employment, on the other hand, of tissue-sedatives, the morbid stimulus is annulled, and the fever movement subsides. Should, however, the paralysis of the sympathetic system have been considerable, it may persist to some extent after the cessation of the inhibitory influence, and may then require the arousing action of such remedies as quinine, and the like.

It is possible that the increased cardiac action in inflammatory fever may also, in part, be occasioned by the local irritation in the inflamed part being reflected directly upon the heart, through the sympathetic ganglia and nerves. The innervation of the organ is thus enfeebled, and, as a consequence, its action accelerated. At the same time the increased heat of the blood stimulates its muscular tissue.

15. The hardness of the pulse in certain sthenic fevers and inflammations implies a contracted state of the arterial coats. This, if general, is an opposite condition to that which is produced by section of the sympathetic, and therefore demands explanation in an hypothesis which is based on a presumed palsy of the system. Now, in sthenic fevers, the primary paresis of the sympathetic gives rise to an abnormal stimulus in the increased heat of the blood, which is by no means inseparably connected with arterial dilatation (*vide* p. 939). The arterial coats, like the heart, retain for a while their irritability, and contract under the direct stimulus of the fevered blood which traverses them. The pulse is therefore hard. In low fever, on the contrary, the pulse is weak and soft, because the poison impairs the vital power of the arterial coats, as well as that of the sympathetic.

So in certain inflammations—*e. g.*, of serous membranes—the hard pulse, as well as the increased cardiac action, result from the circumstance that the contractile tissue of the heart and arteries is at first unimpaired in its energy, and responds actively to the stimulus of the heated blood. In asthenic inflammation, on the other hand, the vital energy of the heart and arteries is impaired by the exciting cause, and their contractile power is enfeebled. Hence the pulse is soft and weak. In the former case, bleeding is borne well; in the latter, badly.

The causes of increased action of the heart require some notice. The action of the organ may be increased as to frequency, or as to energy, or, as often happens, as to both simultaneously. There is, however, no necessary or close connexion between the increase in these two respects. Increased frequency is very commonly conjoined with debility. Acceleration of the heart's action seems chiefly to proceed from partial exhaustion of nerve-force; * *e. g.*, it takes place readily in the feeble and those of weak innervation, whose hearts palpitate violently on the least exertion. It can be prevented by exercise and training which increase the nerve-force, as when a man trains himself for feats of running or swimming; it is diminished, when present, by a stimulant, *viz.*, digitalis, which tones, steadies, and strengthens a weak flabby heart, just as it does a relaxed uterus. On the other hand, increased energy of contraction in the heart depends chiefly on a vigorous, lively, well nourished condition of its muscular fibre, which responds actively to the stimulus of the circulating blood. It is therefore impaired by all influences of an enfeebling or lowering kind, as the poison of influenza or of low fever. In states of sthenic inflammation, on the contrary, the contractile energy of the heart remains for some while unimpaired, or even is actually increased; venesection is borne well, the heart still responding actively to the diminished amount of its normal stimulant. In asthenic inflammation, the reverse is the case. In many instances of increased cardiac action, where the heart is acting quickly and sharply, though, as the feeble pulse shows, with little propulsive power, it seems tolerably certain that the endocardium must be abnormally impressionable, the blood traversing the cavities producing too great a stimulating effect. The condition in this case is analogous to that of gastric hyperæsthesia, where the mucous lining of the stomach is unduly sensitive, and the contact of ingesta provokes abnormal contractions, *viz.*, those of vomiting. Such hyperæsthesia is a common attendant upon states of debility.

[To be continued.]

* This view is, of course, based on the well-known experiments which show that galvanic stimulation of the vagi slows and stops the action of the heart, while section of the same nerves accelerates it. In one experiment I performed, after the left vagus had been divided, the heart's beats were 110 in the minute; after both had been divided, 190. The respiratory movements in the last case were about ten per minute.

Notes of Lettsomian Lectures

ON

CERTAIN POINTS CONNECTED WITH DIABETES.

DELIVERED BEFORE THE MEDICAL SOCIETY OF LONDON.

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LECTURE II.

[Delivered November 30th, 1859.]

HAVING found that the blood in the right cavities of the heart did not contain sugar, but still believing that sugar was formed in the liver, Dr. Pavy had sought to ascertain the cause of its absence. In investigating the nature of the substance called by Bernard "glucogenic", with regard to its relations; and this investigation led to ascertaining an important fact.

The glucogenic substance is very easily obtained by making a decoction of liver and evaporating: the substance appears as a scum on the surface, which is removed as it is formed. To purify it, it is mixed with distilled water, and precipitated by alcohol. The substance is not acted on by potash, even at a boiling temperature. If a liver is boiled with a strong solution of potash, the glucogenic substance is dissolved; it is then precipitated by spirit, and freed by washing from a small quantity of potash which adheres to it.

In composition, it is allied to starch and dextrine; its chemical formula is $C^{12}H^{12}O^{12}$. Like dextrine, it presents a wine-red colour on the addition of iodine.

Its most important property is its ready convertibility into sugar, when in contact with albuminous materials at a somewhat elevated temperature. Saliva acts most energetically on it: if a portion be mixed with human saliva, and tested with Barreswil's solution, the red suboxide of copper is thrown down. It is the albumen contained in the liver which converts the glucogenic substance into sugar after death. Blood has the same effect.

If a little alkali be added to the glucogenic substance, its transformation into sugar is prevented: and the observation of this fact gave Dr. Pavy the hint for obtaining the liver as it existed during life, before *post-mortem* changes had appeared. Observing that alkalies prevent the transformation, he thought that, if the sugar were formed after death, no sugar ought to be found in the liver if the organ were injected during life with a solution of potash. This experiment he performed on a dog, and found the result he anticipated. To obviate the objection that the absence of sugar might depend on the state of health of the animal, he repeated the experiment, causing a part of the liver to be firmly held by an assistant, so that the injected fluid could not enter it. On testing the two portions, that into which the liquor potassæ had been injected yielded no sugar: while the other part gave abundant evidence of its presence. Acids, as citric acid, also prevent the formation of sugar.

But there is a still better method of performing the experiment. The glucogenic substance requires a certain temperature for its transformation into sugar; and, therefore, to remove any objections which might be raised on the ground of the chemical action of the substance employed, a portion of liver, removed instantly after death, was placed in a freezing mixture. This part gave no indication of sugar: while the other portion, which had not been frozen, yielded it as usual. The experiment was repeated on a rabbit which had been fed on oats, with the same result. When the frozen liver is thawed, it yields sugar after a time—three days for instance—showing that the effect of the cold has merely been to arrest the change.

As a substitute for the term glucogenic substance, which had been objected to, the name "hepatine" has been suggested. This, however, would imply that the substance was peculiar to the liver; whereas it, or at least a material closely allied to it, is formed in the muscles, lungs, and placenta. The term "amyloid," or starch-like substance, implies no theory, and is perhaps the best term to be used at present.

In some of the invertebrata also, this amyloid substance is formed. In the common mussel, for instance, the mantle is strongly charged with it: and in this part also the microscope

discovers fat particles and albumen. The mantle, however, does not yield sugar so readily as the liver of the animal; perhaps because the ferment, through which the change is brought about, is less active. The gasteropods, as the oyster and mussel, afford a very convenient means of observing the condition of the liver during life. Articulated animals, as crabs and crayfish, also yield sugar.

In making experiments on the liver of the frog, Bernard noticed that when the body was cold (*i.e.*, at the natural temperature of the animal), the liver was free from sugar; but that if the animal had been exposed to an elevated temperature, sugar was formed. He thought that the formation of sugar was merely increased by an increase of temperature. Dr. Pavy at first thought this explanation correct, and that the elevation of temperature would induce a diabetic state in frogs: but, on allowing some frogs to cool which had been kept in a warm place, he found that their livers yielded no sugar. The explanation was now easy. When the frog is in its natural cold state, the change does not set in early, and it is possible for some time after death to obtain the liver as it existed during life: but when the frog is raised to a temperature of about 95°, it is placed in the state of a warm-blooded animal, and the change occurs rapidly.

Bernard divided the spinal cord just below the phrenic nerves, and placed the animal in a cold place. No sugar was formed at first: but in a few hours, it was detected. He explained this by supposing that the division of the cord had deprived the liver of some power, which it only slowly regained. But, if the spinal cord be divided, and the animal be placed in a warm room, and not on the cold floor of the laboratory, sugar will be at once found, as in warm-blooded animals.

It is clear, then, that the liver does not during life perform the function of forming sugar, because—1, the blood which passes from the liver to the heart is not saccharine during life; and 2, the tissue of the liver during life does not contain sugar.

The amyloid substance appears to be formed from sugar. If an animal be fed on a diet abounding in starch or sugar, the liver increases in weight, and the proportion of the amyloid substance is greatly augmented. The livers of some dogs fed on tripe bore the proportion of half an ounce to each pound in weight of the animal. In other dogs, fed exclusively on bread and barley-meal, the liver was in the proportion of rather more than an ounce to the pound. Other dogs were fed on tripe and cane-sugar; and in these the liver weighed nearly an ounce to each pound of the animal's weight. In both the latter cases, the quantity of amyloid substance was remarkably increased. The results are shown in the following table:—

	Weight of liver in proportion to lb. of animal.	Amyloid substance. Per cent.
Dog fed on animal food . . .	$\frac{1}{2}$ oz.	6.97
„ on vegetable food, above . . .	1 oz.	17.23
„ on tripe and sugar, nearly . . .	1 oz.	14.50

Of two rabbits, apparently from the same litter, and as nearly as possible in the same condition, one was kept without food; while into the stomach of the other an ounce of starch and an ounce of cane-sugar was injected on each of three days. The liver of the rabbit which had fasted weighed an ounce, and yielded 1.4 per cent. of amyloid substance; the liver of the animal which had been fed with starch and sugar weighed two ounces and three-eighths, and yielded 16.9 per cent. of amyloid substance.

Other two rabbits, apparently of the same litter, were fed with starch and grape-sugar; and during three days they were treated in the manner just described. The liver of the animal which had fasted weighed one ounce and two-fifths, and yielded 1.3 per cent. of amyloid substance; the liver of the other weighed two ounces and four-fifths, and contained 15.4 per cent. of amyloid material.

The effect of feeding a rabbit with starchy food is to render the liver much lighter in colour, and more pulpy and easily broken up, than in the normal state.

[At the end of the lecture, Dr. Pavy killed a rabbit by dividing the upper part of the spinal cord. He then immediately removed a portion of the liver, and threw it into a mixture of ice and salt. When it was frozen, he pounded a portion, and boiled it a few minutes in distilled water. On applying Barreswill's solution to the decoction, not the slightest trace of sugar could be detected. A portion of the liver which had not been frozen was treated in the same way; the test gave abundant evidence of the presence of sugar.]

Inventions and Appliances

IN
MEDICINE AND SURGERY.

UTERINE TRUSS: A NEW INSTRUMENT FOR TREATING PROLAPSUS UTERI.

At the quarterly meeting of the Midland Branch of the Provincial Medical Association, held at Derby, on December 4th, 1851, Mr. John Jones of Derby read a paper on prolapsus uteri, and exhibited, for the inspection of the meeting, a new instrument for its treatment. Since that period, the instrument has been greatly improved; and in its present state he finds that it very completely fulfils the purposes for which it is intended, as expressed in the following quotation from the paper referred to:—

"The uterine truss supplies a most important desideratum, by entirely superseding the use of the pessary—an instrument which has hitherto been considered by the profession generally, indispensably necessary in the treatment of prolapsus uteri. It fulfils the following most important indications; viz.: To strengthen those parts which, by their relaxation, have allowed the descent of the uterus; and to remove the pressure on the uterus produced by the superincumbent weight of the abdominal viscera."

As the uterine truss unites strength and lightness with elasticity, it is easy to wear, and efficient in its application. It is highly beneficial under the following circumstances:—1. Delicate females, either married or single, are subject, when walking or standing, to uterine pains, accompanied with a variety of nervous or hysterical symptoms. These are greatly relieved by the truss, which is an admirable auxiliary to medical treatment. 2. When the descent of the womb is considerable, but not amounting to protrusion externally, the inconvenience and pain are proportionably great. In such cases, the truss relieves the pain, and renders walking or standing, which previously were attended with much inconvenience, easy and comfortable. 3. When the disease is so far advanced as to constitute complete prolapsus, the uterus protruding externally, the truss is of inestimable value, as in such cases the pessary often cannot be applied efficiently; whereas the support given by the truss affords great and permanent relief.

In many instances, the truss has apparently produced a permanent cure; as in several very bad cases, and others less severe, Mr. Jones has found that after wearing it for some time, it has been discontinued without inconvenience or recurrence of the disease.

Description. It consists of two parts: an abdominal belt with two spring pads, and a perineal bandage with movable pad.

Abdominal Belt. This is made of strong holland or jean. Two pads are placed in front, each pad formed of two circular tin plates; the outer rather larger than the inner one. They are made to act on each other by an interposed spiral spring, padded with horse-hair, and covered with wash-leather. They are united to each other by interposed elastic web, an inch and a half broad; on each side of the pads is let in an elastic web, about four inches broad. When worn, the belt is fastened with two straps and buckles: on its upper edge are loops, placed at short distances, for the passage of a strap, which buckles round the waist.

Perineal Bandage. This consists of an anterior and posterior portion, united to each other by interposed elastic web, three inches long and two broad. The anterior portion, about four inches broad, has two rows of metallic holes, corresponding with hoops on the abdominal belt; on the inner side is placed a sort of pocket, made of gutta percha tissue, which contains a movable pad, to which is attached a strap with two button-holes, one above the other, corresponding with a button, so as to admit of lengthening or shortening of the pad.