PROVINCIAL MEDICAL & SURGICAL JOURNAL.

No. 33. Vol. II.] LONDON, SATURDAY, MAY 15, 1841.

PRICE SIXPENCE.
[STAMPED EDITION SEVENPENCE.]

COURSE

OF

LECTURES ON PHYSIOLOGY AND SURGERY,

DELIVERED AT ST. GEORGE'S HOSPITAL,

BY JOHN HUNTER, F.R.S.

(From the Manuscripts of Dr. Thomas Shute and Mr. Henry Rumsey.)

LECTURE III.

ON THE BLOOD.

GENTLEMEN,—Animal matter exists in two states, the solid and fluid. Out of the latter is the animal body formed, and by it is supported. Unless the blood were, fluid it would be unfit for these purposes. Blood has been hitherto considered as a passive inanimate fluid. Some have considered the spontaneous changes which it undergoes when out of the body—its chemical properties, and the figure of its parts when seen under the microscope. These inquiries are proper enough in their way, but they can never explain its living principle.

Before, however, I explain my opinion of the blood, it may not be improper first to state some facts, from which I may draw conclusions.

I have first endeavoured to show that animal matter differs from common matter in many circumstances; that this animal matter had a principle peculiar to itself, which I call life, and this life is the second step, or process of common matter, viz. animalization the first, vivification the second. And to prove this, I observed that an animal increased and supported by many substances, which at that time have not the properties of animal matter, of course have not the principle called animal life. I observed, too, that it could be supported by substances which were animal matter, but such as have then not the living principle; or, in other words, an animal can be increased or supported on vegetable and dead animal matter. In the next place, it is observed that these substances, before they can increase or support the animal, become first animal matter. And in the fourth place, that the substances should be so prepared, or animalized, as that they do become part of the body, of course are then endued with the living principle. It is now necessary to trace these changes in the food, till it becomes part of our solids, and observe, as we go along, where it is most probable that life begins.

Blood is not simply a fluid animal matter, it is animal matter particularly arranged, for it differs in every respect from fluid animal matter produced by art.

In vegetable, the first change that takes place before it is rendered blood, is its conversion into animal matter. This change I call animalization. In animal matter it might be supposed that no change was necessary to produce animalization;

but we find this change, whatever it may be, is the same in both, and the process in both is probably similar, for the produce from the digestion of animal matter is as different from common animal matter as anything can be. Were it not so, animal substances rendered fluid by chemical operations, as jellies, broths, &c., would be the same as blood, or answer the same purpose. But the necessity for a total and similar change in animal and vegetable matter from the digestion is evident, because life is to arise out of this change; and it is the first step towards the preparation of the food for vivification. Yet it may be supposed in digestion, the first step with vegetables was simply animalizing them, afterwards making them go through the next change with animal matter, viz. chylification. But this would be supposing digestion and chylification two different operations, which we cannot allow, for it would be supposing two different principles going on in the stomach at the same time, which I should very much doubt.

The second process is vivification, which must take place somewhere, before the blood becomes an active part of the machine. We shall first premise that animalization may take place without vivification; how far this is the case is not easily determined: however, we may say with certainty, that vivification cannot be prior to animalization. Let us first trace animalization of this matter.

Animalization begins in the stomach, and in common language is called digestion, the immediate produce of which is called chyle. These substances animalized into chyle are either vivified in this first operation, or they receive this process afterwards. We have in the whole three changes in the matter, which nourishes our body before it actually becomes part of ourselves.

1. The change of the food to chyle.
2. The change from chyle to common blood.
3. From common blood to the solids of our body.

In the change of food to chyle, we do not see why it may not have received the living principle; for this is such a change as renders blood capable of becoming alive. Yet it may be supposed that this process was reserved for the lungs, where the chyle comes so much in contact with the external air. This air may be imagined to act on it like that on an egg, as moisture and warmth on the seeds of vegetables, giving a power of growth to their particles. But in that case they do not give the principle of life, they only give life its action; that applied to a seed does not give life, it only gives parts their actions.

Blood may still be supposed not to become alive till it be made into a solid, when it becomes part of our body, therefore loses the property of blood, and then its life is indisputable.

The living principle I am apt to believe takes place sooner, which I imagine will appear in the investigations of the properties of the blood, with the many phenomena that attend it in the living body.

I have already observed, that the organization of animal matter was not necessary for life, only for its actions; therefore, fluidity is no objection to the blood being alive. My reasons for supposing the blood to be alive in a fluid state are the following:—

1. It may be observed, that it appears to carry life to every part of the body, for whenever a part or the whole is deprived of fresh blood, it very soon dies. This blood, however, must be such that has undergone some change in the lungs; for if the blood did not undergo this change, it would most probably soon die, therefore would not be capable of keeping up the living power in the other parts. This effect arising from the want of fresh blood being sent to parts is so evident, that it needs no illustration. I may therefore conclude, that it is the only cause and support of life; the nerves having no other part but to produce some of the actions, not life itself, for the nerves themselves die without this living support.

2. We may observe, that while circulating or in useful motion, it is always found in a fluid state. Hence, I think I may be allowed to say, as it is never found in a solid form in the cavity of the blood-vessels, that it has not then the least tendency to become solid,—that such a state is contrary to its nature. This must arise from some principle which is probably in both the blood and vessel. This want of disposition to coagulate while moving in the living vessels, does not arise from the motion; for in many places where the motion is extremely slow, the blood remains fluid. We have instances in this in the veins of the leg, where the crural artery has been tied up, in which case the blood only moves through a few small collateral branches below, and back by the larger veins. Now a small quantity of blood being sent into these larger vessels, must render the motion in them next to stagnation. But while in the living vessels there is any degree of motion, the irritation of imperfection is not given, there is consciousness of its being a useful part, by which is meant that harmony between solids and fluids is kept up. It is curious often to see the small quantity of blood which shall keep up this mutual harmony. In cases where people have been days, or even weeks, in trances, where there is not the least motion in the blood, it has retained its fluidity, because both solids and fluids retained their life, but not their actions. The want of disposition to coagulate in such situations does not arise from any property in the blood, simply as animal matter; for simply as animal matter, whose alterations arise simply out of the compound, (as fermentation,) it could not vary in its effects from circumstances that did not in the least vary the nature of the compound.

I shall observe, that dead animal matter acts on the living body as any other foreign or extraneous matter; therefore the blood being in perfect harmony with the living principles of the solids, when both are in powerful health, is a presumption that the blood is alive.

However, this argument is not absolutely conclusive, for we find in the blood heterogeneous parts which do not destroy this harmony; most probably those heterogeneous bodies are introduced simply as stimulants to the living principle, as extraneous objects are to the sensitive. This harmony of the blood to the solids is more observable in some parts than others. The parts in

which it is with the greatest harmony are the vessels, with which it is in constant contact; this is evident from its retaining its fluidity longer in them without motion, than in any other part of the body, though equally enclosed in living parts.

All the diseases which act on the solids act on the blood, to effect all those spontaneous changes which naturally arise from rest out of the body. So that the blood is as capable of diseased actions as the solids are. If the blood did not change in the diseased state of the solids, it would then lose the natural harmony I have been speaking of. This change is according to the state of the solids, which shows the immediate connexion between the two.

This consent of the blood with the solids is not a diseased alteration in the fluids, but a consent with the diseased disposition of the solids.

On the other hand, the solids are affected by diseases of the blood; I even suspect death in the blood can take place independent of the solids, but the death of the solids will soon follow.

The blood, when at rest, has a disposition to separate into several parts, viz. coagulable lymph, red particles, and serum; the red part being retained in the coagulable matter, and the serum squeezed out in the act of coagulation. This disposition in one of the parts of the blood to coagulate when at rest, from whence the above changes are produced, is more or less according to circumstances.

This property of the blood deserves particular attention, as it throws more light on its nature than any point of view in which it may be considered, it being spontaneous and natural: it is by this change that the solids are formed, which seems to me so important, that I think it almost the only thing necessary to be considered more fully. Indeed, the power of coagulation in the blood throws so much light on the nature of a disease, so far as the blood is concerned, that it is the part only almost that we have recourse to in the examination of the blood after bleeding, when we want to see whether or not the blood is buffy, that is, no more than that there is a disposition for the red globules to sink faster in such blood; or rather, perhaps, that such blood being slower in coagulating, the red globules have time to sink to the bottom, and leave the coagulable lymph at top free from red globules, and that constitutes buff. So that it is owing to this coagulation that we conceive whether the blood is cupped or not, that is, whether it draws altogether, and its edges rise, and then we say it is not only inflammatory blood, but strong, shows great health and strength in the constitution. If, on the other hand, it lies flat in the cup, and makes one even uniform surface, we say this blood is rather loose in its texture, (it may be still buffy and inflammatory,) and shows the powers of the constitution to be weak.

The red globules themselves abstracted, or the red blood abstracted from the others, is hardly considered, as it hardly explains anything. The serum explains also but very little; there may be more of it or less of it than common, but in itself it explains very little.

The power of coagulating in the blood is greatest when out of the circulation and exposed to common air, even more than when extravasated in some cavities in the body; the necessity or use of which is evident, for by this it becomes quicker in

stopping extravasation. A striking instance of this kind happened in the crural artery of a boar. I cut it through, and allowed it to bleed, but before the animal became weak, or at least had the appearance of weakness, the bleeding became less and less, till at last it stopped. On examining the artery, it was found to have a quantity of coagulated blood opposing and surrounding its cut end like a mop, through which no blood could pass.

This power of coagulation, especially when exposed, unites external wounds more readily, and of course preserves the living principle better, and keeps the internal parts from exposure in many wounds, which otherwise would become external; by this means they are united by the first intention.

In all inflammatory dispositions in the solids, whether universal or local, the blood has an increased disposition to separate into its component parts, and the red globules become less uniformly diffused; their attraction to one another becomes stronger, so that the blood, when out of the vessels, soon becomes cloudy or muddy and dusky in its colour, and when spread thin on any surface, it appears mottled, the red blood attracting itself, and forming spots of red. This is so evident in many cases, that it is hardly necessary to wait till the whole coagulates, to form a judgment of it. I think I can say, when blood is coming from the vessels, whether it will be sizzly or not.

When the blood has not an inflammatory disposition, the stream has a degree of uniformity and transparency in its appearance. But it is only an eye accustomed to it can make this distinction.

If the inflammatory disposition of the solids is fever, this disposition in the blood is universal. If there is universal inflammatory disposition from some local irritation, the blood is still universally affected. But if the inflammation is local, and the constitution is not affected, the disposition in the blood is not universal. How far there is local inflammatory disposition of the blood, I do not know; but there is great reason, however, to believe it, and the ready union of parts under a state of inflammation seems to prove it. If the blood does become inflamed in passing through an inflamed part, we must suppose it immediately loses that disposition when it meets with parts in perfect health.

These properties, viz. increased disposition to separate, and a disposition to become a firmer solid, always show increased disposition for action in the living principle, and also most probably increased power. It is one of the signs of strength of the living powers, although the materials for action are weak.

The use of this change in the blood is evident, since it is made fitter for uniting parts by this means; and it is from this disposition that the blood sustains its living principle sufficiently long till union takes place. The inflammation is only in consequence of a disposition for union, or rather the disposition for union arises out of the inflammation; unless the stimulus of necessity for coagulation is given by the solids, the extravasated blood will not coagulate, it will only act as an extraneous body, which often happens, where union is unnecessary, improper, or hurtful, as in many extravasations in the cellular membrane.

This disposition to coagulate when out of the vessels, or when retained in them without motion,

till the consciousness of the use of the motion, and of course fluidity is lost, is one of the effects of the life of the blood.

Now, we have no language existing answerable to all my ideas on the animal economy, and to coin words would not answer the purpose, for then I must make a dictionary of my own. I have not a word for those actions which take place in the body, as if it was conscious that such and such things were going to take place. There are actions in the body which come the nearest to consciousness of the mind of any thing that I can conceive, and therefore I make use of the word; but it is in common language among philosophers always applied to the mind.

Coagulation is a species of attraction arising out of this irritation. It may be considered as a species of generation, for it is the first action, or establishment of a power of action within itself, so as to form itself into muscular fibres, the only powers in an animal; and those again with other parts into organs, to act on the materials from which it arose, for its own support.

As a proof of most of the arguments which I have employed respecting the life of the blood, I will relate one case out of many.

A man came to St. George's Hospital, who had a hydrocele, for which he was tapped with a lancet. The water was clear as serum. When the water was evacuated, the testicle to the feel was found to be larger than common. About a month after, the tunica vaginalis became as full as before. The radical cure was now determined on, the tunica vaginalis was slit up its whole length, and the fluid, which was now bloody, was evacuated; the testicle being exposed was found larger than common, and was extracted. On the body of the testicle, and nearly in the direction of its long axis, and opposite to the orifice in the sac made by the lancet, when the water was first evacuated, lay a coagulum of blood, dark in colour, (almost like a leech when that animal is shortened,) about two inches long, and of the thickness of a common little finger. In the angle between the epididymis and the body of the testicle lay another coagulum, small in some places, adhering to the epididymis, at other parts loose, the body only attached at one end to the coagulum. The adhesion of the large coagulum to the body of the testicle was firm, although it admitted of a separation which was made at one end; when separated, fibres were plainly seen running from the testicle to the coagulum. The adhesion of the small coagulum in many places was still firmer all over the surface of the tunica vaginalis, where were a great many vessels full of blood, and in many parts coagula of blood, like extravasation. In this state I had a drawing made of it, and a small part magnified to show the vessels, and the dots of extravasation as they then appeared. By being put into water, all these vessels and dots disappeared, and it became white. I then injected the testicle by the spermatic artery, which succeeded extremely well. On examining the parts, I observed the following appearances:—The surface of the testicle and tunica vaginalis resumed the first appearance above described, only with this difference, that the injection was of a lighter red than the blood to the eye, and much more so to a small magnifier.

The vessels on the surface were very distinct, and the dots where the extravasation of injection

was as if there had been extravasation of blood. The coagulable lymph on the tunica vaginalis now became vascular. The surface of the adhesion of the large coagulum for about 1-20th part of an inch was injected, and extremely full of distinct vessels. The smaller coagulum was injected in many places through and through its whole substance, in the other only for a little way. On the surface of adhesion of the detached piece, where it only hung by a neck, it had vessels continued along that neck a little way.

If it should be asked how came those coagula there? the answer is, the blood from the wound made by the lancet in the tunica vaginalis in the first operation passing into its cavity, there coagulated on the testicle, which was directly opposite to the wound; and a small quantity of the blood which got down to the chink between the testicle and epididymis had coagulated there also. That this is the most probable way of accounting for it, I think is strengthened by another case, where the tunica vaginalis was found adhering to the testicle, when performing the radical cure, at the very part where before he had been tapped. In half a year, probably, this coagulum would have become wholly vascular, and probably in a little longer time, (it is immaterial the precise length of time,) the whole have been taken away, that is, the whole would have been vascular, would have had absorbents, and the absorbents, as a useless part, would have taken it all up into the constitution.

The tunica vaginalis filling so soon again in the man at St. George's, was the reason perhaps why the tunica vaginalis did not adhere to the coagulum on the other side, so as to produce union between the two.

Quere, for what purpose did this coagulum become vascular, for no visible purpose could be answered by it, as absorption, we may suppose, might have taken place as easily in a coagulum as in the cellular membrane? But perhaps absorption not taking place here was the cause of the collection of water at first, and adhesive inflammation evidently had taken place here, (because it was vascular,) that it might be able to absorb itself.

Thus, then, the materials of which the blood is composed, are joined with the living principle, and properly disposed; it is capable, when extravasated, as it were spontaneously, to form itself into parts fit for motion, and for performing all the offices of any part of the living whole, successively receiving the stimulus of nature from the surrounding parts, forming itself into similar parts, as into bone, cartilage, &c.

In many diseases not inflammatory, viz. those called putrid, where the solids have a tendency to fall into the change natural to animal matter deprived of its preserving principle, the blood has no disposition to coagulate, nor the solids power of raising inflammation, both having taken on the same disposition. In such a disease, both the principle and power are diminished, so that life is hardly able to preserve the matter from falling into its natural changes, though it has still a disposition to keep the vital parts or body moving.

Many circumstances in death, besides putrid diseases, produce this effect on the blood, an instance of which was met with in a gentleman who, being in perfect health, died instantaneously from passion, it being so violent as to produce death in

every part at once, and his blood did not coagulate.

A woman who was very healthy, was taken in labour of her fourth child: as the child was coming into the world, the woman died almost instantly. On opening the body the following day, there appeared no cause of death whatever, every part being natural and sound, but the blood was in a fluid state, nor did it coagulate on being exposed.

A soldier, (a healthy young man,) confined for desertion, received a blow on the pit of the stomach from one of his comrades, from which he dropped down, and died almost immediately. On opening the body, no preternatural appearance was observed; the blood was in a perfect fluid state, and did not coagulate when taken out of the vessels and exposed a considerable time.

Animals struck dead by lightning have not their blood coagulated, nor their muscles contracted, after death; both blood and muscles being killed at once.

There are other instances. Two deer were hunted to death, in which case they acted till the very power of action ceased, and of course death ensued. On opening them the blood was fluid, only a little thickened, and the muscles were not rigid, as we find them when they are capable of acting from the stimulus of death. In both cases the lives of the solids and blood were deprived at once.

These observations of animals hunted to death being tenderer than those killed in perfect health and at rest, are not uncommon.

An animal hunted till it can act hardly any more, its muscles do not contract after death, nor does the blood coagulate.

There is a natural action of the living body which destroys the life of the blood in the act of extravasation: this is the menses in women. If those discharges are natural and healthy, the blood does not coagulate; but on the other hand, if the extravasation is not a healthy one, the blood coagulates as it is extravasated, and comes away in clots. This, perhaps, is best demonstrated in those cases where the hymen is imperforated, and the menses accumulated.

This circumstance leads us to understand something of the menses; for depend upon it, if a woman has her menses come away in clots, it is not a natural, but a diseased, discharge.

To prove that the blood and the solids correspond very much in their actions of death, we may generally only observe, that when an animal dies in the common way, it is by the vital actions being first destroyed; but life still exists, for the muscles contract and the blood coagulates. But if we destroy life instantaneously, or along with the vital actions, then the muscles will not act, and the blood will remain fluid.

Those changes of the blood which appear spontaneous, are not really so; they arise from irritation in the blood itself, as much as any actions in the solids. This irritability produces the natural action of the blood, which produces these effects, and all the properties we see the blood possess in either a healthy or diseased state. We cannot think that the blood has a power of communicating sensation, as it cannot have nerves; its living powers, therefore, are those of simple life, and similar in that respect to the solids of many animals.

As sensation is a principle superadded, intended

to convey fixed intelligence, it is unnecessary that a moving part should have it; but when it becomes a solid and fixed part, it then opens communication with the mind.

Thus far I have endeavoured to show that blood is as much endued with life as the solids are; and the only difference between the two is, that the solids have construction called organization, producing considerable visible effects, while the blood has not this construction, therefore does not produce these visible effects. This theory will appear more evident in treating of the diseases of the animal body.

ON THE

EFFICACY OF OXIDE OF ZINC IN LARYNGISMUS STRIDULUS.

TO THE EDITORS OF THE PROVINCIAL MEDICAL AND SURGICAL JOURNAL.

GENTLEMEN,—If you deem the following case of Laryngismus Stridulus worthy of a column in your valuable journal, I shall feel obliged for its insertion, as from the severity of the case, and the method of treatment that was persevered in, it may prove of some interest to your readers.

Your obedient servant,

JOHN WATERS, M.D.
M.R.C.S. Edinburgh.

9, Alfred Place, Bedford Square, May, 1841.

A child, aged ten months, brought up by hand, and whose dental developement proceeded but slowly, having but two teeth at the time of this report, but in other respects of good constitution, had enjoyed good health from her birth, with the exception of an attack of dysentery, which lasted about eight days, and from which she perfectly recovered; was reported by her nurse to suffer from a slight cough, accompanied with a peculiar whooping noise, which took place only during the night, and to be in the habit of starting up suddenly with these attacks from sleep, as if alarmed; but the cough did not always accompany them; she would struggle for breath as if respiration was obstructed, and, after repeated efforts, would commence to breathe with long and stridulous inspiration; she would occasionally get them during the day, if irritated. The appetite was good; bowels regular, but the dejections were of a dirty white colour; no vomiting observed by me during the day; there was nothing that particularly called attention to the child, so she continued in this state for about ten days, until the evening of the 2nd of January, when I had an opportunity for the first time of observing one of these fits of suffocation; her breathing was suddenly arrested, without previous coughing, the face became of a purplish hue, and, after the lapse of some twenty seconds, the long whooping inspirations came on, and expiration was distinctly heard, occasionally accompanied with a marked change in the cry; this state lasted for about the same period of time, when respiration was performed as usual, but somewhat accelerated; the expression of the child's face was now much altered, and in some short time afterwards she coughed rather violently, with an evident super-secretion of mucus: on percussion there was no

appreciable difference on either side of thorax, and though minutely ausculted, the respiratory murmur was audible everywhere, unaccompanied with rle; there was no inflammation, vascular redness, or apthous concretion in the throat or fauces, but there was observed a congenital malformation of the palate, for the uvula and palatum molle were absent, and a fissure of a triangular shape extended between the bones of the palate for about four lines; heat of surface natural, pulse rather quick. I gave her an emetic, consisting of tartar emetic one-eighth grain, with ten grains of ipecacuanha; it acted speedily and with evident relief; she also took the following mixture.

Castor oil, four drachms; gum mucilage, one oz.; laurel water, one drachm; tincture of conium, one drachm; fennel water, one oz. A teaspoonful every third hour.

On the two following days was much improved, as there was no return of the dyspnoea or cough, but on the morning of the 5th she was again suddenly seized, whilst in the act of playing, with another attack, as if the larynx had been tightly compressed; respiration ceased for about one minute, when the long stridulous inspirations were again heard, and forcible hurried expirations; the face became swollen, of a livid purplish hue, particularly, the lips and inside of the mouth; the eyes became prominent, with a very evident divergent strabismus of the left one; the hands and arms were rigidly extended: the lower extremities were in the same rigid state; the pulse quick and small: this state was followed by a violent fit of crying, which terminated in sleep, which lasted about three hours, and during sleep she started up with several less severe attacks, but on awaking she had one of longer duration; I then observed that the larynx was forcibly drawn lower in the neck than usual; the number of respirations was twenty-eight; no difficulty of swallowing; voice little changed; she did not evince pain on my pressing the larynx; the alvine dejections were still without a trace of biliary secretion; the two upper incisors were on the point of appearing; I lanced the gums, and ordered the following powders:

Calomel, ten grains; antimonial powder, two grains; divide into eight papers; one every second hour. Milk diet.

The paroxysms now increased, and in the evening I counted ten attacks which she had during the day; bowels relieved from medicine twice, bringing away a large quantity of mucus, tinged with green matter. The emetic was repeated, but she passed a bad night; started from sleep with the fits twelve times; she did not pass urine until late in the morning, and then in small quantity; warm sponges to the pubes relieved the distended bladder; strabismus continues during the fits. Continued the powders, with the addition of a small quantity of extract of belladonna, gradually increased; friction with ung. hydrargyri on the right hypochondrium; she refuses her food, and is very irritable; the countenance is exceedingly pallid, with dull expression; features much sharpened. She continued in this state, gradually getting worse, until the 14th, when, on attempting to administer a small dose of ol. ricini, she was suddenly seized with a most violent fit of suffocation, which lasted about five minutes, accompanied with the greatest distortion of countenance and general convulsive movements. Having quickly pro-