Notes on Inflammation
by James Rene Forrop
DEFINITION

In a thesis addressed to the Faculty of Medicine, it seems unnecessary that I should spend time in defining my subject, or in pointing out its interest and importance. And I will only delay for a brief space, in order to make myself clear on a point of some slight moment. It is the fashion with now-a-days to sneer at Celsius or other of our predecessors, who distinguished inflammation by the four symptoms of pain, heat, redness, & swelling. Our moderns generally substitute some intricate and imperfectly established theory as a preliminary definition, thus not only placing their conclusions at the beginning but at once making it highly uncertain what it is they are about to discuss. I shall content myself with the classic definition of inflammation, because it precisely & exhaustively explains to the most unlearned the idea of the term, because it is (as far as a definition can be) correct in fact, and
and because it does not coincide with theory.

The popular notions concerning the causes and dangers of inflammation may be vague in the extreme; the theories people form about it may be unlimited in absurdity. But it is from the signs just mentioned that they draw their conclusions, and it is these signs that induce them to bring the process under the scientific eye of the physician.

I will therefore define inflammation to be a morbid process recognised by the pain, heat, redness, and swelling which accompany it.

Of its importance I need not speak; it is "the pivot on which the medical philosophy of the time has ever revolved."

I have not space to enable me to offer a detailed account of the history of inflammation (that is to say the history of the literature of inflammation), nor would the importance of the task justify me in making the attempt. Until comparatively recently but little knowledge of the subject has been possessed, attained, and an account of the various theories that have prevailed since the time of Celsius might be interesting, but would not be of much practical value.
Without further preamble, I will at once proceed to expand my definition by narration the principal phenomena of inflammation. In doing so it is immaterial whether I select an example of the inflammatory process that has been produced artificially, or one that depends on causes concerning which we are ignorant. For we can at our pleasure institute an inflammation, that will not differ in any essential particular from the process most excites independent of our will.

Let us direct our attention to a simple everyday inflammatory process, say one of the skin. It advances somewhat after this fashion:

A sensation of tickling and uneasiness, at first indefinite but gradually increasing, attracts our eyes, on examination, we find a portion of skin dyed with a redness that disappears. On pressure, the part feels somewhat elevated above the surrounding regions. At times the uneasiness changes into a painful puffy of heat, if pressure, the redness gradually extends, and deepens, and the part expands so as to present the appearance of a swelling. Later on, the pain becomes heavier, it is exacerbated at periods corresponding to the beat of the pulse (throbbling); the redness is permanent, not bleaching on pressure; the swelling is more swollen and begins to feel hard, the part feels hot to the touch, and the thermometer applied locally indicates...
indicates an increase of a degree or two in temperature above the neighbouring parts.

And now there occurs more or less markedly what is termed constitutional disturbance or fever.

This may be so fleeting as to escape notice or so severe as to absorb the entire attention. Its extent generally corresponds to the severity of the local phenomena. The pulse is quickened so many beats per minute; it may be stronger or weaker but is generally harder; usually harder, the general temperature is more or less raised above the normal standard, thirst increased, appetite diminished, and an indescribable feeling of general indisposition excited causing restlessness or even entire sleeplessness. The mental faculties may be even somewhat deranged.

SUPPURATION

The process advances now the local phenomena approach a crisis, the pain no longer increases, the induration has reached its extreme boundary line, the heat is stationary, and the swelling formerly so hard now feels soft as convey the sensation of a fluid being beneath. Cut down into the swelling. Plenty of blood escapes but in addition to it there flows out a limited quantity of a fluid of creamy colour and density. This fluid consists of neutral albuminous serum in which floats a crowd of minute corpuscles (pus).
Such is the progress of a simple, but complete and typical inflammation. With a few rare & remarkable exceptions, the general phenomena of every process are identical with those of the above. Of course it is admitted that the severity & duration may vary infinitely. It may be cut short at any stage of its progress, or it may be protracted to an indefinite period.

We must now examine certain of the phenomena more minutely, if not the most important pain is certainly the most striking. It is one of the most notable of the many provisions whereby the body is enabled to sustain its integrity amid unfriendly conditions, both external & internal, which perpetually threaten its destruction. Its operation confers a twofold benefit. For by it we are not only admonished in the most unmistakable manner of impending danger, we are not only informed where to expect its attack, but the body, preoccupied as it were, of evil cries out for relief and will not suffer the most indifferent of us to disregard its necessity. While there is danger there is no rest. But should the mischief have been irretrievably effected, then pain...
In inflammation pain is a most constant, generally the earliest symptom noticed. It varies very greatly in kind and intensity. It is described as being of a dull, smarting, tinging, or pricking nature; most frequently it is of a throbbing character, or the above kinds of pain are may be aggravated by throbbing. Many inflammations, such as erysipelas, phlegmy, are distinguished by a characteristic pain. It also varies with the character of the tissue involved, being trifling in soft yielding parts, more severe in hard resisting tissues. It ranges from a slight feeling of uneasiness to the utmost agony. And it has this important peculiarity, that it is aggravated by pressure, only to this rule there are one or two interesting exceptions which will be noticed afterwards.

Regarding the causes of this pain there is considerable dispute. It has been supposed that it is at least partially due to that "exaltation of sensibility, which determination of blood produces." This idea is, without doubt, a mistake. An increased supply of blood does not force produce pain in a nerve. On the contrary, it is well known that many (perhaps most) painful affections of nerves are caused by a
deficiency of the supply of blood.

An opinion very opposite to this has been advanced by some respectable authorities. The pain is said to be of a kind peculiar, to be appropriate to a special derangement of the nervous system, arising for de, or at least antecedently to the other derangements of the part affected with inflammation. The arguments that support this theory are not of a very decisive nature, but leave the discussion of them because the pain is sufficiently explained by referring it to one or two simple reflexial causes.

Part of the pain is no doubt caused by the abnormal preparation of the swelling on the local nerves of sensation. This is amply corroborated by the three following facts: (1) This part acute where the tissues are least expansile, (2) the evacuation of pus relieves it, (3) internal pressure aggravates it. Another, and probably, a more serious cause of pain is the dilatation of the arteries. This will afterwards be shown to be peculiar and due to mechanical causes acting forcibly. Now the possible dilatation of otherwise non-sensitive muscular tubes is a frequent cause of great suffering. Witness the pain of colic, the distress of aneurism, the agony of the return of the blood current into arteries that have been for a time emptied, therefore nearly closed. It has been noted that
that the nonreducible types are the seats of
the greatest pain. But these types are also
the least vascular. And, as in inflammation no
new vesicles are produced, congestion in them implies
a greater stretching of the few vesicles that do exist in
them. This greater stretching explains the greater pain.
In some cases external pressure does not aggravate
the pain; if uniform it sustained it often even alleviates
it. Thus, if you have a blister upon the sole of the
foot or at the ball of the great toe and you reapply
gradually upon the part the pain becomes milder.
But at least it seems entirely removed; but the mo-
ment you take off the pressure and raise the
foot from the ground you feel the part begin to
throb, to throb with violent pain” (Bliss). In
architis or swollen testicle pressure proper managing
does not increase the pain but removes it so that the
patient can get up and walk about the room. And
I have noticed that pressure over the gum above the
fang of a decayed tooth often entirely relieves toothache
when the pressure is intermittent, the pain returns in a
stupendous degree. In these cases there can be little
doubt that the relief of pain is due to the relief
of the tension of the blood upon the vesicles.
Other types are subjected to stretching as well as the arteries
and of course increase the distress more or less. Whether the
the presence of any poison in the blood affects nerve nutrition so as to produce pain I know not. It may be so.

In speaking of inflammatory heat, the local rise in temperature is referred to. It is slight in amount when compared with the impression it produces. There is often however an actual rise of half a dozen degrees in temperature. This is greater in parts naturally cool (nonvascular parts, parts at a distance from the centre) it is due to the great amount of blood brought to the part and to the increase of friction there. The heat around at never exceeds the heat of the blood (at the time) in the heart.

By this term redness is meant the increase of colour above the normal standard of the part. It is the redness of congestion and is obviously due to the increased amount of blood contained in the part. The vessels are all much enlarged especially the fine capillaries consequently contain many more red corpuscles than formerly. As congestion runs into inflammation, the depth of colour is increased by a phenomenon afterwards to the be described namely the stages, and by frequent extravasations of blood among the tissue surrounding the vessels.

The swelling is also at first due to the greater quantity of fluid contained in the vessels of the part. Afterwards the swelling is increased by the type of...
of the part into which an abnormally large quantity of fluid is received. This point will be more particularly dwelt on hereafter.

So much for the more obvious symptoms of inflammation. None of them of itself constitutes inflammation. That mere pain will not constitute inflammation must I think be plain. Spasmodic contraction of the muscles, stretching tension of the tissues, a particular state of the nerves, other conditions which do not imply inflammation, may result "themselves be attended with severe pain." Heat alone "neither implies nor constitutes inflammation, for we of the body may be made naturally hot by placing them before the fire, by friction, by exercise, while there is no inflammation." Neither does redness. Its occurrence may be due to simple extravasation, to scirrhosis, or to many causes unconnected with inflammation. Such too are constantly occurring from many other causes than inflammation.

And these symptoms are not absolutely essential to inflammation. There may be no pain in one case, in another the heat may be trifling, or the redness inappreciable. Even the swelling is occasionally unnoticed. But these are exceptions. In most cases there are all four symptoms present: in the vast majority, there are at least three of
of them observed.

It is probable that constitutional symptoms accompany every case of inflammation. The period of their appearance varies considerably. Sometimes (e.g. in smallpox) they are observed before any local change. At other times (as in typical injuries) the local phenomena are well advanced before the fever is noticed. The symptoms are clear enough. At first the pulse is weak, the extremities and face cold and pale, there is loss of strength and spirits, and rigors frequently come on. Afterwards there may be vomiting, the pulse rises, the skin feels hot, pains are experienced in the head, back, joints, and muscles, nausea ensues with loss of appetite. The symptoms are not always well marked; they may even be overlooked, although some of them (such as increased heat and a rose of the pulse) really exist. The rigors supposed to usher in suppuration are in reality a part of the fever. Its cause is the altered state of the blood acting on the nervous centres. This will be disregarded afterward when the obscure pathology of inflammation comes under consideration. At present it is enough to say that fever is neither a cause nor an essential part of inflammation. It is either bound up with it accidentally or appears as a necessary consequence. In the first case accordingly there are two fevers, the first, the fever of the accident; the
the second the fever of the consequence. Such is the case for example in small pox.

Having now discussed the more obvious facts of inflammation, I must venture a little deeper into my subject. And now for the first time difficulties appear. For, to investigate the etiology & pathology of inflammation thoroughly, the acutest perception the coolest judgment assisted by the most delicate aids to our coarser faculties are insufficient. The inquiry some of the most interesting in medicine. Some of the most important discoveries in our science have been made in the attempt to solve obscure questions. But though a great deal has been done lately to elucidate the subject, and although speculations of a lep theory incorrect observation have been swept away, there is still much unknown and puzzling.

The first practical steps in this investigation were made by John Hunter. His acute mind was chiefly impressed by the state of the vascular system in inflammation and from his observations on the branch of the subject he established certain important facts from which he deduced theories which were current for generations. From Hunter to the modern
Modern schools is merely a step, although a very momentous one. Hunter’s doctrines held sway up to the other day. None of his successors professed the ability or the inclination to question and sift his views.

In considering the manner in which the etiology, pathology, of inflammation are investigated by the modern schools, it must be remembered, that it is now assumed that inflammation is a perverted form of nutrition. The elements involved in healthy nutrition accordingly come under consideration. These are

1. The tissues to be nourished.
2. The fluid that is to nourish them.
3. The vascular system that is to distribute and apply this fluid.
4. The nerves that — but here we must take care lest we fall into some unestablished theory at the outset. Many authors of good standing utterly deny the connection of the nervous system with nutrition. But the mere existence of this system distributed so it is through every part of the economy (without regarding the very important physiological pathological phenomena it displays) forbids our omitting it without disparaging these, then, so far as our present knowledge goes.
goes are the elements concerned in healthy nutrition. But of the prove of nutrition, of the origin, of the mutual relation of the respective action of its elements, in fact of the intimate nature of nutrition we know so little that we are forced to refer nearly every action to "vital force." Inflammation, then, a form of nutrition, must be very incomprehensible to us, as all our ideas of it come to us through a mist caused by our ignorance of its first principles. And it is in reality a very different enquiry which we attempt to solve, namely, who are the causes that produce the difference between ordinary nutrition and inflammation, and when and how do they act? This is a point on which I wish to lay some stress. So long as nutrition is not understood, so long as such conflicting theories are now current, can be held regarding it so long must the intimate nature of inflammation be obscure.

For the maintenance of healthy nutrition, then, healthy blood, vessels, tissues perhaps new are essential. For the creation of the inflammatory process at least one of these elements must become deranged. In them we will now examine the morbid phenomenon & endeavour to trace
their causes. Upon all of these elements special investigations have been made, and upon none so completely as upon the vascular system. According to the latest research, they chiefly consist in observing the effect of the microscope the properties of an artificially induced inflammation in a transparent part of the pharynx, observed as follows:

A frog's web or a bat's wing is securely fixed, and placed in the field of a microscope, and the observer makes out the arteries, capillaries, and veins that beset it. He perceives that in the arteries the current is too rapid to be observed, but in the capillaries and veins the proper of the corpuscles is distinguishable. Having accustomed his eye to the calibre of the vessels to the character of the circulation, he lets fall on the web or wing a drop of some stimulant such as nitrofur of capricum. An immediate alteration is perceived: it is pretty generally admitted that the calibre of the vessels suffers a diminution. Lortet says that he could not measure this exactly, but estimated the contraction at about 2/5 of the original visible diameter. Bennett measured it carefully with a micrometer and found the contraction somewhat less than 1/3. At the same time the velocity of the
PERTURBATIONS

The current is altered, but regarding the extent, even the direction of the alteration there is dispute; some stating that the current becomes quicker, others that the current becomes slower. Now if the blood were propelled through a single rigid tube it must follow from a compulsory physical law that the current would be more rapid if the calibre were diminished. But the blood flows through many channels, and when its course through one is obstructed, it is free to pass through neighbouring tubes. And these being elastic often to admit the new stream but still present a certain and considerable resistance to the flow of an extra current. It is probable therefore a priori that the blood does flow through the contracted tube with a somewhat increased velocity, and usually these writers who have stated this have observed it recorded correctly.

All these observations do not (as it has been imagined) contradict other observations that the current becomes slower in the first stage. For in the one case the irritant has been applied to the capillaries, the larger arteries remaining in status quo.
the second case the irritation has affected the arteries. They became contracted and in them no doubt the current was slightly accelerated, although it is nearly impossible to determine this occurrence in arteries. The current would not, however, (for the reasons above mentioned), be accelerated in proportion to the contraction. Consequently the blood would reach the capillaries from the formerly received and the current would become slower than before. And, when the irritation reached affected them, so they also became contracted, the rapidity would only attain to the normal standard.

This contraction of the vessels soon subsides and is followed by an abnormal dilatation, according to Sebert this amounts to 1/4 of the original diameter. Bennett measured it to be 1/3. Of course it must vary in different cases. At first the current may be quicker or slower than natural, and the difference of opinion on this point may be explained in the manner suggested above. But by the time the dilatation is well established, the flow of blood becomes evidently retarded and so far the phenomena resemble those of congestion. But by degrees the current now becomes much slower, and...
PHENOMENA

VALUE

OBSERVATIONS

The primary stages of inflammation can be identified: 1) an accumulation of fluid in the tissues, 2) a reaction of the tissues to the fluid, and 3) the development of a secondary stage. These stages are a necessary consequence of the primary stage.

The primary stage is characterized by the accumulation of fluid in the tissues. This fluid accumulation is due to the leakage of plasma from the blood vessels. The fluid then collects in the tissues, causing swelling and redness.

The reaction of the tissues to the fluid accumulation is the secondary stage. The tissues respond to the fluid by developing a protective barrier. This barrier is composed of white blood cells, which help to fight off infection and repair the damaged tissue.

The development of the secondary stage is a necessary consequence of the primary stage. Without the accumulation of fluid, there would be no reaction of the tissues. Without the reaction of the tissues, there would be no development of the secondary stage.

In summary, the primary stage of inflammation is characterized by the accumulation of fluid in the tissues. This accumulation is due to the leakage of plasma from the blood vessels. The reaction of the tissues to the fluid accumulation is the secondary stage. This reaction is characterized by the development of a protective barrier composed of white blood cells. The development of the secondary stage is a necessary consequence of the primary stage.
is about the most sensitive thing in nature. Vascular
est is mutable. It varies under every imaginable
change of conditions. It is disturbed by heat, by cold,
by the increased or diminished pressure of the at-
mosphere, by our mental emotions. It changes when
we walk, stand, or lie down; when we eat, or when
we fast; when we are afraid, or when we are confident.
If we but rub the back of our hand the vessels be-
neath suffer a visible change — Certain drugs
appear to affect the vascular system peculiarly.
So do certain lesions. Thus section of the sympathetic is
followed by permanent vascular change of the side
on which the nerve is cut. But all active drugs & all
injuries affect the vascular system sooner or later
so sensitive is it — so wide spread are its connections
with the other systems of the economy. Now
these aberrations are in the vast majority of cases
completely transient & resultless. They subside soon
after the influence that produced them has been
removed without leaving any effect behind. It is
ture that inflammation occasionally follows vascular
perturbation. In these cases however there is always
an addendum to the causes that produce simple
vascular disturbance. Thus heat will produce inflam-
mation but it must be heat so great that we may
Suppose
it capable of effecting a chemical or even physical change in the tissues of the part. The same may be said of excessive cold or of excessive pressure. A wound may be followed by inflammation, but not unless some known poison (such as Vaccinia) be introduced into the blood or some as yet unknown influence be admitted through exposure to the atmosphere.

From these considerations it appears that it may be an unwarranted assumption to call these phenomena in the bat’s wing or frog’s web the first stages of inflammation. They may depend on the topical irritation of the muscular parts of the web, on a reflex nervous process, or on the mere struggles of the imprisoned animal but of themselves they lead to nothing and teach nothing.

These phenomena are succeeded by a permanent dilatation of the webs of the irritated area and this is the second point we are to consider.

We must observe that this is a secondary phenomenon, not necessarily connected with the first vascular perturbation or with the irritation that produced it. It may indeed be the reflex result of the first phenomena, but it may also depend on other causes. It invariably precedes the next stage (that of stasis) and as far as our observations of inflammation in general go it precedes no eac.
companies nearly every case. Its effect is to bring a large quantity of blood into contact with the neighbourhood of the inflamed point, and to facilitate the passage of fluid through the arteries, vascular coats, from their natural thinning. I still afterwards endeavour to show that the dilatation is the result of the presence of an irritant element in the blood or of a stimulation of the tissues.

The stasis of the blood is such a remarkable and at the same time constant phenomenon that it has excited the greatest attention & investigation. Its cause is by no means obvious and the greatest efforts have been made to explain it. These have all failed and we are forced to refer it to "vital force" or to say that it is due to some morbid agent in the vessels, blood or tissues which impairs the relations between them. The effect of the stasis is also not very evident. The stagnation of the blood appears to me to be a curative effort of nature when the supply of fluid is cut off from the overstimulated focus of inflammation, but it certainly does not seem to be always efficacious.

NERVOUS PATHOLOGY

Let us next examine the part taken by the nervous system in inflammation. Now most phy
Physiologists agree that all the vital actions of the body are presided over, if not occasioned by the nervous system, and among them that nutrition is kept in order by nervous influence. If this be true then nervous derangement is one of the possible causes of inflammation. And that is so is the view held by the school of the neuropathology. The theory of Hulse was that the stimulæ acted on the sensitive nerve nerve of the part, reached the spinal nervous centre, was reflected in the vascular nerve and occasioned the paralysis therewith a paralysis of the contractile coat of the vessels. This theory has been since presented in a great variety of forms. All are to the effect that inflammations has its origin in the nervous system. In fact, the irritant is at once absorbed by the nervous system and through it produce the inflammation. But if we select a part which in accordance with all observation is entirely destitute of nerves as for example the surface of an articulation cartilage, we can produce altogether similar effects by means of direct stimulation. In precisely the same way there are not infrequently observed in chronic diseases of cartilage nodular elevations consisting of cartilage cells. Now in articular cartilage no nerves at all are found, the terminal ramifications of these nearest to its are at least situated in the medulla of the bone immediately adjoining and that, perhaps, is separated from the irritated spot of
of the surface by an intact intervening layer of cartilaginous tissue one or two lines in thickness. Now it was indeed to be contrary to all experience to conceive that a nerve could pass from the medulla of the bone and exercise a special action on the cells of the surface of the cartilage which were the seat of irritation, without a simultaneous affection of the cells lying between the nerve and the irritated spot. If we draw a thread through a cartilage so that merely a traumatic irritation is produced we see that all the cells which lie close to the thread become enlarged through an increased absorption of material. The irritation produced by the thread extended only to a certain distance into the cartilage whilst the more remote cells remain altogether unaffected. Such observations cannot be explained otherwise than by assuming that the stimulus acts directly on the part to which it is applied, it is impossible to conclude that the irritation is conducted to the nerve by any channel more in accordance with our pathological views than only by reflex action conveyed back again to the parts.

There are certainly but few tissues in the body which are so completely destitute of nerves as cartilage, but even when we observe what happens in the parts most abundantly supplied with nerves, we
find in every case, that the extent of the irritation or disease more accurately the extent of the irritated area by no means corresponds to the size of any particular nerve territory, but that in its type and in other respects normal the size of the affected area essentially corresponds to that of the local irritation. If we make the experiment with the thread upon the skin, a whole series of nerve territories are interfered by it. Still the whole of the territories belonging to the nerves which lie along the thread are not thrown into the same morbid condition it but the nutritive irritation is limited to the extreme vicinity of the thread. No surgeon expects in persons of the kind that all the nerve-territories traversed by the thread will become diseased in their whole extent. Seat complaints would have to be raised against nature if every tissue, every artery were exercised an irritatory influence beyond the limits of the part with which it is in immediate contact upon the whole extent of the nerve-districts which it passes through. Thus we see in a type in which what takes place in such a case can be very clearly traced namely in the corner that is the part of it to which no nerves extend there are
are certainly nerves which form a reticular arrangement, and leave larger smaller districts of tissue between them altogether devoid of nerves. Now if we apply any stimulus directly to the cornea, as for example, a red-hot needle or lunar caustic to the district which is thinly set into morbid action by no means corresponds to the distribution of any nerve. It once happened that the作者 sighted precisely upon a nervous filament, but the morbid action remained confined to the immediate vicinity of the spot, and by no means spread over the whole district appertaining to the nerve.

Such are the arguments by which Virchow denies the influence of the nervous system upon inflammation. Being consistent, he questions the relation of the nervous system to nutrition itself, and although his language is very obscure, London edition 1869 pp 311, 312, its tendency is to overthrow the pretensions of the nervous system to any part in the involuntary vital acts. But the question is so intricate to be asked in Virchow's off-hand manner. Of course we cannot say that nutrition or secretion is excited by the nervous system, until we saw a nerve terminus dipping into each active absorbing cell we could not affirm so much, & the fact that plants absorb & secrete without the aid of
of nerves also prevents our believing them to be essential to the action. But that they preside over the process in some obscure manner as regulating or co-ordinating it is highly probable. The mere circumstance of their minute distribution from a common centre joined to the reflection that every arrangement in the economy serves some purpose commensurate to the indications by its constructive furnishes strong a priori probability of some such function. Other facts corroborate this probability. To enumerate them would be tedious. I will only select as an example the effects of mental impressions upon certain secreting organs. Thus the mental contemplation of a banquet will produce a profuse flow of saliva, and excessive apprehension of impending misfortune causes an increased secretion of urine. The latter case is familiar to students who have undergone an examination.

These mental impressions can only reach the part affected through the nervous system which must therefore be capable of exerting an influence on these organs. It is accordingly quite conceivable that the nervous system may originate inflammation. That it does so, is in the majority of cases improbable. Inflammation has been produced in parts deprived of active sensory nerves, for example conjunctivitis in a case of destruction of the 5th nerve. In this case no cachexia or other effects...
action was produced. And inflammation has been produced in parts cut off from which the influence of the sympathetic nerve has been cut. On the other hand injuries to nerves do not necessarily produce inflammation. In Lister & Bernard's experiments remarkable vascular disturbances were the result of section of the various nerves experimented on, but no inflammation resulted.

On the whole I believe that there is no warrant for saying that the nervous system takes an active part in inflammation, it would however be going too far to say that this is impossible.

We have next to consider the part taken by the tissues themselves.

A series of observations commenced by Schwann carried out by Sosclair & elaborated by Virchow demonstrate the fact that all the tissues possess certain cellular elements, and that these elements provide for the extension of the life of the part. As early as 1872 Sosclair drew attention to cellular centres existing in "all textures and organs" and destined to draw from the capillary vessels, the materials of nutrition and to distribute them to each organ or texture after its kind. Virchow's "Cellular Pathology" is a filling-up of this
outline. And inflammation according to Virchow is the assumption of an increased quantity of fluid by these cell elements. The cause of inflammation is distention of the cells the result of inflammation is increase of the cells. This view is sufficiently simple. Under the subject of Blood pathology I will consider its value.

Into the vexed question regarding exudation I cannot enter. It is one which strictly speaking comes under the subject of nutrition, not under that of inflammation. Whether we regard the increased transpiration from the vessels as an educt or an exudation whether we consider the neoplasms to be built up by an autogenesis or by a multiplication of the preexisting cellular elements our view of the actual results is unaltered. Analogy seems to be certainly in favour of the cellular theory and the whole scheme as traced by Goethe and Virchow is plausible, harmonious. But the facts do not contradict the real theory and Virchow's arguments against it are weak. He admits to the fact that inflammation is only a form of nutrition. We may then in his argument substitute nutrition for inflammation. Let us see how it reads in one particular case (page 38) if nutrition were necessarily
VIRCHOW'S
ARGUMENT

...depending upon a supply of blood you can well imagine that it would be logically impossible to speak of nutrition in parts which do not stand in an immediate relation to vessels. We could not imagine nutrition taking place at a certain distance from a vessel. It would be completely impossible to speak of nutrition of the cornea (excepting as occurring at its border), of articular cartilage (as particular cartilage) excepting as occurring in the parts immediately adjoining the bone, or of nutrition in the internal substance of a tendon. But if we compare the processes which present themselves in these parts with those which are ordinarily seen in nourished parts, the result is unquestionably that the same nutritive processes may occur everywhere alike and that the processes in the vascular parts can in no essential particular be distinguished from those which take place in the non-vascular ones. This certainly sounds very absurd, but it is no travesty for if nutritive fluids can reach a tissue there is no reason why exudations should not. And in fact Virchow cuts his ground from beneath him when he remarks that cells can be nourished by material derived by

transfusion

The change of this expression is involved in changing inflammation into nutrition.
transmission from a distance as Eudoxus observes. The question as to the vascularity of cartilage cannot now excite much interest, when we know that all the textures are in themselves destitute of blood vessels which are accessory parts arising of nourishment not active agents in its deposition. We do not consider cartilage as a texture into which are blood-vessels pene but only as less vascular than some of the others.

We have now to consider the part taken by the blood in the movement. Beyond all this is by far the most difficult obscure part of the enquiry. Besides the phenomena mentioned under the lec!on vascular system, we have only one clear fact to deal with, although an important one. It greatly increased quantity of fluid passes from the vessels into the lymph. As to soluble albumen in the blood, as to the cause of the effusion, as to the manner in which it passes through the walls, as to the organization of it, we can only guess.

Concerning the condition of the blood, attend to or attendant on inflammation few investigations have been made, although the matter from its importance, must incite considerable interest.
That not least several inflammations certain changes in the constitution of the blood precede the morbid phenomena may be safely assumed. For example in the case of smallpox it is well-nigh certain that a specific poison enters the organism in one way or another reaches the blood. That fluid differs from expurgable though vital change which exhibits itself in the altered relation of the blood to the tissues. If all of them nutrition is impaired, in certain of them the disease action goes the length of inflammation which terminates in a characteristic suppuration. Many other poisons produce an equally alarming and unmistakable effect on the blood. And such being the case in so many important instances, the question is forced upon us: whether a diseased condition of the blood is antecedent to all inflammations? I am inclined to think that a change of the blood by the introduction of some foreign noxious element precedes nearly every case of inflammation. I am aware that it is imper- to prove, difficult even to conceive this to occur in many cases, that other theories such as the neuropathogical are much easier. The blood however is not so closely guarded against the other world as might at first sight appear. Foreign bodies sufficiently attenuated can it with the utmost ease and rapidity through the capillaries.
the alimentary canal, through wounds of the surface, even through the unbroken skin. In toxemia it is therefore highly probable.

But it may be asked, Why then are inflammations local while the cause exists in the blood itself? In the more obvious and severe cases such as plague or pimica there is a tendency to the production of inflammations throughout the entire body. In other cases it is a sufficient reply to say that the blood may be poisoned, and one tissue or region and tolerably healthy, quite the rest of the body. No two parts of the body are exactly alike and each separate centre extracts from the blood a fabricum of its own. It is thus easy for the blood to be rendered injurious to any separate part.

We often notice that certain skin diseases, after attacking one portion of the surface, direct their next invasion to that area of skin which on the opposite side exactly corresponds to the part first diseased. The poison is therefore effective against one tissue and alone or if its venom is unexhausted it only attacks that part of the frame which most nearly approaches to the a repetition of the first first affected. Syphilitic nodes also exhibit similar peculiarities.
has its object as well as its cause. No doubt that the foreign poisonous materials may be ejected from the vital fluid which they infect. It is true that the poison of small-pox introduced into the blood is found thrown out into the protuberances formed on the skin. It is difficult to decide by what means the excretion is effected. The dilatation of the vessels, no doubt, by the extension of surface, r by the attenuation of the partition permits a greater (or perhaps a more indiscriminate) fluid transudation of fluid. The dilatation in purely papular. It must be so in coats composed of the types that the vesicles are, and is either mechanical or a mere symptom of weakness. It is consistent with the foregoing views to assume that the cells of the surrounding tissue while in health attract a moderate amount of fluid from the vesicles, as in inflammation become so irritated by the presence of noxious matter in the blood that they attract a much larger quantity of fluid. The capillaries adapt themselves papingly to the increased action of the types r to the increased influx of fluid.

On the other hand there are certain not a few cases which can be only explained by supposing that the types are primarily initiated. Such for example is o occur when a grain of sand falls on the conjunctiva.
Conjunction. In these cases instead of the condition of the blood being altered quod the tiques the ending of the tiques is altered quod the blood. The result is nearly similar although the duration & extent of the process depend on entirely different data in each case.

Here I must stop. It has been merely my intention (and indeed merely in my power) to offer a few remarks on the salient points of an important but interminable subject. In the course of reading up the subject I had the misfortune of finding that many of my own ideas had been previously printed. Many others, no doubt, that I here put forth as my own are already appropriated. For any such mistakes (for oversight they are) I beg to apologize to here beforehand.

[Signature: James P. Torrof]