Fig. 27.—Case II, Mr. E., complaining of Faintness. Body-temperature, 100.4°; Pulse-rate, 111; Systole, .210"; Diastole, .330".

In the final calculations, I have omitted all such cases; and also those which, at first presenting no abnormality, subsequently developed such in the bath.

Fig. 28.—Mr. L., before Bath. Pulse-rate 93; Systole, .260"; Diastole, .385".

Fig. 29.—Same, during Bath, Temperature of Body, 101° F.

On auscultation, a loud systolic and a loud diastolic murmur were heard at the base of the heart, and at the apex a systolic murmur conducted into the axilla. The basic murmur disappeared, but the mitral systolic persisted after the douche. The duration of .260" for systole at a pulse-frequency of 93 is not exceptional, but it, with certain others, was also omitted from the final calculation, the result of which is given below.

Table calculated from 90 cases. Showing, in parts of a second, the average duration of systole for every increase of 5 beats in frequency per minute, from 46 to 130.

Frequency per Minute.	Duration of Systole.
130 ...	.2100" (exertion).
116 to 120 ...	.2350" (mixed cases, approximate).
111 to 115 ...	.2475" (mixed cases, approximate).
106 to 110 ...	.2675" (nearly all cases of exertion only).
101 to 105 ...	.2543" (all taken in bath).
{ 96 to 100 ...	.2540" (bath).
{ 96 to 100 ...	.2730" (normal).
{ 91 to 95 ...	.2690" (mixed cases, approximate).
{ 86 to 90 ...	.2800" (bath).
{ 86 to 90 ...	.3200" (exertion and normal).
{ 81 to 85 ...	.3030" (bath).
{ 81 to 85 ...	.3250" (exertion and normal).
{ 76 to 80 ...	.3032" (bath).
{ 76 to 80 ...	.3300" (exertion and normal).
{ 71 to 75 ...	.3035" (bath).
{ 66 to 70 ...	.3200" (mixed cases).
{ 61 to 65 ...	.3200" (mixed cases).
{ 56 to 60 ...	.3460" (normal).
{ 56 to 60 ...	.3200" (bath).
{ 51 to 55 ...	.3425" (normal).
{ 46 to 50 ...	.3600" (normal).

Under the different conditions, the variations were usually within small limits, and the above durations of systole may be accepted as very fairly accurate for their respective pulse-frequencies. Occasionally, however, a variation in the duration of systole of .04" to .06" may be met with for the same pulse-frequency, without any assignable cause. Perhaps future and more comprehensive observations may, in a measure, explain these discrepancies. I have indicated what variation may be due to body-temperature, and given a table of movements for the different pulse-frequencies. Experiments of this nature entail much expenditure of labour and time; I have endeavoured to establish a basis of facts for future use in the present paper, during the preparation of which I have become much indebted to Dr. Burdon Sanderson for his very kind and generous assistance.

CONTRIBUTIONS TO THE PATHOLOGY OF PARASITIC DISEASES OF THE SKIN.

By GEORGE THIN, M.D.

I. ON TRICHOPHYTON TONSURANS (THE FUNGUS OF RING-WORM).—

The results of the investigations on *Trichophyton tonsurans*, carried on by the aid of a grant from the Scientific Grants Committee of the British Medical Association, were communicated to the Royal Society at the meeting, March 3rd, 1881, and were published in abstract in the *Proceedings*, No. 211; and again in full in No. 217 of that year.

The present paper chiefly consists of abstracts and quotations from the memoir published in the *Proceedings of the Royal Society*, my intention in compiling it being to give a brief account of the experiments, more especially in so far as they bear on the management of the disease which is produced by the parasite.

I have described in the paper to which I have referred how attempts at artificial cultivation of the fungus have hitherto led to contradictory conclusions. Lowe, in 1850,* was induced to believe that *Trichophyton tonsurans* is a spore-formation of the fungus of favus—a specifically distinct parasitic disease of the skin—and that both are forms of *Aspergillus*. Neumann,† on the other hand, whilst believing that his cultivation experiments showed that herpes tonsurans and favus are produced by the same fungus, traced it in both diseases to *Penicillium glaucum*. Dr. Atkinson,‡ again, was led by his cultivations to believe that the fungus belongs to the Mucors, and is probably *Mucor mucedo*.

The reason why the botanical relations of the parasite to the common fungi have been so difficult to determine has been stated by De Bary. "If," he remarks,§ speaking of the vegetable parasites of the skin, "the parasites, when removed from the bodies of their hosts, are cultivated in water, sugar solution, etc., the vegetation of their spores is then observed, and after a short time there appears in the fluids the universally widespread fungi, e.g., *Penicillium glaucum*, *Aspergillus glaucus*, or *Torula*. The latter and the mycelium of *Penicillium* resemble more or less the spores and mycelium of the parasites in question, and, being found in immediate contact with them, it seems as if they had been developed from them in the artificial medium."

Köbner,|| who endeavoured to solve some of the problems connected with the development of the parasite by clinical experiments, found that *Trichophyton tonsurans*, when inoculated on the skin, produced only herpes tonsurans, and that he could not produce this disease by inoculation with *Penicillium glaucum*.

A strong reason exists, independently of experimental results, for believing that trichophyton is not a form of the common fungi. The facility with which ringworm is communicated from one child to another by contact, or by interchange of caps, shows that the fungus takes root easily on the scalp; whilst, as many a country medical practitioner can

* *Botanical Transactions*. Edinburgh. 1850.

† *Lehrbuch der Hautkrankheiten*. Second Edition.

‡ "On the Botanical Relations of the *Trichophyton tonsurans*." *New York Medical Journal*, December 1878.

§ Hofmeister's *Handbuch Physiologischen Botanik*, Band ii, Abth. i, p. 224.

|| *Klinische und Experimentelle Mittheilungen*. Erlangen. 1864.

testify, bareheaded children may be exposed indefinitely to contact with all the spores with which the atmosphere is pregnant, without a single instance of the disease being produced.

In cultivating ringworm hairs, it is a matter of the greatest nicety and difficulty to distinguish between the growth of the parasite and the luxuriant development of fungi, the spores of which, being in great numbers in the atmosphere, find a suitable soil in any hair-root moistened with cultivation fluids. Those authors who have spoken of the cultivation of trichophyton as an easy matter, have, I am compelled to believe, never got so far as sufficiently to realise the difficult nature of the problem which they were endeavouring to solve. Some of the adventitious fungi that develop round the hairs cannot be distinguished, either by size or form, from trichophyton, for which the observer, unless he be exceedingly careful, is apt to mistake them.

The best method of avoiding this source of fallacy is to place a freshly extracted ringworm hair on a cover-glass, moistened with a drop of the fluid which is being tried, and to apply the glass to a cell prepared in the usual way. The cell is kept at a temperature approaching that of the human body, and examined frequently under the microscope. It is thus possible to keep under observation spores which were seen on the edge of the hair as soon as it was mounted; and if they grow, the progress of growth can be watched. It is also possible to manipulate hairs that have been allowed to float on the surface of a fluid, or to lie in contact with moist substances, so that the fungi surrounding the root can be sufficiently removed to enable the observer to examine the condition of the trichophyton spores which are lying in the hair, and which, from their characteristic position, can be recognised. It frequently happens that, after the adventitious fungi have been removed, the spores in the hair are found in the condition in which they are seen in an ordinary hair affected with ringworm. If, however, the ringworm fungus have grown under cultivation, many of the trichophyton spores will be seen to have sent out mycelial formations beyond the edge of the hair.

My earlier experiments were a long unbroken series of failures. I was for a few days under the delusion that seems inseparable from first attempts to cultivate trichophyton, and I imagined that nothing was easier than to produce a luxuriant growth. I was soon convinced that this was an error. I had mistaken a fungus, whose spores seemed to be omnipresent, for trichophyton, it being impossible to distinguish the one from the other by simple inspection of the mycelium. This fungus closely entwined itself around the root of the hairs. By careful manipulation, however, it could be ascertained that it did not penetrate the hair-shaft; and, after it was removed, the trichophyton spores could be seen unaltered.

The experiments with negative results have established that trichophyton and the common fungi are essentially distinct.

The list of fluids with which cultivation experiments failed, is a somewhat long one. No results were obtained with two that are well-known and frequently employed—viz. :

1. A solution consisting of sodium phosphate, 1 gramme; ammonium tartrate, 10 grammes; distilled water, 1,000 cubic centigrammes; formerly used by Dr. Sanderson, I am informed, at the Brown Institution, where I got the formula; and
2. Magnesium sulphate, 1 gramme; potassium nitrate, 1 gramme; calcium phosphate, 0.2 gramme; distilled water, 500 cubic centigrammes (Cohn's fluid).

Nor, finally, with milk, tap-water, carrot infusion, salt solution (0.75 per cent.), turnip infusion, egg-albumen, egg-albumen and potash, and vitreous humour and potash.

Ringworm hairs were placed on bread, soaked in the two first-mentioned fluids. Common fungi grew around the roots, but the trichophyton spores did not germinate. A similar result occurred with turnip infusion. To take an example: bread soaked in this fluid was placed in a box, and ringworm hairs placed on the bread at different points. The box was laid out in an incubator. After four days, the bread was found covered with fungi. The ringworm hairs were picked out, macerated in potash solution, and examined. All the spores were round, and there was no appearance on the sides of the hairs of germinative or early mycelium formation.

The only fluids with which I succeeded in cultivating trichophyton are aqueous and vitreous humour; and vitreous humour was chiefly used on account of the facilities for getting it in large quantities from bullock's eyes. I found, however, that the hairs should be only moistened, but not immersed, in the vitreous humour.

Successful observations were made by examining ringworm hairs in cells, the hairs being moistened but not covered. When the hairs were covered with the drop, trichophyton did not grow. With cells kept in an incubator, at a temperature of 96° to 98° Fahr., the sprouting of the

spores on the sides of the hairs can be easily observed. But the small quantity of vitreous humour which is available for the growth of the fungus, in these conditions, is soon used up; and I found it convenient to employ another method.

The engravings illustrate the different stages of the growth of trichophyton under cultivation.

Fig. 1. Spores germinating. Drawn from a preparation in a cell the same day in which it had been placed in the incubator.

Fig. 2. Two days' growth in a cell. (In the cell-cultivations, the mycelium did not grow long, and the formation of spores usually took place whilst the mycelial tube was short.) Magnified 750 diameters.

Fig. 3. A hair from a cultivation on the surface of vitreous humour in a test-glass. A mass of germinating spores on a portion of the internal root-sheath, which was attached to the hair, is observed at *a*. Buds and mycelium are sprouting from the sides of the hair. (In order to reduce the size of the drawing, the centre of the hair-shaft has been left out.) Magnified 450 diameters.

Pure test glasses were charged with pure vitreous humour,* and the hairs were floated on the surface of the fluid. The glasses were then placed in the incubator. By observing hairs treated in this manner, it is seen that *trichophyton tonsurans* grows freely when moistened with vitreous humour, and kept at a temperature of 96° to 98° Fahr. But, although the method may be relied on for the cultivation of ringworm fungus, it cannot be considered certain; and, in my experiments, I was not able to exclude the possibility of failure. To any one familiar with work of this kind, occasional failures will not be a matter of surprise.

Simultaneously with the experiments on trichophyton, I had made a number of cultivations of the common fungi found in our houses, and

* For the methods by which purity was secured, and for other technical details see the paper in the *Proceedings of the Royal Society*.

had learned how delicate are the conditions of growth to which they are all subject. One of the most important of these conditions is the requisite degree of moisture, which must be neither in deficiency nor in excess. The failures may possibly have been due to the hairs having become too much immersed, or the spores themselves may have been incapable of germination from changes effected in them by inflammatory exudation around the hair-follicles before they were extracted.

The fact that I had been unable to produce growth of trichophyton in cells, so long as the spores were completely immersed in vitreous humour, led me to make the following experiments. Ringworm hairs were extracted from a patch of untreated ringworm. Some of them were inserted into a small glass tube, which was placed at the bottom of the test-glass, and others were floated on the surface of the fluid in the usual way. After two days, the hairs were examined. There was an abundant growth of mycelium around the roots of those hairs which were on the surface. The mycelium was of the size of that of ringworm, and in some of it black pigment had been deposited. No spores had formed. I satisfied myself at the time that it had developed from the ringworm spores. On macerating the hairs, the mycelial growth of trichophyton inside the hair-shafts were also found pigmented.

In the hairs deposited in the tube at the bottom of the test-glass no growth had taken place, although, on maceration, they were found to contain mycelium and spores of trichophyton, both containing black pigment.*

In another instance, in which the experiment was conducted in precisely the same conditions, an examination was made after the test-glass had been six days in the incubator. There was free growth of trichophyton in the hairs which had been floating on the surface of the fluid, whilst there was no growth in the hairs which were in the tube at the bottom of the glass.

In these two experiments, all the hairs, both those on the surface and those at the bottom, contained trichophyton; and, in each experiment, both the surface and the sunk hairs were taken at the same time from the same patient, every condition being alike, except that in the one case the hairs were on the surface of the fluid, and in the other they were completely immersed in it.

These experiments further suggest the view that inflammation cures ringworm by drowning the fungus. The data supplied by recent pathological researches show that serous effusion from the blood-vessels is the invariable concomitant of inflammatory action, however it is produced. When a persistent inflammatory congestion is kept up by irritants around the hair-follicles, it of necessity follows that the serous effusion should make its way through the root-sheaths; whilst the inner root-sheath and the cuticle of the hair are more or less broken up by the growth of the fungus. It is a fair inference from the experiments described in this paper, that the capacity for growth in trichophyton is destroyed by the resulting immersion in serum. Clinically, and as a matter of fact, we know that this is just what takes place; and the only reason why ringworm is such a tedious disease under treatment is, that the same amount of irritation by external agents does not produce the same amount of congestion in any two patients, and that a careful practitioner will always hesitate to induce such an intensity of inflammation as might injure the health of the patient or produce partial baldness by destruction of the hair-follicles. *Trichophyton tonsurans*, although it grows in the epidermis of children and adults alike, and thrives in the hairs of the scalp in children, cannot, as a rule to which there is hardly any exception, live in the hairs and follicles of the scalp of adults. The explanation of this peculiarity will probably be found in the anatomical relations of the inner root-sheath and the hair; and I suggest, as an hypothesis, that the fungus does not penetrate between these structures in the adult because it does not find there sufficient moisture for its development.

The conclusions regarding *Trichophyton tonsurans* which are warranted by the experiments recorded in the paper read before the Royal Society are, that it is not one of the common fungi, and that it can be cultivated artificially when moistened by vitreous humour. When it was completely immersed in vitreous humour, I found no evidence of growth.

So far as we know, this fungus only grows in the epidermic elements of a limited number of mammals. A careful consideration of the views of previous observers, who have described it as being simply one of the common fungi, accidentally growing on the skin, has led me to the conclusion that these opinions are based on erroneous observations.

In their cultivation-experiments, they had not succeeded in excluding growths of the spores of the common fungi present in the atmosphere.

The experiments which I have described are pregnant with instruction regarding the management of ringworm. Cases of this disease are divisible into two categories. In the first, owing to the superficial position of the spores, the fungus can be destroyed by the application of parasiticide lotions and ointments. In the second, owing to the depth of the hair-follicle, the spores are beyond the reach of these applications. In this latter class of cases, we have recourse to applications which provoke inflammation; that is to say, to an effusion of serum around the follicles. With the thorough penetration of serum or pus through the internal root-sheath and into the fungus-logged hair-root, the parasite dies: a clinical fact established and understood by all competent observers. The limits of this paper do not permit me to enter fully into the best means of provoking this curative inflammation; but I desire to warn practitioners against placing too much confidence in any one kind or form of application. The age of the child, the probable depth of the hair-follicle, and, above all, the degree of susceptibility of the superficial blood-vessels to irritation, must determine the substance used, and especially the strength in which it is to be employed. In all chronic cases of ringworm, the practitioner must, in the first instance, proceed cautiously and experimentally, in order to test this susceptibility of the skin, increasing the strength of his remedies and the frequency of application until he has obtained a moderate but persistent congestion of the skin of the affected patch. With young children, this experimental process must be carried on with a certain amount of caution; with older children, and more especially with boys over ten years of age, much time need not be lost in making a very decided impression. In ringworm of the scalp, it is not so much the remedy that is of importance, as the judicious use of the remedy.

In ringworm of the body, the parasite is so well within reach, that its destruction presents no difficulty. I find one application of tincture of iodine, and subsequent scrubbing with soap and water, sufficient to effect a cure.

II. MICROSPORON FURFUR.

The microscopic appearance of *Microsporon furfur*, the parasite which produces the disease of the skin known as tinea (or pityriasis) versicolor, is favourable to a study of the life-history of the fungus by attempts at cultivation. The isolated clusters of round spores connected by mycelial threads are distinctive; and, when the epidermic scales in which they lie are permeated by the adventitious fungi which grow in our cells or cultivation-glasses, there is not much difficulty in determining which is microsporon and which is common fungus.

The results of my investigations regarding the nature of this fungus have been entirely negative. I have not succeeded in getting it to grow; and, so far as our present experience goes, nothing is known concerning it except that it is found on the human skin, and that when found on this soil it is fairly uniform in size and form.

The mechanism of the attempted cultivations was the same as that employed in the trichophyton experiments, and need not be again described; the incubator temperature being mostly about 96° to 98° Fahr. The media in which I failed to get microsporon furfur to grow, are:

1. *Lard*.—Three cells were prepared, and scales were also placed at several points on a slide smeared with lard. The cells and slide were three days in the incubator.
2. *Acid Albumen*.—The cell was four days in the incubator.
3. *Milk*.—The scales were floated on a glass which was placed in the incubator.
4. *Water with Urea and Lactic Acid* (three days in the incubator).—The experiment was repeated again for three days.
5. *Vitreous Humour with Urea and Lactic Acid* (three days in the incubator).—The experiment was repeated.
6. *Vitreous Humour and Urea* (three days in the incubator).—The experiment was repeated.
7. *Vitreous Humour and Lactic Acid* (three days in the incubator).
8. *Salt Solution* (0.75 per cent.), pure and combined severally with Lactic Acid, Urea, and Urea and Lactic Acid (three days in the incubator).
9. *Solution of Phosphate of Soda*, 1 gramme; *Tartrate of Ammonia*, 10 grammes; and *Distilled Water*, 1,000 cubic centimetres.—The subjoined table shows briefly the nature of the experiments made with this fluid.

No. of Experiment.	No. of Cells used.	Time in Incubator.
1	1	3 days
2	2	4 "
3	1	6 "
4	2	12 "

* This patient is not the only one in whose diseased hairs the ringworm fungus was pigmented. I have found the same peculiarity in other cases, and in the affected hairs from a patch of this disease, in a black horse, I found pigmented mycelium and spores very common.

Bread was soaked in the same fluid, and inoculated at several points with epidermic scales containing the fungus. The bread was shut in a tight box to prevent evaporation. There was soon an abundant crop of adventitious fungi on the bread; but when the epidermic scales were picked out, macerated, and examined, there was no appearance observed which led me to suppose that *Microsporon furfur* had grown.

10. *Cohn's Fluid*.—A cell, with scales containing microsporon, was in the incubator two days. Scales were placed on bread soaked in the fluid, as in the experiment with the fluid previously mentioned (No. 9). There was a crop of aspergillus, but microsporon did not grow.

11. *Turnip Infusion*.—A cell was seven days in the incubator, and scales floated on the fluid in a test-glass nine days. Microsporon, in scales placed on bread soaked in the infusion as in previous experiment (No. 9), did not grow after four days; but there was a plentiful crop of other fungi. The experiment was repeated. The bread was covered with aspergillus, but microsporon did not germinate.

12. *Vitreous Humour*.—My success in growing trichophyton on this fluid led me to persevere with it longer than I did with the others; but the results were again negative. Vitreous humour of ordinary consistency was used in some experiments; in others it was thickened by evaporation, in the vain hope that the parasite might find the soil more congenial in this condition. For the sake of brevity, I have tabulated the experiments.

No. of Experiment.	No. of Cells.	No. of Days in Incubator.	No. of Experiment.	No. of Cells.	No. of Days in Incubator.
1	...	2	...	3	...
2	...	1	...	5	...
3	...	1	...	14	...
4	...	1	...	18	...
5	...	4	...	6	...
6	...	2	...	7	...
7	...	2	...	5	...
8	...	2	...	7	...
9	...	1	...	7	...

In Experiments 1 to 6, the vitreous humour was concentrated by evaporation. Scales were floated on vitreous humour in a test-glass, which was placed in the incubator for three days. There was no growth of microsporon, but other adventitious fungi grew.

The scales containing microsporon, which were used for these experiments, were in every case transferred with little delay to the cells and cultivation glasses. They were usually removed from the skin of patients in my consulting-room, and were, within a few minutes (probably in most cases within a quarter of an hour), transferred to the cells and glasses in my workroom, in which an assistant had everything prepared, with the view of saving time. The experiments being made in summer, the temperature was high.

The fluids selected were, in some instances, intended to approach what I conceived might be the possible composition of the moisture on the skin of those patients on whom microsporon finds its soil.

The conditions were thus so far favourable, and the continued series of negative results warrants the belief that microsporon is a fungus that requires very special conditions for its development. Whence it comes we are in absolute ignorance. The great majority of persons afford no soil for its growth. The most intimate personal contact does not lead to its being communicated from one individual to another, unless the susceptibility exists. Whether, in such persons as do afford the soil for this dainty plant, the spores have always come from the skin of some other person on whom it has grown, or whether there is another soil in nature from which it is transferred to the human skin, is a problem which has not yet been solved.

The required soil for the development of microsporon is not only the human skin of certain individuals, but of certain individuals within certain limits of age. *Moist parts of the skin of certain individuals during the period of sexual activity* would seem to be a definition of this soil. Tinea versicolor develops after puberty, and disappears spontaneously on the approach of age.

While this parasitic disease may coincide with a condition of perfect health, it is well known that it is frequently found associated with certain cachectic states of the system, and notably with phthisis. This frequency has, perhaps, been overrated. Through the kindness of Dr. Douglas Powell, I was able to examine the skin of a number of patients in the Brompton Consumption Hospital, and I found that only six men out of eighty-three had tinea versicolor: a proportion, however, undoubtedly much above the average of an equal number of persons taken irrespectively of their condition of health.

The main and most important result of the experiments which I have thus briefly reported is the evidence they afford that microsporon furfur, like trichophyton tonsurans, is a specific parasitic fungus, and is not one of the ordinary fungi whose omnipresent spores chance to find a suitable soil on the skin of a small proportion of individuals.

Addendum.—THE ACHORION SCHÖENLEINII—THE FUNGUS OF FAVUS.

Attempts were also made to cultivate *Achorion Schœnleinii*, with negative results. The value of the experiments is, however, much weakened by the fact that the available material was not recently taken from a patient. The favus-crusts which were used had been removed from the head of a boy, and kept for upwards of a year before the attempts at cultivation were made. The same apparatus and methods were used as in the experiments with trichophyton and microsporon furfur. Eight attempted cultivations with vitreous humour and five with Cohn's fluid failed. Small portions of the crusts were placed on bread soaked in the cultivation-fluid No. 9 of the paper on microsporon furfur, under the usual conditions. The bread was soon covered with aspergillus, but the *Achorion Schœnleinii* did not grow.

III. BACTERIUM DECALVANS: AN ORGANISM ASSOCIATED WITH THE DESTRUCTION OF THE HAIR IN ALOPECIA AREATA.

One part of the work undertaken with the assistance of the Grants Committee of the British Medical Association, consisted in investigating the condition of the hairs on the border of patches of alopecia areata, and a paper giving the results of my observations was read before the Royal Society on February 19th, 1881. This paper was published in abstract in the *Proceedings*, No. 211, and in full in No. 217, of that year. References to the literature of the subject, and an account of the methods employed in the investigation, will be found in that paper.

Previously to beginning the investigation, when searching in vain for the fungus which some authors have described as being present in this disease, I had observed, in connection with the root-sheaths of affected hairs, objects which in form resembled micrococci, and also occasionally undoubted spheroidal-shaped micro-organisms.

In the year 1880, I made, in six cases, a special examination, in order to detect, if possible, the existence of organisms in the roots of the diseased hairs, and I believed that I found evidence of their presence in five of them. I had, at the same time, obtained evidence in seven cases—evidence supported by subsequent experience—that a treatment designed to arrest the development of organisms, and mechanically to prevent their transportation from one hair to another, sufficed to arrest the disease. The treatment consisted simply in the free use of sulphur-ointment, and proofs of its efficacy are given in a paper contributed to the Section of Medicine at the meeting of the British Medical Association in 1881.

The demonstration of organisms in a hair is attended with great difficulty. In a comparatively sound hair it is very difficult to bring minute objects like bacteria under observation; and in hairs which are considerably affected, the shaft is found, when prepared for examination, to be so full of pigment and other granules, that it becomes very difficult to distinguish organisms amongst them, presuming these to be present.

The processes to which the hairs were subjected were devised so as to get rid of oily particles, and in some instances to break down, by solutions of potash, the cells of the hair-shaft, whilst the cuticle of the hair was left entire.

The bodies which I believe to be minute organisms were uniform in size and in their refractive qualities. They were frequently in pairs, the long axis of each member of the pair forming a continuous line. Sometimes three of them were found end to end, with an appearance of one continuous sheath for the three. I have attempted to show the form and size of these objects by means of camera drawings; but it is somewhat difficult to get the exact size of such small bodies. In order further to ensure accuracy in this respect, I obtained the kind assistance of Mr. Noble Smith, whose capacity as an accurate draughtsman in all that relates to microscopic objects is recognised and appreciated. Fig. 1 has been engraved from a drawing by Mr. Smith. He determined the outlines of the hair, and drew a number of the objects (or organisms) to the size in which he saw them. The others were filled in to the scale determined by Mr. Smith. The magnifying power represented in the drawing was estimated by measuring the hair.

From the appearances observed, I have inferred that the bacterium enters the hair-follicle between the internal root-sheath and the shaft. Towards the root of the hair, it penetrates the hair-substance, and, as it multiplies, ascends upwards in the substance of the hair. The breaking up, loosening, and disappearance of the hair are to be attributed to the disorganisation of the hair-substance by the growing organisms.

In extracting hairs for examination, I took them from a considerable breadth of margin; and, as the proportion of the hairs examined which showed any change or evidence of organisms was small, it is probable that they are present only in a narrow zone; and that, after a hair is once attacked, development takes place rapidly, and the hair soon falls.

The following sentences form the concluding paragraphs in the paper published in the *Proceedings of the Royal Society*.

Fig. 1. Case of J. F. Organisms between the root-sheath and the shaft of the hair near the root. (Drawn by Mr. Noble Smith.) Magnified about 470 diameters.

Fig. 2. Organisms from the group shown in Fig. 1, more highly magnified. (Camera drawing.) Magnified 560 diameters.

"It may be well to divide the statements made in this paper into two heads: those which relate to ascertained facts, and those which relate to a theory of the causation of alopecia areata, which I believe is sustained by these facts.

"1. The facts are, that minute bodies of definite and fixed shape and size are found in and on the hairs in alopecia areata. These bodies are distinct from the granular elements present in hairs, and are neither oily particles nor crystals. They are of the size and shape, and have the refractive qualities, of bacteria. When present in small numbers on the shaft, the hair is entire; whilst within some hairs much affected by the disease they were found in great numbers.

"2. The theory is, that these bodies are bacteria, and that the disappearance of the hair is due to a breaking up of the hair-shaft by the multiplication in it of the organisms.

"As I believe it is desirable to give to definite objects like those which I have described a name which will mark their association with the theory I have founded on them, and as I am myself satisfied as to their nature, I suggest the term *Bacterium decalvans* as a convenient designation."

* Subsequent recent investigations have confirmed the author's views regarding the existence of this bacterium. He has now observed it in all the phases through which a bacterial organism may be traced, and will shortly be able to publish an account of methods by which it can be more readily observed.—August, 1882.

THE DEATH-RATE OF BILSTON last year was the most satisfactory on record. The average death-rate of the place thirty years ago was from 31 to 32 per 1000; last year, thanks to sanitary improvement and the efforts of the medical officer of health, it was reduced to 16.1 per 1000, which must be regarded as very satisfactory for a Black County town. Only 31 deaths, moreover, out of the 381 recorded were due to infectious disease, a result which may, or may not, be due to Bilston being "one of the best drained towns in the country."

AN ADDRESS

DELIVERED AT THE OPENING OF

THE SECTION OF PATHOLOGY.

At the Annual Meeting of the British Medical Association,
in Worcester, August 1882.

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PATHOLOGY is the basis of every rational system of therapeutics. That, possibly, the greater part of our most effectual treatment is at present empirical I would not deny, but that therapeutics will become rational is what we all hope. To those who are quietly and laboriously working at what may, superficially looked on, seem to be obscure pathological problems, steady advances in diagnosis and rational therapeutics will be chiefly owing. It is evident that, for rational therapeutics, we must know what there is to be treated. No man in our profession deserves greater credit than the pathologist—including, of course, the clinical pathologist, and never forgetting the medical officer of health. The medical officer of health is the Pathologist of the Social Organism, and deserves the highest social recognition. Speaking more narrowly, tacitly assuming the obvious qualifications, the best practitioner, perhaps not the most confident one, is he who has carefully made most *post mortem* examinations. I do not mean him who stops here, who stops in a stage which is rather to be called one of morbid anatomy than of pathology. But a man must begin here—must begin here to learn for himself, at any rate. The best knowledge for practice is what a man gets for himself. The only way of being thoroughly practical is to face the facts, to get verification or disproof of our opinions. A *post mortem* examination never flatters us. If, for an example, we diagnose tumour of the cerebellum during the life of a patient, we may, *post mortem*, find one in the anterior cerebral lobe. Such a rap on the knuckles is good for us. It makes us less confident, and teaches us to be more careful. A *post mortem* examination may tell us that we have been treating a patient with useless, perhaps with injurious, drugs.

Every medical man has some system of pathology. But there are systems and systems. Besides scientific pathology there is a crude pathology, and there is, unfortunately, a metaphysical pathology. We have long heard that old maids' husbands are always well behaved, and on the same principle the pathology of those who do not make *post mortem* examinations is often confident and definite. But the really important thing is to be accurate and precise, otherwise we confidently organise error in definite formulæ. A man's pathology may be too definite in the wrong way, because he has not worked for himself at pathology. It may be only superficially and verbally definite and really crude. He who has made many *post mortem* examinations is not so metaphysical in his explanations of the pathology of some of those cases of disease of which there is no known morbid anatomy. In looking carefully for himself into the coarsely concrete, a realistic habit of mind is produced in a person, and thus he avoids verbal explanations of those most difficult cases which are without known morbid anatomy—of those, for example, commonly called the Neuroses. To my young hearers I say, always endeavour to obtain *post mortem* examinations. Unless you are in the habit of facing the facts, your diagnoses will be untrustworthy, and much of your therapeutics indefinite. If a man do not learn pathology when he is young, he is not likely to learn it properly later. Unless he have seen much for himself, he will not practically realise the researches of others, nor be able to judge them. I would urge on young medical men the formation of clubs for making *post mortem* examinations. Let me mention a slender personal experience. Many years ago, at York, a club of this sort was formed. It had no other organisation than the agreement that each member should obtain an examination whenever possible, and ask the other members to attend. The history was stated by the person who, so to speak, owned the case, and then each of us saw what there was to be seen, and notes were taken. In this way it is not difficult to get a large experience of direct value for practice. This very simple method has, I suggest, some advantages over reading papers and more elaborate demonstrations, although these are necessary for organisation of know-