FURTHER OBSERVATIONS ON THE CONDITION OF THE BLOOD AFTER DEATH FROM SNAKE-BITE.

By G. B. HALFORD, M.D.,

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[MR. JAMES PAGET, F.R.S., in forwarding the subjoined communication, writes:—"I enclose a slip from Professor Halford of Melbourne, on the growth of cells in the blood of animals killed by snake-poison. It tells the result of a continuation of experiments of which you were so good as to insert an account in your JOURNAL during the summer. I hope you will deem it right to publish this also; for the facts are very strange—so strange, that it may be well for me to add that Professor Halford, writing to me, says, that I may 'depend on the patience and fear of error' with which he has worked at them."]

Professor Halford, in again bringing this subject before the Society, said he should confine his remarks this evening to the life of the foreign cell he had the honour of describing to the Society at the June meeting, and to the passage of the poison from the mother to the embryo. Perhaps nothing was more difficult and tedious than to trace the growth of a microscopic particle, but he would endeavour in a few words, and by the help of diagrams and microscopic preparations, to present to the Society all he had been enabled as yet to learn on this important subject.

The following was the result of numerous experiments on dogs and cats. Blood soon drawn from an animal bitten by a snake contains a larger amount of nebulous or finely granular matter than is usually seen. After the lapse of one hour this nebulous matter is much increased in quantity, lying in the intervals of the red corpuscles, and presently it breaks up into small masses, out of which the cell is gradually evolved. In two hours after the bite the cells may be seen in great numbers, but very indistinct. From this time every further microscopic observation shows them in great abundance; and from the sixth to the twelfth hour they may be seen in perfection, macula and nucleus included. Whilst this is taking place the nebulous matter disappears. The nebulous matter must therefore be regarded as the germinal matter out of which the cells are formed. At this time the cell-wall is extremely delicate, the macula very plain as a bright particle, and the nucleus either single, reniform, double, triple, or multiple. It would appear that the cells are now increasing in number by division of their nuclei, and the minute particles, having the vibratory movement of molecules in fluid, may be seen between the nucleus and cell-wall. On one occasion he watched for upwards of half an hour a constant revolution within the cell of a particle corresponding in all particulars to a macula. This particle passed regularly round the nucleus at an uniform rate, revolving both in the direction of and against the current of the fluid in which the cell was floating, reminding one of the movements seen in *Valisneria*, etc. Twenty-four hours after the bite, the cells attain their greatest size, and, supposing the animal then dead, have probably ceased multiplying, and are simply living; or perhaps growing, the nucleus being usually single, the macula extremely distinct, and the cell very large. It is not uncommon at this time and later to see a cup-shaped hiatus in the cell-wall from which the macula has escaped. The cells may be seen in the blood for many days, their presence seeming to be preservative against putrefaction. Where they have most room, as in the *venæ cavæ*, cranial sinuses, and cavities of the heart, they attain the greatest size and most circular form. In every instance the cell-wall is very elastic, and accommodates itself to surrounding pressure.

To ascertain how soon after inoculation these cells appear, is a matter of some difficulty. It is not necessary to suppose that at first they are very numerous; and, in order to detect them so early, it might require fifty or a hundred microscopes and observers at work at the same instant. Still, from their having been seen two hours after the bite, and from all we know of the rapidity with which new formations occur, both in health and disease, it is doubtless extremely soon. Of one thing we are sure; viz., that the nebulous germinal matter from which they spring is within a few minutes diffused all over the body; for, supposing an animal to die in five minutes, and hence all circulation stopped, the cells are as readily seen in its blood a few hours after death as if it had lived as many hours as we say minutes. The macula is, doubtless, a particle of germinal matter; but, whether it is to be regarded as that from which the whole cell has sprung, or whether it has been detached from the nucleus and is destined for independent existence, it is difficult to say. The fact that it is almost invariably large when the cell is small, and small when the cell is large, favours the first view. Perhaps the most impor-

tant point must be left still undecided. Has the blood built up these cells, directly or indirectly, from the germinal matter of the serpent? The answer to this question the Professor would endeavour to give at a future meeting; but in either case the result was the same: Storing up of force in the new growth, at the expense of the nutritive properties of the blood, and by perversion of those chemical changes necessary to the maintenance of the life of the infected animal.

That the germinal matter exists in a state of extreme minuteness, the following experiment shows. A cat, being with young, was inoculated with the poison, and, dying in three hours, her four kittens were removed from the womb. They were dead, and the blood of all contained the foreign cells, as did that of the mother. To pass from the cat to the kittens, the germinal matter must have penetrated the delicate membrane covering the tufts of the foetal vessels. If the poison of serpents can thus readily be traced through the body, and from parent to offspring, why should not the path of all infections be tracked? Some months ago, it was stated that it was conjectured that a child had been bitten by a snake. No doubt need ever exist for the future; a drop of blood will always furnish the necessary evidence. He trusted the subject would not be let fall to the ground in Victoria, for it would assuredly be taken up at home. It had been to him a matter of surprise that, while this colony very properly appoints men to survey her coasts, explore her skies, and the ground beneath her feet, no one systematically explores her diseases, a subject in which the rich and poor, the living and those about to live, are equally and deeply concerned, and in comparison with which many other subjects that excite her people are trifles. The Professor would not conclude without thanking Dr. Gummow of Swanhill for having sent him a fine supply of snakes, nor without expressing his acknowledgements to Messrs. Lawrence and Ashworth for their ready assistance in his many experiments.

AN IMPROVED METHOD OF EXTRACTING IN CASES OF CATARACT.*

By CHARLES TAYLOR, M.D. Edin., F.R.C.S.E.,

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I WAS led early in the year 1865 to devise an operation which should combine the advantages of the old flap and those of Schuett's method, without the peculiar risks attendant upon either, and I found that extraction could be accomplished through a wound small enough to admit (without danger) of manipulation of the eyeball, and yet of sufficient dimensions to permit the exit of the lens without the introduction of any instrument into the eye. I arrived at this conclusion by various experiments upon animals' eyes, and some operations on the dead subject, and have since exclusively adopted the method I am about to describe in all cases of senile cataract coming under my care. I was then satisfied that, with the enlarged pupil and extended surface for operation, obtainable either by a combined or preliminary iridectomy, the large flap formerly employed became unnecessary, and that an extended flap-like incision, comprising a little more than one-third of the corneal surface, if made well back in the corneo-sclerotic junction, would suffice for the ready exit of the lens without the use of any traction instrument. I found, also, that a wound, flap-like in form, yielded more readily to the advancing lens than one more strictly linear in its character, while it was still sufficiently slit-like to close without artificial apposition, strong enough to resist protrusion, and too resilient to permit of accidental reflection.

I may mention that I had fully worked out this method and demonstrated its advantages before I had heard of Professor von Græfe's modification of linear extraction, and before any account of his experiments had been published. In my first operations I used a ground-down cataract-knife, reduced to about the size of the secondary cataract knives sold in most cases of ophthalmic instruments. I have since used Von Græfe's knife, and Bader's smallest sized iridectomy-knife; provided, however, that the incision is made within the prescribed limits, it is of little consequence what instrument we employ. If the narrow bladed knife be used, it should be entered in the corneo-sclerotic margin about the junction of the upper and middle third of the cornea, passed across the anterior chamber, and brought out at a counter-puncture similarly placed. The site of the entrance puncture should vary somewhat, according to the size of the globe, as a very shallow flap will suffice if the cornea be of more than average dimensions, and a deeper one will be required if it be below the standard size; as a rule, the knife is entered three lines lower down than in Von Græfe's method,

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and more forward in the corneo-sclerotic junction; after its emergence at the counter-puncture, it should be held parallel to the iris, and the operator should cut directly upwards for about two and a half lines, or until the edge of the knife is on a level with the central summit of the cornea, when it may be turned forwards, and the section completed.

As the conjunctiva is only to a very slight extent implicated, there is usually very little trouble from hæmorrhage; should it occur, however, it is well to arrest it by slight pressure, applied through the medium of a pad of cotton-wool, before proceeding to the next step of the operation, which, if an iridectomy has not been premised, will be the excision of a piece of iris; this is readily accomplished by inserting the iris-forceps into the central portion of the wound which occupies the summit of the cornea. Care must be taken to excise the iris freely at the angles of the incision, as small portions are very apt to prolapse in this situation. If the anterior chamber become filled with blood, it should be sucked out, and gentle pressure applied, so as to arrest the flow. The iridectomy being completed, the capsule should be opened freely, from bottom to top, and on a level with the equator of the lens; not infrequently, the cataract comes forward as soon as this is done; but if, from adhesions or other cause, it should be retarded, it will be necessary to make pressure on the eye, while the posterior lip of the wound is gently pushed back with the curette. The strabismus-hook is very convenient for this purpose, and should be applied to the globe behind the insertion of the inferior rectus tendon, and transferred to the lower border of the cornea, as the lens advances. Cortical fragments may be usually extruded by slight manipulation; but, if this do not suffice, it is advisable to suck them out, and to remove carefully any pieces of capsule remaining. The operation completed, I apply a drop of neutral solution of atropine to the lower lid, and cover the eye with a pad of cotton-wool, fixed *in situ* by strips of soap-plaster. Perfect rest for a few days, with partial exclusion of light, is all the after-treatment required, and the great majority of patients may be discharged on the seventh day.

Since 1865, I have operated in succession upon forty-six patients, by the above-described method: five of them were upwards of 80 years of age, two 85, and many were from various causes most unpromising cases. No selection was made; and all who would submit were operated upon without exception. In two cases, there was protracted healing. One patient died of apoplexy, thirty-six hours after the operation, and on *post mortem* examination the wound was found healed, chamber filled, and pupil clear. In another case, suppuration threatened for twenty-four hours, but the patient ultimately recovered with a closed pupil and chance of restoration of sight by a subsequent iridectomy. One only was a positive failure; and this occurred from vomiting (caused by chloroform) and imprudent exertion immediately after the operation, in a patient 85 years of age, who had been blind for twelve years, and suffered from shrunken irritable globes. The remainder recovered without any bad symptoms, and (including the two cases of protracted healing) acquired useful vision.

These gratifying results give me great confidence in recommending the above operation to all who would adopt a method which is, as near as may be, free from danger.

ON THE NATURE AND EXAMINATION OF THE ORGANIC MATTER IN POTABLE WATERS.*

By CHARLES R. C. TICHBORNE, F.C.S., Dublin.

THE importance of my subject must be my excuse for bringing before you this rather heterogeneous mass of remarks and notes upon the subject of the Organic Matter in Water. During the cholera visitation of last year, I made some observations in connection with water-analyses, the cream of which experience is embodied in my paper.

It must be palpable to every one, that no individual point in the analyses of waters can give much information as regards their fitness or unfitness for drinking purposes. But it is also quite as evident that the danger (when there is any) lies buried in what the chemists term the organic matter; and that there are times when that organic matter is in a more than usual dangerous state. The point of difficulty in the examination of potable waters, is not so much its quantitative determination as its qualitative. You may have a water rich in organic matter, yet harmless; or a water containing but a minimum of organic matter, yet organic matter of such a deleterious nature, that our ideas of the most virulent substance fall short of the horrible results that these invisible poisons can accomplish. Weight for weight, or bulk for bulk,

how far behind in virulence are such poisons as hydrocyanic acid, strychnine, or the secretion of the dreaded cobra fangs.

I may say, our opinion upon the state of a water, or rather the state of the organic matter therein (presuming it contains any), is, so far as the chemists have gone, only to be arrived at by the putting together of many examinations. For all the following points bear upon the state of the organic matter, or its qualitative examination.

Total Estimation of the Organic Matter.—If this be present in abnormal quantities, that cannot be explained by its origin, such water should be at once condemned.

Ammonia.—This again depends upon the source from which the water was obtained. We possess a very good test for ammonia. Messrs. Wanklyn and Smith have pointed out some important facts connected with the examination of water; that, on distilling water that contains urea (a probable ingredient in sewage-water), it is converted into ammonia. Thus, an approximate estimation of the nitrogenous substance resembling urea may be made, after making an allowance for the ammonia occurring as such. The experiments of Messrs. Wanklyn and Smith in connection with the nitrogenous matter are well worthy our careful consideration, although we do not agree with them entirely.

A ready and quick mode of estimating the organic matter in solution has yet to be discovered—the estimation by a volumetric solution of permanganate of potassium being worthless.

The *microscopic examination* of any sediment, if there be any present, is of the utmost importance, as often an accidental and recognisable impurity will afford evidence of the inroad of sewage.

Taste, odour, hardness, chlorine, total saline ingredients, sulphuretted hydrogen, relative proportions of the gases dissolved in the water, are all points connected with the state of the organic matters, but call for no particular remarks upon my part.

Another very important point in connection with water intended for drinking purposes, is the colour. Every kind of water, whether from a spring, river, or reservoir, possesses a certain tinge, however faint that tinge may be. An instrument, which I will call the chromimeter, is particularly suited to this purpose. In a paper, which I wrote some years ago, On the Urinary Pigment (*Chemical News*, March 1862), I described this instrument, and suggested its use for the determination of the relative amount of pigment voided. A similar instrument is now used by Dr. Letheby for the examination of water. I shall describe my own arrangement of this instrument. To observe the colour, a pencil of light passing through a considerable body of the water is viewed by means of a tube. The apparatus consists of this tube, a yard in length, well closed at one end by a stopper. The stopper is preferable to a permanently fixed end, as it enables the operator to clean the tube perfectly—a matter of some importance. On the bottom is fixed a piece of white porcelain—a sight, if I may use the term. The tube is graduated into convenient divisions for the relative examination of different samples. By filling the tube with the water to be examined, and looking through the water at the white disc at the bottom, a faint colouration is at once perceived. Thus an experienced eye will, after a chromatic examination, prognosticate the character of his microscopic examination. The green chlorophyll tinge is almost invariably produced by the presence of desmidiaceæ and other algæ, or similar bodies. A white opacity is frequently indicative of fungoid growths. The finely suspended basic persalts of iron frequently found in waters rich in organic matter, which pass through iron-pumps, etc., are instantly recognised by a peculiar ochrey colour. True chalybeate springs also deposit a similar precipitate when exposed to atmospheric oxygen. Another important application of this tube is the determination of the state of oxidation of the iron-salts in the water, if present. This is a matter of some importance, particularly in connection with the organic matter; and I shall perhaps be excused if I dwell a little upon this point.

Iron is almost always present in well-waters, and frequently so in river or reservoir water. If present in very minute quantities, the primitive state of oxidation can only be recognised with the aid of the chromimeter.

As the microscope magnifies the form, so does the chromimeter magnify the colour so as to be recognisable by the eye. We are enabled to extend the range of our ordinary chromatic tests, and to recognise minute quantities of the proto- and per-salts of iron. Any attempt to concentrate the water for examination would alter the state of oxidation, and the results would be fallacious. Thus, on adding to separate portions of the water in the tube a few drops of the ordinary reagents, the following results are obtained. Sulphocyanide of ammonium develops a pink tinge, indicative of the persalts of iron. A few drops of nitric acid are added to another specimen, and tested with sulphocyanide of ammonium. A darker shade is produced than in the first experiment. This is indicative of the presence both of per- and proto-salts of iron. Colouration, only produced after the addition of nitric acid and sulpho-

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