The health of the blood-vessels / by David Fraser Harris.

Edinburgh Health Society.

HEALTH LECTURES For the PEOPLE.

SEVENTEENTH SERIES.

No. 6.

The Health of the Blood-Vessels.

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EDINBURGH:
MACNIVEN & WALLACE.
1900.

PRICE ONE PENNY.

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THE
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By DAVID FRASER HARRIS, M.D., C.M., B.Sc. (Lond.), F.R.S.E., F.S.A. (Scot.),

Lecturer on Physiology and Histology in the University of St Andrews.

Mr Chairman, Ladies and Gentlemen,

Our blood-vessels are a system of completely closed tubes which, beginning at the heart in two great vessels, are distributed by very many branchings and divisions to all the tissues and organs of the body, and return from all these parts to the heart, which they enter by six great tubes. The outgoing tubes, relatively thick-walled, are called "arteries"; the incoming, relatively thin-walled, "veins."

The heart is itself a four-chambered, pulsatile, muscular, valved dilatation in the chest placed between the terminations of the veins and the commencement of the arteries. I must resist the temptation to enter upon a consideration of the heart in health and disease, a subject unquestionably of the greatest possible importance, but one involving more physiological knowledge than I have any right to expect of you, so that I shall only allude to the heart when to omit it would be to do injustice to the topic I have chosen for this evening. We may conveniently distinguish the following portions of the vascular system, always remembering there is in Nature no sharp line of distinction between the beginning of one part and the ending of another,—aorta and great vessels of the chest, systemic arteries, arterioles, arterial capillaries, venous capillaries, the venules, the systemic veins, and lastly, the great veins in the chest entering the heart.

The diameter of these tubes diminishes from almost one inch at the aorta to $\frac{1}{3000}$th inch at the capillaries, and increases to about half an inch in the large veins at the heart: through

this closed system the blood *circulates*, *i.e.* goes round and round and round, as the great Englishman, Dr Harvey, proved almost three hundred years ago, does *not* go backwards and forwards in an ebb and flow, as the Ancients thought.

In health the arteries should be a little over-full, the capillaries just full, and the veins not quite full ; the veins *can* accommodate all the blood of the body. Now the structure of the wall of the vascular system is by no means the same in the different regions of it : the great arteries near the heart, and for a long way out from it, have thick walls composed of two tissue elements — white connective-tissue and yellow elastic-tissue ; the former possessing toughness so as to resist any great strains, the presence of the latter permitting, by its elasticity, considerable distension of the arterial wall, *i.e.* increase in the length, and what is more important, increase in the internal diameter of the vessel. Thus it is that these arteries being distensile can be somewhat over-filled, but being distended, the vessel-walls tend to contract on the contained blood, and so aid in forcing it onwards, since by the closure of the valves of the heart it cannot return there.

As we pass to arteries of smaller and smaller diameter, we find less and less connective-tissue but more and more of a special kind of muscle circularly disposed, which muscle is, moreover, supplied by nerves whose function it is to convey from the central nervous system impulses of such a kind that at one time they tend to induce the muscles to shorten and so reduce the vessel's calibre, at another to lengthen and so enlarge the calibre. This innervation of arterial muscle, whereby nervous control over the diameter of small arteries is possible, is one of the more recent and one of the most interesting discoveries in physiology. Those portions of the vascular system where the amount of this muscle is relatively at a maximum are called arterioles : by degrees the arterioles loose their muscle until they end in capillaries or tubules whose wall is only one cell-layer thick, the cells composing it being extremely thin, perfectly smooth, and set together like the components of a mosaic.

The material (endothelium) that forms the wall of the capillary is the same tissue which constitutes the smooth internal lining of all the rest of the vascular system. Endothelium thus offers minimum resistance by friction to the blood-flow, and in some

way its presence prevents the blood clotting—a very serious condition when it occurs inside a vessel.

Almost all arteries end *via* arterioles in capillaries which are of the greatest possible importance to the life of the tissues seeing that it is by their means that the all-necessary blood is conveyed to the immediate neighbourhood of each cell so that the all-necessary oxygen may pass directly from the blood to the living material of the cell.

By degrees the capillaries become confluent to form venules, and these, veins—tubes wider and thinner-walled than the corresponding arteries. Veins bring blood back from all parts to the heart, and in health are not quite full, *i.e.* never fully stretched. In the walls of veins there is less of each kind of tissue, endothelium excepted, than in arteries, less connective tissue, less elastic-tissue, and very much less muscle.

The interior of many of the veins is *valved*, *i.e.* furnished at certain spots with two little pouchings or pocketings of the inner surface so disposed opposite each other that pressure of the blood exerted backwards closes them on each other, and so prevents the venous blood from flowing back to the tissues whence it came.

We may regard the vascular system as made up of three great divisions or circuits:—

1. The systemic, to and from the body (trunk), limbs and the viscera (the splanchnic).
2. The pulmonary, to and from the lungs.
3. The cephalic and cerebral, to and from the head and brain.

Blood is simultaneously sent from the heart to each of these three circuits, and simultaneously returned from each, so that if the capacity for blood of any one of these is altered, the quantity of blood in one or both of the other two will be affected. All blood returning from head and body must pass through the lungs before being sent to the head and body again, the right side of the heart being exclusively concerned in receiving body and head blood and sending it to the lungs, while the left side of the heart is exclusively concerned in receiving lung blood and sending it to the body and head. When we run or engage in muscular exercise, the muscular contractions, coupled with the rapid breathing, cause a great rush of blood to the right side of the heart, so that it and the pulmonary circuit are liable, for a time,

to be overloaded, and we feel, in consequence, a peculiar discomfort or even pain in the chest and about the heart. By bandaging an animal's four legs, a perceptibly additional quantity of blood is thrown *via* the lungs into the cephalic circulation.

Modern science possesses methods for visibly demonstrating the fluctuations in the quantity of blood in certain portions of the body at any given time. The instruments are called plethysmographs, the tracings they yield, plethysmograms. Suppose a hand or arm be enclosed in such an instrument, then, when all is normal, the tracing given is the usual volume-pulse. But any condition whatever, which, no matter how slightly, occasions a redistribution of blood in the body, will affect the character of the plethysmogram. For instance, raising the other arm, coughing, listening to music, sleeping, all increase the quantity of blood in the part under observation, whereas a sighing respiration, and very curiously, mental exertion, diminish it. The last mentioned is particularly interesting showing that as more blood is required by the active brain, the withdrawal of it must reduce the available quantity elsewhere : only an instrument of great delicacy and precision could demonstrate this.

We may now ask ourselves—

What are the functions of the blood-vessels ? in plain language, what are they for ? Their chief uses may be comprised under the following heads—

1. To convey the nutrient blood to every part of the body for the nourishment of its cells, and to drain off the blood which has become impure, and bring it back to the heart.

2. To *regulate* the *quantity* of blood in a tissue, organ or region of the body.

3. To permit of the formation of lymph, the fluid which actually bathes the cells, from which they derive their food and to which they give their waste products.

4. To express certain emotional states.

Now at this stage what we want to know is, how is the blood caused to pass continuously from the heart to the tissues and from the tissues to the heart ? To reply in a word ; by reason of the positive arterial *blood-pressure.*

Some amplification of this statement may perhaps give us some clearer ideas as to the forces at work in the movement of the blood : first of all as to blood-pressure.

The heart is, physically, a valved force-pump which 70-75 times per minute forces a quantity of blood (about 3 fluid ounces) into the already full aorta—the great vessel at the base of the systemic vascular system. The blood is a thick liquid—much "thicker than water"—and owing to its internal friction (viscosity) it does not flow through the arterioles and capillaries like so much water would, but encounters what is known as the "peripheral resistance" on attempting to pass through the multitude of vessels of small bore. There must be an expenditure of energy in order to overcome the resistance. The combined result of the force exerted by the heart behind and the peripheral resistance in front is the "blood-pressure." Now the blood that is ejected into the aorta (not being able to fall back into the left ventricle owing to the closure of the three semilunar valves) creates a temporary increase of pressure within the great arteries which is transmitted in all directions, seeing that blood is incompressible. The arterial wall not being rigid, but containing plenty elastic-tissue, is hereby suddenly dilated.

In this way a state of increased pressure is created in the blood, and one of dilatation of arterial wall in the vessel, and these states as they travel on towards the periphery are known as the "pulse" or "pulse-wave."

But of course the stretched arterial wall will, by reason of its elasticity (retractibility), "recoil" or contract on the contained blood, thus assisting the heart to force the blood onwards. This "blood-pressure" is a very real thing, just as real as the pressure in the mains of the water-pipes of a city which, as you know, forces the water to the highest cistern in the town, and if the pipe bursts will throw up a jet of water many feet high.

The arterial blood-pressure depends on—(1) the force of the heart; (2) the rate of the heart; (3) the magnitude of the peripheral resistance. Each of these factors can vary from time to time. The pressure is ~~increased~~ measured by the height of a column of mercury which it can sustain against gravity; the height for the pressure in a dog's carotid is about six inches, for a man's about nine.

Normally there is a pulse only in arteries—that is, in them the flow is jerky, whereas it is continuous in capillaries and veins. There is no pulse and very little pressure in capillaries, because the energy of the pulse-wave has been expended in expanding

the arterial wall at each point throughout the arterial system—that is, in doing work against its elastic force, and hence, as it travels to the periphery, its dilating force gets spent. The phenomenon of the pulse depends on the degree of *elasticity* of the arterial wall; if the wall has become inelastic from thickening or rigid from atheroma, gouty conditions, calcareous infiltrations as in old age, then the arterial pulse is less perceptible, but a pulse instead may appear in the capillaries, since it has not been able to expend itself on the inelastic arterial wall.

If the arterial blood-pressure be considerably reduced, as happens when the peripheral resistance is greatly diminished, owing, for instance, to dilatation of the arterioles over the whole skin, *e.g.* in a warm bath, then the pulse-wave does not spend so much of its force as before against the arterial wall, and thus, not being exhausted on arrival at the capillaries, may pass over not only into them, but into the veins, giving rise to the venous pulse. It will therefore be apparent that unless arteries were always a little over-full you could have no pulse-wave, for if they were flabby and half empty, their walls would not be stretched by the blood thrown out of the heart.

In the veins, the blood-pressure is still less than in the capillaries, and in connection with this it may be noted that the walls of veins are very thin; as they have no great pressures to withstand, they need not be thick. Nature is usually economical. Quite close to the heart the pressure in the veins becomes what is called "negative"—that is, it is less than the pressure of the atmosphere, so that if such a vein be opened, air is liable to be sucked in, carried to the heart, and thence to the lungs, where it blocks up some of the capillaries.

Venous blood returns to the heart because of aspiration of heart and chest in their movement, and also through muscular contraction coupled with the presence of valves in veins. Arterial blood-pressure may vary within the limits of health; a persistently high arterial pressure ("tension") may be the sign of a more or less serious condition; it may indicate plethora, certain forms of kidney disease and gouty tendencies. A high blood-pressure, especially if associated with degenerated arterial wall (fatty, calcareous or atheromatous), may result in the vessel bursting: when this happens in the brain it is known as "apoplexy." The blood-pressure must be of a certain

magnitude in order to efficiently maintain the circulation, if the pressure falls below its normal, the circulation will correspondingly fail.

Fainting is, in fact, a temporary abolition of consciousness from a temporary diminution of the blood-pressure in certain cerebral vascular districts, usually in consequence of the heart having failed to throw sufficient blood into the carotids.

Into all the causes liable to "inhibit" the heart as it is called, or to render its action intermittent, we cannot at present go; but there are two that are quite familiar, great pain and certain emotions.

Thanks to anæsthetics, the great pain attending surgical operations nowadays rarely affects the heart to the extent of inhibiting it; and thanks apparently to an improved "tone" of the female nervous system, fainting on the part of ladies has become very rare indeed.

According to the novels of the early years of this century, to faint frequently was more of the nature of a fashionable accomplishment than an evidence of nervous disability, so that poor Miss Tox seems to have been judged rather harshly by Mrs Chick in that memorable scene in Princess Place.

There seems no doubt at all that it would be as difficult for the girl of to-day to faint to order as it was easy for her great-grandmother, and this seems only a particular case of the improved condition of general nerve-health or, at any rate, lessened affectability on the part of women.

Weeping on the slightest provocation has, like fainting, also gone out of fashion, and it is a matter for distinct congratulation that notwithstanding the undoubtedly large amount of nerve illness at the present day, there is a type of more robust female nervous system being rapidly evolved. All *sudden* diminutions of cerebral blood-pressure are to be avoided as productive of a tendency to faintness and even perhaps sickness and giddiness.

It is dangerous for certain persons to rise suddenly as out of bed or from the sofa, from the horizontal to the vertical position in fact, since so much blood may be able to leave the brain by the veins under gravity, that the heart may not have been able to send up against gravity a sufficient quantity of fresh blood to replace it.

Thus it is that after child-birth or after the removal, for instance, of a large abdominal tumour, the patient ought not to

be allowed to sit up suddenly, since an unusually large amount of blood may be accommodated for a time in the abdominal veins and a correspondingly diminished amount reach the brain. One ought not to sit up after a hot bath, and should lie down in the hot room of a Turkish bath for the same reason, namely, that so much blood is in the dilated vessels of the skin that there may not be enough in the brain to prevent fainting.

The knowledge of these elementary facts will guide us in treating persons who are supposed to have fainted. A doctor may not be near: a little knowledge may save life. We want to get the blood to return to the head: lower the head then, even below the level of the body of the person who must be made to lie down. Thus blood will reach the head by gravitation: but we also want to get the heart to beat again or to beat more strongly, and we wish the breathing to be quite unimpeded. A little cold water may be sprinkled on the face or a wet towel used as a stimulus to reawaken the heart's action, and anything that is tight about the neck should be loosened.

But it is not necessary the moment a person is reported as having fainted to pour a whole bucketful of cold water over the face as though you were putting out a fire, or to burst up whatever the person may be wearing round the neck, or to attempt to make the person drink water or spirits or anything else. People who are unconscious cannot eat or drink.

Quite otherwise is the treatment in supposed apoplexy: here we desire blood to leave the head; raise the head a little, therefore, above the level of the body, and above all things do *not* stimulate the patient, for the ubiquitous whisky bottle will appear: in nine cases out of ten the apoplexy is due to the too frequent previous appearances of that same bottle.

I need hardly say that the face and lips of a person who has fainted are pale, whereas those of one in apoplexy are generally full of colour and even bloated.

Blood-pressure determining the quantity of blood in the brain, is a factor in the question of *sleeplessness*. In normal health we are enabled to go to sleep by a diminution in the energy of the cerebral circulation, the blood no longer sent to the head being accommodated in the now dilated vessels of the skin, which, as we all know, becomes flushed and warmer during healthy sleep in bed. The topics of sleep and sleeplessness

would carry us too far away from our subject to-night, but the point at present is, that sleep will not ensue unless there be a diminution in the vigour of the cerebral circulation. Thus we shut out light, noise, etc.—all stimuli that would engage attention and so necessitate blood being in the brain, and by aid of pillows we raise our heads slightly above the level of the body so that gravity, at anyrate, will not keep blood in the brain.

Professor Mosso of Turin has by a beautiful device proved the fact of this redistribution of blood in sleep : a person is made to lie upon a specially constructed horizontal balance very delicately poised : as he goes to sleep in this position, his feet dip down and his head rises, showing that now more blood has gone towards his feet than towards his head.

Redistribution of blood occurs during full digestion to such an extent that less blood is sent to the brain than before, so that sleepiness may supervene.

Now, it not unfrequently happens that after a full meal a man has to deliver a speech for which a certain degree of wakefulness is necessary on his part, whatever may be required of his hearers. It has been actually suggested to a man so unfortunately situated, that he should previously provide himself with a fairly tight abdominal bandage, the effect of which would be to prevent too much blood accumulating in the abdomen. At present the more usual course is by means of alcohol to stimulate the cerebral circulation. The suggestion to wear a tight abdominal belt is, however, an excellent one for all those liable to fainting, giddiness, or loss of ideas at after-dinner speaking.

Facts such as these will make it clear why people ought not to be kept standing too long on their feet, whether in the "attention" or "stand-at-ease" position ; for not only is it fatiguing, but in the absence of muscular movements to assist the return of blood, all the effort of raising the blood against gravity from all planes below the heart must devolve upon the heart. Thus the recent regulations about providing seats for women in shops are not only humane but what in common justice are actually necessary : everyone should be permitted to sit down when tired. Since the standing posture tends to permit blood to stagnate in feet and legs, there will be a corresponding diminution in the brain ; hence children at school should not be taught standing, nor recruits be made to think out things except when comfortably seated.

II. We can now proceed to consider the second great function of the blood-vessels, viz., the power which the small arteries possess of increasing and diminishing their calibre and thereby permitting more or less blood to reach the capillary districts. This endowment of contractility is entirely due to the presence of "involuntary," circularly disposed muscle present in the wall of these arterioles, and it is this muscle which has been found to be under the control of the central nervous system.

Certain nerve-fibres supplying the vessels on being stimulated cause the muscles to shorten: this is known as vaso-constriction; other fibres on being stimulated cause the muscles to lengthen (vaso-dilatation).

These nerve-fibres are functionally connected with what is called a "centre" (vaso-motor), situated in the highest part of the spinal cord, quite close to some other very important centres, for instance, those for regulating the heart and breathing, and for producing vomiting. A centre is a group of nerve-cells whose function it is to emit impulses through nerves to particular tissues; in the case of the vaso-motor centre, impulses which on arriving at the muscles induce them to maintain a state of moderate contraction.

Now a centre can receive as well as emit impulses, and the vaso-motor centre is ever receiving impulses (afferent) by nerves coming from heart, blood-vessels and tissues, and those impulses give rise in the centre to others (efferent), which descend the vascular nerves, and either dilate the vessels, if the part requires more blood, or constrict the vessels if the part requires less blood. Such phenomena are called "reflex-actions," and in the case in point they would be vaso-dilator reflex actions and vaso-constrictor, respectively.

These mechanisms are outside the reach of our will, and save in their effects, also outside of our consciousness and conscious interference; they go on "of themselves," that is, reflexly; they are exquisite adjustments and beautiful examples of the adaption of means to ends.

Of a great many vascular reflexes we are quite unaware; for instance, we are unaware of how, when the stomach and intestines want more blood to digest a meal, they send messages up to the vaso-motor centre for dilatation of their vessels, and it needs a physiologist to tell us that such mechanisms do exist; but I

think we can get one or two examples of vascular reflexes whose results, at anyrate, come within the pale of consciousness.

For instance, a cold bath reflexly constricts the vessels of the skin, and a hot bath dilates them; mere pain reflexly constricts them, as may be seen by the pallor of the face of the sufferer, the homely mustard-plaster dilates them, as may be observed in the reddened patch. Now the pain might be in the toe and the pallor in the forehead, so you see how long may be the reflex path, and how one part is put into communication with a distant part by means of nerves; they and they alone are the channels of communication between any two parts no matter how far distant they may be.

But these nervous influences on vessels can only exist so long as there is muscle present in the vessel-walls to respond to them. If the muscle has become degenerated, then it cannot respond to the nerve impulse, nor to such drugs as are given to act on blood-vessels.

In inflammation, which in its most usual form is the result of some antecedent excessive vaso-dilatation, we sometimes give drugs to constrict arterioles; this is only possible through the muscle they possess, it is the only tissue on which drugs act. Atropine (of belladonna) and amyl nitrite dilate arterioles, while ergotine and extract of supra-renal gland constrict them. Thus when it is desired to rapidly reduce peripheral resistance and so ease a labouring heart, amyl nitrite is given; it dilates the vessels, reduces peripheral resistance and blood-pressure, so easing the heart.

The pulse-wave we saw was due to the *elasticity* of the walls of the arteries, the possibility of their varying in calibre is due to their *muscularity*.

After death the muscular coat of the arteries is contracted, hence the arteries are then found empty, the blood having been squeezed on into the capillaries and veins. The ancients, finding no blood in the arteries, and imagining they contained air, called them "arteria" (from the Greek ἀηρ air, and τηρεω to contain).

III. We may now pass to a function of blood-vessels of the very highest importance to the body, the formation of lymph on the part of the capillaries.

Lymph is a liquid formed from the liquid portion of the blood

by a process of transudation through the extremely thin capillary wall.

It is rather more dilute than blood in respect of albuminous material, and it has no red blood corpuscles though plenty white ones, but as to its salts it closely resembles blood plasma in composition. It is the liquid which actually bathes the living cells of the tissues, for blood itself in health never comes into contact with the tissue-cells,* being always separated from them by the capillary wall. The lymph supplies all cells with their appropriate liquid nourishment. To the lymph the cells yield up certain waste materials, products of the life of the cell, so that *physiologically* speaking there is a pure lymph just formed from arterial blood and about to nourish the cells in its neighbourhood, and also an impure lymph just come from cells laden with effete stuffs and about to be carried into lymphatic vessels and so reach the stream of venous blood.

Thus the lymph has two functions: it is concerned in the first place with the ultimate stage in absorption, with presenting the cells with their food in its final condition for incorporation, and in the second place with receiving from the cells their effete material. In consequence of the fact that all cells live immersed in an aqueous medium, it has been strikingly said that the tissue units even of the highest mammals are after all aquatic organisms, as most certainly are the lowest known forms of animal life.

The power of specific selection of material from the lymph possessed by the various cells is another very interesting subject, for it is certain that a bone-cell does not take from or give to the lymph the same materials that a muscle-cell does, and a brain-cell and a liver-cell give and take quite different things also: thus every cell has not only a life of its own, but a *characteristic* life of its own, an individuality in its mode of living quite as well marked as its particular form may be.

Formation of lymph by transudation from the blood can only go on under an adequate blood-pressure, this physical phenomenon once more showing us its importance.

Blood capillaries not only exude lymph, they can also absorb material; but beyond mentioning the fact, I will not trouble you with the subject.

* Except in the spleen.

IV. The last function of blood-vessels we shall notice is the expression of emotion.

Emotion is a state of mind whose physical substratum is a state of brain: but emotion can only be *expressed*, that is rendered visible to other people, by a change of state in some bodily tissue.

The tissues most often concerned in the expression of emotions are glands and muscles, muscles of the face, limbs and body-wall, muscles of the alimentary canal, of the iris, and of the heart and blood-vessels. With the last we are alone concerned at present. A good example of expression of emotion by vascular muscle is the *blushing* of the face, ears and neck, in consequence of some emotion present in the mind.

Without analysing deeply what is going on, this much may be said, that in consequence of a certain active state in the highest regions of the brain—the physical counterpart of the emotion or the emotional idea in the mind—impulses descend by tracts of nervous matter to the vaso-motor centre, and thence fresh impulses descend to the muscles of certain arterioles which in consequence dilate, more blood rushes to the capillary areas supplied by these arterioles and the "blush" is made apparent. On the other hand, an emotion of another order—fear, anxiety—causes a vaso-constriction, and in consequence a *blanching* of the same regions of the skin.

Thus blushing and blanching are but particular cases of the expression of emotion through the agency of muscles, in this case vascular muscles. It is a matter of common observation how certain persons blush or blanch much more easily than others, and how children as a rule are more sensitive than adults in this respect. Now such expressions of emotion may be regarded as reflex actions; they cannot be voluntarily brought about, and they certainly often take place in direct defiance of the will. Children exhibit reflex action much more abundantly than do adults who have acquired a certain degree of control over their primitive reflex actions; in the case of children, Nature takes her own way in the matter of blushing, and the emotion is reflexly expressed. The more primitive the reflex, the less "control" have we over it, but to a certain extent it is true that most adults acquire the power of preventing the frequent

occurrence of the reflexes leading to blushing and blanching, that is, the antecedent emotion is to this extent unexpressed.

There can be no doubt that nowadays blushing is not nearly so commonly witnessed among women as formerly. There was a day when it was "the thing" for the girl of the period to be blushing if she was not fainting—"nous avons changé tout çela."

I cannot help thinking that this change must be taken to indicate a more robust or, at any rate, a less affectable nervous system.

Blushing is one of Nature's methods for reducing blood-pressure usually previously raised by accelerated cardiac action; we know the feeling of something being "let go," no doubt it is a reflex inhibition of the tone of the vaso-motor centre that has occurred.

We may now close our study of the blood-vessels by some reference to their states in morbid conditions. It would, however, serve no good end for me to describe certain of the rarer forms of disease which may attack our blood-vessels, and we have already agreed not to enter upon diseases of the heart itself, but the healthy condition of vaso-motor centre and of the blood-vessels is of the utmost consequence to the well-being of the body. It has been admirably said * that the vaso-motor centre is the "hub of the wheel of life."

The centre itself, as a mass of nervous tissue, is happily outside the reach of our conscious interference, but we can refrain from dosing it with poisons, chief amongst which, of course, is alcohol. Now while the purest form of ethylic alcohol does undoubtedly damage both nervous and vascular tissue, by far the greatest injury wrought on the body is traceable to what are technically called "adulterants" of whisky, but in plain language, cheap, bad whisky itself. It is these cheap, impure spirits taken into empty stomachs which account for 90 per cent. of the frightful physical havoc which lies at the back of the misery and iniquity of all our great cities.

I desire to protest in the most solemn manner conceivable against the possibility of the manufacture of certain kinds of spirit, so notoriously impure, that the sale of them constitutes a colossal anti-social crime. Any police magistrate you like to ask will corroborate the necessity for this protest.

* By Mr Leonard Hill, Lecturer on Physiology, London Hospital.

Looking for a moment at the *inherited* disabilities of the vascular system, I would like to briefly allude to rheumatic and gouty affections, seeing that in this damp and cold climate of ours they are so very prevalent. I don't for one moment mean that those diseases are only of the vascular system, but prominent in many attacks of rheumatism is a serious inflammation of the interior of the heart and of its valves, whereas in gout there is an equally well-marked tendency to rigidity of the arterial wall.

Now rheumatic tendencies often display themselves very early in life, and it is a safe rule to treat every case of a child complaining of "growing-pains" as one of latent rheumatism. There is no reason why normally growing bones should give rise to pain, and it is now customary to regard a case of "growing pains" as of some gravity, and one in which the onset of the more familiar symptoms of rheumatism should be carefully watched.

The clothing of the body day and night, summer and winter, in flannel is an exceedingly wise preventative; of course chills and draughts are to be avoided, and by way of treatment some of the well-known preparations of cod-liver oil and of phosphates should be given.

It has been remarked that the very people who ought to eat fat—the tubercular—have a great dislike to it; in like manner it frequently happens that the very people who ought to wear flannel next the skin have a marked antipathy to it. It is certainly after all a matter of habit dating from childhood, and as quite young children have no idiosyncracy against flannel, parents ought to see to it that the practice of wearing flannel is continued when the children are growing up. Tendencies to rheumatism are found in both sexes, and the above remarks apply not only to boys but to girls whose antipathy to flannel is greater than in the case of boys. By wearing flannel constantly, I mean flannel day and night, and that means, sleeping in blankets. The majority of women do not suffer from sensations of cold to the same extent as men do, but at the same time, considering the variableness and treacherous character of the climate of these islands, a very large number of young women are too prone to wear materials a very great deal too thin. Manufacturers have certainly now produced garments without any tendency to irritate the skin, hence these young women have no excuse.

As to gout, it is pre-eminently a disease of the male sex; among women none but those after middle age suffer from it.

It is by no means unknown in quite young men, when it may be safely assumed to have been inherited. I cannot at this time give any account of gout or its treatment, but for those likely to suffer from it, I want once more to emphasise the necessity for living in flannel, avoiding chills, taking of exercise in the open air, and eating only digestible materials. One expression of a gouty constitution which concerns blood-vessels is the unfortunately far from uncommon Hemicrania, or one-sided headache, which arises in connection with catarrh of the intestine, stomach, liver, and throat. Rest, a very light diet, and the drinking of hot water in many cases relieve this condition, though diuretic drugs are very often necessary.

There is one other morbid condition of blood-vessels which particularly deserves notice from its commonness in young people of both sexes, I mean the chilblain. This very irritating affection of the blood is by no means confined to the nursery or the girls' schoolroom, it is much oftener than is supposed found annoying grown-up persons.

In many cases, I firmly believe, it is an expression of gout, in others of a sluggish capillary and venous circulation.

Frequently, especially with children, cod-liver oil gives relief; in more persistent cases in adults the syrup of the iodide of iron, teaspoonful doses in much water after two meals a day, may be needed.

The internal remedies are more important than the external: as to the latter, a local anæsthetic ointment should be used, and every care taken to prevent the skin cracking or "breaking," for when that has happened certain ointments, harmless on an intact skin, could not be used.

With reference to diseases of the blood-vessels which may be *acquired* during one's lifetime, I shall only allude to two, aneurism and varicose veins. By aneurism is meant a condition of morbid, permanent dilatation of the wall of a blood-vessel, usually of a large artery, although aneurism of the heart itself is not unknown. It is pre-eminently a case where prevention is better than cure. All conditions which *suddenly* raise the blood pressure tend to induce this condition, often popularly called "strain of the heart." All sudden and violent muscular exertion,

as in lifting heavy weights, over-doing gymnastic exercises, too much swimming in fresh water, should be avoided, and especially in cases where inherited weakness of the wall of the blood-vessels may be suspected.

Allied to arterial aneurism is the condition known as varicosity of veins, by which is meant an insufficiency of the valves of one or more segments of a vein. Owing to the valves not closing properly, the blood tends to stagnate in the vessels. Varix occurs in both men and women: in the case of men there is often the history of a blow from a cricket or hockey ball or stone; but as often as not, the immediate cause is obscure.

It seems to indicate an inherited "weakness" of the walls of the veins. It is well to protect parts that are varicosed by wearing some kind of bandage, not only to diminish the risk of physical injury, but by the pressure to assist in the return of the blood. Bleeding from varicose veins may be pretty serious, and though surgical aid may have to be at once called in, every one should remember that in bleeding from veins you should compress on the side of the wound farthest from the heart, in arterial bleeding, next the heart.

I cannot now allude to the action on blood-vessels of poisons, metallic or vegetable, nor of drugs, nor of microbes, save to say with reference to that ever-present poison alcohol, that its direct action on blood-vessels is a tendency to paralyse, that is to dilate, this leading to the loss of more heat than is compensated for by the heat-production arising from the far from perfect oxidation of the alcohol in the body.

Our subject could lead us to consider very much more than there is time for on this occasion, such as the anæmias, which are, however, blood diseases, rather than blood-vessel diseases; but perhaps someone, better qualified than I to speak with authority, may take up the blood and its diseases as the subject of a future Health Lecture.

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