tailed. They are, therefore, worthy of a further extension. It was found that waters containing different organic substances, when allowed to decompose, do not give rise to the same microscopic phases of life; but certain substances seem conducive to certain species. It would, however, extend this paper too much to enter into the microscopic examinations.

I am of opinion that peroxide of hydrogen is a substance which ultimately may be used with advantage for the purification of drinking water. It may be viewed as water supersaturated with oxygen, the extra equivalent of oxygen being held by the faintest phase of attachment coming within the term of chemical attraction; so that the least disturbing agency imaginable would decompose it into oxygen, ozone, and water. Peroxide of hydrogen oxidises organic matter, and stops fermentation: therefore, providing that we had a pure article, we could oxidise the organic matter, without introducing anything but pure water. But at present peroxide of hydrogen is very dear, and, as found in commerce, is much too impure to be used in drinking water. Another doubtful point is, that this curious substance sometimes seems to play the part of a reducing agent, as well as an oxidiser. If so, sulphuretted hydrogen might be generated by its action upon sulpho-compounds, such as albumin.

It has been lately stated that charcoal will not, after a little time, purify drinking water; and that, so far from taking from the water organic matter, it gives up again a certain amount. Thus: that water, on analysis, before and after passing through charcoal which had been some time in use, was more contaminated with organic matter after having been passed through the said filtering medium. If it were not for the fact that the paper containing the above statement had received a considerable amount of commendation, and, *ergo*, publicity, I should have passed it by. But the author of that paper evidently misunderstood the position. The *modus operandi* by which charcoal acts on oxidisable organic substances is not so much by virtue of any attractive or selective power that it possesses; but, as a carrier of oxygen in a concentrated form, it is one of the most powerful oxidisers we possess. The oxygen condensed within the charcoal acting more energetically than the available oxygen, we can apply in the form of permanganate of potassium. The original experiments of Dr. Stenhouse in connexion with the action of charcoal have received ample confirmation from the late investigations of Professor Calvert (*Journal of the Chemical Society*, June 1867).

It is true that charcoal, after a certain time, becomes effete—its activity destroyed; but it is equally wonderful to observe the length of time a charcoal-filter with the following provisions will retain its vitality, if I may use the expression: 1. That the water passed through it does not contain a very large percentage of organic matter; 2. That it is drained from the water the better part of each day, so that the atmospheric oxygen (with as little of the dust as possible) may have access to it. Charcoal, under these circumstances, will be found to do its work well. You must, however, give it its food quietly as it can digest it.

I can hardly believe the statement made, that charcoal will, after a certain period, transfer again organic matter to water. I have examined water before and after passing through a charcoal-filter which had been in daily use in my own house over a month. There was not much difference, it is true; but the water which had passed through the filter had most decidedly the advantage. I can well imagine that, as the charcoal acts as a mechanical recipient to the insoluble organic matter, that substance may at last accumulate to such an extent as to enter itself into a state of fermentative change. The activity of the charcoal, being by this time exhausted, or at least only sufficient to supply a minimum of oxygen, would only assist such a decomposition. This state of the case would be simply the putrefaction of a mass of solid organic matter independent of the charcoal—not the rendering back from the charcoal of something it had absorbed from the water. I would suggest that a well-constructed water-filter should have an arrangement by which the insoluble organic matter should be separated before the water comes into contact with the filter. In such a filter, the organic matter could never accumulate.

In conclusion, I may point out that the most valuable method of examining water is that which I believe was first used by Dr. Frankland—that is to say, to examine the relative amount of oxygen and nitrogen found in water. In absorbing atmospheric air, the oxygen is dissolved with a little greater avidity, so that that gas is found in water in a larger relative proportion than in atmospheric air; viz., the relative proportion of oxygen to nitrogen is about 21 to 79; but as found in water it is about 32 to 68. Now, if the enclosed air is found to contain less oxygen, it shows that that element is being consumed by chemical changes going on within the water; or, in other words, such a water is not in its normal state, and therefore is unfit for general use.

The aqueducts of antiquity show how important the blessings of pure

water were considered from time immemorial, and how necessary to the welfare of all communities. But I cannot see that we have improved upon our forefathers; for, whilst they spent enormous sums to produce stupendous supplies, we seem to me to spend our money in merely building immense reservoirs. Anything is, however, better than that "like a dog we should return to our own vomit."

"Most blessed water, neither tongue can tell
The blessedness thereof; no heart can think,
Save only those to whom it has been given,
To taste of that divinest gift of heaven."

HISTOLOGICAL AFFINITY OF TUBERCLE AND FIBROID DEGENERATION.

By H. CHARLTON BASTIAN, M.D.,

Professor of Pathological Anatomy in University College, and Assistant-Physician to University College Hospital.

[At a recent meeting of the Pathological Society of London, Dr. Bastian exhibited specimens of lung, liver, and kidney, tending to show the close histological affinity of tubercle (grey granulation) to the early stage of fibroid degeneration or substitution. As the subject is one of peculiar scientific interest at this moment, we report [at length] his remarks on the subject.]

At the present time, when the question of the inoculability of tubercle is attracting so much attention, it is a matter of great importance that pathologists should not only be quite agreed as to the microscopical characters of that particular morbid product which they call tubercle, but also that they should be thoroughly familiar with the minute structure of such other morbid products as are most akin to it histologically, and which, therefore, might possibly be confounded with tubercle on microscopical examination.

In common with many other pathologists, I look upon the grey granulation, such as we meet with in cases of acute tuberculosis, as the type of tubercle: so that these bodies, first described by Bayle, and regarded as distinct from tubercle, are now looked upon as the only morbid products undoubtedly deserving of this name. This view is based upon the fact of the grey granulation being the only one of the morbid products to which the name has at various times been applied, which has a constant structure, in whatever organ of the body it may be found; and from the fact that it occurs in various organs and tissues of the body simultaneously, in the diseased condition known as Acute Tuberculosis. Now, I am prepared to show that even an additional complication must be introduced into the history of tubercle, as I think that the microscopical specimens which I submit to the examination of members of the Society will clearly demonstrate that the histological elements met with in the tubercular grey granulation are indistinguishable from those met with in the early stages of what has been called fibroid degeneration. For the sake of comparison, I have brought sections through grey granulations as they occurred in the lungs, liver, and kidney of a child who died during an attack of acute tuberculosis; and also other sections (all from specimens hardened in chromic acid) of similar organs in which the so-called fibroid degeneration was advancing, taken from individuals in whom there was not the slightest evidence of the existence of tuberculosis.

It is not my intention to enter minutely into the histological characters of tubercle, since this is now pretty widely known, and the structural affinity of its more characteristic elements to those entering into the composition of lymphatic glands has been fully insisted upon by Virchow and others. Suffice it to say, that it has a fibro-nuclear structure; and that, on examination of transverse sections, a number of spherical or ovoidal nuclei may be seen, whose prevailing size is about 1-4000" in diameter (or rather less than that of a red blood-corpuscle), situated between the meshes of a delicate fibrous network. The nuclei mostly contain a few granules, and one or two larger dots or nucleoli. Here and there, cells are seen, within each of which is contained a nucleus similar to those just described. A smaller number of nuclei, also, are met with, having a more elongated or oat-like shape; and these occur principally in the vicinity of more abundant fibre-tissue—for, in different parts of the section, it will be seen that the amount of fibre-elements and the number of nuclei bear different proportions to one another. The more or less spherical nuclei of the size named, however, exist far more abundantly than either of the other cellular or nuclear forms. Precisely the same description suffices for the early stages of fibroid degeneration or substitution: its microscopical elements seem to me absolutely indistinguishable from those of tubercle. But, having said thus much, I am bound, on the other hand, to say that in most cases one would not have much difficulty in discriminating between the two, notwithstanding the histological identity of the elements of which they are com-

posed. Tubercle occurs in little rounded masses, whose size rarely exceeds that of a hempseed, and each of these masses has been formed, as it were, from several separate centres; so that we see (in transverse sections through a granulation) what appears to be a section through a small tumour whose elements are more or less *concentrically* arranged around several centres. This concentric arrangement of elements is frequently absent altogether in cases of fibroid substitution, and is never by any means so marked as in the grey granulation. Where fibroid substitution is commencing in an organ, the new tissue, often starting from the walls of a blood-vessel, proceeds continuously in different directions, and has no tendency to produce rounded masses only, similar to those of tubercle. It often advances rather in the form of bands, and in proportion as this new tissue grows, so do the proper elements of the organ disappear before it; so that at last large tracts of fibro-nuclear and fibre tissue are found in the place of the anatomical elements proper to the part, every vestige of whose original structure has ceased to exist. These are pretty well marked differences as regards (1) the more obvious anatomical peculiarities of the two morbid products, and others even more notable obtrude themselves when we consider (2) their ultimate fate, and (3) their mode of origin. Tubercle always existing in the form of miliary tumours, the more internal elements of each of the component nodules (by the aggregation and union of which a grey granulation is formed), have a strong tendency to undergo fatty degeneration and disintegration—a process which may spread outwards, and ultimately involve the whole nodule*; whilst, with fibroid substitution, it must be clearly understood that the fibro-nuclear condition represents only one temporary stage of this morbid condition; and that, after a time, the number of nuclei gradually diminishes, whilst the fibre-tissue becomes more abundant, and the organ begins to diminish in bulk. No particular tendency to fatty degeneration is evinced; and the rounded and ovoidal nuclei seem for the most part to disappear before the gradually increasing fibre-tissue, just as the proper anatomical elements of the part originally disappeared before the fibro-nuclear growth. Then, again, tubercle is the anatomical lesion characteristic of a grave constitutional disorder; whilst fibroid substitution seems in most cases to depend far more upon local than upon constitutional causes; and, in those instances where it does seem to be more dependent upon a diathetic condition, this condition is one entirely distinct from tuberculosis.

Several pathological conditions have been described under different names, all of which I am disposed to look upon as fibroid substitutions, whose existence is due more to local than to constitutional causes. Thus, the condition which Laennec described as *grey tubercular infiltration*, and which is frequently met with surrounding more or less slowly formed caverns in the lung-tissue, was called chronic pneumonia by Chomel, and is still called so by many pathologists, though Addison and others have described it under the simpler name of grey or iron-grey induration. Grisolle and Charcot agree in the opinion that such indurated tissue is due to a new fibre-growth; the characters of which, moreover, they hold to be precisely similar to that which is met with when what they call chronic pneumonia occurs as an almost immediate sequence of an acute pneumonia. But, seeing that the so-called chronic pneumonia thus occurring, and that met with around old lung-caverns—or even around adventitious products, such as acephalo-cysts—presents similar structural changes, and that these anatomical characters are altogether different from those of acute pneumonia, this name seems an unsuitable one: more especially since the character of the morbid change is absolutely similar to that which Dr. Handfield Jones and Dr. Sutton call fibroid degeneration, and which, when existing in its most extreme form, gives rise to the condition known as Cirrhosis of the Lung. All these fibroid changes, therefore, as well as the analogous processes which occur in the lungs of artisans whose air-passages are exposed to the contact and irritation of foreign particles, and the induration which often binds closely packed nodules of tubercle together even where no caverns exist, are intimately related to one another, and are due, I believe, much more to local than to constitutional causes. Because these fibroid indurations or substitutions coexist so frequently with tubercular and so-called scrofulous diseases of the lung, we must not look upon them as necessarily and immediately dependent upon the same constitutional cause. It is well known that precisely the same kind of induration is produced around such an accidental cause of irritation as the existence of an acephalo-cyst in the midst of the lung-tissue, as we find produced around the walls of a tubercular or scrofulous cavern. Mechanical irritation, produced by the inhalation of fine foreign particles, produces the same kind of induration in the lungs of artisans who may be quite free from constitutional tubercular taint; and, as I have stated on a former

occasion, a very large number of the cases of Cirrhosis of the Lung in its pure form, no tubercle whatever is met with. Such facts should, I think, tend strongly to convince us, not only that fibroid changes may exist alone in the lung, quite independently of any tubercular or scrofulous taint, but also that, when coexisting in the same organ with the products peculiar to either of these constitutional conditions, these changes may even then be secondary and local, rather than primary. They are, in fact, as we so often see, rather conservative in their nature, and to this extent, so far as tendency is concerned, may be considered as directly antagonistic in their action to the destructive course of the more primary products of disease.

This group of morbid changes has been referred to the category of chronic inflammations by some pathologists, whilst others have preferred to speak of them as fibroid degenerations. In my opinion, the process by which this morbid alteration is brought about differs in important respects from inflammation on the one hand, and from degeneration on the other. It seems to occupy an intermediate position, since it simply leads to the formation of a new growth foreign to the parts. Looking upon a characteristic inflammatory process as one in which there is not only a greatly increased *formative* stimulus leading to a rapid hyperplasia of tissue-elements, but also a rapid necrobiosis or molecular death of the new-formed and old adjacent elements—so that rapid production and rapid death are advancing side by side—the process in question seems to present the formative stimulus and increase, and to be almost entirely wanting in the destructive part of the inflammatory change, since the new-formed elements persist. On the other hand, there is not merely the damage to the actual structural elements of the part, such as we meet with in degenerations (of which the fatty may be taken as the type), but rather the complete disappearance of the functional elements of the organ, whose place is gradually occupied by an advancing new growth. The new growth, it is true, is functionally inert, so that there is an amount of functional degradation of the organ answering to the textural replacement, although there is no degeneration of tissue in the strict sense of the term. For these reasons, I would propose that all such tissue-changes should neither be styled chronic inflammations nor degenerations, but, instead, that the process should be spoken of as one of *fibroid substitution*. This name seems a good one, as it is merely descriptive of what actually takes place, and implies no theory as to the nature of the process by which it has been brought about, concerning which differences of opinion may exist.

SPONTANEOUS AMPUTATION OF THE FOREARM.

By J. R. SWANTON, M.D., Bantry.

ON the afternoon of Saturday, October 5th, a boy, aged 7, was brought to my surgery, having, it was stated, strayed into a field for the purpose of picking blackberries, and while there been brutally attacked by a donkey. He certainly presented a pitiable sight, with scarcely a shred of clothes remaining, the countenance indicating the dreadful fright the little fellow must have had; so much so, as to make him almost insensible to pain.

On examination, the bones of the forearm were discovered to have been fractured; the skin appeared to be bruised, but there was no solution of continuity. From the bloodless appearance of the hand, the father was informed that amputation would be advisable. To this, he decidedly objected. The arm was put up in light splints, well padded with lint. Next morning, on calling at the house, I found the splints removed, and others rather tightly put on. A bone-setter had been called in. The child suffered much pain; had a sleepless night, with raving. Of course I discontinued my attendance, and saw nothing of the case for some days; until, as the child's suffering was increased, and danger apprehended, a dispensary ticket was sought. The medical officer kindly asked me to accompany him. The splints and bandages were forthwith removed; several of the fingers were gangrenous; but pulsation and warmth led to the hope of saving others. The discharge was most offensive.

After some days, the bones of the wrist became exposed, and soon the whole hand had mortified. As the healing process was slow, and the child's constitution not robust, the question of secondary amputation was considered, with a view to lessen the suppuration and give a good stump. It was decided, however, to remove with a pliers merely such portion of the bone as projected from the wound, which was accordingly done. The healing progressed favourably, and the child has now a good stump formed of half the forearm. The dressings throughout were of the simplest character, due attention being paid to the support of the constitution.

* There also seems reason to believe that, much more rarely, the grey granulation may shrink in size, and become organised into more fully formed fibre-tissue.