THE MEDICAL JOURNAL OF AUSTRALIA.

VOL. II.—4TH YEAR. SYDNEY: SATURDAY, DECEMBER 8, 1917. No. 23.

RINGWORM AND ALLIED PARASITIC SKIN DISEASES IN AUSTRALIA.

By Henry Priestley, M.D.

(From the Australian Institute of Tropical Medicine, Townsville.)

Although parasitic skin diseases are not uncommon in Australia, little has been published as to the causative organisms. W. J. Munro (*Australian Medical Gazette*, 1907, p. 509) mentions the occurrence of a microsporum and of a large spored trichophyton in cases of ringworm.

N. Paul (*The Medical Journal of Australia*, 1916, Vol. 1, p. 237) examined thirty-four cases of ringworm of the scalp in Sydney, and found microsporum (*M. audouni, M. lanosum* and *M. felineum*) in fourteen, and endothrix trichophyton (*T. crateriforme* and *T. acuminatum*) in nineteen and an ectothrix trichophyton in one case.

In Townsville fifteen case of ringworm of the scalp and body due to an endothrix trichophyton (*T. sulfureum*), two cases of ringworm of the body due to a microsporum (*M. scorteum*), two cases of *tinea interdigitalis* due to a trichophyton (new species), and one case of onchomycosis due to a trichophyton (*T. griseum*), besides several cases from New Guinea, have been examined.

Favus has been reported on two occasions in human beings in Australia, and by J. B. Cleland in mice.

English text books give few details of the methods of investigation of the parasites of ringworm and an account of the procedure of examination of infected hairs and skin scales, and the methods of cultivation of the parasites may be useful.

The parasitic fungi causing ringworm in man belong to four genera, *Trichophyton, Microsporum, Epidermophyton* and *Achorion*.

The fungi belonging to the genus *Epidermophyton* grow superficially on the skin, but do not attack hair and hair follicles. They cause the disease known as "dhobie itch."

The fungi of the genera *Trichophyton, Microsporum* and *Achorion* attack both skin and hairs and hair follicles, but there is a group of the genus *Trichophyton* which does not attack the hair.

The achorions and many of the trichophytons are pyogenic, the microsporums are doubtfully so, and the epidermophytons are not pyogenic. In Table I. is given a summary of the appearance in the lesions of the fungi of the four genera. Each of the genera contain numerous species which are more or less distinct. Somewhere about fifty species of the genus trichophyton, twenty of the genus microsporum, five of the genus epidermophyton and five of the genus achorion are known to produce disease in man. The trichophytons are divided by Sabouraud into four main divisions depending on the position and size of their mycelial spores in relation to the hairs. These are:—

(1) *Endothrix*—spores entirely within the hairs.
(2) *Neoendothrix* — spores almost exclusively within hairs but a few outside.
(3) *Ectoendothrix microides*—small spores within and around the hairs.
(4) *Ectoendothrix megaspores* — large spores within and around the hairs.

Table I.

		Microsporum.	*Trichophyton.*	*Epidermophyton.*	*Achorion.*
Lesions	Ringworm	Large, very few healthy hairs in affected area	Smaller; number of healthy hairs	Large	Favus
	Hairs	Long, with greyish sheath extending 3 to 4 mm. from the skin	Short	Never affected	Long. Dusty grey
	Infection of smooth skin	Not common	Common	Always	Common
Parasitic Life	Mycelial spores	Spores small round not in chains, but forming irregular mosaic on surface of hairs, never within hairs	Spores large and round or square, regular and in chains within hairs in endothrix group; small or large round, in chains within and around hairs in ectoendothrix group		Spores polymorphic inside hairs; no chains of spores around hairs
	Mycelium in skin squames	Mycelium not rectilinear, but curved in different planes; lateral protuberances frequent; very few transverse septa visible	Mycelium generally rectilinear; mycelial elements short, sometimes oval, then in sinuous curves	Mycelium very polymorphic, consisting of regular quadrangular or oval elements, usually rectilinear	Mycelial filaments composed of elements of irregular length in sinuous curves, separated by a mucilagenous material

PRIESTLEY

There is also another group of trichophytons which do not affect the hair but grow exclusively in the skin squames.

The microsporums and the achorions are divided into those of human and those of animal origin, and in each case the two groups differ markedly in the effects produced and culturally.

Methods of Examination.

It is usually recommended to treat the affected hairs or skin squames with 40% potash in order to clear them for microscopical examination. While in many cases this procedure is useful, it is a rather severe treatment, and subsequent staining of the preparation is difficult or impossible.

The use of lactophenol or chloral-lactophenol for clearing can be highly recommended. These substances clear as well or better than the potash, and do not injure the specimen in any way. For permanent preparations the slides may be ringed with some cement or lute, or the clearing agent may be washed out and the preparation stained.

Lactophenol consists of—

Lactic acid	1 gm.
Phenol, pure	1 gm.
Glycerine	2 gm.
Distilled water	1 gm.

Chloral-lactophenol is—

Chloral hydrate cryst.	2 parts by weight
Pure lactic acid	1 part
Phenol cryst.	1 part

For stained preparations the best results are obtained by the use of Sahli's borax methylene blue. The skin squames or hairs are treated with chloroform, to remove fat, boiled for two to three minutes with formic acid, washed for a few minutes in water, and stained with Sahli's methylene blue, washed, differentiated with alcohol if necessary, dehydrated and mounted in balsam.

Gram's method, or its modifications, although more frequently used, does not give such good results.

Methods of Cultivation of the Parasite.

The composition of the medium has a considerable influence on the appearance of growths of parasitic fungi, and the same organism may give entirely different colonies on two different media. For this reason it is advisable to use a standard medium for cultures, and Sabouraud's maltose agar is, for many reasons, the best suited for this purpose. For purposes of differentiation Sabouraud's glucose agar and potato are often of use.

Most of the parasitic fungi grow readily on maltose agar, but one often has to inoculate a large number of tubes in order to obtain a pure culture. Infected hairs, which may with advantage be divided into a number of small pieces, or portions of skin squames are seeded on to the surface of tubes of maltose agar, four or five pieces to a tube, and at least six tubes used. The inoculated tubes are kept at room temperature, and after three, four or more days small downy tufts will be noticed in the successful inoculations. These continue to grow at a greater or less rate, but usually take five or six weeks to reach their maximum development. The appearance of the cultures of the different species differs considerably. Many are white in colour, some coloured red, violet, yellow, etc. The surfaces may be moist looking or chalky, or covered with a more or less thick down or duvet. Some have a regular surface, in others the surface is crateriform, in others extremely irregular. The microsporums of animal origin grow most rapidly, the achorions of human origin are very slow growers, and the colonies never become large.

In Table II. is given a summary of the cultural reactions and morphological characters of typical members of the different groups.

The morphology of the parasites cannot be satisfactorily studied from preparations of growths on solid media. For this purpose cultures are made in hanging drops of glucose peptone water, and the progress can readily be observed microscopically. For permanent preparations these hanging drop cultures are dried, fixed for a second with pure acetic acid, washed in absolute alcohol, stained in 1 in 400 aqueous eosin, dehydrated and mounted in balsam.

Most species of parasitic fungi undergo a pleomorphic degeneration. After a certain number of weeks, on various points of the surface of the culture, small white tufts may be observed. If subcultures from these tufts are made, they are quite different from the original cultures, and usually appear as thick downy growths. Morphologically they show considerable differences from the original cultures, and have either no organs of reproduction (spores) or these are but little differentiated.

Morphological Characters of the Parasitic Fungi in Cultures.

Microsporum.—The growth consists of mycelium, consisting for the most part of rectilinear elements, with here and there swellings giving the so-called racket-shaped elements (Fig. 1). The ends of many of the hyphæ are more or less curved, and show short denticulations on one side, the so-called pectinate bodies (Fig. 5). The organs of reproduction are of three kinds: (*a*) lateral conidia, (*b*) fusiform or spindle-shaped spores, and (*c*) chlamydospores. The conidia are small oval bodies, 3 to 4 μ in length, growing as protuberances along certain hyphæ and at the terminations of these hyphæ. These hyphæ are usually simple and little branched (Fig. 4). The fusiform spores are large bodies, 30 to 60 μ long and 15 to 18 μ wide, which may or may not be divided by several septa. The surface of the free extremity is covered with short spines. These spores grow from the sides and ends of hyphæ. They are very numerous and well developed in the microsporums of animal origin (Fig 3).

The chlamydospores appear as club-shaped swellings, 12 to 18 μ in length and 6 to 8 μ in breadth in certain of the hyphæ and at their terminations. These are thick-walled, resistant spores, and their contents are granular (Fig 2).

Trichophyton.—The mycelium is similar to that in the microsporums, but the racket-shaped swellings only rarely appear. Pectinate bodies are not found, but in many of the trichophytons the ends of some of the mycelial hyphæ are twisted into spirals (Fig 9). There are the same three types of organs of reproduction as in the microsporums.

The lateral conidia are more rounded than in the microsporums, and are supported on short sterigmata. The spore-bearing hyphæ, in many cases, are richly branched, forming grape-like masses of spores (Figs.

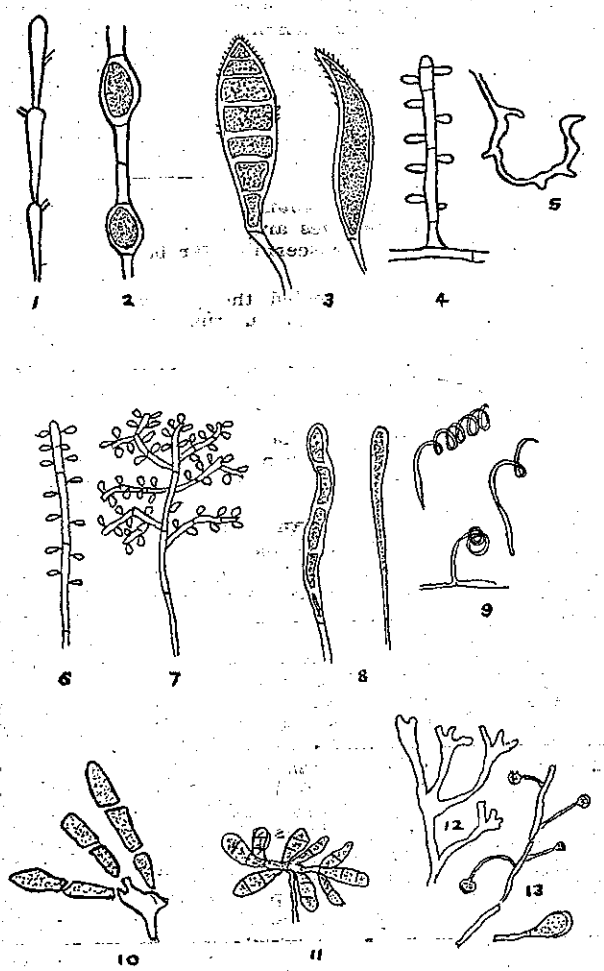
Table II.

		Type.	Rate of Growth.	Character of Growth.	Fusiform Spores.	Conidial Spores.	Mycelium.	Pectinate Hyphæ.	Spirals.
Microsporum	Microsporum of human origin	*M. audouini*	Slow	Growth round, white, covered with short, greyish down (duvet); pleomorphism rare	Very few; minute spurs on apex	Oval or truncated, sessile; not in bunches	Racket-shaped elements common	Common and well marked	———
	Microsporum of animal origin	*M. lanosum*	Rapid	Growth round, white, longer, down (duvet); pleomorphism always	Extremely numerous; minute spurs on apex	Ditto	Ditto	Ditto	———
Trichophyton	(1) Endothrix; spores entirely within hairs	*T. tonsurans* (*crateriforme*)	Slow	Growth elevated creamy white, surface powdery; pleomorphism well marked	Rudimentary	Round, on short sterigmata, in bunches like bunches of grapes	Regular	Absent	Absent
	(2) Neo-endothrix; few chains of spores outside hairs, most within hairs	*T. flavum* (*cerebriforme*)	Slow	Growth elevated, creamy white, surface powdery and very much folded	Rudimentary	Ditto	Regular	Absent	Absent
	(3) Ectoendothrix microides; small round spores within and around hairs	(*a*) *T. asteroides* (*gypseum*); chalk-like growth	Rapid	Central umbo, numerus rays; surface powdery, chalk like, white	Well marked, smooth surface	Ditto	Regular	Absent	Well marked
		(*b*) *T. niveum*; downy growth	Rapid	Downy surface, longer or shorter peripheral rays	Absent	Round; short sterigmata; not in grape-like bunches	Regular	Absent	Absent
	(4) Ectoendothrix megaspores; large round spores within and around hairs	(*a*) *T. equinum*; velvety growth	Rapid	Velvety surface, white; on potato moist, yellow ochre coloured growth	Absent or rudimentary	Round, lateral buds on long hyphæ	Regular	Absent	Absent
		(*b*) *T. ochraceum*; faviform growth	Very slow	Growth of small ochre yellow tubercles; resembles achorion	Absent	Absent	Irregular	Absent	Absent
	(5) Not attacking hairs	*T. albiscans*	Very slow	Whitish, with powdery surface	———	———	———	———	———
Epidermophyton		*E. cruris*	Slow	Citron yellow growth, powdery surface; pleomorphism rapid	Very numerous; in groups like bunches of bananas	Absent	Regular	Absent	Absent
Achorion	Achorion of human favus	*A. schönleinii*	Very slow	Growth yellowish white; resembles a piece of sponge	Slender and not septate	Irregular, pyriform, sessile, rare	Very irregular	Very well marked	Absent
	Achorion of animal origin	*A. quinckeanum*	Rapid	White, downy growth	Fairly well differentiated	Resemble those of microsporum	Regular	Absent	Absent

6 and 7). The large fusiform spores are not so abundant as in the microsporums, and the surfaces are smooth (Fig. 8).

Chlamydospores are rare and of the same type as those in the microsporums.

Epidermophyton.—The morphology is quite distinct. There are no spirals, no pectinate bodies, no lateral conidia. There are very numerous multiseptate fusiform spores (Fig. 10), which are very fragile, and appear laterally on the mycelium and in irregular bunches of 5 to 10 at the ends of mycelial hyphæ, resembling in some ways bunches of bananas (Fig. 10). Chlamydospores also appear in old cultures.



Achorion.—In the achorions of human origin the mycelium is very iregular, and in slow-growing cultures there are numerous chlamydospores of various sizes. Lateral conidia are rare. Pectinate bodies may be well developed. There are two special structures among these achorions: (1) claviform bodies, (2) favus yellow bodies. The claviform bodies (Fig. 12) appear as claviform swellings at the ends of mycelial hyphæ, often in irregular bunches, giving the appearance of a chandelier. The favus yellow bodies (Fig. 13) are rounded or oval bodies situated at the ends of filaments, and are to be considered as terminal chlamydospores. In the achorions of animal origin lateral conidia and multiseptate fusiform spores are well marked.

Parasitic Fungi Isolated in Townsville.

(1) *Trichophyton rubidum* (new species).—This parasite was isolated from skin squames of a soldier returned from Rabaul, who presented an extensive erythro-squamous eruption over both buttocks, the inguinal region, the lumbar region and the side of the neck. The lesion was in parts pustular. The parasite was abundant in the skin squames, and had the appearance of a trichophyton.

The fungus was characterized by the beautiful port wine tinted discolouration of the medium in a glucose agar culture. The growth itself was creamy white with a short duvet or down, and the medium under and around the colony was of a deep port wine colour, becoming almost black under the centre of the growth. Cultures on Sabouraud's maltose agar were of the same appearance, but there was no discolouration of the medium, and the central part of the colony was of citron colour. On ordinary nutrient agar the growth was slower, and the whole colony was yellow in colour, slightly reddish in the centre.

Pleomorphic degeneration appeared early, and was marked. Two types of pleomorphic growth were obtained. The more usual form was of the usual type obtained among the trichophytons, showing rapid growth of downy appearance. Glucose agar cultures of this form showed the same discolouration of the medium as in the normal form, but this only appeared after the colony had reached a considerable size, and had been growing for some weeks.

The other form of pleomorphic growth consisted of small buff-coloured, flattened colonies with no duvet, which never reached more than 1 cm. in diameter. Subcultures from this form would sometimes give the more usual form.

Morphologically the fungus showed numerous conidia, most often as lateral outgrowths from simple hyphæ, but grape-like masses were not uncommon. Very occasionally fusiform spores were seen, and these were not well developed. Nodular bodies were occasionally seen; chlamydospores were common in old cultures, and were often very irregular in form.

The first form of pleomorphic growth showed nothing beyond regular mycelium and, very occasionally, spore-bearing hyphæ.

In the second form of pleomorphic growth the mycelium was most irregular, consisting of ovoid, round or irregular elements, but no organs of reproduction were noticed.

Attempts to infect animals from cultures were unsuccessful, but a successful inoculation from a culture was made in a human being, an erythro-squamous patch of about 2 cm. diameter, with minute pustules resulting. Cultures were made from skin scales from this lesion, which was then cured by vigorous treatmen with *tinct. iod.* No infected hairs could be found in the lesion.

This fungus differs from any of the trichophytons previously described, and the name *Trichophyton rubidum* (new species) is proposed for it.

2. *Trichophyton interdigitale* (new species).—This parasite was isolated from two cases of *tinea interdigitalis* and a case with a scaly circinate lesion in the groin. The fungus was abundant in the skin squames, but there was no infection of hairs. A growth of seventeen days on Sabouraud's agar was about 5 cm. in diameter. There was a small central boss obscured by duvet. The rest of the culture was covered with a well-marked duvet which was very distinct at the periphery. The central part of the culture was pale buff coloured, the surrounding parts white. There was no discolouration of the agar. On glucose agar there was a central boss surrounded by an area of light buff colour. This was surrounded by a ring of lighter shade, and the periphery was white. There was very little duvet on the glucose agar cultures, and the whole appearance of the surface suggested a piece of blotting paper. The agar under the growth was coloured chestnut brown, almost black in the centre and becoming yellowish towards the periphery.

On ordinary nutrient agar there was a flat white growth covered with medium duvet. On potato there was an abundant white growth with short duvet.

Pleomorphic degeneration appeared early. The pleomorphic cultures consisted of a plate of thick white duvet, and showed nothing characteristic. Microscopical examination showed numerous grape-like masses of conidia, fairly numerous, well-formed multiseptate, fusiform spores, and some spirals which became abundant in older cultures. There were no nodular bodies. In some old cultures chlamydospores were numerous.

The pleomorphic cultures showed complete degeneration, no organs of reproduction being seen.

Attempts to infect animals were unsuccessful.

This trichophyton appears to be closely allied to *T. lacticolor* and *T. farinulentum*, but differs from these in several respects.

The name of *T. interdigitale* (new species) is proposed for this fungus.

Trichophyton griseum (Vasconcellos).—This parasite was isolated from a case of onchomycosis of the great toe.

It has been previously described from a circinate lesion on the arm of a patient in Brazil. It is characterized by the peculiar concentric arrangement of its cultures.

Trichophyton sulfureum (Colcott Fox).—This fungus was present in fifteen cases of ringworm of the scalp and various parts of the body. It is characterized by the sulphur yellow colour of its cultures. It is a typical member of the endothrix group.

Microsporum scorteum (Priestley).—This was isolated from a case of *tinea circinata* presenting two inflamed circular lesions on the leg. It is a typical microsporum of animal origin. It has been described elsewhere.

Epidermophyton cruris (Castellani).—This has been isolated from several cases of *tinea cruris*.

Reports of Cases.

SOME INTERESTING CASES.

By William T. Chenhall, M.D., F.R.C.S.,
Honorary Surgeon, Royal Hospital for Women, Sydney.

Large Ovarian Cyst.

Case I.—K.D., *aet.* 79 years, a multipara with eight children, was admitted to the Royal Hospital for Women in June, 1917, suffering from an enormous enlargement of the abdomen. Many years ago a slight swelling was noticed in right lower quadrant of the abdomen. This had slowly but surely increased in size, gradually added to her discomfort, and, finally, so embarrassed her circulation and loaded her body as to render her incapable of effort, and enforced her to rest in bed.

The history suggested an ovarian origin, but ovarian tumours so filling the abdomen must be distinguished from all other large abdominal tumours, and the difficulty of precise diagnosis bears a definite ratio to the size of the mass. This arises from the difficulty of outlining any surrounding area of tympany, the absence of free space in which the tumour, under palpitation, may be moved about and the impossibility of demonstrating the existence of a pedicle or its position.

On palpitation and percussion I found a vast, dull area over the tumour, at its sides and extending down into the pelvis, but tympany was discernible far back in the flanks and under the lower ribs.

Vaginal examination revealed the presence of a tumour pressing on the pelvic floor. The uterus, except at its cervix, could not be defined.

Confirmation of the ovarian origin of the tumour was afforded by the characteristic "bossy" surface with evident fluctuation over a large area.

I believed the tumour to be a multilocular adenoma-cystoma, with enormous enlargement of one cyst, which was spherical in form and which, by rotation and adaptation, had bulged the anterior abdominal wall. Yet it strongly simulated an unilocular ovarian cyst.

I have seen some curious cases of large parovarian cysts which, filling the abdomen and pelvis and, being irregular in form, closely simulated polycystic growth. This important fact should constantly be remembered in connexion with the differential diagnosis of large tumours.

Ascites demanded consideration, but there was an entire absence of "flat top" and "lateral bellying," such as is seen in a bladder half filled with water; this completes the characteristic picture of ascites occurring in a multipara with lax abdominal walls.

It has been rightly stated that a large ovarian cyst creates a characteristic form of abdomen. The distension occurs chiefly in the lower abdomen where the splinting of the walls over the tense sac occurs. The rise, from the pubes up to the point of greatest prominence is rarely so abrupt as is the case with large spherical myomata.

Another practical diagnostic point is that above the level of the greatest prominence the abdominal walls rise and fall with the respiratory movements. Again, a very large cyst usually so fills the flanks that they do not sag as in ascites, and the generally flattened cylindrical enlargement so characteristic of ascites, is absent.

Facies ovariana was not definitely expressed, presumably owing to the absence of severe emaciation.

Curiously, although pain had recently become almost unbearable and the weight oppressive, neither circulatory, respiratory nor excretory functions had been seriously impaired. The great weight of the mass and its increasing pendulosity compelled rest in a horizontal or inclined posture. Patient's appeal for relief prompted me to undertake the removal of so large a tumour from a woman of such mature age. The conditions of the circulation did not contraindicate anæsthesia, though I confess the case presented an anxious task; and the strength of her body and the relatively sound condition of her kidneys warranted hope for her ultimate recovery which, I am glad to report, has been complete.