tion. It belonged to that group now known as the trichophyta megalospora. And what to me was still more astonishing was the fact that a commensal of this Chinese fungus had likewise remarkable power of digestion; and this observation acquired peculiar significance when I discovered it to be not a trichophyton, strictly speaking, but an aspergillus, an order of fungi which are universally distributed over temperate climes as saprophytic moulds.

In a thesis entitled the *Introduction to the Mould-Fungi Parasitic on Man* (1893) I illustrated the artificial origin of ringworm. The method was again briefly described in the BRITISH MEDICAL JOURNAL of September 29th, 1894. In 1895 Dr. Allan Macfadyen¹ brought forward evidence to prove that "the ringworm fungus" produced a proteolytic enzyme capable of digesting gelatine. Macfadyen, who worked with fresh specimens of a trichophyton (variety not mentioned), based his conclusions upon the examination of the soil in which the fungus had grown. He found that a solution of gelatine in which the trichophyton had grown had active proteolytic powers, and was capable of digesting fresh gelatine apart from the fungus. He further showed that the active agent was destroyed by heating for two minutes at 100° C. He found that acids retarded, while alkalis favoured the action of the enzyme. Macfadyen could find no evidence of a sugar-inverting ferment. He was not able to satisfy himself that the proteolytic ferment had any action on fibrin or on hair; but he made the further observation that his specimens of trichophyta could grow on soils composed almost entirely of keratin.

Four months later I published² the evidence which led me to conclude that the keratolytic function, that is, the power to digest keratin and corneous structures, was more extensively possessed by fungi than had been previously suspected. I proposed to call these hair-digesting organisms the keratolytic fungi, a group which included not only the trichophyta proper, but favus, and some species of aspergillus. In 1896 my observations were confirmed by Pelagatti³ in Parma.

My own observations on the proteolytic ferment of the trichophyta, which I will now briefly record, were made on different lines to those of Macfadyen. This observer dealt with fresh specimens of the fungus in question, and, as I have said, his conclusions in regard to the ferment were based on examination of the soil in which the fungus had grown. On the other hand, the specimens which I examined were all aged, some of them 6 years old, and from which all traces of the original nutrient medium had disappeared. They were in fact simply dry museum specimens, which had long since lost the power of reproduction. The fungi which I tested were trichophyton microsporum (homo), T. megalosporum (homo), T. equinum, T. caninum, and achorion.

Observation 1. Trichophyton Microsporum.—The specimen was 6 years old (less 39 days), and in a perfectly dry state. On the surface of this dried specimen I poured 4 c.cm. of a 5 per cent. solution of gelatine in distilled water, and placed it in the incubator (32° C.). After fourteen hours it was removed, when the gelatine was found to have lost the power of resolidifying at low temperatures.

Observation 2. Trichophyton Megalosporum.—This completely dry specimen, 5 years and 10 months old, was covered with 4 c.cm. of a 10 per cent. gelatine solution, and maintained for nineteen hours in the incubator at the temperature of 32° C. When removed and allowed to cool down to the temperature of the room (16° C.) the gelatine, which was clear, remained perfectly limpid, and refused to set even when surrounded by cold water.

These observations show:

1. That the active agent in the liquefaction of the gelatine is contained in the mycelium itself, and not formed outside the body of the fungus by secondary changes in the soil.

2. That the active agent can retain its activity in a dormant state for a period of six years, when the fungus has been preserved in a perfectly dry state.

3. That the activity of the agent is independent of the life of the trichophyton.

What is this agent which can retain its functional activity and integrity over so long a period, and can resist the common tendency to disintegration?

Observation 3.—A small quantity (0.6 c.cm.) of a previously digested 5 per cent. gelatine solution (Observation 1) was added to 4 c.cm. of a 10 per cent. fresh gelatine solution. After maintaining this for twenty-one hours in the incubator at 32° C., the gelatine was found to have lost the power of resolidifying at low temperatures.

Observation 4.—The same quantity (0.6 c.cm.) of digestive gelatine was placed in a clean watchglass and subjected over a waterbath to a temperature of 85° C. for exactly two minutes. It was then mixed with 4 c.cm. of fresh gelatine solution and allowed to stand for twenty-one hours in the incubator (32° C.). After this period of incubation it was permitted to

cool down to the temperature of the room. The gelatine resolidified; there had been no digestion.

The following conclusions can be drawn from these two observations:

1. That very minute quantities of the active agent can digest comparatively large quantities of gelatine.

2. That the activity of the agent is completely destroyed by an exposure of two minutes to the temperature of 85° C.

3. That the active agent is of the nature of enzyme or soluble ferment.

Observation 5.—A small quantity of the enzymed gelatine from the last experiment was evaporated over a water bath at 65° C., and the residue extracted with absolute alcohol. This alcoholic solution was allowed to evaporate slowly at the temperature of the room (20° C.). A whitish opalescent residue was left, which had the faint odour of a trichophytic vegetation. This residue from the alcoholic extract was now rubbed up with a small quantity of distilled water; but only a small portion appeared to dissolve, most of the residue being held in a state of suspension. This watery mixture of the alcoholic extract residue was then poured on the surface of 4 c.cm. of 10 per cent. fresh gelatine, and maintained for twenty-one hours in the incubator at a temperature of 32° C. After removal, when allowed to cool down to the ordinary room temperature, the gelatine was found to have been unaffected, and resolidified equally as well as the control gelatine.

We may conclude, therefore, that the absolute alcohol is not capable of extracting the enzyme from the mycelium.

Observation 6. Trichophyton Equinum.—The specimen, which was perfectly dry and of a deep brown colour, was covered with 4 c.cm. of distilled water, and made to stand for twelve hours in the incubator (32° C.). This watery extract of trichophyton was then poured over the surface of a 10 per cent. gelatine solution, and maintained for twelve hours in the incubator (32° C.). When removed the gelatine was found to be digested, and to have lost the power of resolidifying at low temperatures. The same specimen (T. equinum) which had already been extracted with the distilled water, was now covered with 4 c.cm. of a 10 per cent. solution of gelatine, and made to stand twelve hours in the incubator at 32° C. When it was removed, and allowed to cool down to the ordinary temperature of the room, the gelatine was found to be undigested, and resolidified like ordinary gelatine.

The conclusion of this observation is obvious, namely, that pure water has the power of extracting the proteolytic ferment from the mycelium, which by such treatment ceases in a few hours to be enzymophorous.

In respect of an amylolytic ferment, my observations, so far as they go, point to the conclusion that this does not exist in the trichophyta. I have examined many specimens of British and foreign trichophyta, also T. equinum and T. caninum, and have never been able to detect the slightest evidence of the presence of a starch-digesting ferment. Its absence, however, does not surprise me, for the trichophyta can assimilate starch as such without any saccharine transformation.

It may be asked, What is the relation of this proteolytic ferment to the keratolytic ferment? I think there can be no doubt that the two are perfectly distinct and different ferments. The proteolytic ferment, as we have seen, is soluble in pure water, and may excite active fermentations, apart from the life of the fungus. It is simply an enzyme or soluble ferment. On the other hand, the keratolytic or keratine-digesting agent is an organic ferment, whose operations are purely vital, depending not only on the life of the organisms, but varying in intensity and in kind from one species to another.

Another point of much interest is that the keratolytic action of the T. megalosporum in scalp ringworm is directed against the interior substance of the hair, leaving, when this is digested, a hollow shell of cuticle. T. microsporum, on the other hand, directs its keratolytic powers against the cuticle, digesting this first and subsequently attacking the interior cortical matter.

REFERENCES.

- ¹ *Journal of Pathology and Bacteriology*, vol. iii, p. 176, 1895. ² *Ibid.*, vol. iii, p. 300. ³ *Transactions of Third International Dermatological Congress*, London, p. 590.

ON TONSILLAR CALCULI.

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THE occurrence of large calculi in the tonsils is a condition so relatively rare that it merits a description of the following case.

The patient is a healthy man, aged 50. About six years ago he began to suffer from repeated attacks of tonsillitis, which often ended in suppura-

tion. His occupation as reader in a large newspaper office exposed him to chills. These inflammatory attacks laid him up very frequently and especially during spring and autumn. About three years ago the submaxillary glands of his right side began to enlarge and become painful. They ultimately suppurated, and discharged by a small sinus in front of the neck at the level of the thyroid cartilage. This discharge continued more or less persistently for several months, until the outflow was obstructed in some way, when a diffuse cellulitis of the neck set in. This extended from the right ear forwards, and reached as far downwards as the middle of the sternum. His temperature rose, and the breathing became somewhat embarrassed. The sinus was therefore slit up as far as the glands, and a large quantity of pus evacuated. The patient made a rapid recovery from the operation, and since then has had immunity from further attacks of tonsillitis. For the last two years his health has been remarkably good.

At the end of June of the present year, while spending his holiday at the seaside, he thought that he had caught a slight cold, as he experienced a fullness in the throat. He noticed that he could not drink fluids so rapidly as before, and that he had to take them in sips. On July 3rd he retired to rest feeling perfectly well. During the night, however, he was awakened by a feeling of suffocation. He made a strong inspiratory effort, and was nearly choked by some large body in his throat. He sprang out of bed, thinking that his false teeth had slipped back, and, coughing violently, a large, elongated, somewhat oval stone was ejected. There was no bleeding either previously or at the time of expulsion of the stone. On palpating the throat a few days subsequently a rough tuberculated area was felt behind the right pillar of the fauces, and in the centre of this a depression from which the calculus had evidently been extruded. A gland on the right side below the angle of the jaw was enlarged and hard.

The calculus is somewhat oval in shape, and corresponds in size to a rather small hen's egg; one extremity is a good deal broader than the other. It is of a pale yellow colour, and though the surface is fairly smooth it presents a worm-eaten appearance. When fresh it had a very disagreeable smell, reminding one of rotten cheese. Its greatest length measures $1\frac{1}{2}$ in. and greatest breadth $1\frac{1}{2}$ in., corresponding to 42 and 36 millimetres respectively. It weighs almost 1 oz. (26.8 grammes). The layers of which the stone is composed are arranged concentrically.

This is by far the largest tonsillar calculus which I have been able to find any record of. The most of these described have varied from the size of a pea to that of a small nut. Dr. Nixon¹ removed a calculus as large as the first joint of the thumb from the tonsil of a young man, but this standard of comparison is unfortunately very variable.

Calculus from right tonsil; weight one ounce.

Etiology.—Such calculi seem to occur in persons who have suffered from repeated attacks of tonsillitis. In most of the cases there is a history of suppuration of the tonsil either precedent to or coexistent with the extrusion of the calculus. When once the concretion has formed, however, it may itself be the cause of the repeated tonsillitis. In three cases related by Alexander Munro the attacks of tonsillitis were extremely frequent. One of these cases was that of an old woman who had suffered constantly for twenty years from inflammation and suppuration of the tonsil, with quiescent intervals seldom exceeding three months. In other cases, however, the tonsillar abscess has discharged itself long before the expulsion of the stone, as happened in the case which I have related. Dr. Hewitt² narrates the case of a woman who nine years previously had suffered from suppuration of her left tonsil, and from which a calculus the size of a field bean had been expelled. Six years subsequent to this attack and during pregnancy two smaller calculi were expelled without previous inflammation or suppuration, and two years later, during a second pregnancy, the glands of her neck swelled greatly, and one month after delivery the left tonsil again suppurated, and a stone weighing 11 grains was extruded. The concretion in such cases remains evidently for long without giving rise to any disagreeable symptoms. When, however, such a tonsil becomes inflamed as a result of

cold or other cause, the symptoms may rapidly become severe, with marked dyspnoea and dysphagia. Dr. Baker³ records the case of a highly scrofulous woman, aged 43, who was attacked with severe sore throat, accompanied by great pain in the ear. The throat rapidly swelled, and she experienced great pain and difficulty in swallowing, accompanied by a choking sensation. During violent coughing the tonsillar abscess burst, and a calculus as large as a pea was discharged from the right tonsil. In Dr. Bryant's⁴ case the patient had suffered from sore throat eighteen months previously. All the symptoms had, however, passed off, and little inconvenience was felt. The right tonsil was large, firm, and painless. While coughing the patient felt sudden pain in the right side of the throat and at the same time a hard and rough calculus, the size of a small nut, came away. The patient of Dr. Nixon was a young man aged 25. He had sung in public two days previous to the expulsion of the calculus, and had felt no inconvenience from the large size of the concretion in the left tonsil until attacked by the general inflammation of the throat due to cold.

Origin of these Calculi.—Some authors affirm that they are of gouty origin, but in most of the cases related no tendency to this affection was present. The father of the patient whose case I have recorded did certainly suffer from gouty troubles, but the son has, up to the present at least, shown no signs of this affection. Other writers think that they are formed by a deposit from the buccal secretion, and that they are similar in nature to the tartar which accumulates round the bases of the teeth. Robin⁵ suggests that they may originate in small calcareous crystals which may be seen, he says, in the centre of the tonsil. In all probability, however, the smaller concretions are due to the retention of caseous material in the enlarged follicles of the tonsils. When not extruded, this caseous matter dries up and forms a nucleus round which inorganic salts are deposited or the cheesy matter may be itself replaced by lime salts. It is highly improbable in my opinion that they can have their origin in the retention of particles of food in the cup-shaped depressions left in the tonsil after an attack of follicular tonsillitis. It has been suggested that these particles of food undergo subsequent calcification. The larger calculi probably result from the retention of pus in the interior of the tonsil. The abscess has either never broken or has imperfectly discharged itself; and the residual matter has undergone caseation and subsequent calcification. Such stones when retained may grow in size by a further gradual deposit of lime salts until it may attain the enormous size of the stone from the case I have related.

Size, Shape, and Colour of Concretions.—The calculi are generally small in size, and are compared to grains of barley. The larger ones on account of their rarity, have usually been reported in the medical journals. Calculi thus noted have been said to be equal in size to a pea, bean, small nut, olive kernel, and first joint of thumb. The weight when given has varied from $3\frac{1}{2}$ to 11 gr., or from 0.04 to 3 g. Their shape is generally elongated. Some are described as pyriform. They are usually more or less rough on the surface, and in some cases this is so marked that they are said to resemble small mulberry calculi. One which is described by Dr. Yearsley resembled a piece of rock coral in the irregularity of its shape. The odour which they give off when fresh is disagreeable and foetid. When they are dry, however, it resembles that of old bone. In colour they are pale yellow or light brown.

Chemical Composition.—Their chemical composition is rarely given. Baker states that the concretion which he had examined was composed chiefly of carbonate of lime, with some oxalate of lime and animal matter. Bryant says that carbonate and phosphate of lime are the chief salts present. The only accurate analysis of a tonsillar concretion is that given by Robin as a result of Langier's analysis:

Water	...	...	25.0	per cent.
Phosphate of lime	...	...	50.0	" "
Carbonate of lime	...	...	12.5	" "
Mucus	...	...	12.5	" "
			100.0	" "

My analysis of the calculus in the case which I have described, and in which I had the invaluable help of Dr. Milroy of the Physiological Laboratory, showed that the greater part of the stone was composed of phosphate of lime and magnesia along with a small amount of carbonate, the figures are as follows:

Organic matter	18.40 per cent.
Inorganic matter	81.60 " "
Phosphoric anhydride... ..	50.00 " "
Calcium and magnesium oxides ...	28.20 " "

Tonsil Affected.—There does not seem to be any special tendency for one tonsil to be affected more than the other. In 14 recorded cases right and left tonsil were in equal proportion the seat of the calculus. In several of these cases both tonsils were enlarged at the same time.

Hereditary Predisposition.—It is hardly possible to say anything definite regarding the influence of heredity as a predisposing cause, as the recorded cases are so few and information on this point is seldom given in those which are reported. In the 3 cases of tonsillar calculus mentioned by Munro the disease affected two sisters and a near relative. A daughter of the patient whose case I have related suffers from chronic sore throat with enlargement of the tonsils.

Diagnosis.—Unless in very evident cases where the concretion is near the surface diagnosis must always be difficult. Patients, however, who suffer from repeated attacks of angina with only short intervals of comparative ease, and whose tonsils are persistently of large size, form fit subjects for the development of tonsillar concretions. In such cases we should make a thorough examination of the throat by palpation. If there be any yellowish ulcers on the surface of such chronically inflamed tonsils the probe should be used. If a calculus be present it will thus be readily detected.

Treatment.—As soon as the exact condition is recognised the concretion ought to be removed, as dangerous symptoms may suddenly supervene. If the stone be large and be spontaneously evacuated there is the possible danger of suffocation as nearly happened with my patient. Had the stone been only a little smaller it might have become firmly impacted in the man's throat as a result of his sudden inspiratory effort and asphyxia might have resulted.

REFERENCES.

- ¹ Nixon, *Transactions of the Royal Academy of Medicine in Ireland*, 1883, iii, p. 289. ² Hewitt, *London Medical and Physical Journal*, 1800, iii, p. 446. ³ Baker, *Transactions of the Pathological Society of London*, 1850-51, xi, p. 106. ⁴ Bryant, *Lancet*, No. 17, 1860, ii, p. 487. ⁵ Robin, *Traité des Humeurs*, second edition, 1874, p. 111. ⁶ Terrillon, *Des Accidents causés par les Calculs de l'Amygdale*, *Archives Générales de Médecine*, August, 1886, ii, p. 129. ⁷ Fobold, *Berliner Klinische Wochenschrift*, January 18th, 1869, p. 31.

MEMORANDA:

MEDICAL, SURGICAL, OBSTETRICAL, THERAPEUTICAL, PATHOLOGICAL, Etc.

ACUTE SUPPURATIVE TONSILLITIS WITH CONVULSIONS.

A GIRL, aged 7, residing in the same house as myself, came home one evening complaining of "sore throat." Her mother (my landlady) asked me to see her. On examination the tonsils were found swollen (the right most so) and very red. The temperature was 101°. I ordered a mild purgative and a gargle of potassium chlorate. The child was fairly comfortable, and did not complain a great deal; towards night she grew restless. In the early morning the right tonsil, which had become distinctly suppurative, burst, after which the child slept some short time. All that day she was restless, eating nothing, until towards evening she again became drowsy, and seemed to sleep. Suddenly, whilst I was in the room, she sat upright, burst out into rambling statements, laughing and crying, and the next minute was seized with a severe and distinct convulsive attack, lasting some five minutes. I immediately placed her in a hot bath, and gave her a dose of ipecacuanha wine. The bath seemed to ease her, the temperature falling from 104.4° to 100°. She dosed off and seemed to sleep well for a short time, and then, waking up, vomited. She immediately seemed quite in her usual spirits, sat up, talked, and wanted to eat. She never had any more trouble, and was out and about again in a few days. Henoch has noted the occurrence of convulsions, I find, but says they must be very rare. The case seems to me interesting, not only from the convulsions, but from the rapid onset of the trouble. The child, although belonging to a neurotic family, has never had any signs of convulsions before, even when

teething. She has had so far very fair health, except for a discharge from the left ear, which has been going on for some time.

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EXTRACAPSULAR FRACTURE OF FEMUR IN A WOMAN OF 82 WITH MORBUS CORDIS:

RECOVERY.

Mrs. B., aged 81, was attended by me from April till August, 1897, for mitral disease, she being at one time *in extremis* with general anasarca, etc. To my surprise, after continuously taking a mixture containing digitalis and strychnine for eight months, she began to improve, and eventually became much better.

On the evening of March 20th, 1898, I was asked to see her, as she had hurt her thigh. On visiting her, I was told that she had, owing to failing eyesight, missed sitting on a form, and fallen. I found fracture of the neck of the left femur, with the usual signs, but with marked crepitus and a good deal of discoloration. She was very intolerant of examination, and greatly exhausted.

I at once applied a long Liston splint, which she kept on for two weeks. Next I tried a poroplastic splint, but after a week she said it was uncomfortable, so I had a Thomas's splint made to enable her to get up, but she obstinately refused to do so, and as there were no signs of bedsores she was allowed to remain in bed.

After wearing the latter splint for six weeks, it was removed, and I found that union had apparently taken place; in fact active movements were soon performed. She remained in bed for another two weeks—eleven weeks in all—and was then lifted out daily into a chair. Being nearly blind, she was afraid to use crutches, but in a short time she began with help to hobble about.

Since then I have attended her again for her heart, her legs becoming very dropsical, but under the same medicine as before she improved considerably.

At the present time she is fairly well; can bear the whole of her weight on the injured limb, and with the help of a stick, etc., gets about in her cottage very well.

There is at least 1½ inch shortening, but she does not wear a patten, as she is afraid of tripping with it. She has twice to my knowledge fallen down, but no harm has resulted.

The case appears to me worth reporting on account of:

1. The great age of the patient, together with the cardiac affection.

2. The difficulties to be overcome in a cottage with well-meaning but quite inadequate nursing, the neighbours doing everything for her.

From the signs, I take the case to be one of extracapsular fracture, which is unusual in old people, and it is all the more surprising that she should recover on account of the additional severity of the constitutional disturbance in that variety as compared with intracapsular fracture.

Caldicot.

CHARLES CORBEN, M.R.C.S.

STRANGULATED HERNIA IN PERICARDIAL SAC.

On October 24th, 1898, I was requested to make a *post-mortem* examination on a well-built muscular Kaffir, who had died rather suddenly the same morning. The history, as given by his wife, was that up to the morning of October 22nd he was in perfect health, but during the afternoon he complained of pain about the ensiform cartilage and the umbilicus. It appeared to extend upwards into the chest, and to cause breathlessness and an uneasy feeling about the heart. Vomiting began about the same time; it continued at frequent intervals, and the pain increased steadily in severity during the night and the next day (23rd), so that the slightest movement was accompanied by unbearable pain. The abdomen from the first began to swell, and nothing was passed from the rectum. Everything taken by the mouth was promptly rejected. On the morning of October 24th he got up with the aid of a stick with the intention of micturating; he went a few yards, and was found dead a few minutes afterwards.

Post-mortem Examination.—About eight hours after death the abdomen was greatly distended. On throwing back the sternum and cartilages the pericardium was found distended.