Observations

ON

SOME SKIN AFFECTIONS DUE TO YEAST-LIKE FUNGI.*

BY

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WITHIN recent years considerable advances have been made in the etiology of skin diseases by the discovery that certain "yeast-like" fungi, previously believed to be saprophytic and harmless in the skin, are pathogenic and responsible for various forms of dermatitis of which the causation has long been a matter of controversy. As these affections are commonly met with in general practice, and since on the recognition of their cause depends their rational and successful treatment, I have chosen them as the matter of this address. I propose to illustrate it by a series of lantern slides, which have been specially prepared from photographs of cases in my own practice or which have been kindly lent me by my colleagues, and from specimens and cultures made in the St. John's laboratory.

It is only within the last few years that the yeast-like fungi pathogenic in the skin have attracted much attention in this country, and most of the literature is American, French, or German. I do not propose to discuss the different mycotic findings in their chronological order, or to attempt to apportion the credit due to the various workers on the subject, but simply to describe in a general way the present position. At the same time, however, I should like to express our indebtedness to all the workers on the subject—to Gilchrist, Stokes, Ricketts, Ormsby, Shelmire, Weidman, Finnerud, and others in America, to Dubreuilh and Ravaut in France, to various workers in Germany and Austria, and to Castellani, Chalmers, and my colleague J. B. Dowling in this country.

As a preliminary it will be necessary to consider briefly the group known as the yeast-like fungi from their close relationship and morphological similarity to the yeast fungus (*Saccharomyces cerevisiae*). The fungi in question belong to the group of the "fungi imperfecti," and are of a lower order than the yeasts, in that reproduction takes place in the simplest manner by budding, without the formation of asci (receptacles containing spores). They consist of the Monilias, the *Pityrosporon* of Malassez, and, of a higher order and more nearly related to yeasts, the *Blastomyces* and *Coccidioides*. These fungi are members of the great botanical division of the Thallophyta, and have a vegetative part consisting of mycelium, made up of filaments or hyphae, usually septate, and a reproductive part consisting of spores which multiply by budding, or under certain conditions are developed from hyphae as lateral buds or conidia.

As early as 1889, when Tommasoli described six different yeasts which might occur in the epidermis, it was known that yeasts were common denizens of the skin, and to be found chiefly in moist intertriginous parts such as the axillae and genito-crural region. They seem to be especially common in the skin in tropical countries, and Castellani years ago observed a number of cases of yeast infections in Ceylon, to which he gave the name of intertrigo saccharomycetica.

There was no consensus of opinion, however, as to whether the yeasts were responsible for the intertrigo or simply existed in these regions as harmless saprophytes. Since then cases have been reported from time to time in which fungi believed to be yeasts and to be pathogenic have been isolated in intertriginous dermatitis. In the light of the study of monilia infections and further knowledge of the true yeasts it appears that in such cases the fungi are not saccharomyces, but monilias and other yeast-like fungi. It is now known that the yeast fungus itself is not pathogenic; when inoculated on the skin it produces no definite lesion, and men whose occupation entails con-

stant handling of yeast, such as workers in breweries, are not specially subject to dermatitis, whilst baker's itch, once attributed to yeast, is now considered to be due to the hygroscopic action of the dough itself.

MONILIAS.

The monilias belong to the family of the Oosporaceae. They reproduce themselves by free spores or conidia, and present budding forms on cultivation on artificial media. The spores are ovoid or rounded in shape, vary in size from 2μ to 6μ in diameter, and have a tendency to be arranged in chains, hence the name monilia, from *monile*, a necklace; the mycelium shows hyphae, which are usually long and septate. In culture the fungi are Gram-positive, liquefy gelatin, and ferment certain sugars such as glucose and maltose, with, in the case of glucose, the formation of gas and the emission of a characteristic odour. They grow readily on Sabouraud's maltose agar at 25°C . in from twenty-four to forty-eight hours; young cultures show round or ovoid yeast-like cells, and older cultures single or branched mycelial hyphae with lateral buds.

There are several varieties of monilia, certain of which are pathogenic, while others are only saprophytic. Morphologically they may be indistinguishable, but differences can be detected by means of biochemical tests based on their capacity of fermenting different sugars. The most familiar member of the group is the *Oidium albicans* of thrush, which it is now customary to designate the *Monilia albicans*. Other well-known pathogenic monilia are the *M. pinoyi* and *M. candida*.

The *M. albicans* is a slightly higher fungus than the others in that culturally it occasionally shows endospores, and certain mycologists have claimed it as an endomycetes. The cultural distinctions between the *M. albicans* and the *M. pinoyi* on maltose agar are as follows: the *M. albicans* at 25°C . grows in twenty-four to forty-eight hours as a crinkled culture of a light yellowish-brown tint, while the *M. pinoyi* on the same medium and at the same temperature appears as pinhead-sized hemispherical colonies, which are smooth, shiny, and of a dirty beige tint, which is darker in the centre.

Mucous Membrane Lesions due to Monilia.

Monilias may produce lesions in the mucous membranes in the mouth, vagina, anus, and bronchi. It was in 1853 that Charles Robin gave the name of *Oidium albicans* to the fungus of thrush, and it was believed for long afterwards that this familiar clinical condition was due to a single fungus. It is now known that a number of different fungi may be responsible for it, not only monilias, but cryptococci, and possibly others.

In the mouth the fungi produce the well-known whitish or cream-coloured, wash-leather-like membranous patches, situated on the tongue and the inner surface of the cheeks, which on removal leave a raw red surface but no ulceration or bleeding. Not infrequently cracks appear on the tongue or at the commissures of the mouth, where they may be associated with maceration, desquamation, and crusting of the red portions of the lips, and with an erythematous-squamous dermatitis spreading for a quarter of an inch or more from the corners of the mouth, which is generally known as "perlèche," and was attributed until recently either to a streptococcal or staphylococcal infection.

In a case under my care, in a boy aged 10 years, with extensive thrush of the mouth and associated perlèche, *M. pinoyi* were found in scrapings of the scales at the angles of the mouth as well as in the buccal mucosa. In another case, in a girl aged 8 years, crusted, cracked patches were present at the angles of the mouth, at the nasal orifices, and on the eyelids, and from these lesions the *M. pinoyi* was isolated and cultivated.

In 1929 Finnerud reported an epidemic of perlèche in an orphanage near Chicago in which 100 cases occurred out of 1,250 children.

It appeared first as greyish-white thickenings on the mucous membrane side near the angles of the mouth and spread out on the neighbouring skin in the form of erythematous-scaly or crusted patches with one or more cracks. In certain of the cases perlèche-like lesions were also present at the nasal orifices, and in one or two instances scaly patches like seborrhoeic dermatitis were observed on the chin and cheeks. In 77 per cent. of the cases fungi of the monilia or cryptococcus type were isolated. It was believed that the infection in this epidemic had been spread by drinking-vessels, sucking pencils, the use of common towels, kissing, or possibly by the habit the children had of sharing fruit with each other and even biting the same apple.

In the vagina monilia infection may give rise to a membranous or purulent vaginitis suggesting gonorrhoea. It would seem to be specially prevalent in diabetics and in pregnant women. Cases of conjugal infection where a

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husband has presumably contracted it from an infected wife have also been reported.

Monilia infection has been known to occur in the mucosa near the anal orifice in association with the presence of the fungus in the rectum and in the faeces, and to spread from there to the circum-anal skin; it may also occur in the urethra and glans penis.

Skin Lesions due to Monilia.

The lesions of the skin which may be caused by monilias are almost as multiform as those due to the fungi of ringworm. At the same time apparently identical lesions may be produced by different monilias, and it is just as impossible to predict the exact fungus responsible in monilia infections from the appearance of the clinical lesions as it is to foretell the precise microsporon or trichophyton which has caused a patch of ringworm. The cutaneous lesions due to pathogenic monilias may be widely distributed, certain parts, such as the intertriginous regions, being specially involved, or they may be localized in one or more situations as in *perlèche* or perionychia.

The disseminated type is met with most commonly in suckling infants, in whom the eruption may or may not be associated with buccal thrush. It is usually first seen around the anus, and spreads from there to the genito-crural fold and genitalia and down the thighs. In severe cases it may extend to the buttocks, abdomen, interdigital spaces of the hands and feet, and may even be met with on the palms, soles, and face. The initial lesion is either an erythematous-squamous macule, or a superficial vesicle or vesico-pustule, which on rupturing leaves a small denuded surface enclosed by a ring of undermined epidermis. These lesions increase peripherally to form confluent patches with an indefinite border of detached epidermis, beyond which are numerous isolated vesicles or inflamed scaly macules. In older patches the scalliness may so predominate that an appearance results which is indistinguishable clinically from ringworm. As a rule, however, the presence of the detached epidermal border enclosing a pinkish, somewhat moist central patch will serve to indicate the diagnosis.

In severe cases the fungus may be present in the alimentary tract and stools, and it is in such cases that there is a danger of general infection, which has been known to terminate fatally. Buccal moniliasis in sucklings may lead to infection of the nipples and breasts of the mother.

In the adult the intertriginous regions usually implicated in body ringworm—namely, the genito-crural region, axillae, beneath the breasts in stout women, and the interdigital folds—are the usual sites of infection. As in the infant, the eruption begins as minute papules or vesicles which eventually form a red scaly patch, irregular in outline, occasionally fissured, and bounded by an edge of detached epithelium, beyond which variously sized discrete lesions may extend for some distance. The presence and growth of the fungi in the skin causes itching, and certain cases of pruritus ani or vulvae are caused by it.

B. C. Smith, in an interesting paper on dermo-moniliasis among natives of West Africa, isolated monilias which he regarded as pathogenic in connexion with a desquamative dermatitis of the scrotum, psoriasis-like patches scattered over the trunk and limbs, and lesions of an impetiginous character covered with crusts. The fungus, believed to be *M. pinoyi*, was found microscopically in scrapings, in culture, and in histological sections about the hair follicles, but not in the hairs themselves.

There are various factors which predispose the skin to monilia infection by rendering it a suitable soil for the growth of the fungus. These are the moisture and warmth of the intertriginous regions; excessive sweating; the presence of glycosuria, sugar favouring the growth of the fungus; and maceration of the skin from wet dressings, or from immersion in continuous baths, such as those employed in Vienna as a routine treatment for certain cutaneous affections. In the continuous bath cases it is usually most marked about the hands, knees, and axillae, regions which are not continuously immersed, but for parts of the day are out of water and exposed to the air.

In the interdigital folds monilia infections are indistinguishable from ringworm, and may occur as a papular or vesicular eruption like dysidrosis, which spreads from the clefts to the neighbouring skin of the back of the hands

or the dorsum of the foot, or it may appear as whitish patches of sodden skin, not infrequently fissured, to which type of lesion Fabry gave the name of "*Erosio interdigitalis seu blastomycetica*."

Another variety of monilia infection is perionychia, chiefly of the fingers, with a pad- or bolster-like swelling of the nail-walls, which on being squeezed emits a bead of pus on to the nail-plate, the result of the presence of minute abscesses on the undersurface of the nail-wall. This condition is painful and singularly intractable. It is most common in women, and seems to be especially prevalent in those whose occupation necessitates the handling of sugar, such as confectionery workers, pastrycooks, etc. In these industries various factors are combined which further the inoculation and growth of the fungus—for example, the heat of the workrooms, the moistness of the hands of the operators, the sugar, and the liability to abrasions from sugar granules or traumatism.

The nails themselves may be infected by monilia by spreading of the fungus from the nail-fold or the nail-bed. The appearance of the affected nails is similar to ringworm. In both the nail-plate becomes opaque, discoloured, irregular, ridged, and brittle, and may be raised up from the nail-bed by greyish-white keratotic masses. In certain cases the infection takes place from the mouth, and may persist indefinitely after the buccal thrush has been cured.

In a case of this kind which came under my observation a lady sought advice on account of an affection of the nails of the hand which had been present since childhood. The appearance of the nails suggested ringworm, but on microscopical and cultural examination the fungus found proved to be the *M. albicans*. All manner of treatment had been tried without success, and even on one occasion the nails were removed, but the affection recurred with their regrowth. There was a history of recurrent attacks of inflammatory perionychia, but at the time of examination the perionychia was quiescent. As it had been present in infancy it was regarded by the patient as a congenital defect. On questioning her it transpired that as a baby she had suffered from persistent buccal thrush, and there seemed little doubt that the infection had taken place at that time and continued ever since.

This case is interesting in that it shows that an apparently trivial action such as sucking the fingers in infancy may have a profound influence throughout life.

Pathogenicity of the Monilias.

Numerous inoculation experiments have proved that certain monilias are definitely pathogenic. By inoculation on normal skin of culture material from monilia lesions in the mouth or skin a vesico-pustular dermatitis can be produced, and from the roofs of the vesicles and from scrapings of the experimental lesions the fungus can be recovered, demonstrated microscopically, and successfully cultivated. Conclusive experiments of this kind have been done by various workers, including myself, both with the *M. albicans* and the *M. pinoyi*. As a rule the artificially produced lesions clear up rapidly under treatment or even become involuted spontaneously, but this does not invalidate the pathogenicity of the fungus, as the inoculated skin may have been uncongenial soil for its growth. The inoculations took best in the intertriginous situations, such as the anal fold and the interdigital spaces.

In the epidemic of *perlèche* described by Finnerud, lesions of a persistent type and indistinguishable from *perlèche* were produced in nine out of ten cases experimentally inoculated from pure culture of monilia, and from them the organism was recovered and cultivated.

So far as I am aware no successful experiments have been carried out in connexion with inflammatory perionychia due to monilia in man, but Guggenheim claims to have infected the claws of a guinea-pig by the inoculation of a culture from moniliasis of the human nail. Animal experiments have also been done with the fungi in mice, rats, rabbits, and guinea-pigs, by local inoculation on the shaved skin and by subcutaneous, intraperitoneal, and intravenous injection. In this way inflammatory lesions have been produced in the skin of a papulo-vesicular or scaly type, while intravenous injection of a culture of *M. albicans* in mice has proved fatal, and intramuscular inoculation in a guinea-pig has given rise to local abscesses. In short, both human and animal experiments have proved that two at least of the monilias are pathogenic and conform to Koch's postulates.

Diagnosis of Moniliasis.

The diagnosis of cutaneous moniliasis from the clinical appearance of the lesions is as a rule impossible, but the presence of lesions in intertriginous parts associated with buccal thrush should naturally suggest a common origin, and the peculiar type of perionychia with its bolster-like nail-wall, beads of pus, and discoloured, opaque nail-plate should point to a monilia infection. In every instance the diagnosis should be confirmed by a microscopical examination. With this object scrapings should be made of the cutaneous patches or of the affected nails, and examined microscopically, either in potash solution or after staining by Gram or gentian violet, and the microscopical findings confirmed by cultivation on maltose agar.

Treatment of Moniliasis.

The treatment of moniliasis depends on the situation affected.

In buccal cases the mouth should be cleansed with a 2 per cent. aqueous solution of borax and potassium chlorate, and the membranous parts of the tongue and cheek painted subsequently with a 1 per cent. aqueous solution of gentian violet. The use of artificial teats should be discontinued as they are liable to harbour infection.

Lesions in the intertriginous parts should be treated with potassium permanganate baths followed by the application of a 2 per cent. benzoic and salicylic ointment, or of a 2 to 5 per cent. solution of gentian violet in 15 per cent. spirit.

In the interdigital spaces the papulo-vesicular type may be cured by the use of Whitfield's benzoic and salicylic ointment or by the application of 1 per cent. chrysarobin ointment, but in the resistant type with white sodden fissured skin more drastic treatment is necessary, and it may even be necessary to resort to curettage and the application of 5 to 10 per cent. solution of silver nitrate.

In perlèche from monilia the application of 6 to 10 per cent. solution of silver nitrate or the gentian violet solution should effect a cure.

In suppurative perionychia the hands should be immersed in warm saline solution for half an hour, dried, and then painted with 5 per cent. solution of silver nitrate or 10 per cent. solution of iodine, which should be pushed in below the nail-walls as far as possible with a soft camel-hair brush. This treatment should be repeated at intervals of two or three days until a cure is effected.

In monilia of the nails the treatment is as unsatisfactory as in ringworm. An attempt may be made to cure them by soaking the affected fingers in warm saline solution, scraping the nail-plate as thin as possible, and dressing either with the following iodine solution (iodine 1, potassium iodide 2, water 1,000) or with Fehling's solution. It may even be necessary to extirpate the affected nails, and treat the nail-bed freely with gentian violet solution till regrowth of the nail takes place.

THE PITYROSPORON.

The second yeast-like fungus to which I wish to refer is the pityrosporon.

This organism was first recognized by Malassez in 1874, and was named after him the "spore of Malassez." It was designated subsequently by Unna, on account of its shape, the "flask-shaped bacillus," or *B. asciformis*, by Hodara the "balloon bacillus," and by Sabouraud the "bottle bacillus." As the organism is one of the yeast-like fungi of the family of the Cryptococcaceae (Kützing), and not a bacillus, it is inadvisable to perpetuate these synonyms, however descriptive of its morphology they may be, and to adhere to the title of "spore of Malassez," or, as it produces a scaly dermatitis, the pityrosporon. Like the monilias it is of a lower order than the yeasts, and shows no reproductive asci on cultivation; it is believed to be closely allied to the *Microsporon furfur* of pityriasis versicolor.

Morphology.—The morphology of the fungus can be studied in extempore preparations of scales and scrapings in liquor potassae, and in stained preparations of scales and cultures. It is Gram-positive, and stains readily with gentian violet, methylene blue, and Giemsa. Its spores are polymorphic, and vary considerably in shape and size. Their usual form is that of a gourd or flask with a large spherical portion surmounted by a small, rounded process or bud, but they may be hour-

glass shaped, or, more rarely, ovoid, round, or sausage-shaped. In size they average from 2μ to 4μ in their long diameter. They may be arranged singly or in groups or chains varying in number up to twenty or more. In preparations from the skin and cultures from solid media no mycelium can be detected, but in fluid media mycelium is found in abundance in the form of delicate non-septate hyphae with clubbed extremities and lateral buds. It is distinguished from monilia in that the spores are polymorphic, instead of being ovoid or lemon-shaped; they average in size about 3μ in diameter, while the monilia spore averages about 4μ , and on cultivation the pityrosporon shows no mycelium on solid media, but abundant mycelium with thin, delicate hyphae in fluid media, while monilia shows mycelium with thick hyphae in solid media and no mycelium in fluid media.

Cultivation.—Great difficulties have been met with in the cultivation of this organism. As early as 1908 Mr. W. G. Garner, pathological assistant in the laboratory of St. John's Hospital, succeeded in growing it at 25°C . on acid glycerin agar, Sabouraud's maltose agar, and peptone broth with the addition of 1 per cent. oleic acid and 1 per cent. glucose, by scraping scales off the scalp with a sterilized knife into a sterile watch-glass and planting them on the media. On solid media it grew in twenty-four to forty-eight hours as a white, glistening, smooth culture, which readily assumed a yellowish or fawn tint. On oleic peptone broth it appeared as a flocculent growth in which an abundant fine mycelium was present. Other workers also claim to have grown it; in 1926 Templeton reported that he had cultivated it on beerwort agar, and in 1929 Panja announced that he had succeeded in getting it to grow on scales as chalky points or pinkish bead-like masses in a medium consisting of equal parts of meat infusion in 15 per cent. glycerinated water and egg, tinged with gentian violet to inhibit the growth of staphylococci, and that in sub-culture he had been able to grow it on all laboratory media, but best on glucose agar.

Biochemical Reactions.—It ferments galactose with no gas formation; maltose with slight gas formation, and glucose with slight gas formation; it does not ferment saccharose, insulin, lactose, and mannite. Gelatin is not liquefied by it.

*Cutaneous Lesions Caused by Pityrosporon.**(1) The Scalp.*

On the scalp the pityrosporon produces the familiar condition variously known as dandruff, pityriasis capitis, or seborrhoeic dermatitis of the scalp. In its mildest form this affection occurs as delicate, pellucid, powdery scales, either present between the hairs or around them in the form of small collarettes, which are shed when the hair is brushed, and tend to fall down and collect on the coat collar. It begins as minute scaly patches, which extend and coalesce, and, as the affection is progressive, eventually cover the whole scalp.

In mild cases the inflammation of the scalp is so slight that no obvious signs of it can be detected, but in severe cases there is an inflammatory base, which extends beyond the scaly areas, and the scales themselves, instead of being fine and powdery, are coarse and greasy. In the affected parts the hair becomes lustreless and brittle, and tends to fall out, at first about the vertex and sides of the forehead, leaving bald areas, which gradually spread till only a fringe of hair is left at the sides of the head and the occiput, where it may persist long after the rest of the scalp has become bald.

In many of the cases the defluvium of the hair is associated with a greasy condition of the scalp due to an oily and waxy substance containing an excess of oleic acid or stearin, which oozes from the orifices of the follicles. The oiliness of the scalp may be aggravated by a hyperactivity of the sweat glands (hyperidrosis oleosa).

(2) Glabrous Skin.

The pityrosporon infection is liable to spread from the scalp on to the glabrous skin, and to be responsible for the different types of lesion which have been grouped together under the heading "seborrhoeic dermatitis." These consist of scaly papules, scaly patches on an inflamed basis, characteristic circinate or gyrate patches with a well-defined border of a brownish-yellow tinge and a smooth or slightly scaly surface, and eczematized patches situated chiefly in the flexures of the larger joints and in the intertriginous regions. These different types of lesion are due to individual peculiarities of the skin affected, differences in the situation of the lesion, and secondary changes from

rubbing, scratching, and the inoculation of septic organisms. From the scalp it spreads readily on to the forehead in pinkish scaly festoons (corona seborrhoica), down behind the ears, and on to the nape of the neck. On the face it may occur as ill-defined, pinkish, scaly patches, or it may attack the eyebrows, margins of the eyelids, or moustache region, giving rise to chronically inflamed scaly patches. On the trunk it is frequently met with in the sternal and interscapular regions in the form of circinate or figured lesions, to which the appropriate name of pityriasis circinata has been applied, and which have for long been popularly known in this country as "flannel rash," since the wearing of flannel next the skin predisposes to the eruption, as it encourages the growth of the fungus by increasing perspiration and sebaceous flux, and by keeping the skin moist and clammy from its non-absorbent characteristics. It is also liable to affect the intertriginous regions—namely, the axillae, genito-crural fold, and interdigital spaces, and is not infrequent about the umbilicus, nipples, and scrotum, where it is liable to become cracked, moist, and eczematized.

Other types of lesions may be met with on the trunk, such as groups of small follicular papules with definite horny plugs or patches with a reddish border studded with minute vesicles. On the limbs it is generally most marked on the flexor aspects, especially the bend of the elbows and the popliteal spaces. On the scalp and trunk it is generally associated with itching, which is aggravated by heat, and which leads to scratching and eczematization, and in rare instances to exfoliative dermatitis.

Pathogenicity of Pityrosporon.

It is only recently that the pityrosporon has been established as the cause of seborrhoic dermatitis. It occurs invariably in the different lesions of that disease, and is present in the scales of dandruff, in the scaly lesions about the trunk and intertriginous regions, in the circinate and gyrate lesions, and in the horny plugs in the follicular type of lesion, and is absent in other types of scaly dermatitis. Experimentally it has been proved to be pathogenic on the human skin and scalp, and to be non-pathogenic in the usual experimental animals, such as mice, rabbits, and guinea-pigs.

Though it had long been known that seborrhoic dermatitis is auto-inoculable and capable of transmission from one person to another directly by contact, as in the case of a suckling infant infecting the breast of the mother, or indirectly by the medium of infected brushes, combs, caps, etc., and although it had been regarded as the cause of dandruff by Unna and others, it was only in 1928 that conclusive inoculation experiments proved its pathogenicity. These experiments were carried out by Dowling in the St. John's Hospital Laboratory, and are described in detail in a paper published by Dowling and myself in the *British Journal of Dermatology* (1928, xl, p. 139). The experiments were briefly as follows:

Experiment 1.—A drop of suspension of the fungus in water was injected intradermally in patients with seborrhoic dermatitis.

Experiment 2.—Organisms taken from cultures of pityrosporon were implanted after light scarification in patients with seborrhoic dermatitis and in controls on normal skin.

In every instance lesions precisely similar to seborrhoic dermatitis were produced by the inoculation, these being most marked in patients suffering from the disease, and especially in greasy skins. In some cases the artificially produced lesions were even more prominent than those which occurred spontaneously. They appeared in twenty-four hours, reached their maximum development in four days, and persisted two to three weeks before involuting. Like the spontaneous lesions, they appeared first as follicular papules arranged in groups, and under suitable conditions developed into characteristic circinate lesions.

These experiments seemed to us to prove beyond doubt that seborrhoic dermatitis in all its forms is a local infection like moniliasis or ringworm, and due to the pityrosporon.

Other Pathogenic Considerations.

For the last quarter of a century a controversy has raged around the etiology of seborrhoic dermatitis, and the disease has been a fruitful source of discussion in dermatological congresses and societies. This has been due not only to the fact that most previous attempts to cultivate the pityrosporon have failed, but that it is not present

alone in the scales, but generally in symbiosis with other organisms believed in the past to be pathogenic. These organisms are: (1) a slightly virulent staphylococcus known as the "grey coccus" of Sabouraud from the tint of its culture, or the "morococcus" of Unna from the arrangement of its cocci in mulberry-like clusters; (2) a small bacillus known as the micro-bacillus of Sabouraud or the acne bacillus of Unna which occurs in scales and scrapings from seborrhoic dermatitis and in vast numbers in comedones.

The "grey coccus" is found chiefly in symbiosis with the pityrosporon in the more acute types of seborrhoic dermatitis with greasy scales of both the scalp and glabrous skin, its precise relation to the lesions being undecided, but it seems most probable that it is of secondary importance and responsible for aggravating the lesions already produced by the pityrosporon by increasing the inflammatory disturbance. The micro-bacillus was believed at one time to be the cause of the comedo and also of seborrhoea, but is now almost universally regarded as non-pathogenic.

Another controversial factor in connexion with pityrosporon infections is the greasy condition of the skin due to excessive activity of the sebaceous glands, and to some extent of the sweat glands, known as seborrhoea. This is most marked where the glands are largest, as about the intertriginous regions, sides of the nose, auricles, etc. It was believed by certain writers to be a pathological condition, and it has even been suggested that it is of microbic origin; Sabouraud, for example, attributing it to the micro-bacillus. Its importance lies in that it renders the skin a favourable soil for the growth not only of the pityrosporon but of staphylococci, such as the grey coccus, the excessive growth of which may be largely responsible for transforming rather insignificant scaly lesions into acute inflamed itchy patches covered with greasy scales.

The microbic theory of the origin of seborrhoea, however, is no longer tenable, and it is now believed to be essentially a physiological process which becomes active in most individuals about puberty in association with the appearance of hair in certain regions of the body, and may persist through early adult life, but which may be met with also as a hereditary peculiarity running in families, an idiosyncrasy, or an acquired condition the result of a dyscrasia due to some endocrinal derangement, or of a faulty dietary with an excessive fatty or carbohydrate intake.

The exact mechanism by which the falling of the hair takes place in seborrhoic dermatitis of the scalp is uncertain. It has been attributed on the one hand to the direct action of the pityrosporon, and on the other hand to the underlying seborrhoea. A third suggestion is that it is due to an interference with the balance which normally exists in the pilo-sebaceous follicle between the hair and the sebaceous gland, and that when the gland becomes hyperactive and hypertrophic the hair itself undergoes a compensatory atrophy.

BLASTOMYCES.

Another pathogenic yeast-like fungus is the blastomyces, so named by Gilchrist in 1894, a fungus of which we have had comparatively little experience in this country. The cases of infection by it have nearly all been in America, and only a few have so far been reported here, though in all probability others have occurred which have escaped recognition.

This fungus is nearly related to the pityrosporon, and is one of the pathogenic cryptococci. It is readily found in the crusts and sero-purulent discharge from the lesions caused by it and in small abscesses in the tissues.

It occurs as round or oval bodies, arranged singly, in pairs, or in small groups, 5μ to 10μ or larger in diameter, with a single or double wall and a fine granular protoplasm.

In culture it shows a rudimentary mycelium with short pod-like segments containing spores. It reproduces itself either by budding from spores or by lateral and terminal conidia on short hyphae, but never by the formation of asci. It grows on ordinary media; on glycerin agar it appears in about seven days as greyish-white colonies, and on blood agar at 37°C . it has been grown in three days as small cream-coloured colonies. It neither liquefies gelatin nor ferments sugar. It is pathogenic in man, and in mice, rats, guinea-pigs, sheep, etc. When introduced intraperitoneally in experimental animals it gives rise to a systemic infection with the formation of abdominal nodules and frequent involvement of the testicles.

Lesions in the Skin Produced by the Blastomyces.

The lesions in the skin caused by the blastomyces constitute what is generally known as blastomycetic dermatitis. They begin as groups of small, reddish-brown nodules, which increase and coalesce to form irregular patches, which may be dry and hard or moist and soft, and are separated by fissures from which oozes a sero-purulent or sanguineous discharge, which wells out when the patches are squeezed. The borders of the patches are well defined and abrupt, and usually slope gradually down to the healthy skin. The lesions so closely resemble the verrucose type of tuberculosis cutis that they are usually mistaken in the first instance for it, and the diagnosis is only established by the discovery of the fungus.

The patches are usually multiple, are spread by auto-inoculation, and are most commonly situated on the face, hands, back, and legs. Histologically they are verrucose granulomata with minute abscesses in the epidermis and corium, where the fungus can usually be detected. The infection, as a rule, remains local without glandular involvement, but in rare instances it has been known to become generalized and to invade the internal organs, with the production of multiple abscesses.

Under suitable treatment with potassium iodide retrogressive changes may take place, with the formation of red, shiny, smooth cicatrices, which may completely or partially replace the whole lesion.

Coccidioides.

The "*Coccidioides immitis*" of Rixford and Gilchrist is the last of the yeast-like fungi to which I wish to refer.

It is a more highly developed fungus than the blastomyces, belongs to the family of the Endomycetaceae, and forms a connecting link between monilias and true yeasts. It occurs in the tissues as variously sized, rounded bodies, much larger than blastomyces, of 10μ to 30μ or larger in diameter, some of which contain spores. It grows slowly on dextrose peptone agar in the form of a milky white culture, which subsequently becomes cream-coloured. It reproduces itself by endosporulation in the tissues, the spores being small and capable of dissemination through the blood stream and lymphatics, and in culture it shows mycelial threads, which may be branched or straight, and asci.

The fungus is found in the discharge from cutaneous lesions, in the pus from abscesses, and where the infection has become generalized in the sputum, blood, urine, and faeces. In the tissues it may be found in small abscesses or in the midst of the granulomatous infiltration, either free or in giant cells of the Langhans type, in the form of round or oval bodies, sometimes containing a large number of spores. The fungus does not ferment sugars. It is pathogenic in man, and in the lower animals, such as mice, rabbits, and guinea-pigs.

Unlike the blastomyces it usually gives rise to a general infection which only occasionally originates in the skin, and most frequently takes place through the lungs and affects the skin secondarily. Cases of the infection have been described in the past under various headings, such as saccharomycosis, coccidioidal granuloma, and dermatitis coccidioides, and have occurred chiefly in California, where as many as 160 have been reported. Its most marked feature is the presence of multiple abscesses situated in the skin and internal organs.

In the skin it appears as crops of small nodules, pustules, or occasionally verrucose papules about the size of a pea, which become red, enlarge, soften, and break down, forming ulcers with an unhealthy granulated floor, from which oozes a purulent discharge which dries up to form crusts.

The internal abscesses are present chiefly in the lungs, liver, kidney, and spleen, but may be met with also in the muscles and may cause necrotic changes in the bones. The presence of abscesses in the lungs may give rise to symptoms suggesting tuberculosis, and in the kidneys and intestine to albuminuria and diarrhoea, and the neighbouring lymphatic glands are invariably enlarged. As a result of septic absorption an irregular temperature and malaise occur, and death usually supervenes from pyaemia.

CONCLUSION.

These four yeast-like fungi which we have had under review must be regarded simply as types, for just as there are variants of the ringworm fungus, so there are variants of the monilia, blastomyces, and pityrosporon, but the variations which occur are so apt to be inconstant that their precise classification in the present state of our knowledge is almost an impossibility.

SOME OBSERVATIONS ON THE MENTAL DEVELOPMENT OF FEEBLE-MINDED CHILDREN.

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DURING the last nine years periodic examinations have been carried out to discover what educational progress, if any, is made by children who have attended the special school for defectives in Bath. Under the Education Acts, it is incumbent on local authorities to provide a special school for those children who, in the opinion of the school medical officer, are incapable of benefiting by education in the ordinary elementary school, but are not so deficient in intelligence or adaptability as to be totally unable to fend for themselves. In other words, the school provides for those children who legally come under the category of feeble-minded. In practice the child is referred from the ordinary school as being probably unable to benefit by instruction at that school, and must have reached the age of 7 before he is allowed to be dealt with by certification. He is examined by a school medical officer, using the Terman scale as the criterion, and if in his opinion he can be classified as feeble-minded, he is certified as such, and sent to the special school. In the course of the present investigation it has been found that quite a large number of children admitted to the special school have proved to be imbeciles—that is to say, they are not able to fend for themselves in life, and therefore must be cared for in some way or other, either by being sent to special residential institutions, or by being placed

under the protection of some specified guardian, who may be the parent. This guardian is responsible for the protection of the imbecile against himself and society, and of society against the imbecile. At the age of 7 children may appear likely to turn out to be imbeciles, but where there is a doubt on the subject the child is naturally given the benefit of that doubt, both on humanitarian and economic grounds, and afforded a chance of improvement at the special school. If, as often happens, such children do not improve, it becomes necessary to hand them over to the care of the statutory mental deficiency committee, which is responsible for dealing with imbeciles by sending them to institutions, or putting them under special guardianship, or by supervising them in their own homes.

The special school under discussion contains on an average 45 children—25 boys and 20 girls. They are taught very slowly along ordinary lines up to the level of Standard II or a poor Standard III of the elementary school, and at the same time practical manual work is encouraged. The staff of the school consists of two specially experienced teachers of ordinary school subjects, and of instructors in bootmaking, carpentry, and domestic subjects respectively. The size of the individual classes varies with the number of children being taught in the special departments at any given time. The education authority has power to retain children in a special school until the age of 16.

During the period under review 86 children passed through the school and were discharged as follows: 27 per cent. were passed to the statutory mental deficiency committee as imbeciles—that is to say, they proved unable to fend for themselves in life; 36 per cent. were classified as low grade feeble-minded, probably unable to fend for themselves; and 37 per cent. were considered able to fend for