does not disappear during spontaneous division (see Essay, p. 4), after which it remains finally visible as a collection of very fine granules.

In considering these facts with the appearances presented by the corpuscles during division, I would be inclined to believe it probable that the internal is thinner concerned than the external in the formation of the two new corpuscles which result. These being in fact modelled out of the contents of the original, just as the two cells are modelled out of the gelatine-mass in the commencement of the process of cleaving. This would also accord with what we know of the multiplication of the plant-cells by division, of all the circumstances of which we can satisfy ourselves more completely, in account of its larger size.

After the process of multiplication by division as above described has begun to decline, how are the corpuscles produced during the remainder of fetal life? This question, so much more of which we are unable to derive any information from observations on the embryo during his period (from the 12 day to the termination of incubation), may perhaps be explained by the following result of Prof. Kölliker's. From observations on human and manumotherin embryos he concludes as follows. As soon as the liver becomes developed, the multiplication of blood-corpuscles in the general mass of the blood ceased, and in its place is
The development consists of a formation of colorless blood cells round nuclei, which are transformed into colorless blood corpuscles by the formation of colorless matter in their contents, either directly or after they have just undergone a process of multiplication."

There is reason to suspect that the colorless cells in question are at all organized, connected with the liver, as they bear no relation to any of the normal tissues which their organs present in the fetus. Their connection with it seems rather owing to the circumstances suggested by Prof. Kobeler, that during a considerable period of embryonic life preceding the development of the liver, the white blood of the umbilical vein passed through the liver into the general circulation, and consequently as this blood contains all the nutritive material from the placenta, the development of blood cells must be supposed likely to grow into great activity in the capillary system of that organ, without its being necessary to suppose that it possessed any direct influence on the process. Kobeler however believes that the liver has a very decided influence, and compares it in this respect to that of the lymphatic glands in the adult, supporting the activity of the
process to be dependent not upon its secreting function, but upon the activity with which, during this period of foetal life the development of new vessels in the liver takes place.

As to the mode of formation of the non-nucleated corporacles, which gradually increase in frequency towards the termination of foetal life in the Mammalian Embryos, Kolliker's observations lead to the conclusion that they are formed from the nucleated by a gradual disappearance of the nucleolus. It is observed in the Embryos of the chick that also to the same extent. During the latter part of the period of incubation it may be seen that the nucleolus, in all the corporacles, becomes gradually relatively smaller, and although it of course does not entirely disappear, the adult corporacles in the bird being nucleated, it is obvious that if the same process of gradual diminution were continued, it would eventually do so, as is actually the case in the Mammalian Embryos.

Dr. Schaffner has maintained that in the Embryos of the sheep and other animals, certain cells exist in the liver, in the interior of which blood corporacles are developed. This assertion seems to me to be in the last degree questionable. In relation to it I have repeatedly examined the foetal liver of the sheep, perhaps occasionally at various ages, but always with the result of finding no traces of the corporacles.
I also a paper by E.K.trer "Über die Bedeutung der Leber für die Bildung der Blutkörperchen in der Embryonen"Zeitschrift für inn. Med. 10 Feb. 1889.

These observations tend to confirm the results of Köhler and to show that in the liver of the blastodermic shell of the frog at certain periods of life, a formation of blood-encapsules goes on in the liver cells.
of any such structures. I have already alluded to Mr. Schaff's
and similar observations relative to the spleen; it appears
probable that these may admit of the same kind of explanation.

From all the facts which have been con-
didered, we may come to a conclusion which is a very
important one, namely, that the doctrine of those
physiologists is false who maintain that the aden-
ous corpuscle is a body different in its signification
from the blood, or that the latter stands in the re-
lation of nucleus to the former as another cell. We have
seen that, in the chick, it is possible to trace from day
to day the successive and gradual changes by which
the original embryonic cell is transformed, lead
to assume the characters of the perfect adult
blood-corpuscle. We may pursue as closely as
possible to treat of the mode of multiplication of
the corpuscle after these changes are completed during
adult life.

Almost all observers who have investigated
the subject on which we are entering have agreed in
supposing the colorless corpuscles as in some way or
other dependent on the colorless or lymph-corpuscle for its
origin. This is to show that facts exist sufficient to
throw very great doubt on this doctrine, and for the sake
of brevity I shall include in the following pages, the con-
Note. In the development of the nucellar cells, these can be seen, and the illustration is a good one, as the nucellar cells differ from the colorless food-cells in no respect. Numerous pathologists have described this process as consisting in the aggregation of granules, and in making this observation with high power, a minute hair
parent-cells will be seen, in relation to and around which the granules place themselves and which is the daughter descendant to these.
Declaration which is not strictly necessary for this purpose.

The lymph-corpuscle or colloid or blood-corpuscle, as it occurs in the blood, exists under two pretty distinct forms, referable to different stages of its history. Its primary origin we know little except that it first exists in that part of the vascular system which is in relation with the lymphatic glands. There is no evidence however that it is at any time organically connected with these organs or, in other words, that it ever forms a constituent of their structure, as it else would. Can be pointed out to exist in those which corresponds with any stage of its development.

It would appear that it first originates as a true parent-perfectly homogeneous vesicle of no considerable size, which becomes surrounded with two or three or eventually with numerous granules. This however cannot be demonstrated. But some very probable from the earliest appearances which it presents.

A form corresponding to every early condition of the corpuscles is shown in Plate 2, as occurring in the thorax of a dog. This consists of a cell which contains, besides a number of granules, a vesicular nucleus.

After two modifications of the colourless corpuscle which, as above mentioned, occur in the circulating blood, that

Note: The clear space to which the peculiar muscular groove is very frequently described as the cell-cavity, which is a complete mistake.
which seems to occur most frequently diffuse but little from the form just described. It persists when not acted on by reagents a granular cell about 1300ths of an inch in diameter which does not possess very well defined margins. When acted on by trichlo and weak nitric acid, it presents the appearance represented in Fig 2 and 3. The reaction is produced with the greatest uniformity and is evidently owing to the production of such a degree of adaptation of the vesicular nucleus which always occupies the site not the center of the corpuscle as to burst the internal membrane thus remaining merely as if adherent on one side of the mass of granular contents.

During last summer had the best possible opportunity of studying the anatomy of the colorless corpuscles in the blood of the fly. Today in nature they were in such abnormal abundance. They corresponded in general both before and after the action of reagents to the form above described. After treating them for a long time with water they present the appearance shown in Plate Fig 4 in which is most distinctly evident the perfect separability and independance of the vesicular nucleus.

When a little acid of ordinary strength was added to these corpuscles, they are displayed highly refractive horse shoe-shaped nuclei of a form similar to that represented in Plate Fig 1. To ascertain the relation of these to the
Note. Even in the same individual at different periods different forms are assumed by the colourless flower-corpuscles. This observation I have made not only in a species of this, but more especially in various Proline which I have cultivated myself, that at certain periods the general one after colourless corpuscles was in a more advanced stage than at others.
Vesicular nuclei already referred to, I allowed some of the corpuscles shewn in figure 2 to be gradually acted on by weak acetic acid, by which means we obtained the appearances shewn in figure 3. Wherein it is evident that the most thorn-shaped nucleus insoluble in acetic acid is placed at that part of the granular content which adheres to the vesicular nucleus, and in the immediate vicinity occupies its concavity, being situated towards the centre. Hence probably this body consists of those granules which constituted the corpuscle in its earliest state, the rest being of later origination, hence more soluble in acetic acid.

Therefore conclude that this form of the colocalized corpuscles consists of the following parts, viz. 1st the external cell-membrane, 2ndly the cell-cavity containing (a) a nucleus soluble in acetic acid, (b) a granular nucleus insoluble in acetic acid. (c) a vesicle (after Erlichmeister, Mr. Jones). From observations on the colocalized corpuscles in these cases similar results are to be arrived at.

In this, however, the great mass of the corpuscles present a somewhat different appearance, viz. at the same time we can easily recognize to be only an advanced form that is, more nearly approaching the period of degeneration, after dense structure. Here the corpuscles then enamelled tinctures the addition of reagents soluble very much more...
last described, except that they are a little larger.

When water is added and subsequently very dilute acetic acid is added according to the mode recommended by Mr. Pharram Jones, the appearance which he describes is presented, the vesicular nucleus ("celliform nucleus") being displayed, which has now assumed a spheroidal, instead of the irregular figure previously with corpuscles previously described.

When treated with the ordinary dilute acetic acid they display sometimes the horse-shoe-formed nucleus, but more frequently the trilobed or trifoliate nuclei, formed by supposed to be characteristic of the first corpuscle, is made visible before such addition is made, and is situated between the "celliform nuclei" of Wharton Jones's outer membrane.

If this above fact be admitted, it will be

nearly necessary to adduce further proof that the coloured corpuscle is not formed from the colourless, as such a doctrine is certainly at variance with the anatomy of the liver, and the history of its development. I shall however, shortly mention the principal special arguments which have been brought forward in support of the doctrine, and the objections with which they may be met.

The theory advanced, as maintained by different other

...under two distinct modifications.

According to the first, the colorless blood-corpuscle or lymph corpuscle is transformed directly into the colored; sometimes while in this view maintaining that in this process the contents clear up and disappear; while St. Wülfer maintained that the nucleus becomes adherent to the external membrane and is permanent.

According the second, the nucleus of the colorless corpuscle is transformed into the colored; the internal membrane and granular contents disappearing.

The arguments in support of this first doctrine are the following:

It is said that direct observations have been made by Fällé proving a gradual transformation of the lymph corpuscle into the colored blood-corpuscle, each stage in the alteration as regards form & color having been demonstrated. To this it may be replied that the accuracy of the observations is denied by very many observers, and that from their own nature they are liable to many fallacies.

Lastly it is said that in many corpora, the nuclei occur indistinctly in transition stage. This is denied by the great majority of observers and is inordinately untrue.

Lastly Prof. Holme also adopts the theory that the nucleus disappears during the transformation, adding the following fact, viz., 1st, the minute lymph corpuscles often become disd
are actually of the same size, often darker than the external envelopes. Lastly, their membranes resemble that of the external envelopes as to appearance, action of reagents to become wrinkled as theuffle is incorporated in the same manner and without signs of dissolution. Both these apparent facts may be admitted without in the least injuring the doctrine of ever rendering it probable. Köhler further uses in contradiction to Mr. Jones that the cell is wholly not in the nucleus but in the cell cavity. The only fact of two such good observers make such opposite statements is the best illustration of the carelessness of the observation. Lastly, Köhler maintains that the lymphs or perinuclear protoplasm is in a less degree the flattened form of the chorin-epidermis. To this it may be said that many thin epidermis as those of pupae are also flattened and that therefore the circumstances prove nothing.

Why it is argued from analogy, that is in the Echinus an undoubted transformation from the nucleated to the non-nucleated form takes place by the disappearance of the nucleus, so according to Köhler may it be concluded "obehow nicht mit vollkommener Sicherheit, doch mit größerer Wahrscheinlichkeit" that in the adult the same thing takes place. In a question like the present analogy affords a very insufficient ground of argument and besides there is *eisprofit*, although he shows...
Mr. Jones, Phil. Trans. 1826
De laclée, in op. cit.
a gradual transition from the nucleated to the non-
nucleated form during the latter period of its life in
the white mass of the corpuscles, that owing such transfor-
mation takes place in the individual corpuscles themselves.

The second doctrine, namely that the nucleus
of the colorless corpuscle is transformed into the colonized
is supported principally by the observations of Mr.
Markton Jones. It also is advocated by Delachez and Besse.
Mr. Jones divides the history of the development of the colonized
corpuscle into 3 stages, terminating in the formation of
the colonized. The first stage is represented by the "gran-
ule" form to which he applies the term of
"granule blood-cells." This, he believes, becomes "fully granu-
lar" by the gradual solution of its contents. After that a
nucleus begins to be visible in the form of nucleated cell
is assumed. Finally, the nucleated cell burst and
the elongated nucleus is liberated, and becomes the
colonized corpuscle. All these facts are butt for exceptions of
in a least, perfectly correct, and may be doubt be demonstrated, without difficulty be demonstrated in the blood of
some individuals, though not of all owing other differences before attended to. The doctrine however that the
"elongated nucleus" are identical with blood corpuscles is
eventually uncomfortable. Yet, because many of the colonized
corpuscles are much smaller than the smallest
Siehten insp. et al. 1874.

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of the nucleus in question and, secondly, because no transition forms can be detected, which could not possibly be absent, were this theory correct one. The great resemblance existing between lower forms of these nuclei and the coloured corpuscles is generally admitted, no law of it being questioned that they often follow, as Mr. Lee has described, a well-marked colour when examined in the moro which he recommends. This latter circumstance however implies nothing, for if water be added to any animal fluid containing blood-corpuscles in quantity, the colouring matter will be dissolved and any cell-structure of whatever nature which may happen to be present will assume a blood-tinge.

Remark was led to the similar conclusion to that
of Mr. Lee's from the result of the following experiment. He took 50 c.c. of blood from a horse and subsequently at intervals of several days examined the remaining blood under the microscope. The day after the bleeding the blood contained an inconsiderable number of colourless blood-corpuscles, in many cases as numerous as the coloured. About the tenth or twelfth day, many of these corpuscles had possessed a single or double nucleus, lost their granular contents, and then appeared at the same time, after the addition of water, "isolated colourless bodies of the size of the colourless corpuscles, which no nucleus was visible.}
but a reddish coloured round smooth body nearly as large as a blood-corpuscle, compressed laterally, in the true manner was apparent at the nucleus, beyond which his clear colourless wall of the vesicle itself projected. Subsequently those nuclei became free and gradually assumed the form of the perfect colourless corpuscle.

The above observations correspond very exactly with those of Sir Jones and his later adherent of the same explanation. The fact that after a large bleeding the colourless corpuscles exist in individual members, does not in the least imply that they have any connection with the reproduction of the colourless; it being equally well accounted for whatever theory we hold as to the constituent of the blood where they are dissolved form. I may add that Stibner the superintendent of Pemire but without any satisfactory result. The horse with which I employed was ble

successively on the 20th, 21st, 22nd & 23rd of November until to between 600 or 700 lbs. No difference in which any conclusions could be founded, the red structure either of the colourless or the coloured corpuscles, although the animal was under observation until the 15th of December.

The circumstance which, of all others appears to me the most conclusive in reference to the question before us, is that which was alluded to above viz. that the colourless corpuscles built in healthy blood which
are by far the smaller than the coloured corpuscles or their nuclei. These miniature corpuscles, unlike the uniform occurrence and present to well defined structure that there can be no doubt that they are in reality normal, distinctive constituents of the blood. They occur however in greater frequency in obese individuals than in others. During the last 6 months I have been observing them in the blood of a man, Henry Smith, a patient in the IN Department who, though suffering from internal disease, is otherwise in tolerable health. In this man they occur in great frequency, varying from 1-670 white 1-4000 white in diameter. They are among the few objects which cannot be satisfactorily described without an object glass. We will define well with a magnifying power of from 500 to 600 times.

We have already seen that it is impossible to attribute the origin of the coloured corpuscles to the colourless. We have also seen that it is impossible to assign it to any organic constituent of the liver, spleen or other organ. We are therefore shut up to the conclusion that it is developed by a process which itself is alone conceivable, but of the nature and exact which we are as yet ignorant. If the facts related above be admitted to be correct, we seem to have in them our indication of the direction which we ought to follow in future research.