REFRACTORY SUBCUTANEOUS ABSCESSES CAUSED BY SPOROTHRIX SCHENCKII. A NEW PATHOGENIC FUNGUS.[1]

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(*From the Pathological Laboratory of the Rush Medical College.*)

Plates II and III.

In the Bulletin of the Johns Hopkins Hospital for December, 1898, there appeared an article by B. R. Schenck "On Refractory Subcutaneous Abscesses caused by a Fungus possibly related to the Sporotricha." "The primary point of infection was on the index finger, whence it extended up the radial side of the arm, following the lymph channels, and giving rise to several circumscribed indurations, which were in part broken down and ulcerated." This infection proved very refractory to treatment. The organism supposed to cause the lesions in this case was obtained in three cultures from two different foci of the disease, twice in pure culture.

Schenck carefully describes the cultural characteristics, the morphology and development and the results of the inoculations of this organism which Dr. Erwin F. Smith, of the United States Department of Agriculture at Washington, tentatively assigns to the genus *Sporotrichum.*

During the last few months we have had occasion to study a case presenting similar refractory subcutaneous abscesses from which an organism has been isolated which is identical in the essential details with the one described by Schenck.

[1] Presented at the Fifteenth Annual Meeting of the Association of American Physicians, held in Washington, May 1–3, 1900. A brief statement concerning the organism was also made by Professor Jordan for the authors at the meeting of the Society of American Bacteriologists in New Haven, Conn., Dec. 28, 1899.

Clinical History (Dr. Perkins):—"On March 16, 1899, Charlie C., aged five years, was brought to my office by his parents, suffering with a sore upon his left index finger, concerning which I elicited the following history: Ten days before he had been using a hammer and had struck himself denuding a surface as large as a split pea on the dorsal surface and over the second joint. This abrasion did not heal up, as his father thought it should, and he applied some 'verdigris salve' to the injury. At present the finger, from the first to the third joints, is swollen to twice its original size, presenting in the centre a deep, well defined, sharp, undermined ulceration, the size of a ten-cent piece. The base of the ulceration is rough and covered with grayish-looking pus. This, when sponged away, leaves a bright red surface; the ulcer extends through the whole thickness of the skin. Surrounding the ulcer over about one-half of the infiltrated area are a large number of vesicles and a few pustules. The dorsal surface of the hand and the extensor surface of the forearm present a chain of swollen lymphatics along which are about twenty nodules the size of a small pea to a large hazel nut. There is no evidence of suppuration in any of them at this time. The little patient does not complain of much pain, either in the finger or arm. The hand is cleaned with green soap and washed with sublimate solution 1 to 2000; the surface of the ulceration mopped over with 95% carbolic acid, powdered boracic acid dusted on, and bichloride gauze and borated cotton applied.

"Subsequently the dressing was changed every second day for ten days and reapplied as at first. At the end of this time ulceration has increased to nearly twice its original size. The nodules are somewhat larger and are getting tender though I cannot detect pus, either by fluctuation or aspiration. On March 28 I began using iodoform as a dressing, but met with no better results. Do what I would, I could not get the finger to improve in the least. The vesicles had formed pustules and the epidermis over nearly all of the infiltrated area had loosened, leaving a raw oozing surface.

"During the first ten days under my care the child seemed to feel reasonably well, but he now began to develop a little fever, and for the next month the temperature ranged up to 100.5° F. There developed about April 1 an annoying and persistent cough and coryza. Early in April the swollen lymphatics began to suppurate. I opened and curetted eleven abscesses in the next week. Some contained not more than thirty minims, others probably four drams of pus. Upon opening one large abscess about the middle of the forearm, I was surprised to

see it drain another smaller one four inches from the incision. This was refilled with the irrigating solution and opened. The fistulous tract was irrigated and a swab with carbolic acid upon it was passed through. The pus from the abscesses was of a mahogany color, thick and tenacious.

"Up to this time (May 25, 1899), I have opened twenty-one abscesses, four have opened spontaneously and still there are more to follow.

"The lymphatic glands in the axilla and neck on the left side have been inflamed, but are smaller now and bid fair to return to their normal size without suppurating. The abscesses which have been opened have shown considerable destruction of the fascia, intermuscular septa and skin.

"Suspecting farcy and with the expectation of having my opinion confirmed, I inoculated two tubes with a quantity of pus from an uncontaminated abscess and mailed them May 2 to Prof. L. Hektoen for examination. At his request, I again sent him tubes about May 9 or 10.

"The family being poor, I have had the mother dress the arm part the time. I once saw her doing this when she had a cut over one-half inch long on the thumb. The quantity of pus from the sores was large at this particular time and it seems impossible that she did not get germs into the wound. This fact and that the patient has mingled with several other children in the family have convinced me that the danger of infection is not very great.

"Internal treatment has varied somewhat: Cough mixtures for two or three weeks; calcium sulphide in ¼ grain doses; corrosive sublimate 1/100 grain with quinine sulphate 1 grain. The last named associated with wet dressings of 1 to 100 carbolic acid seemed to do the most good. Two small photographs were taken before any of the abscesses had been opened. A larger one was made May 25, 1899, which shows the present condition very well (Plate II, Fig. 1). The boy's condition has improved very materially and my opinion is that he will fully recover in another month" (which proved to be the case).

Bacteriological Examination.—The glycerine-agar tubes, inoculated by Dr. Perkins on May 2 and again on May 10, all developed pure cultures of the organism in question. After about 6 days, the last four being in the incubator at 37° C., there appeared several greyish-white, raised, irregular colonies, about as large as a pin's head, confined exclusively to the area of the surface of the medium covered by the bloody exudate. In one tube similar but smaller growths

appeared in a small quantity of exudate accidentally smeared upon the glass. The colonies were rather dense and viscid; considerable increase took place and wrinkled masses formed. Repeated subcultures upon various media show the following cultural characteristics:

Agar (Plate II, Figs. 2-4).—At the end of 24 hours in the incubator there is some growth of a greyish color and granular in appearance along the streak on plain and glycerine agar. After 48 hours the growth appears as a delicate, slightly raised, whitish line with symmetrical feathery fringes and some hairy downgrowth into the substance of the agar. At the end of 72 hours the growth assumes the form of a band with numerous transverse wrinkles; in a couple of days more the surface becomes more markedly corrugated and looks like the chains of mountains on a map. About the 7th day the growth, which has increased some in thickness, becomes light brownish in color, the margins being smooth and wavy, marked by shallow transverse grooves. Still later the growth becomes distinctly and even dark brown, the surface wrinkled and velvety, in some cases covered by a very delicate fuzz. The medium becomes slightly brownish.

On wort-agar a thick yellowish, wrinkled membrane develops, extending some distance upon the sides of the tube. This, or glucose-agar, is one of the best media for rapid growth.

The individual colonies upon glycerine-agar plates appear at the end of 2 to 4 days as irregular, greyish-white dots, 0.4-1 mm. in diameter, resembling somewhat minute flakes of snow. Under the microscope they are made of a central network of threads which at the periphery grow outward in a radiating manner and become tipped with small clusters of minute dots; similar dots (conidia) also appear along the sides of the outgrowing threads (Plate III, Fig. 5).

Individual colonies on agar slants, after three or four days, appear as minute shreds which gradually develop into round, circumscribed, raised, somewhat pearly masses which send fluffy prolongations into the medium; later the surface of the spreading colony becomes raised into irregular wrinkles and eventually a brownish color generally appears.

The early surface-growth in the glucose agar stab presents a whitish, heaped up centre and delicate radiating margins; with time a uniform growth develops along the stab with fine, thickly set, lateral branches. No fermentation.

In one or two instances streak cultures upon agar have resulted in a flat, granular, sparse growth only, consisting almost wholly of round and

oblong budding bodies. Subcultures from such growth give rise to characteristic folded and wrinkled membranes.

Blood serum.—In 48 hours small colonies appear which are covered by a white frosting; the growth increases slowly but presents no special characteristics. There is no liquefaction.

Gelatin.—The deep growth is confined to the upper end of the stab; it increases slowly and sends out lateral branches which are longest immediately underneath the surface which becomes covered by a flat, spreading layer. At the end of about 6 to 7 days a slight liquefaction is apparent; in about 14 to 18 days later the liquefaction is nearly complete, the surface is covered by a dense membrane which has a tendency to sink down into the clear liquid.

Wort-gelatin, acid gelatin and 4% glycerine gelatin are more favorable for growth, and liquefaction takes place earlier; on shaking, the thick surface layer falls to the bottom, afterwards a new layer forms on the surface and delicate threads may be seen growing vertically along the space of the tube. The liquid gelatin remains clear.

Potato.—Twenty-four-hour cultures show a slight brownish-grey or yellowish nodular growth which increases quite rapidly, becomes raised and wrinkled, the surface presenting smaller and larger districts of a white, frosted appearance. The older growths become discolored at the same time as the potato is darkened.

Milk.—Litmus milk is not changed in color and not coagulated; but slight growth takes place.

Bouillon.—The growth is fairly abundant; little tufts or shreddy masses form which settle at the bottom or cling to the sides of the tube; a white, crumbling surface-film is occasionally observed; no change in reaction. The rate of growth seems about equal in plain, glucose, and glycerine-bouillon.

Vegetable infusions.—The fungus grows in hay, turnip, carrot and potato infusions as a whitish, flocculent precipitate, the fluid remaining clear.

Hydrant water.—A very slight growth?

Gasperini's Starch.—A flat, slightly raised, greyish-white, hard layer forms rather slowly.

Fermentation Test.—Glucose, lactose and saccharose bouillon, prepared according to the method of Theobald Smith,[2] shows a characteristic growth in the aërobic bulb, the anaërobic tube is unchanged and there is no gas formed.

[2] *Journal of Experimental Medicine*, 1897, ii, p. 546.

Anaërobiosis.—There is no growth in the tubes in Buchner's jars.

Temperature.—The optimum temperature for development would seem to be about 37° C.; good growth occurs at the room temperature but at a much slower rate. No growth occurs at a temperature just above the freezing point, but cultures kept at this temperature for 5 weeks remain alive and give rise to vigorous new growths on reinoculation.

Thermal Death-Point.—The organism is killed by an exposure to 60° C. for 4½ minutes; a slight growth occurred after an exposure to this temperature for 4 minutes. No growth could be obtained after exposure to 59° for 10 or 5 minutes, to 61° and 62° for 2 minutes, to 65° for 1½ minutes.

MORPHOLOGY.—Cover-slips from the cultures, stained with methylene blue, show masses of more or less parallel, or tangled, straight or curved, unevenly stained, rather thick threads with rather infrequent true side-branches. Interspersed among the threads lie numbers of ovate or apiculate bodies, from 3 to 5 μ in their longest diameter. In the stained preparations no definite connection is to be made out between the majority of the bodies and the threads. In some preparations the bodies predominate. Occasionally bodies are seen connected with a thread by a small pedicle. The threads seem thinner when stained with Gram's method which gives them a light violet, granular appearance with irregular clear spaces. Gram's method stains the spore-like bodies a deep blue; occasionally there is an unstained area in their interior. Some spores appear to be growing out to form short threads.

In the unstained preparations and in hanging drop cultures of bouillon and gelatin, the threads of the mycelium are seen to be doubly contoured; the protoplasm is somewhat granular and interrupted at fairly regular intervals by transverse septa; the diameter of the threads varies somewhat, the average being about 2 μ; the branches are not frequent and do not bear any fixed relations to the septa.

In the hanging drop cultures the relations of the conidia to the mycelium are very nicely shown. The spore-bearing branches, which grow out in a radiating manner from the central felt-work, are commonly tipped by a cluster of from three to six or more conidia which, in the case of the larger clusters, are attached by the smaller end to the slightly expanded extremity of the branch. Similar ovate buds also arise from the sides of the hyphæ at shorter or longer intervals.

The spores are also doubly contoured and granular, resembling very much yeast cells.

These various features are well shown in the photographs of the growing hanging-drop cultures (Plate III, Figs. 6 and 7).

The attachment, by means of short pedicles, of the spores to the threads is very easily severed as shown by the difficulty in obtaining stained preparations with the spores in situ.

Development.—When placed in the hanging drop the conidia grow out into one or more straight germ tubes which spring from either, or both ends, or from the sides. These embryonal threads again give rise to lateral or terminal buds, which in all particulars resemble the spores and some of which form branching spore-producing threads, so that in the early stages very peculiar looking bodies are produced.

Histological Examination.—A small bit of skin including part of the wall of an abscess was excised by Dr. Perkins and sent to me in alcohol. The sections show some thickening of the epithelial layer; there are rather broad interpapillary downgrowths. On the cutaneous surface there is much horny material, altered red blood-globules, detritus and polymorphonuclear leukocytes often collected into dense foci within and upon the horny layer. The epithelium and the cutis show many leukocytes, with long drawn-out thread-like and contorted nuclei, apparently going in various directions and also aggregated into small groups. The vessels of the cutis are congested.

Along one side and part of the lower or deep surface of the section there is considerable bloody and leukocytic exudate; the adjacent tissue is infiltrated with leukocytes with greatly elongated nuclei which might be taken for fragments of fungus threads.

In sections stained by the Weigert and Gram methods are short threads which cannot be otherwise distinguished from the leukocytic nuclei mentioned. With this possible exception no micro-organisms are seen.

Animal Experiments.—*Rabbits.*—I-II. Injections of 2 cc. of a 24-hour bouillon culture into the abdominal cavity and into the ear vein of two large rabbits respectively produced no symptoms in 8 weeks.

III. A few drops of a bouillon culture inserted into the anterior chambers of the eyes of a small rabbit in 3 days produced a moderate whitish exudate, and a few, pin-head sized, white clumps formed which persisted for 2 days after which rapid recovery took place.

Guinea-pigs.—I-III. Intraperitoneal injections of 2 cc. of a suspension in bouillon did not produce any symptoms or changes after 6 weeks in the case of three animals.

IV. May 17 I injected a guinea-pig with 2 cc. into the subcutaneous

tissue over the abdomen. A number of small, pea-sized, firm nodules developed about the site of the injection. The animal died May 29. The subcutaneous nodules were small abscesses; in the pus were numerous oval and oblong bodies staining irregularly with methylene-blue and with Gram's method. No other organisms were found and pure growths of the sporothrix developed in the cultures from the pus. The internal organs were sterile and of normal histological structure.

V. A guinea-pig inoculated subcutaneously with 2 cc. July 25 died Aug. 18. There were no local changes visible and cultures from the internal organs remained sterile. At this time a number of guinea-pigs in the laboratory were dying from unknown causes.

Dogs.—I. Intravenous injection of 1 cc. of a suspension in bouillon did not produce any symptoms; all organs appeared to be normal and proved to be sterile when the animal was killed on the 34th day.

II. Two cc. of a bouillon suspension was injected into the subcutaneous tissue of a large, female dog. In a few days a small swelling appeared which was quite tender; a diffuse slightly tender induration remained for some time.

Twenty-eight days after the first injection 2 cc. were again inoculated under the skin of the thigh followed by the development of a small, fluctuating swelling. There was no enlargement of the corresponding inguinal glands. The animal was killed on the 15th day. The internal organs were normal and sterile. At the site of the first injection was an area of scar tissue which on microscopic examination showed islands of marked round cell infiltration; no organisms could be demonstrated in the sections and the cultures from the scar tissue remained sterile.

At the site of the second injection was a small, soft, whitish spot or cavity containing a gelatinous material, smears and cultures from which showed the organisms injected to be present in fair numbers. The sections, stained by Gram's method, showed organisms in fair numbers among the leukocytes in the little cavity which was enclosed in a recent fibrous tissue. The organisms resembled somewhat the conidia of the fungus, stained irregularly, and varied in size, being oval or oblong and from 2 to 3 or 4 μ in length.

III. Intraperitoneal injection of 2 cc. of a bouillon suspension did not produce any lesions, the organs being healthy and sterile, when the animal was killed on the 26th day.

White Rats.—I. Subcutaneous injection of 2 cc. of a bouillon culture did not seem to have any effect, the animal remaining well and fat.

II. About two months after the intraperitoneal injection of 2 cc. of

a bouillon culture, during which time the animal remained well, it was noticed that the scrotum was very large and dragged on the ground, interfering with the animal's movements; the hind legs were œdematous. Killed by chloroform. The larger part of the small intestine and omentum occupied the two sides of the scrotum. The peritoneum over the lower third of the abdominal cavity and lining the scrotal cavities, was covered with numerous yellowish, tuberculiform nodules, arranged now singly, now in groups or clusters. On incision each nodule was found to contain a quantity of yellowish-grey, viscid purulent material composed of leukocytes and innumerable, irregularly stained (Gram), oblong and oval conidia from 2 to 4 μ in length. Many presented a transversely striated appearance, in others there was a clear spot near one end. There were no threads present in the pus. The other organs seemed normal; cultures from them and from the heart's blood remained sterile; no organisms were present in any of the smears. The cultures from the abdominal nodules gave rise to innumerable characteristic colonies solely of the organisms injected.

The sections from the peritoneal nodules show small cavities enclosed in recent fibrous tissue; these cavities contain polymorphonuclear leukocytes, nuclear detritus, and the conidia of the organism in large numbers (Plate III, Fig. 8), most numerously just around the inside of the wall; here they are scattered about singly or arranged in groups; nearly all are extracellular but intracellular groups occur; if the Gram stained sections be allowed to remain in alcohol for a little longer time than that just sufficient for decolorization then the organisms lose their stain largely and may appear as cocci or short, thick bacilli of various sizes. The organisms cannot be distinguished in the hematoxylin and eosin specimens. Giant cells are not seen in the interior of the abscesses but in the recent fibrous tissue of the walls lies an occasional multinuclear cell of the tubercular type. In a few places the appearances indicate beginning abscesses; the first effect of the organism is a necrosis of the tissue followed by cell accumulation; it cannot be made out clearly just how the organisms are carried, or go, from an older to a recent focus; the presence of bodies within cells, especially leukocytes, indicates that they may be transported by wandering cells; a few single bodies are found scattered about in the tissue outside of the abscesses.

Grey mice.—I. Intraperitoneal injection of .5 cc. of a bouillon suspension produced death in 2 days. There was a purulent peritonitis, the organism being recovered from the exudate in pure growth. The internal organs were sterile and normal.

II. Subcutaneous injection of .5 cc. was followed by death after 2 days. There were no special changes and the cultures remained sterile.

III. Subcutaneous injection of .5 cc. was followed by evident symptoms of illness ending in apparent recovery. The mouse died 18 days afterwards, but on account of beginning decomposition no cultures were made.

IV-V-VI. Subcutaneous injection of .5 cc. Twenty days later one died, but the body was eaten by one of the survivors. This died two days later; there was some induration about the site of the inoculation, the tissues being dry and shrunken. The cultures and smear preparations were negative. About this time the third mouse showed considerable shrinking about the injection—at the root of the tail; a small, dry ulcer formed, one of the extremities appeared fixed and rigid so that the animal limped a good deal. It became thin and died four weeks after the inoculation. The tissues about the ulcer were firm and fibrous; underneath the skin over the upper part of the right thigh and extending upon the under surface of the abdomen was a collection of whitish, viscid, caseous pus which contained oval and oblong bodies in large numbers, and growing readily on glucose agar. The internal organs appeared normal both on gross and microscopic examination and the smears from them did not show any organisms.

White and tame mice.—Four white mice were inoculated with .5 cc. of a 48-hour old bouillon culture under the skin at the root of the tail. All reacted in about the same way. None died soon after the injection. In the 2nd or 3rd week they appeared to be getting thin. Beginning at the root of the tail and extending for a variable distance over the back there now formed a hairless, red area with an uneven surface; scattered over it were occasional yellow spots. The posterior part of the body seemed more or less shrunken, the hind legs stiff, one often more so than the other; in one mouse the left posterior extremity seemed fixed and drawn up against the body. I killed one with chloroform on the 23rd day, one died spontaneously on the 26th, one on the 35th, and the fourth on the 40th day. In all there was found some undermining of the edges of the ulcerated surfaces described; the ulcer was superficial and did not extend into the muscles; at some points the tissues about the margins were firm and fibrous; where the skin was undermined small quantities of semisolid cheesy material were found; sometimes such collections would extend for a considerable distance in the subcutaneous tissue; this material was composed largely of leukocytes and among them were found, in varying numbers, organisms like the conidia of the

fungus; in one animal there were numerous cocci also; in this case the cultures were mixed, most of the colonies being cocci, but quite a few colonies of the fungus developed. In all cases the internal organs were normal with the exception of a possible enlargement of the abdominal lymph glands; no organisms were found in the smears and the cultures remained sterile from the organs, which, including the lymph glands, were fixed in Zenker's fluid; the sections showed no changes and organisms were not found in those stained by Gram's method or otherwise.

In order to study the evolution of the anatomical changes produced by this organism, four tame mice were injected simultaneously into the abdomen with 1 cc. of a bouillon suspension of the same culture and killed at successive intervals of one week each. At the end of the first week a number of small nodules the size of a pin's head had developed near the site of the injection and in the omentum near the spleen which was adherent to the stomach; the retroperitoneal glands were not enlarged; the cultures from the nodules remained sterile; the sections (Weigert, hæmatoxylin, etc.) of the nodules show accumulations of cells with marked nuclear fragmentation and the formation of fibrin especially at the periphery; scattered about are oval and lanceolate organisms often in groups of 4-6 or more.

At the end of the second week there were found nodules, a little larger, scattered principally over the peritoneum of the scrotal pouches. Cultures successful. Sections show the nodules to consist largely of a cellular granulation-tissue with smaller foci of marked nuclear disintegration containing a much larger number of organisms than the nodules of a week's duration.

The third mouse died spontaneously on the 20th day after the injection. There was a small ulcer over the lower part of the abdomen, and innumerable yellowish areas and more diffuse flat thickenings with distinct spots of viscid softening over all parts of the peritoneum, the under surface of the liver, etc. Cultures successful. The sections show the tissue to be more fibrous while the foci of softening contain granular and amorphous detritus, small nuclear clumps and innumerable organisms often aggregated into heaps which appear as blue spots visible to the naked eye. In none of these nor in any of the animals were fungous threads found in the lesions.

The fourth died spontaneously and was eaten in the abdomen by another mouse in the same cage.

There can therefore be no question but that the spore-forms multiply in the lesions they produce in susceptible animals.

Pigeons.—Subcutaneous injections in two white pigeons of 2 cc. of bouillon cultures did not produce any lesions or symptoms in 3 weeks.

There can be no doubt in regard to the identity of the organism described by Schenck and the one described in this article. The two correspond morphologically and culturally and their pathogenic actions in animals are the same with the exception of a few easily explainable, insignificant differences. Schenck observed a general infection after subcutaneous injections in mice; as far as I know this did not occur in any of the animals that I used. And I obtained more decided pathogenic effects in guinea-pigs than Schenck seems to have done. These are differences that might reside just as well in the different races of animals used as in the organisms. In a personal communication Schenck states that on comparison the two organisms appear identical in form and in culture. Through the kindness of Dr. Schenck I was enabled to compare the two organisms and I could not detect any distinguishing differences either culturally or morphologically. The injection of Schenck's fungus into the abdominal cavity of a mouse (December 5, 1899), was followed by death after four weeks, and the anatomical and histological characteristics of the lesions did not differ in any essential from those of the lesions produced by the organism from Dr. Perkins' case.

It is regrettable that circumstances prevented the demonstration of the organism in the human lesions. More thorough study of the histological changes produced by the organism in man are also desirable. An abscess should be excised in an early stage of formation.

It is exceedingly interesting to note that we have here a pathogenic fungus that in the lesions it produces in animals exists in the spore-form, or in a modified spore-form, and that it undoubtedly multiplies as such; threads do not seem to develop in the tissues of susceptible animals. The exact manner in which the spores reproduce themselves under these circumstances I have not attempted to determine.

The fungus produces a slow, circumscribed and nodular inflammation with necrosis and pus formation in the centre and the development of granulation and fibrous tissue at the periphery—encapsulation. This is seen especially well in the abdominal cavity of white

rats and mice. The destruction of tissue after subcutaneous inoculation in mice may be quite extensive, large ulcerated surfaces with undermining and purulent infiltrations at the margins being the result. In less susceptible animals, such as the dog, dense areas of scar tissue are produced.

A characteristic clinical feature of the human cases is the refractory nature of the subcutaneous abscesses. This was pronounced in both Schenck's case and in the case under Dr. Perkins' care. Brayton[3] describes a similar case clinically; it occurred in a healthy, young florist who punctured a finger with a wire while making bouquets; a succession of chronic abscesses with gelatinous contents appeared, extending during a period of two months from the finger to the elbow, much scarring being left behind. This case was not examined bacteriologically.

The three cases have much in common; in all a succession of similar, refractory, small abscesses of the upper extremity developed consequent upon injury by similar means; in Schenck's case the scratch of the skin of the finger by a nail; in Perkins' case the blow upon the finger by a hammer; and in Brayton's case the puncture of a finger by a wire.

DESCRIPTION OF PLATES II AND III.

PLATE II.

Fig. 1—Photograph of arm of patient, showing ulcers and scars, at a late stage of the lesions.

Fig. 2.—An original culture of the sporothrix, three weeks old.

Fig. 3.—Slant culture on glucose agar, 4 days old.

Fig. 4.—Slant culture on glucose agar, 8 days old.

PLATE III.

Fig. 5.—Colonies on glycerine-agar plate, 48 hours old.

Fig. 6.—Margin of living hanging drop culture (gelatine). × 150.

Fig. 7.—Same as Fig. 6. × 1000. Unstained living culture.

Fig. 8.—Photograph of section of abdominal nodule in white rat. × 1000. Gram's stain. Cells and spores, the latter oblong and deeply colored.

[3] *Indianapolis Medical Journal*, 1899, xviii, p. 272.

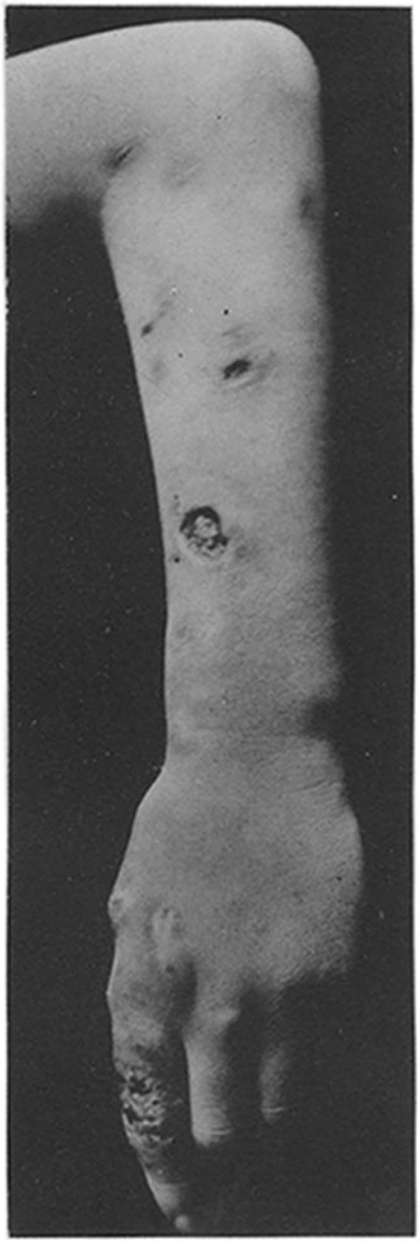
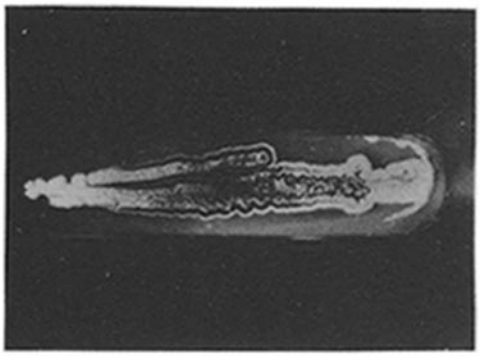


FIG. 1.



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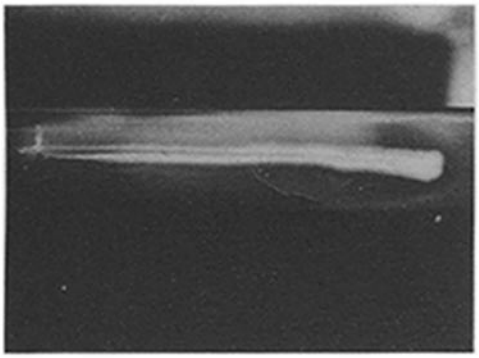

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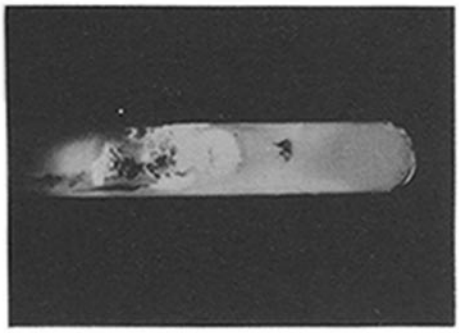
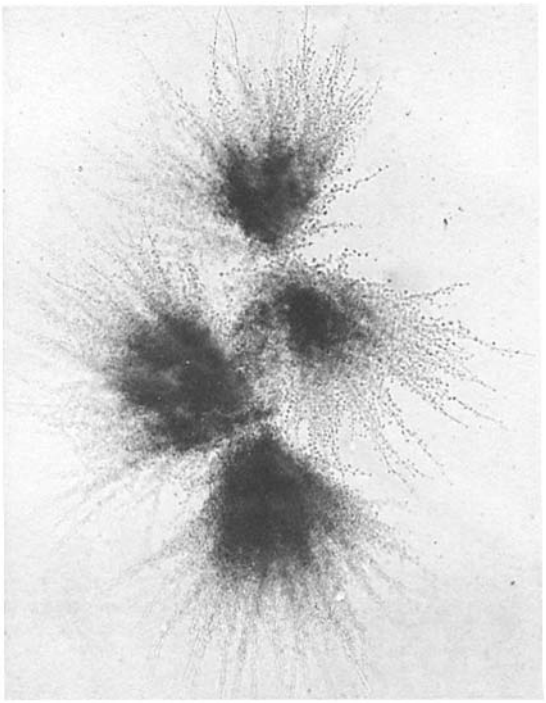


FIG. 2.



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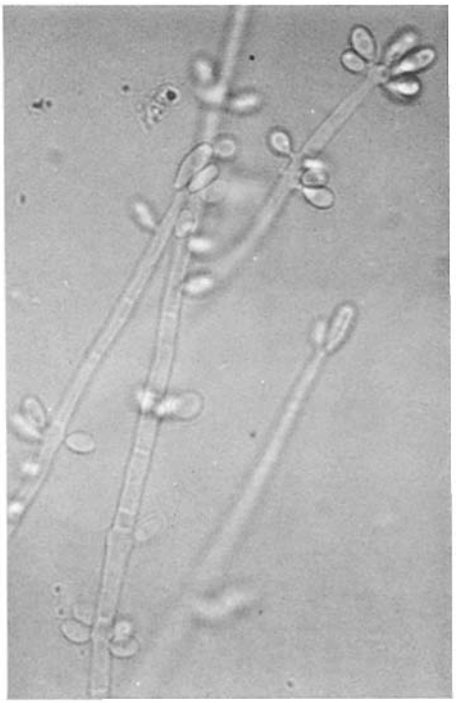

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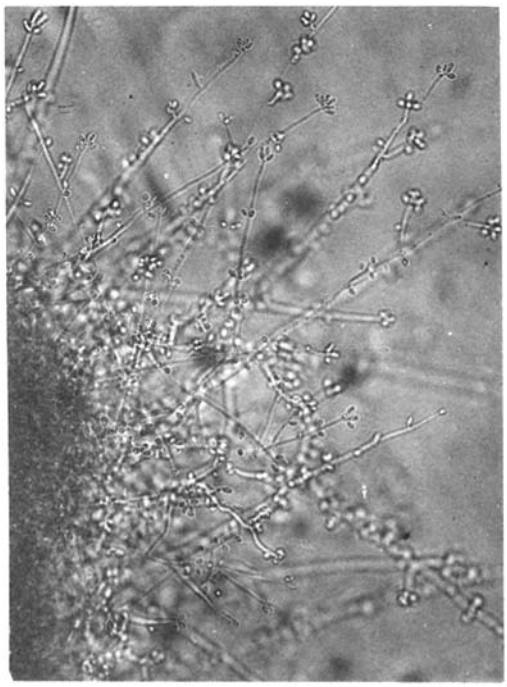

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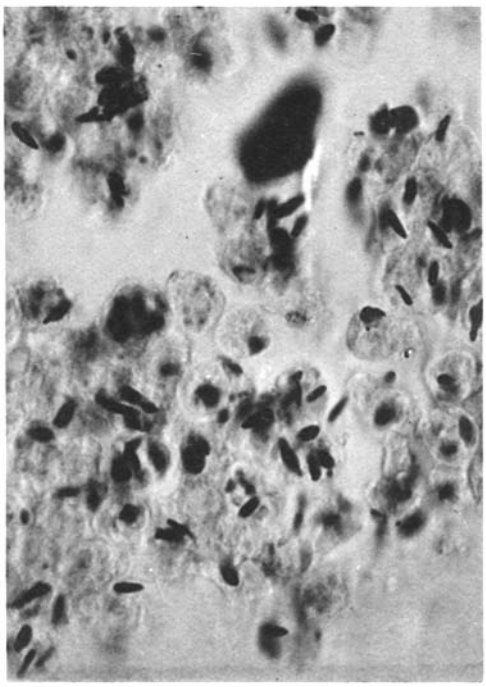

FIG. 8.

THE HELIOTYPE PRINTING CO., BOSTON.