heart's impulse, clear sounds, reduplicated second sound. The patient, who had no asthma, passed less and less urine, with constant albumen in it, and died. His large arteries exhibited endarteritis obliterans. The Malpighian afferent vessels and capillaries showed Gull's hyaline degeneration.

CASES III and IV showed similar general arterial degeneration; but their kidneys were large, red, tough, moderately granular, but not contracted; and the inference drawn is, that asthmatic and cerebral symptoms exhibited during life were due to changes in the heart and brain secondary to the vascular degeneration; and that the patients died prematurely, but in an early stage of what would have become small red granular kidneys.

If now we accept this hyaline-fibroid vascular degeneration as the cause of the interstitial renal disease, as Gull and Sutton and Dr. Leyden would ask us to do, and because it is sometimes far advanced when the renal disease is only beginning, and mainly because it well explains the hypertrophy of the heart and some of the associated mental and cerebral symptoms of renal atrophy, it must be admitted that we have more facts in support of endarteritis obliterans as a change following upon ordinary renal degeneration, than of its being the cause of it; and, from the paucity of the facts in support of Gull and Sutton's hyaline-fibrosis theory, we infer that this is a rare change even in well-marked atrophied kidneys.

Gull and Sutton's original argument was, that this arterio-capillary change was wide-spread throughout the body; that atrophied kidney was one symptom of it only; that it was a premature growing-old or wearing out of the blood-vessels, which led to structural local degenerations situated principally in the kidneys, the brain, the spinal cord, the heart, and the lungs—local degenerations which have been elevated to a too great importance, and regarded apart as local diseases; that in the kidney, and I suppose that they would add in the lungs and in the liver—three of the most vascular glands in the body—these fibrosis-changes may be expected to manifest themselves most prominently. The changes in the kidney entail, however, a peculiar train of symptoms, from the function of this gland; and these have been moderately well understood and studied, under the name of Bright's disease. The kidney is found atrophied in a peculiar way; and the disease, which is really a general one with some remarkable local tendencies, is, they say, wrongly attributed entirely to the organ which is found to have suffered predominantly. Thus they would altogether separate the small red kidney from Bright's disease.

The increase of knowledge of all disease is to make us realise our ignorance of its first beginnings, and to acquaint us further with the evidence of its extension throughout the body. Man is not built in separate compartments well fitted together, although he may be studied thus. This new conception of the cirrhotic granular kidney is bold, and may be true; but we must hold it, as yet, far from proved.

Lastly, we must say something of the widely maintained views in France and Germany, that the change in the blood-vessels mainly concerns their inner coat, and is an endarteritis obliterans. This, doubtless, is the change most extensively associated with chronic renal disease and an impure blood, and, we believe, nearly as often with the white contracting kidney, in its later stages of contraction, as with the red granular one; but this is a degeneration principally affecting the larger arteries, and very usually secondary to hypertrophy of the heart, and dilatation of the arteries. Admittedly, it is not the change in the capillaries and arterioles, to which Gull and Sutton allude; and herein, we think, lies the explanation of the differences of opinion. Dr. Johnson is describing one thing, a very apparently real muscular hypertrophy, although one difficult to estimate; for the state of contraction or dilatation and the mode of treatment after death, whether by injection or otherwise, of an artery, makes a singular difference in the apparent thickness of its muscular walls; Drs. Gull and Sutton are describing another; while Lancereaux, Bartels, Charcot, Rendu, are referring to a third. All are right, and each is only wrong in misunderstanding the other.

Side by side, and therefore most conveniently placed for comparison, in the same volume (xxviii) of the *Pathological Society's Transactions*, 1877, may be read three papers upon this interesting subject from the pens of Drs. Gull and Sutton, Johnson, and Mahomed. It is encouraging once more to find that a feature of such importance in the history of Bright's disease, as these vascular changes are, should have been first publicly notified by his countrymen. But we are not of opinion that they detract at all from the entity of Bright's disease. At most, Gull and Sutton establish one form of renal degeneration secondary to a vascular degeneration. But when the renal degeneration has reached the stage of imperfect or insufficient urinary depuration, the symptoms are in the main those of ordinary Bright's disease.

[To be continued.]

THE CROONIAN LECTURES ON THE INFLUENCE OF THE CIRCULATION UPON THE NERVOUS SYSTEM.

Delivered before the Royal College of Physicians.

BY WALTER MOXON, M.D., F.R.C.P.,
Physician to Guy's Hospital.

LECTURE III.—PART II.

THE consideration of fainting, epilepsy, and the fatal coma of cerebral exhaustion, has confined our attention, so far, to the influence of the circulation upon the nervous centres. But there are other bearings of the influence of the circulation on the action of the nerves which are worthy of some notice, and the chief of these is the condition known as angina pectoris.

Perhaps no complaint has attracted more attention than this singular and painful affection, and perhaps the attention devoted to a complaint has never given rise to so large a record of somewhat incongruous anatomical lesions as causes of the disorder. To select among these, in the hope of finding a proximate cause of the angina, is not a promising task. For one might well say that every kind of disease of or about the heart has been found to be the cause of angina pectoris. Hence, pathologically, angina pectoris had become a rather wearisome topic, when new interest in it arose through the clinical observation of its connection with a certain state of the circulation. No medical discovery in recent years has received a more marked and more just attention than that made by Dr. Lauder Brunton, as to the power of nitrite of amyl to relieve angina pectoris. Indeed, it stands among a very few instances in which the physiology of a disease has enabled a trained and acute scientific mind to infer successfully the remedial powers of a physiological agent. It is well known that Dr. Lauder Brunton observed that, in cases of angina pectoris, the tension in the arteries is very high, and that nitrite of amyl, by relaxing the small arteries, reduces the tension and relieves the suffering.

But, whilst the benefit thus obtained in some cases of angina pectoris is most satisfactory, in other cases it is so utterly wanting, that there must be some differences in the cause of the pain corresponding to so great a difference in the effects of the remedy. I will now ask your attention to some facts which may throw light on this difference.

I will send round tracings from the pulse of a man who is in Guy's Hospital for angina pectoris, and who is always relieved by the amyl. Afterwards, I will send round tracings from the pulse of another man, who died of angina pectoris, which never was relieved in the slightest degree by amyl, but in whose case there is some good reason to believe the amyl acted injuriously. The man who obtained relief is in No. 10, Philip Ward; he is sixty years of age, and has done no work for eighteen months, on account of pain in the chest, which is not constant, yet is present for the most part as a moderate pain. But this pain seizes him at times in a much more severe manner; it then has all the characters of angina pectoris—an excruciating sense of pain and compression of the chest, extending through the left shoulder and down to the fingers of the left hand. This seizure of great pain generally occurs when he is walking. When he has persevered, in spite of the pain, he has several times fallen and been convulsed. Two such convulsive attacks observed in the hospital were seen to be epileptic. (I may remark, in passing, that the epileptic convulsions of this man are more nearly certainly due to anæmia of the brain than in any case I have met with; but the same association of angina with epilepsy has been observed before.) Examination of the heart and great vessels shows evidence of obstruction of the aortic orifice. The man never had rheumatic fever, so that the obstruction doubtless arises from disease of the aortic wall, invading the valves.

Dr. Galabin has been kind enough to take tracings during an attack of the angina, and during the relief which the patient was obtaining from nitrite of amyl. When the paroxysm is at its height, the tracings show that the heart is labouring against high pressure. This is to be inferred, because the pulse bears four ounces and a half pressure; and also because we find a slanting up-stroke, a round top, and almost no dirotic wave. As soon as the amyl begins to act, and the pain to be relieved, these signs of "high tension" begin to rapidly pass off, and

the pulse-tracings return to the condition usually seen in this man. The relief of the pain goes with evidence of more effectual circulation. But there is some doubt whether this more effectual circulation is brought about merely by reduction of the arterial tension; for the pulse in the natural state bore a much higher pressure than it would bear during the angina; so that the actual tension appeared rather lower in the paroxysm, and the state of the artery during the paroxysm would be better ascribed to the heart's failing to keep up to its hard work. The first tracing after the nitrite of amyl shows rather slanting up-stroke, then deep dip, but slight dicrotic rise. Next tracing shows sharper up-stroke and more dicrotism. It looks as if the drug first relaxed the arteries and reduced tension, and then, a little later, stimulated the heart to act more sharply. The tracing with the effect of nitrite of amyl going off after the paroxysm is very like the ordinary tracing without the drug. It may be observed that the pulse is slower, though the tension is lessened in the attack; so that the cardiac regulating-apparatus does not act quite normally.

From this observation, it would appear that the pain in angina pectoris occurs in persons whose arterial tension is high; but that the attack of angina does not coincide with an increase of tension; rather, indeed, with a decrease of it. The pain comes on through a temporary, and in fatal cases a permanent, failure of the power of the heart to cope with the high tension in the arteries. And the relief of the pain by amyl comes partly through the nitrite relaxing tension, and partly through its stimulating the heart. In short, angina pectoris arises in this man whilst the heart is labouring in vain against an ordinary high tension—that is, through relative failure of the heart against high tension; and, as pain occurs with a lower than normal tension, the painful parts must, at the time, have increased sensibility to such tension. In other words, we must recognise state of nerve, as well as strain of vessel, among the causes of the pain.

Now my second case, in which amyl did not in the slightest degree relieve the excruciating and overpowering suffering, shows in the pulse-tracings a very different state of affairs. The pulse, in its ordinary condition, has characters, which appear like those of slightly higher tension than normal, about the degree of increase of tension that is met with in chlorotic girls. A pressure of four ounces develops the tracing best, and the tracing offers a marked tidal wave and a slight dicrotic wave. But a pressure of five ounces flattened and a little more crushed, the pulse. These tracings were taken by an authority, whose skill in using the sphygmograph and ability in interpreting its writing is, I had almost said, unequalled. Dr. Galabin, who took the tracings, ascribes the condition of the pulse, rather to inelastic arteries than to high tension: concluding this to be the case on account of the sudden crushing of the pulse by a moderate pressure. Now when the gentleman whose pulse furnished these tracings, used some effort and produced the pains of which he complained, and when Dr. Galabin took a pulse tracing as speedily as possible, and whilst yet some of the pain remained, it was thereupon found that the pulse showed lower tension than in its natural condition. And when nitrite of amyl was at once administered, there was scarcely any effect at all produced by it upon the pulse, hardly any dicrotism appeared, although there was a slight diminution in breadth and increase of weight of the tidal wave; and the amyl produced no relief whatever. Shall I be excused for giving full particulars of this case, important as it is from the completeness with which the conditions of it during life and after death were allowed to be observed? The history is as follows: Mr. B., Civil Engineer, 42 years old; a well-built, healthy-looking man, of appearance younger than his stated age, said that he had been ten years in India; when there, he had nothing beyond a very slight sunstroke, and inflammation of the bladder of a few days' duration, which, however, he said, rather brought him down in the way of nerve-power; he recovered on the way home and has been well ever since, until a month ago, when going up a hill he suddenly felt a pain which stopped him; the pain went across his chest at the level of the heart, and up the breast-bone and down the left arm into the fingers. When he persevered in the attempt to walk the pain went up his neck to his jawbone, and seemed to fix his jaws; when he desisted from the effort, his pain soon ceased. But since the day when he was taken, he finds himself unable to go up a hill without a recurrence of the pain; and latterly it has been more easily brought on, and in fact stops him whenever he goes walking, and stops him in the most absolute way. The pain is not accompanied by palpitation or any sense of effort of the heart, or fault of the heart's action that he is conscious of; he ascribes the pain to his liver. There is no tendency to sickness when he perseveres in walking or tries to do so. He praised his appetite and digestion. Up to that time, he had not had a single attack that was not caused by exertion. The possibility of such a thing had not struck him. I examined his heart very carefully, and could not detect any abnormal murmurs; the sounds them-

selves were rather feeble, the apex-beat was scarcely palpable. These conditions were not more evident than is the case in many quite healthy persons. The temporal arteries were not visible, nor were the radial arteries either thick or tortuous. The pulse was, however, slightly visible at the right wrist. This gentleman was advised to take with him in his walks some nitrite of amyl capsules, and when pain appeared, to break the capsule and use it by inhalation. Dr. Bosworth, of Sutton, wrote to me December 14th, "he still has the pain, he has carefully tried the nitrite of amyl capsules, but they have not the least effect either in abating the pain or preventing its recurrence." Meantime Dr. Galabin kindly took the tracings I have shown.

The next I heard of Mr. B., was December 23rd, from Mr. Ewen, of Exmouth, who said that Mr. B. had been seized there with an attack of angina, whilst in bed. Again, two weeks after that, he had had a cerebral attack, including aphasia; and finally, I heard that Mr. B. had died suddenly. An inspection was made, and the heart and roots of the lungs were sent to me, intact, by Mr. Ewen for examination. The specimen is here, and it very clearly shows why nitrite of amyl failed to relieve the pain, and failed to produce any marked effect at all upon the sphygmographic tracing. The heart is of about natural size. Its left ventricle is dilated, and the wall is thin. The portion of this ventricle, near the apex; for about two square inches, is changed to a yellow fat-like substance, looking quite unlike muscle; a lesser degree of the change in the form of fibrous degeneration extends around this part, so that but a moiety of the whole substance of the thin wall of this ventricle is free from change. Where the change is most extreme at the apex, there was seated an *ante mortem* polypus of clot as large as a filbert. This was burst open, and its contents partially gone. Microscopic examination showed the yellow leathery substance to be altered muscular fibre; fully one-third of the wall of the ventricle was thus destroyed and the rest was thin, wasted, and flabby.

Now, in this case, the symptoms were those of angina pectoris in its most characteristic form, as described by Heberden; and the symptoms were utterly unrelieved by amyl; and when we consider the facts, which are beyond doubt in this case, we must see reason to conclude that high arterial tension is not the only, or the necessary, cause of angina pectoris, even if it be the principal cause.

For the facts are these. First: sphygmographic tracings showed rather inelastic arteries than high tension. Second: exertion which brought on the pain lowered the tension of the pulse, as shown by the sphygmograph. Third: nitrite of amyl produced very little change in the pulse, as shown by the sphygmograph, and brought no relief at all. And lastly: the state of the left ventricle, as found on *post mortem* examination, showed such extreme wasting and degeneration, that it appeared impossible that tension could have been raised by its action; and to confirm this impression, an old *ante mortem* clot gave evidence of a long-standing passive and stagnant state of the blood in the left ventricle. The condition of the cardiac nerves, which no doubt caused the angina, I will presently describe. In short, the doubt as to high-tension which the pulse contributed; the nearly certain assurance that there could be no high tension which the heart contributed; and the conclusive evidence that there was no high tension to relieve which the total inefficiency of amyl contributed: all these sum up to prove that in this case the angina, typical as it was, must have arisen from some other cause than high tension in the arteries.

Let me now show another set of tracings, taken by Dr. Galabin from the pulse of a gentleman who has angina pectoris in a most typical form. In this case the disorder has lasted about two years; some of the attacks have been so severe that recovery appeared hopeless to the medical attendant, so intense was the pain he endured, and so great was the consequent prostration. But in the height of the attacks no change was noticeable in the pulse, either in rate or in quality. I could not obtain tracings of this pulse during the paroxysm. The tracings taken in the interval are thus described by Dr. Galabin. "The pulse is fully developed by a very low pressure—one ounce and a half, but bears pressure up to three ounces (about the average pressure for a youthful normal pulse) without much change; a pressure of three ounces and a half destroys its characters, as you will see; and a very little more quenches it altogether. The curve differs from that of a perfectly normal soft pulse only in the fact that the tidal (predicrotic) wave commences too early in the descent. I should think that the general conclusion is, that the arterial elasticity is in very fair condition, considering the patient's age, and that there is no excess of tension, the pulse being a soft rather than a hard one."

Now, in this gentleman's case, the inhalation of nitrite of amyl produced no relief whatever. Injections of morphia were the only means by which the pain could be assuaged. Here, then, we have evidence that, in the intervals between the attacks, the tension was low; whilst in the attacks we can infer that there was no high tension, inasmuch

as amyl proved of no service whatever : in other words, relaxation of the arteries did no good.

In the series of three cases just related, we have, first, a patient with signs of aortic disease, whose pulse-tracing during the paroxysm gave the characters of high tension, and whose pain was relieved by nitrite of amyl ; thus showing that the tension was an essential factor in the attack of pain. But, at the same time, it was observed that the tension of the pulse was lower in the attack than in the patient's ordinary condition ; so that some other factor than the tension brought on the attack, although lowering the tension took the attack away. Thus, even where the relief of the tension removed the attack, the tension is proved to have been but one factor in the causation of the pain.

In the second case, slight signs of high arterial tension were present in the ordinary pulse ; but it was observed that in the pain this tension was lowered, whilst nitrite of amyl was utterly useless. Here we find tension reduced in the attack, as in the first case ; but it is not in this case a factor in the production of the pain—relief of tension has no effect.

In the third case, there is no high tension, but quite the contrary ; the pulse is of low tension, and amyl is again utterly useless. In this case tension passes out of sight altogether.

The general conclusion is, that high arterial tension is not to be regarded as the determining cause of angina pectoris, but as one factor of pain in some cases of angina pectoris ; and that, whilst it is true that amyl gives relief when high tension is present, there is reason to be cautious in pressing the amyl when it fails : for, by lowering tension when already low, the amyl may dangerously increase the tendency to stagnation of the blood ; and there was evidence, in two of the cases, that tension was really lower during the pain. Indeed, the aching which are suffered at the heart are of two distinct kinds, like the aching which are suffered in other parts—say the teeth. In either case, there is a kind of ache which is more properly a tenderness of the part, so that it suffers in its ordinary service, as when a tooth cannot chew, or the heart cannot beat without pain, more or less severe. Here, in the case of the teeth, we are able to use the other side of the mouth, or even, if hard driven, to live on liquid diet, and give the tender organs a rest for their recovery ; and even in the case of the heart, when its work distends the aorta and causes pain, we can take advantage of what Dr. Lauder Brunton has so well taught us, and can open the distal vessels with nitrite of amyl, so as to relieve the tension.

The relief thus given lasts only for a while, and often only for a short while ; and it is very desirable, if possible, to find means of lowering pressure permanently. If the pain in angina, which is relieved by amyl, is caused by the pressure of a bulging aorta, there is a fair prospect of permanently lessening or removing such pain by any measures that would tend to permanently lower general arterial tension. But what means have we of permanently lowering arterial tension ? Such a result is not so easily obtained as might at first be supposed. It is natural to think that if blood be drawn, the tension in the vessels must be reduced with the loss of their contents ; but it has been shown by experiment that this is not the case. Bleeding does not with any certainty, or to any large extent, lower the pressure in the arteries. Neither, indeed, will any attempt to suddenly alter the whole quantity of blood in the body succeed in suddenly lowering arterial tension.

Yet it is certainly possible to lower vascular tension by lessening the quantity of liquid in the whole blood mass. This is shown in a rather horribly conclusive way, in some experiments of Kussmaul and Tenner, in which they desired to remove the cerebrum, and then to examine the results of further sections of the cerebellum. But they found that all their normal rabbits bled to death before the ultimate conditions for their experiments could be reached. Hereupon the experimenters kept some rabbits on a dry diet of corn, etc., for two weeks, and the effect of this deprival of liquid in the food was so satisfactory, and the blood in the vessels fell to so low a tension, that such a rabbit could have its calvaria and cerebrum cut away, and its occiput and cerebellum mutilated to any desired extent, without dying too soon for Kussmaul and Tenner's purposes. Here we see the power of bleeding and dry dietary crucially contrasted ; and the result is to show that the method of Valsalva for the cure of aneurysm, so far as it proceeded by bleeding, did not correspond with the most hopeful line, neither so far as it proceeded by starvation of solids did it correspond with the most hopeful line. The experiment of Kussmaul and Tenner rather shows clearly that for reduction of blood pressure it is not necessary to bleed, nor is it necessary to reduce solids in the diet, so far as they are truly solid, and not succulent ; but that a very great degree of reduction of tension may be reached by starvation of liquids.

In the *Clinical Society's Transactions*, vol. iii, there is a case of angina pectoris relieved by nitrite of amyl. It is very ably and carefully reported by Dr. Lauder Brunton ; and it shows well the signs of

high tension in pulse-tracings taken during the pain, and also the relief of the tension as the amyl came into operation. The pulse was quickened during the attack of pain. The sphygmograph used by Dr. Brunton did not enable him to estimate the degree of pressure upon the pulse. His conclusion was that, in this case, the attack consisted in spasmodic contraction of some, if not all, of the small systemic, and probably of the pulmonary vessels, causing great increase of the blood-pressure on both sides of the heart. He remarks upon the fact, that with the high tension the pulse becomes quicker, thus showing a derangement of the cardiac regulating apparatus, which should cause the pulse to become slow as the pressure rises. But I believe that, unless we can estimate the pressure borne by the pulse, one cannot certainly conclude from the pulse-tracing that the tension is positively high ; all that can be said is, that it is high relatively to the power of the heart. So that there may not have been unusually high tension, but rather a failure of the heart to cope with the existing tension, such as Dr. Galabin found in my case. Dr. Brunton concludes that the pain was not originally in the nerves composing the cardiac plexus, but was produced by a pressure of blood upon those of the heart and arteries, and that the pains were of a rheumatic character.

It appears, then, to be exceedingly difficult to decide what was the proximal cause of the pain in these cases ; but it is a significant fact, that Dr. Brunton's case, which was relieved by amyl, was one of aortic disease with regurgitation, and my case was also one of aortic disease, and as it was not rheumatic it was in all probability of the nature of deforming aortitis. Indeed, I believe that it is chiefly for the relief of attacks of anginose pain in aortic disease that nitrite of amyl has come into such general use in our hospitals since Dr. Brunton's valuable discovery was made known ; whereas I have been generally disappointed with amyl when there has been no sign of disease of the aorta. Cases of relief by amyl in angina in which there was no evidence of heart-disease are recorded ; but I do not know of any such cases which have been cleared up by *post mortem* examination.

But we have seen that the cases of angina pectoris which are due to high arterial tension form only a part of the whole number, and there are other cases of angina which are more purely neuralgic, and are not relieved by amyl ; and these latter cases have an altogether different kind of cause. It may be that the pathological change which produces the more purely neuralgic angina is not always the same. But an example of what I have found, in many cases, to be a very evident cause of the pain is before me now in this specimen, which is the heart in my second case, that of Mr. B., whose pulse showed reduced tension when under the pain, and whom amyl failed to relieve. The state of the nerve accompanying the anterior coronary artery of this heart is sufficient to account for any degree of pain. In searching for the cardiac nerves, I observed that the aorta was quite healthy. It was quite separable from the texture around. The cardiac nerves in their course between the aorta and pulmonary artery, close to the origin of these vessels, were easily found ; and on following them down, they were quite natural in appearance until the anterior branches came to a diseased part of the corresponding coronary artery. Now the mouths of the coronary arteries were natural, and the anterior vessel was natural for about half an inch, then suddenly became swollen at a bifurcation so as to be thick and white. At the same spot, it became impossible to separate the vessel from the tissue around so as to render visible the exterior of the artery. In fact, here, dissection of the vessel became impossible, and the nerve could no longer be separated from the artery without tearing or cutting the vessel. At one inch from its origin, the artery was quite blocked up, and full of pus-like detritus of old clot ; the diseased part of the heart's wall corresponded to this part of the artery. Microscopic examination of sections of the vessel showed a good example of deforming arteritis. Whatever was the origin of this patch of inflammation in the artery, it extended to the tissue around, with the effect of causing a dense fibrous change, which involved the branch of cardiac nerve. In short, the nerve was involved in the inflammatory decay of the artery in the same way as the branch of dental nerve is involved in the inflammatory decay of a carious tooth.

Let me give one perhaps yet more striking case of neuralgic heart-ache. The most remarkable case of angina pectoris which I have met occurred in a child of eleven years of age, who used to be seized with onsets of intense thoracic pain when at play. No physical signs of heart-disease were found in her. In one of her seizures the child died ; and, on examining the heart, I found the aorta in the first two inches of its length softened, and with almost gelatinous appearance, through subacute inflammation. At the point where the cardiac nerves passed between the aorta and pulmonary artery, they were involved in the thickening and inflammation which surrounded the former vessel. Neither the valve nor the coronary arteries were at all involved in the

disorder. But the implication of the nerve in the inflammatory disease of the vessel was most obvious, and the pain was a completely explained by the *post mortem* appearances as facial neuralgia is explained by finding an exposed branch of dental nerve. In both these cases, the nerve was involved in inflammatory decay of the artery. A similar case of inflammation, including the cardiac nerves and causing angina pectoris, is given by Lancereaux, and is figured in his *Atlas of Pathological Anatomy*.

From the foregoing observations, it would appear clear that there are two distinct kinds of angina pectoris: one which is a result of tenderness under overstrain of the great vessels. In this kind of pain, high tension in the arteries is a factor, although a morbidly sensitive state of the nerves must at the same time be present. Such pain corresponds to pain and tenderness in the teeth during mastication, and it is lessened by whatever will lessen the strain upon the tender parts—so that amyl nitrite, or (less certainly) nitro-glycerine, will bring welcome relief, even when it does not give entire comfort. But the relief thus afforded is apt to be temporary, and often only partial—so that, even in these cases, we have to bring in other means, and supplement the service which the amyl renders in relieving the strain upon the vessel by such further service as morphia can render by reducing general sensitiveness. A second form of angina pectoris is a kind of neuralgic heartache, arising from actual inclusion of a cardiac nerve in the inflammatory decay of an artery, and no signs of high tension in the vessels are present. This disease corresponds with such neuralgic toothache as arises when a branch of the dental nerve is involved in inflammatory decay of a tooth. It is more paroxysmal and violent than the first form, the intervals are more free, and there are usually no signs of disease of the heart or great vessels. The means of relief are those which are found useful in the similar neuralgia of the face; and lead us, firstly, to reduce morbid sensitiveness by such improvement of tone in the general health as may be possible; secondly, to employ such alternative drugs as, like arsenic and quinine, have proved themselves to possess some power of controlling the tendency to neuralgic pain; and, thirdly and chiefly, the use of sufficient quantities of morphia to afford relief in the attacks. Morphia, given in the form of subcutaneous injection, will produce the most satisfactory result in the way of temporary relief of this form of angina pectoris.

But angina pectoris does not always arise from organic changes in the heart or arteries: for, like facial neuralgia, it may occur secondarily, as a reflected pain, whose source is at a distance. The primary disturbance which gives rise to reflex angina pectoris is usually seated in the course of the pneumogastric nerves. A very remarkable example of this occurred in the person of one of the greatest surgeons of our own or of any past time. My late friend and colleague, Mr. Hilton, was attacked, three years before his death, with severe angina pectoris—so severe that the cramping thoracic pain would not allow him to walk many steps, and he was obliged to have a cab to go a distance of one hundred yards. This pain, after causing great suffering for several months, passed away; and then, very gradually, during the next two years, the symptoms of cancer of the stomach developed themselves. The heart and great vessels were found after death to be entirely free from all morbid changes.

But, not only may the gastric branches of the pneumogastric thus influence the cardiac nerves, and give rise to the special pains of neuralgic heartache; but, on the other hand, I have met with some remarkable cases, which time will not allow me to detail, in which aortic disease has been associated with abdominal pain in the hepatic region, of a neuralgic character; and, in its mode of onset, and conditions of relief, behaving just like angina pectoris. Nor is it only the sensory fibres that thus vicariously suffer. A lady, fifty years of age, has been for three years under my observation, with no other sign of organic disease than a weak heart and feeble pulse. This lady is reduced to a most sedentary mode of living by the fact, that, if she tries to walk but a few yards, she is suddenly attacked with vomiting. Heberden, in his description of angina pectoris, mentions that some of his patients, who persevered in walking in spite of their pain, were attacked with vomiting. In this lady the vomiting appears without the preceding pain; the onset of gastric disturbance, without previous nausea, is as sudden and surprising to her as is the pain which seizes the chest in angina.

The largeness of the subject I chose, when the College honoured me with an invitation to deliver these lectures, was not so broadly apparent to me as it is now that I have to take leave of it, with so deeply felt a sense of the imperfection of the treatment it has received at my hands. I can only hope that the few points I have brought before you may contribute a little towards maintaining, for the hour, that interest which continuously belongs to everything affecting the brain.

In my first lecture, that part of it which spoke of the cornu of the

fourth ventricle, I adduced Dr. Guy's observations as in support of the suggestion I made with respect to the function of the choroid plexus in the cornu. I inadvertently reversed the bearing of a part of his results, and they were thus made to appear more favourable to my suggestion than they really are. I did not say that the choroid plexuses of the fourth ventricle are overlooked in our anatomical works, but that the occupation of the cornu by the choroid plexus is not mentioned.

A LECTURE ON THE PATHOLOGY OF SCROFULOUS LYMPHATIC GLANDS.

Delivered at the Royal College of Surgeons of England.

By FREDERICK TREVES, F.R.C.S.,

Erasmus Wilson Professor of Pathology at the College: Assistant-Surgeon to the London Hospital.

MR. PRESIDENT AND GENTLEMEN.—There are few matters in the domain of pathology that are at the present time more indefinite, and more in need of scientific limitation, than is the pathology of scrofula; and probably in the past there will be found no condition of disease that has been more susceptible to varied interpretation, or more burdened with repeated change and frequent amendments of opinion. That this should be so, it is not hard to understand; and I believe that the explanations of the difficulty depends mainly upon two factors. In the first place, the less marked forms of this disease constantly merge into the manifestation of what is known as mere ill-health, mere delicacy of constitution. These terms refer to conditions that are without any definite significance, without a pathology, and without the least scientific meaning. The very condition, indeed, known as poor or delicate health, represents a wide and blank area in all pathological surveys; it exists as an indication of want of knowledge and lack of precise and inclusive notions of disease; it is, from a pathological point of view, a species of common land unowned and uncultivated; many diseased conditions besides scrofula encroach upon it, and every year's increasing acquaintance with morbid change causes some portion of this area to be absorbed by one disease or by another, and rendered thereby definable and distinct. So long, however, as it will be possible to ascribe any morbid conditions to mere ill-health, to delicacy, to a feeble state of body, so long will pathological knowledge be incomplete; and as scrofula has been bordered widely by this chaotic district, it is a matter of no surprise that the term should still be somewhat vague, and the character of some of the included diseases a little indistinct. In the second place, the subject of scrofula has been considerably complicated by its connection with the subject of tuberculosis. In commencing any discussion upon the pathology of scrofulous affections, it has been customary, if not necessary, to open the argument with a definition of tubercle, and to then proceed to answer the question, is scrofula a tuberculous or a non-tuberculous process? This forced alliance of a vaguely defined disease, with a still less distinct morbid condition has, I believe, proved a serious bar to the proper appreciation of scrofulous processes. Notions as to the nature of tubercle have undergone, from time to time, most rapid and emphatic changes; attributes, once considered as essential, have been one by one eliminated; the very term has shifted from this morbid appearance to that; and the tubercle of one period of knowledge has not been the tubercle of another. The forced association of scrofula, therefore, with this unstable element, the very Proteus of pathology, has, I believe, contributed not a little to the present indistinctness in our knowledge of that affection. The great point has been, to range such facts as have been adduced on the one side or the other; to class them as tuberculous or non-tuberculous. Thus it happens that few additions to our knowledge of the histology of scrofula have been made, that have not been seriously encumbered by theoretical matter; new observations have been influenced, often to no slight degree, by an attempt to make appearance accord with theory; and many sound investigations have been lessened in value by the deductions and inferences with which they have been introduced.

The clinical difficulty, therefore, on the one hand, of clearly isolating scrofulous affections from the unknown factors of ill-health and frailty of constitution, and the pathological difficulty, on the other, of avoiding the indistinctness that appears to have been always the hereditary right and