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The physiology and pathology of the fibrine are matters of such high and importance both scientifically and practically that I have elected as the subject matter of this official essay, a concise recapitulation of some of the more prominent points in this controversy. While the accuracy of the theory first promulgated by Miller that fibrine, albumen and caseine, were compounds of one fundamental substance—hence the term 'proteine'—there has, of late, been thrown considerable doubt (to say the least) by the recent progress of physiological chemistry. There is, in fact, much reason to believe that these three proteine compounds are readily convertible into one another. Reasons in support of this assertion are derived from the phenomena of the human or animal, of the animal-body, as well as from the reactions and results of organic chemistry. Thus congealed fibrine, or caseine, may be rendered soluble by the neutral salts of the alkali, aided by a little caustic alkali (or, by partial satiating, inducing solution of the rest if covered with water and left to itself, the same result may be obtained); and the solution will then exist
...all the characters of albumen — congealing by heat, and acting on polarised light as albumen acts. Again, by means of some caustic alkali, coagulated fibroin or albumen may be dissolved — the solution possessing now the character of casein — the product of the decomposition of these proctinate compounds acted upon by oxidising agents are alike identical in all these — e.g. aldehydes, acids of the C.H.O series, bases of the indole series, laccine, tyrosine, etc. Besides these chemical proofs of their neutral convertibility unity, the animal body must have the power of effecting this neutralisation. Thus in the egg, there is the fibroin, as also in the milk; yet fibroin is produced from both these sources — again the blood of the carnivora contains less fibroin than does that of the herbivorous animals — the absence, too, of fibroin from the chyme — especially in carnivora — all these facts are clear indications of the fibroin of the food having undergone some alteration, and of its not being necessary, as such, to nutrition.

With respect to the question of the proctinate compound fibre is, and has been much controversy — whether it be excremenations, or recrementations — in other words is fibroin the result of destructive or constructive processes in animal life — an interesting inquiry, and one well worthy our attention. Some physiologists, considering fibroin as a nutritive plastic substance, hold the opinion that it is subservient to the production of new tissues — especially muscular & contractile tissues — and look upon its power of spontaneous coagulability as an indication...
higher development, when its relative increase in
inflammation disorders as an indication of the
self-healing powers of nature, as evidenced in the cir-
cumstances, ejection of abscesses and a thousand other
cases—
Among the most distin-
quent of the supporters of this view of the recor-
"onization uses of fibrous, is Dr. Carpenter who
holds that congelation is an act of vitality as shown
by the subsequent fibillation and organization — in case
where this phenomenon is absent, he attributes a want
of true elaboration of the fibrous or to the destruction
of this forst by some reason intangible — that the
exercise of this power is kept in check by the
vital endowments of the living tissue — and that its
activity is due to an equivalent of these offensive action.
He holds that the idea that fibrous is specially
apparented to serulative operations, as having been widely
shaken — this opinion having been originally based to some
degree upon its supposed close alliance to muscles — in some
degree, in the supposed higher vital endowment of fibrous
fssible, however, has shown that instead of them being any
evidence of the identity of fluid fibrous with muscle,
the evidence is rather that precisely Potter says, and that
there are granules both structural and chemical for re-
regarding fibrous as being mere allied to the fibro-gelatins,
tissues, than to the cellular albuminous — hence
Dr. Carpenter regards it rather as the special fibulism of the
connective tissue, those tissues whose physical function
are so important to the economy, whose vital endowment
are so low — and he regards it as possibly subservient
by its formative power, to the generation of these tissues
when any demand for them arises.
The doctrine of its being an effete product is (Dr. Carpenter)
Adopted to the whole physiological history of fibres - to its gradual development in the chyle - to its immense production in the blood, (if the eucercinations) compared to the other fluids matter such as urine, uric acid etc. - to its beneficial and medicinal aids in hemorrhage, wounds, and limitation of serous and effusions.

This last view - that of fibres being eucercinations - was first put forward by Zimmermann in opposition to that which generally received. This physician regarded fibres not as a substance conducive and subservient to the nourishment of certain tissues and to be by them absorbed but that it ought to be counted among the secondary products in the blood, resulting either from its own decay or from the waste of the tissues. For on the former hypothesis how could so small a proportion as ten in three parts in 100 be reconciled with the idea that the substance built up the tissues.

In support of Zimmermann's view may be mentioned a few established facts -

After standing bleeding, in academic states, and states of exhaustion and increased waste, the proportion of fibres is unaltered or increased - and under the same conditions the red corpuscles are found to be in direct contrast with the fibres - (a fact of importance)

In the chyle there is no fibres - in the chyle very little - and in the carcerina less than in the horizon - in lymphatics and weak persons, the ratio of fibres is higher than in those of a robust and sanguine constitution.

It was ascertained by André de Gavaret that an improvement in the breed of an animal always tended (ceteris paribus) to increase the proportion of red corpuscles, but diminish that of the fibres.

In the chyle of the lactating there is little fibres - in the chyle of the lymphatics, it is abundant - hence it would appear that while the fibres of the food is altered in constitution, are it
In a normal state, the variation in the ratio of the fibrine to the other constituents of the blood, is very trifling, while sex or individuals be considered—2:5 or 3 parts in 1000 may be taken as a fair average—but whatever mood excitement—especially inflammatory excitement, local or general—disturbs itself; then as certainly do we find a steady increase of the fibrine—an increase progressively pari passu, with the degree of intensity or extension of the inflammatory process—and having some relation with the nature of the inflamed tissues—and this increase may attain as much as 8 or 9—sometimes 9, and (it is known) rarely even as high as 10:5 and 13:3 parts in 1000. The rate of the increase varies directly with the aggravation or mitigation of the inflammatory action.

It is, however, to be noticed that this increase, accompanied as it may be with an apparently greater richness of the blood, does not coincide with a like elevation of the quantity of the red blood cells.
In acute inflammation, as also in starvation, the number of these little bodies is altered in an almost inverse ratio - an un
only decrease of corpuscles but a diminution of the albumen, blood
accurately proportioned to the increase of fibrin, occurs at the
same time. An analogous modification in the constitution
of the blood results from the repeated abstraction of blood -
and the degree of modification varies with the frequency of ab-
straction and with the quantity of blood thus abstracted - under
these circumstances, the blood coagulates more rapidly - owing
to the increase of fibrin, which (in an animal blood freely every
day) was found, at the lapse of one week, to have risen from
37 to 7.6 parts in 1000 - the red corpuscles falling from 97 to
33 in 1000 parts.

I may, too, mention that in the
plenic vein, the fibrin in considerable excess - the
blood cells in diminished proportion - the spleen being
supposed to exercise some destructive influence on the
latter.

On the other hand, in certain debilitated conditions of the
system - e.g. typhoid fever, the converse of the modification
obtains - the ratio of the fibrin falling below even the
lowest of the normal variations, the amount of the red
corpuscles undergoing at the same time no diminution,
unless after repeated resection and prolonged low diet.

In that debilitated state, called chlorosis, we find increased
amount of fibrin; but then too, there is a noticeable
-very noticeable loss of red blood corpuscles.

Many other examples of the reverse ratio (observed in similar
conditions) between the fibrin and blood corpuscles, which barely
admits me to omit.

On reconsidering and comparing together these facts, we find
them not discordant or isolated cases. But plainly - most
plausibly explicable on one view - the relation of the
red blood corpuscles to the fibrin
Now the fact of increased quantity of fibrin may resulting
from inflammation may be accounted for on one of two
view. Of either (1) that the living tissues cause the removal or destruction of the fibrine—which action being accomplished by the inflammatory process, a greater amount is, consequently, retained in the blood. But how these are to explain the augmented quantity of fibrine under starvation, or repeated vaccination—or why fibrine is so plentiful (when compared with the chyle) in the lymph—or why we find the alteration in the respective quantity of fibrine and corpuscles, so generally in reverse ratio, unless these latter constituents of the blood have some correlated formation.

Dr. (2) that the fibrine is the product of the tissues, and of the wear and tear of these tissues—the increased vital action, due to the inflammation, being, consequently, necessarily accompanied by an increased amount of fibrine which is the product of that action. This latter view seems more consistent with observation, and the facts before mentioned. But how, then, is there so small a proportion of fibrine found in the blood, if it really be due to the wear and tear of the tissues, unless this be readily increased by any local inflammation? This (I think) can only be explained by its destruction or elimination, progressing pari passu, with its appearance in the blood—and, in fact, the reverse ratio which I have already noticed and pointed out, between the relative amounts of fibrine and blood (red) corpuscles seems to indicate some special correlation between these two constituents of the blood—viz. that the corpuscles may be the agents whereby various modifications—doubtless complicated modifications—in the molecular constitution of the fibrine, are affected, ere it becomes converted into these forms—or rather secondary products such as urea, uric acid etc.
in which it is ultimately eliminated by the different excreting organs.

Now I have before alluded to the marked results of repeated venesection—debility, increased fibrin, and diminution of red corpuscles. To what in this case, are we to ascribe the increased amount of fibrin? Surely not to the general excitement and rapid intensity of vital action causing this increase—the system being weakened and deprived—not, I say, to more abundant production of fibrin so much as to impairment of the process of elimination, due to diminution of the number and consequent of the action of the corpuscles.

Considering then, as we may, not without good grounds, the blood as subject to the action of two opposite and inter-connected processes, which maintain a balance during the continuance of health, but in disease, are subject to disturbance—the one process that situates in the tissues, forcing fibrin into the blood-stream— the other, dependent on the aggregate mass of blood cells, modifying this fibrin so as to convert it into a non-coagulable albumenoid or procoagulate compound, or producing such changes in its composition or molecular arrangement as to promote its elimination in some less complex, as it were, considering it thus. I say, we may regard the blood as undergoing a series of continuous, mutually counter-balancing changes; and its composition as varying with the degree of intensity of either of these actions—fibrin-producing actions in the tissues, and fibrin-destroying actions peculiar to the mass of red.
corpuscles.
The investigations of F. Simon have shown that the correlated function is well grounded — the cases (examined by him) of altered composition of the blood invariably showed a relation, in a higher or lower degree inverse, between the respective quantities of these two components of the blood — increase of the one being always concurrent with diminution (certainly not augmentation) of the other.

Increased amount of fibrine, then, is (leading generally) owing to two chief conditions:
1) Increased functional activity of the tissue, ceteris paribus.
2) Diminished number or activity of the red corpuscles, ceteris paribus.

Hence it can be easily understood that any change in these two conditions which do not relatively correspond, will induce an altered state of the blood. An example of the first is that offered by ordinary local inflammations, causing increased amount of fibrine — of the second, is that offered by chlorosis — the fibrines being unaffected, at least not diminished, in quantity, but the red corpuscles exhibiting a greater or less loss.

Again we should expect a diminished proportion of fibrine not only when the functional activity of the corpuscles is unusually active, but also in cases of impaired functional activity of the tissue — and, accordingly, in scrofulosis, characterized by impaired function of the tissue, we have diminution of fibrine with unaltered certainly not
Anemia may be regarded as affording an instance of decreased proportion, or activity, of the corpuscles, concomitant with impaired power of the tissues to produce fibrine; the blood, consequently, retaining nearly much the normal amount of fibrine, (and albumen), but less globules.

This view of regarding the fibrine as being produced and eliminated simultaneously by two distinct, contrasting agencies — the vascular tissues and the aggregate amount of corpuscles — offers some explanation of facts apparently paradoxical. Thus, excited muscular exertions hasten the circulation, and increase the wear and tear, as well as the product of the wear and tear, of the tissues; and proportionally, the amount of fibrine in the blood. But, on the other hand, the accelerated circulation, and excited activity, of the respiratory process, as well as (as may be inferred) the excited activity of the red corpuscles, must tend to counterbalance this increase, by the resulting increased action upon the fibrine.

In conclusion, it may (I apprehend) be not unreasonably inferred, that the fibrine of the blood — although subservient to uses so varied and so beneficial, especially in certain muscular, or mortif, conditions, as in hemorrhage, limitation of hemorrhage, effusion, healing of wounds, and reparation of breaches — that the fibrine
I say, is not to be considered as essentially a recrementitious substance, necessary to nutrition and to plastic transformative operations; but that, on the contrary, while present in the blood, it is tending downward, subject to metamorphosis and destructive influences, and soon to be eliminated by the excretory organs in the form of compounds more adapted to the structure and function of these excretory organs: and there are strong grounds for believing the red blood corpuscles as playing no insignificant part in effecting these modifications.

Edward Adamstone