Illustrations of Disturbed Balance of the circulation.

by James Capie.
It was our intention to have noticed the various forms of disturbed balance of the circulation, but our time has only permitted us to illustrate the principle involved in the phrase 'the stimulus the affluent.'
Belief in the stability of the order
of Nature being a fundamental principle in human
reasoning, and as the mind cannot conceive of any
change occurring in the external world without com-
promise, every phenomenon—whether a knowledge of it
has been arrived at by direct observation or by a pro-
cess of reasoning—immediately excites the idea of combination
and is looked upon as the result of the combined operation
of various antecedents. In endeavouring to account for
its occurrence, it is our object to discover those antecedents
to become acquainted with all the material agents
concerned in its production, to ascertain the condition
in which each individually existed at the moment
of its occurrence, and the circumstances in which
they were placed relatively to one another. As this
combination of circumstances is observed to be in-
variably followed by the same result, it is consid-
ted to stand in relation to the phenomenon as cause. The
possession of properties is ascribed to the agents—the
exercise of their producing a force which is the immediate cause of the phenomenon, and the circumstances we discover are the occasion of the exercise of this force.

In endeavouring to analyse every phenomenon which comes under its cognisance the mind may be said to have two different objects in view: Man holds certain relations to all the rest of nature, and in some of these he experiences feelings of pleasure and comfort, in others of pain and uneasiness - and as he desires to enjoy the one mode of existence and to avoid the other, the source from which in either case the particular feeling arises becomes an important object of knowledge. From the constitution of his mind the more prominent of the relations of material agents to one another and of the modes in which certain phenomena affects himself, with the means by which their influence may be enjoyed or avoided, are easily recognised. The occurrence of many phenomena, however, appear, on a superficial observation, to be extremely mysterious: as if either the material agents themselves were endowed with consciousness or were immediately guided by the will of some reasoning power. Attentive observation, however, leads him to perceive the invariableness with which certain combinations are followed by
the same result, and to believe not only that every change in nature must have been preceded by other changes operating as causes, whether these are evident or not, but that the instruments concerned in it have in themselves powers efficient to the production of observed changes, and that these powers will always be exercised in the same circumstances.

By becoming acquainted with the nature of the agents employed in the production of natural phenomena, their relations to one another, and the succession with which the changes in any case occur, he is able to interfere, and break or modify this succession, and so avert consequences which he dreads; or he can arrange the elements around him in new combinations, and obtain results fitted to promote the interests of himself and of society. When he listens to the roll of thunder, or observes the oak driven asunder by unseen agency, his belief in the operation of agents, acting to infallible laws, is as strong as when he observes the fly-wheel of the steam-engine revolve with force almost irresistible in consequence of antecedents arranged and combined by his own ingenuity; and by persevering in his observation of facts, and testing the truth of his suggestions by experiment, he is at last enabled to discern the thunder-bolt of its terrors, and to direct the harmlep
course of the electric influence to the earth. By still further playing, as it were, with the same power, and studying in various ways its relations to substances around
him, he is at last enabled to produce certain combinations by which his thoughts may be communicated to almost any distance with the rapidity of lightning.

But, once called into activity, the mind experiences the greatest pleasure in exercising its own powers and in hopefully striving against difficulties which oppose the attainment of some object. In preference to,
and even at the sacrifice of physical comfort, the yearnings of this restless activity of mind must be satisfied. As one of the fittest fields, therefore, for the exercise of its highest powers, it formulates nature in all her aspects, determines her various modes of existing and operating — and discovers the laws according to which phenomena occur. In addition to that derived from mere activity, there is pleasure in the consciousness that the faculties exercised form the distinguishing feature of the human intellect, and that the solution of problems afforded appropriate by the objects on which their energies are directed, constitutes its highest triumph.

Is it not noble, spirit-stirring, sweet,
To woo immortal nature in her pride?
To gaze into her deep-eyed countenance,
And gave against to give her secret out?
To be proposed, and to propose her too.
The bride of genius, and the child of God?

In giving expression to what it conceives to be
the laws of nature the mind affirms general facts. While
in many cases it is unable to go further, cannot be able to account
in any way for these, as in the laws of gravitation, in others
it calls to aid the illustrations of analogy. And, in order to
explain more clearly how known combinations produce
observed results, it conceives of modes of existing and
operating for the truth of which it has principally the
satisfactoriness with which its difficulties are thereby
solved. Thus to account for the known laws of chemical
action it conceives matter to be made up of mechanically
indivisible atoms, and supposes that chemical combination
results from the union of one or more atoms of one
element, with one or more of another. Though the ex-
istence of these atoms is in the first place a matter of conjecture,
their admission is so consistent with all observed facts,
and serves so well to account for these — their explanation
is brought so much more nearly to resemble that of those
which result from the attractive influence of gravitation
that their absolute existence is strongly insisted on, and the
“laws and the states” of the atoms serve to account for a very num-
eroso important class of changes in the material world.
As in the study of phenomena belonging to the sciences of Physics and Chemistry, so is it with those presented in Physiology. The idea of life is received by action, and in the investigation of these actions it is our object to discover the nature of the instruments employed in their production, and the conditions under which they operate.

The instruments are found to be in themselves very complex, and to consist of a great number of structures varying considerably in their physical aspect and properties, and chemical constitution. So that the part which each structure performs must be made the subject of separate investigation, with the manner in which the whole co-operate in effecting the result. Some of the structures are more immediately concerned in the production of those phenomena which are considered characteristic of the individual or of the organ; others in facilitating the operation of these—removing obstacles, or otherwise supplying conditions necessary to their action.

Every organ may be studied as a distinct individual—as possessed of inherent powers which are capable of being called into active exercise under the exciting influence of certain conditions. But when its action is looked at in connection with that
of others as one of the succession of phenomena presented
during the life of an individual, every organ and
structure must be considered as depending upon the
operation of others for conditions of the development and
exercise of its powers, and in its turn affecting the
action of others.

While health continues a circle of phenomena
is thus carried on and in the utmost harmony in the
animal system — the life of the individual depending
on the life of its component organs; the powers of the
latter, again, depending on their own constitution, the
preservation and exercise of which results from a
proper relation to other structures and functions.

As a field for exercising and testing the
highest powers of the intellect, physiology yields to
nothing — and indeed in its widest study may be said
to comprehend all the others. The earth may then be
looked at in its planetary relations, in the equilibrium
of forces and circulation of fluids upon its surface,
as furnishing conditions essential to the very existence
of life, as well as the adaptation of any structure
to the office it performs, or the manner in which any
function contributes to maintain the general harmony
of the entire individual —

In determining the conditions most
suitable for preserving the healthy constitution of the system, or when its harmony is disturbed, and suffering or inconvenience, or danger to life occasioned, in pointing out the seat, ascertaining the nature and cause of the arrangement from observed symptoms, and a knowledge being possessed of the manner in which the functions are affected by certain substances of nature, in indicating the remedy to be employed in removing the local affection, or state of the system, or in alleviating urgent symptoms. The importance of an intimate acquaintance with the principles of physiology cannot be estimated.

A condition essential to the sustained exercise of function common to all the textures, is the continued circulation through them of a due amount of healthy blood. Every texture in order to advance a step in its development, or to exercise its properties in producing a palpable result, must become changed in its chemical constitution—in the number, disposition, or nature of its component particles. If the animal or organ has arrived at its full development, as the former composition of the texture was one of the essential sources of its power, either the function of the part must become altered, or the particle so altered must be removed, and the integrity of the texture preserved by the substitution of others capable
of going through the same changes and producing the same result.

Means are provided for effecting the latter object, and the blood is the principal agent concerned in the process—being the vehicle by which the elements of nutrition are conveyed to the tissues, and by which many of their effects, matters are removed. When the blood which has been sent from the heart has arrived at the capillaries, a fluid containing all the elements necessary for sustaining the development of the constituent particles of the tissue, passes out of the vessels into close proximity with them. From this fluid every cell-germ selects and incorporates certain elements, and in its growth and decay considerably alters its constitution. When it again enters the vessels and is substituted by another supply.

If the conditions in which any organ is placed were always uniform, and the nutrition and waste of its textures were nicely balanced, the same circle of changes might recur in it for an indefinite period. And consequently the same amount of blood would be required by it. Thus, if the heart had always the same amount of blood to propel, and experienced the same degree of
Resistance in the exercise of its function—its own supply being of a healthy constitution—the quantity of blood required by it would be uniformly the same and except some foreign influence interfered to alter the nutrition of its textures, their structure as well as functional power might be preserved for an indefinite period.

The functional activity however being greater or less according to the intensity of proper stimuli, its degree greatly influences the circulation through it. "When there is any excitement to the processes of secretion, nutrition &c. a determination of blood towards that part quickly takes place and the motion of blood through is increased in rapidity." The final cause of this principle is readily recognised, but the question as to its immediate cause has been a subject of much discussion among physiologists—some maintaining that "determination of blood is caused by enlargement of the arteries, and this enlargement is the effect of the pressure of the arterial distension from behind, acting on a tube which has lost some of its contractile power." Others insisting on the importance of an influence of exerted at the capillaries, of which the determination of blood is the result & not the cause. Adopting
In the latter view we will in order to illustrate it examine how the ordinary changes of nutrition proceed into the circulation through the capillaries.

In the nutrition of a texture there are three phenomena, each of which may be made the subject of independent consideration.

1st. The movement of blood in the vessels in consequence of the action of the heart. A force being exerted by that organ sufficient, it is said, to propel it through the capillaries and veins back again to the heart.

2nd. The changes taking place in the ultimate structure of the texture.

3rd. The Excrinosis and Endocrinosis of fluid between the capillaries and intervascular spaces.

As the agency of the heart "must have the same general ratio to each part of the body whatever the changes occurring in its own rate or region of action" it may be entirely left out of view in connection with our subject.

Looking first at the changes occurring in the ultimate structure of the organ it is to be remembered that the power of each of its component particles are inherent - that every cell tends in
favourable circumstances to produce a certain result, and, so far as its own growth is concerned—certain conditions as to temperature being also fulfilled—the presence of a fluid capable of yielding it its elements of nutrition is all that is required. We have been shown that immediate conditions are fulfilled by the walls of the capillaries allowing such a fluid to traverse through them—and to bathe the ultimate particles of the texture.

The growth and dissolution of the cells considerably alter the constitution of this fluid, causing its elements to enter into new combinations. Circumstances are thus occasioned altogether unsuitable for the development of their offspring, which with a constitution similar to that of their parents, would be unable to separate the elements necessary for their growth. It is therefore necessary to provide means by which a fluid similar in constitution to the blastema which fostered the parent cells may be supplied.

We have now to consider the relation of the fluids within and external to the capillaries—the former charged with oxygen and alluminous compounds, the latter loaded with carbonic acid and other products of decay—Being
miscible and separated from one another by an organic membrane, the laws of Endocytosis must come into play and an interchange of fluids take place—then within the capillaries passing through their walls into the inter-vascular spaces, whilst the fluid in the latter passes inwards into the vessels.

Of the fluid within the capillaries was of the same constitution in both directions from a point at which conditions were present suitable for the occurrence of this phenomenon. Currents would tend to flow towards that point from either side. The products of decay passing in opposite directions—In the tissues however it is only in one direction that we have a fluid capable of serving the purposes of the parenchyme. And before speculating on how such a combination of circumstances can influence the motion of blood through a texture we may refer for illustration to certain facts in physics which present continuous analogy.

"When two different liquids are brought in contact in a porous solid which is wetted by both, but by them unequally, that one which has the greatest affinity for the solid, or whose wets it most perfectly, will pass most rapidly..."
* Draper
through it, and may even drive the other entirely before it." *

The relations of the textures to arterial and venous blood are in some respects very similar to those existing between the porous solid and these two fluids—supposing arterial blood to be contained in a capillary we have seen how it may rapidly assume a venous character in consequence of the impulse by which every particle of the texture tends individually to produce some certain result. It alters the constitution of the fluid surrounding it, and as long as this change continues to be effected, will the interchange of fluids take place. The introduction however into the intravascular space of elements fitted to sustain the action of the texture, takes place more readily and in greater quantity at one point, or in one direction, than in any other. The degree of attraction exerted in that direction must be greater consequently, and possibly actual repulsion is occasioned in the opposite. The fluid at the former point is enabled to drive the venous blood onwards before it—free interchange is allowed to take place, and the texture is enabled to sustain unimpaired its impulse.
In those cases where a force less than that exercised by the heart causes disturbed blood to circulate through a portion of the animal body, would the perfusion anywhere with the perfusion needle have caused it to stop as it does naturally?
towards a further state of development.

We thus see how the component pheno-
mona of nutrition apart, and are mutually
dependent on one another. That the force of
the heart is sufficient to propel the blood through
all the capillaries of the system we think extremely
improbable. And must regard some supplementary
force to be exerted at the Capillaries. There ex-
ternal to the vessel we find cells surrounded
by a nutritive blastema. In consequence of
the changes effected on the latter it would for
present a poisonous relation to the structures.
but its removal and the introduction of a fluid
more fitted to sustain the changes which the
texture tends to undergo. are made mutually
to subsist one another. The presence of the
latter stimulates the texture to further development,
and the changes consequent on this alters the relation
between the fluids and fluids—the degree of at-
traction between them being lessened, if not
actual repulsion occasioned. As the fluid
immediately behind what is in contact with the
solid possesses a superior attraction for the latter
it is enabled to displace the other, and propel
it onwards. And is in its turn supplanted in
a similar manner—

If these principles be correct it does not seem difficult to account for alteration in the relative distribution of blood in consequence of the greater or less activity of function. The result obtained in consequence of this activity will be made evident in the state of the textures themselves, in the amount of their secretion or otherwise, implies increased activity on the part of the individual particles, and consequently increased rapidity in their growth and decay.

We cannot prove whether the stimulus exciting this activity is exerted first on the capillaries or on the veins. It may probably be in some cases it is on one, in some on the other, but it is evident that simple dilatation of the former, although permitting the ingress of an increased quantity of blood, would cause a corresponding blowett in the current through them. So that to account for the increased rapidity of the current, as well as increased quantity of the fluid, it is necessary to take into consideration the influence of the changes occasioned in the texture—

The free circulation of blood through a part being favoured or occasioned
by the changes taking place in ordinary secretion it is but natural to suppose that when these take place with increased rapidity, or an entirely new action, such as that of secretion is set up, they will promote the facility or increase the force with which that fluid passes along the capillaries.

Granting that the exercise of a force, however small it is occasioned in such circumstances, we have then to take into consideration the immense number of points at which it is exerted. As we are able to observe the capillary circulation during life, it is only in parts where the changes of nutrition take place with comparative slowness; but even here, as in the web of the frog's foot, observation with the microscope can detect alterations in the amount of blood in the same capillaries. "It may be observed that a single capillary will sometimes enlarge or contract without any apparent cause." Whilst in other times may be "great and sudden alterations in the velocity of the current." In secreting surfaces, and in parenchymatos organs generally, the capillaries are much more minutely distributed, and the nutritive changes take place with inconceivable rapidity. Alterations in the amount
of blood. And in the rapidity of its circulation in these vessels will therefore occur more readily and
to a greater extent, and the combined operation of a great number must exert considerable influence over the distribution of the blood.

To supply the demand which is set up in the capillaries, the excitement, if it may be termed, extends backwards into the arteries,
the current through them being more rapid, the pressure exerted against their walls becomes greater, and causes their calibre to be increased.

We have thus at least one mode in which dilatation of the arteries may be occasioned without the intervening agency of the nervous system. Not need we suppose that they have lost any of their contractile power. It is not denied, however, that the agency of the nerves may have an important influence in regulating the supply of blood, but the manner in which it operates is not very obvious. The increased activity of the changes can scarcely fail to affect in some manner the nerves of the sympathetic system distributed in the textures. In irritation or impression will in consequence of the intercommunal nature of their function be transmitted to the
ganglia with which they are connected, and an influence may then be generated which when transmitted along other organic fibres distributed on the vessels will affect their calibre. To suppose however that this would cause their dilatation is at variance with our ideas respecting the action of the nerves on contractile tissues. It will rather tend to check their too great distention and perhaps in combination with the increased pressure occasion the throbbing of the arteries.

We may now allude to a few phenomena which are illustrated by the principles we have laid down.

Inflammation

The process of inflammation affords one of the most obvious illustrations of our subject. The greatly increased vascularity of a part being in many cases one of the most common signs of its presence, and this being an "increase not only in the quantity of blood in the small vessels of the part affected, but of the quantity transmitted through them in a given time."

Our knowledge of the nature of the changes which occur in normal nutrition is too
limited to allow us speculating for on the
modification of these which takes place in infla-
mation. The characteristic result of this process
is said to be the expansion of liquida sanguinis
from the vessels. If the opinion be correct, how-
ever, that "inflammation is dependent on the existence of
albumen rather than of fibrine in a blastema,
and that the latter constituent is more connected
with the decreasing than with the formative state
of life," we may be allowed to question how far
the plasma present in the intervascular spaces or
on lesionous,arious, or granulating surfaces is to be
considered as an indication at all. Does the
fibrine as well as the albumen pass outwards
through the walls of the capillaries? During an
inflammation its quantity in the blood becomes
greatly increased, and if it is just of all obtained by absorption from the tissues, it seems extremely
improbable that it should be exuded from the
vessels at the same place, or afterwards ab-
 sorbed in the same form.

By looking at the whole process from
a different point of view, as we have indicated to do in the following brief statement,
the explanation of many of the phenomena
Accompanying and consequent on inflammation may probably be rendered more simple.

Applying the principles we have already endeavoured to illustrate, we must, in order to account for the increased velocity and increased transmission of blood in the vessels, infer that the nutritive changes, whether or not abnormal in kind, take place with greater rapidity than natural. The quantity of fibrine formed in the intervascular spaces is thereby increased, but its absorption is not equally rapid. The increase in its proportion again interferes with the nutritive changes, causing them to take place more slowly, and the motion of blood is consequently rendered less rapid. As the tendency to the intervascular change of fluids between the vessels and intervascular spaces becomes less, their attraction of coagulation becomes greater, and this is at last too powerful for the action of the heart to overcome, so that stagnation and then coagulation of the fluids ensues.
Hunger.

As it has been endeavoured to infer.
The proximate cause of this sensation to some condition of the capillary circulation, we may endeavour to discover a priori what this condition is likely to be in the state of system in which the sensation of hunger is occasioned.

The stomach being an organ whose functional activity (which includes a variety of processes) is only excited by physical stimuli directly applied to itself—by the introduction of alimentary or other materials into its cavity—and as the duration of the stimulus is only temporary—by the introduction of alimentary or other materials into its cavity—and as the duration of the stimulus is only temporary—it is obvious that this organ must present considerable variations in regard to the amount of blood circulating through it. When the food which has been submitted to its action has passed the pyloric orifice, and the muscular movements and the secretion of gastric fluid are in consequence suspended, a considerable drain upon the blood will have ceased, and an immediate decrease in the amount of that fluid sent to the stomach will take place. The stimulus given to the nutritive process, and the increase in the total amount of blood in the system from assimilation of the
Aliment may cause the amount to be greater for some time than it was previously to the introduction of the food. But after a while both of these causes cease to operate and the stomach becomes as it were a superfluities organ in the system—taking no part in the performance of any action which now immediately concerns the life of the individual. We may suppose that in the meantime many of the muscles and various portions of the nervous system are vigorously exercised in their respective functions. A necessary result of this activity is the disintegration of the tissues and the supply of materials for their regeneration. The continued circulation through them of a nice amount of blood is required. But by exercising the effects matters with which it has become loaded, the total amount of blood in the system has become diminished, so that it is impossible that every organ can continue to receive its usual quantity. If a supply is not afforded by the introduction and assimilation of food a change in the relative distribution of blood must take place. And while those organs whose functional activity is sustained receive nearly the usual amount of it, those part
where the stimulus for its presence is least will receive a proportionally smaller quantity. The stomach as long as it remains empty evidently belongs to the latter class. As soon as its activity exceeds the amount of blood sent to it becomes diminished, and this quantity we believe will continually become less until its function is again excited by the introduction of food.

May not the proximate cause of the sensation of hunger be the anemic condition of the stomach produced in this manner? When the amount of blood has been reduced to a certain extent, may not the nerves, probably from some alteration in their nutrition, be affected as to give rise to that peculiar feeling which in the healthy state is "a true index not only of the state of the stomach but of the immediate wants of the system at large?"

The proximate cause has been referred to precisely the opposite condition, namely to "determination of blood to the organ".* And this seems to be the view held by Dr. Carpenter. In addition however to what we have already stated in order to prove that the opposite state of the circulation exists—

* Viz. a forte
exercised by the liver will also have considerable influence in preventing the accumulation of blood in the capillaries of the stomach.

If our explanation be admitted it is obvious how the introduction of imnutritious materials into the stomach may act in allaying the sensation as by calling that organ into action they occasion the determination of blood towards it, and so remove what we have supposed to be the cause. We will notice the manner in which mental emotion may act in dispelling its cravings. When we speak of disturbed balance of the circulation through the brain.

A similar mode of reasoning may be employed in endeavouring to discover how that condition on which the sensation of thirst depends is occasioned.

This feeling depends upon a dry condition of the mucous membrane of the mouth and fauces. Which, again, is caused by deficiency in the proportion of water in the blood. And is experienced in the greatest intensity when the function, exhalation and evaporation of the animal fluids is most active. Taking, for example the condition of the body when exposed to
a high temperature, the skin is stimulated to separate a greater than usual quantity of the water element of the blood, by the evaporation of which the temperature of the body is prevented from rising above the natural standard.

Supposing, as before, that no fluid is introduced from without, the proportion of water in the blood must continue to diminish, and the difficulty of separating it will consequently be increased. If any organ is enabled to separate its usual or more than its usual relative quantity, the circumstances in which it is placed must be rendered proportionately more favourable for the separation of water.

It is natural to suppose that when this condition of the blood has been occasioned, those parts which are usually moist without the presence of any strong stimuli will be the first to suffer, and this seems to be precisely the case with the mucous membrane of the mouth and fauces. The conditions necessary for the separation of water are not rendered more favourable there in proportion to the decrease of its amount in the blood. So that even when it is moistened from without the fluid quickly enters the vessels.
and serves the purposes of other parts. From the position and extremely sensitive nature of the surface, not only is their physical condition easily recognized, but the sensation occasioned is even more intolerable than that of hunger.

Disturbed Balance through the Nervous Centres.

The causes and results of disturbed balance of the circulation through the nervous centres presents an extremely interesting and important field of investigation, at which we can at present only glance. The principles regulating the circulation there must play an important part in many phenomena presented by the nervous system — whether spinal centres, spinal or cerebral. When any reflex action fails to be performed on the application of the usual stimulus, either some change must have taken place in the nervous centres affecting the conditions under which it was accustomed to act, or increased obstruction must be prevented to the instruments employed in its production. The suspension of the respiratory movements...
When the attention is intensely directed on any object as in attempting to distinguish faint sounds. plans to afford an illustration of the latter mode. slight attention may show that in such circumstances a great number of muscles, including those concerned in the movements of Respiration, are thrown into a state of tonic contraction. implying increased action on some part of the nervous centre. The body assumes a particular posture which is rigidly preserved. When it is in an easy position it is extremely difficult if not impossible to impress the mind so far on any object as to cause the respiratory movements to be suspended. One of the final causes of this suspension may lie in that a check is thus instinctively placed on some of the causes which might interfere with that uniformity in the supply of blood which must be so essential in distinguishing and having印象 on the memory. faint impressions.

When the action fails to be performed in consequence of some condition under which the nervous centre was accustomed to act. not being fulfilled—deficient vascular supply from affections of other parts causing
* Bennet -
A derivation of blood from it is probably one of the most important.

The influence of this cause is most evident in actions which are Encephalite: "The brain in a state of health entirely fills an unyielding case of bone by means of which all atmospheric pressure, or any other disturbing cause is prevented except such as is communicated through the bloodvessels which enter it." The total amount of blood circulating through it therefore cannot be materially altered, although its current may be more or less rapid.

But as the Encephalon is subservient to a great variety of actions which are distributed among different portions of its mass, the amount of blood circulating through these must be liable to considerable variation. In the nervous as in all the other textures the conditions of active circulation must be to a great extent, if not altogether dependent, upon the performance of the nutritive changes, and be excited by its functional activity. Then an impression is perceived from a sensitive nerve, when an emotion is excited, an intellectual effort sustained, or volition exercised. The
motion of blood through the capillaries of the part affected or subventient to the operation. Must be increased. To supply the demand thus occasioned. The excitement extends backwards into the minute arteries. And then dilatation being occasioned, an increase in the total amount of blood in the part takes place. Pressure is consequently exerted on the surrounding nervous substance, which will be in proportion to the intensity with which the function of the part is excited, and the extent of the nervous texture involved in it.

The influence of this pressure on other parts will vary in different cases. If exerted on a part whose circulation is already excited in consequence of activity of function it will have a depressing effect on the action and circulation there. In other cases it will "produce excitement of the part followed by an increased or augmented action."

It is well known how the intensity of a sensation is increased by the attention being strongly directed towards it. One reason of this may be that the part where the impression is received is in such circumstances placed
in the condition most favourable for receiving a full supply of blood.

Again, its intensity is diminished or a sensation is not at all recognized when the mind is earnestly engaged on some other object. When an emotion is strongly excited or when some other sensation "overpowers" it. Thus the sensation of hunger is not recognized when the mind is actively employed, and its keenest cravings are dispelled by strong excitement of the feelings. This cannot be simply a mental phenomenon, resulting from the law that the mind can attend to only one object at a time, but the derivation of blood from the part receiving the impression, and perhaps pressure exerted on the tissue must have an important influence in causing the intensity of the impression to be actually less.

When a sensation is of such intensity as to cause acute pain, momentary relief is obtained in giving expression to loud cries or in showing various parts of the body into convulsive action. As these are in many cases instinctive and performed in spite of strong efforts of the will to control them, they may probably be in consequence of the law
that "moderate or partial pressure on any portion of the nervous system more immediately connected with motion, sensibility, and intelligence, produces excitement of that part, followed by an increased or augmented action."* The same being occasioned in the manner we have already stated - The final cause of the actions is also easily perceived in the derivation of blood they occasion from the part and as before this rendering the sensation less acute.

The application of these principles in various other laws of the nervous system, and in many pathological phenomena presented by it - especially in spasmodic diseases and also in mental disorders - presents a tempting field for speculation - Our time however prevents us from entering at all upon it, and we must conclude our essay with the following crude remarks on Blushing.

It is laid down as a law of mind that its attention cannot be directed at one and the same moment to two distinct objects. Every sensation, every voluntary action, and every act of thought must engage the mind for a certain time, to the exclusion of
others. Although that time may be inconceivably short. In the mental condition of the individual in whom blushing is occasioned there are several points on which individually there is so strong a tendency to give the attention that not only is the voluntary power of directing it for the moment lost, but the new train in which it tends to be directed is very imperfectly followed.

This condition may be produced in various ways. Thus we may be placed in circumstances in which our actions are the subject of attention and criticism, and through them an opinion formed as to our character and abilities. The actions themselves may be judged of as right or wrong, or the motives prompting them performance as base or generous. The means employed as well as ill-adapted for accomplishing the end in view. And the degree of skill exhibited in the use of these means as creditable or not. The mere knowledge of being placed in such circumstances or even the suspicion of it is sometimes sufficient to distract the mind as to prevent it from concentrating itself on subjects towards which the will would direct it. It tends to reflect on the effect likely to be produced by the
actions on the minds of others. On how the opinion respecting one's character or abilities will be affected by them. Thus when an individual is detected in the commission of some action, the discovery of which he dreaded and to which he had appointed the idea of disgrace—there will be an immediate and strong tendency to dwell upon the results likely to ensue from the discovery, as that his character will be here returned or himself exposed to ridicule. But on the other hand there is a strong effort to counteract this tendency to collect his ideas, and keep their direction under the control of the Will. In proportion as this struggle is equally balanced will be the degree of “confusion of face” occasioned. While the predominance of the thoughts in one direction will prevent the phenomenon from occurring. If the consequences are of great importance to the individual they may be vividly presented to his mind, and even painting of the countenance he produced over will it occur if he can altogether control these tendencies and assume an air of indifference.

In every other case in which the phenomenon is presented we think that an analysis of the mental condition will invariably
show that there is a momentary struggle in it as to which of two points to turn to - antipodes mutually exciting between voluntary effort on the one hand and involuntary tendency on the other.

The manner in which the mental emotion causes blushing is very obscure, but still we do not think it necessary to refer it entirely to an influence exerted by the nerves on the caliber of the capillaries, there being also, we believe, increased pressure on the blood through the vessels.

Remembering what has been said on the conditions of active circulation through the nervous centres, and though as phrenologist - believing that the circulation through the cerebrum will be modified according to the nature of the mental operation, it is evident that this will be disturbed in the first place. The interruption to one train of thought causes the blood circulating in that portion of the cerebrum subservient to the mental operation to become less in quantity, and as the tendency to be directed in another direction has been ineffectual, the blood is thrown backwards towards the heart. If the same amount of blood is sent along the carotids it meets with obstruction in its progress - it is not transmitted through the nervous substance
with the same degree of rapidity. And if any channel presents itself by which the superfluous blood can force its way, it will immediately be directed through it.

Several objections prevent us from referring the phenomenon of blushing entirely to these circumstances. Thus when a ligature is applied to the principal artery of a limb, we have seen such dilatation of the skin supplied by the arteries above the ligature as is observed in the face in blushing. And further, at least from the manner in which we have stated the succession of phenomena: it might be expected to occur when there was a voluntary elevation of some mental effort.

Granting however that a dilatation in the contractile force of the capillaries is in some way affected, we seem to have in the manner in which the circulation through the brain is affected by the mental condition: at least one of the sources from which the blood directed to the face is derived.

James Cepíe