reported recurrence took place within one year after the operation. It seems, therefore, reasonable to assume that if a patient continues well for one year he may regard himself as cured.

There are some points in the technique of the operation which experience shows worthy of mention. The sac, after being dissected from the cord, should be carefully emptied of its contents, and a continuous suture should be passed through the neck before the sac is excised. A ligature may slip and give rise to hemorrhage from some of the numerous vessels adherent to the outer surface of the peritoneum. The wound should be treated precisely like any other wound in the peritoneum. In some cases the sac is hard to find, but it should always be carefully sought for and removed, as this is one of the most important features of the operation.

When the omentum is small in amount it can be returned into the abdominal cavity, but when there is a large quantity of omentum it is more or less matted together and elongated at the point involved, and may become a source of danger when returned, being liable to form a band capable of producing intestinal obstruction or of facilitating a return of the hernia. There is little danger of hemorrhage if the various clusters of vessels which supply the part to be removed are tied separately. In very large hernia the amount of omentum removed is sometimes enormous; but such hernia, although they seem formidable to attack, present in reality no greater technical difficulties than the smaller hernia.

The sutures with which the skin was brought in apposition were silkworm gut in the majority of cases. This material can be used as an interrupted suture or as a continuous buried suture. The latter gives a somewhat more esthetic result, and theoretically is less liable to produce stitch abscess; but I cannot say that I have seen any special advantage in its use.

Great pains should be taken in the preparation of the skin before operation, as this is a region unusually hard to sterilize. I am in the habit of using the permanganate-oxalic-peroxide of hydrogen process, and of repeating the washings after the dressing has been removed at the time of operation.

Cases of large umbilical hernia are usually observed in stout, elderly women who have borne several children. There is then considerable danger of strangulation. At first these hernia contain only a small nodule of omentum, which acts as a sort of plug to the opening in the sac to which it is usually adherent. As the hernia grows, a knuckle of intestine is liable to be pushed into the sac behind the omentum after some unusual exertion, and this gives rise to an attack of colic for which the patient seeks relief. This pinching of the bowel occurs often, but in very large hernia strangulation is rare. Inflammation and suppuration may, however, be one of the complications of umbilical hernia. Permanent relief from colic is usually obtained by the intelligent adjustment of a truss, and in very fat or elderly patients it is better to try this form of treatment, as recurrence after operation is much more common in this than in other forms of hernia. I believe, however, that increased experience will bring with it a decision to resort to the operation more frequently. In 1 case I have succeeded in curing an enormously large hernia after the second operation. The time of election is in early adult life while these hernia are still small.

Umbilical hernia in children are almost invariably cured by the truss.

I have had 2 cases of congenital umbilical hernia into the cord.¹ In one case the contents of the sac was the liver, in the other a large loop of intestine. Both cases recovered from the operation and one was permanently cured. The other infant had a very small umbilical hernia when last seen, which will doubtless in time disappear.

Congenital inguinal hernia is not always healed by the truss. When a young man, in the neighborhood of twenty years of age, applies for treatment of this affection, the operation should be advised.

In non-descended testicle we find the organ usually in the inguinal canal, and the question arises as to whether or not it should be removed. The patient usually objects strenuously to the removal of the organ, and there is no particular harm in leaving it, but after operation it usually atrophies and slowly disappears. These hernia should not be operated upon in youth, as the testis may eventually descend into the scrotum, and the hernia disappear.

I wish to express my indebtedness to Dr. R. B. Greenough for the preparation of the statistics of these cases.

ACTINOMYCOSIS.¹

BY CHARLES ALLEN PORTER, M.D., BOSTON.

At this session last year several cases of actinomycosis were reported by different surgeons. Increased interest has been aroused on the subject by a very thorough analysis of all the American cases by Dr. John Kulrah, of Baltimore, in the second volume of the *Annals of Surgery*. In that article 62 cases are reported, and 5 more added in a subsequent appendix.

Since the last meeting here, 11 cases have been found at the Massachusetts General Hospital, 1 of primary rib or lung disease, with general actinomycotic pyemia—in this instance the diagnosis was only made at autopsy—and 10 of the maxillary form of the disease. Drs. Homans, Mixter and Balch, 1 each, and 6 of mine were all discovered in the Out-Patient Department. The fact that these 6 cases occurred within three months, and 4 within a week, is, I think, sufficient evidence that the affection cannot be a rare one among us, and that many cases are overlooked.

I will limit myself to the maxillary form, and briefly speak of the histories of these cases.

Though actinomycosis has been considered a relatively rare disease, it seems more probable that it is one which is very commonly overlooked. In its clinical aspects there is little that is characteristic. Though the course of the infection may make the surgeon suspicious, examination by microscope and culture is essential for a positive diagnosis.

The object of this paper is to attract your attention to the possibility that a proportion of the cases ranking as alveolar abscesses may be due to this specific organism, and by a few briefly reported cases to give you an idea of the disease as it affects the mouth, jaws and neighboring regions in man. Statistics of the relative frequency of this disease are really of little

¹ Read before the Surgical Section of the Suffolk District Medical Society, April 4, 1900.

¹ Transactions American Surgical Association, 1893.

value. In 1892 Illich, of Vienna, gathered only 42 cases in man from all that were at that time reported. Dr. Ruhrah, of Baltimore, has published an article in the *Annals of Surgery*, 1899, in which he has collected all the American cases, 72 in number, occurring in all parts of the body. In the past two years I have been especially interested in this subject, and during eighteen months' work in the Out-Patient Department at the Massachusetts General Hospital I have found 8 cases of actinomycosis in about 60 so-called alveolar abscesses examined, and 4 cases have been found by other surgeons. Six cases of mine have occurred within three months, and 4 within one week; so we may conclude, I think, that the disease cannot be one of great rarity.

I will pass about some photographs of these cases, as well as a painting of the pus from the abscesses, which shows very well the gray or grayish-yellow granules which may be found in typical cases.

CASE I. J. C., age thirty-two, coachman, entered Out-Patient Department, November 7, 1899. Five weeks ago noticed a small lump on inner side of right lower lip; this grew larger, without marked pain, until two weeks ago, when an inflamed area was evident on the outside of the lip. There was a red inflamed nodule, size of a five-cent piece, on right lower lip; the surrounding tissue was indurated to the size of a quarter; fluctuation was evident in the centre; no communication with mouth. Under cocaine a small incision was made on the inside of the lip; about one-half a teaspoonful of seropus escaped, with numerous granules, which showed the typical appearance of actinomycosis under the microscope. Simple excision was advised, but the patient would consent only to a thorough curetting through an external opening; the surface was disinfected with peroxide and painted with iodine and packed with iodoform gauze. In two weeks the small wound had almost closed, with considerable induration at the base. No colonies could be found in the discharge.

December 15th, five weeks after operation, only a soft red scar remained; no induration. Whether this infection started from the inside of the mouth cannot be determined; there were no carious teeth, nor any history of a wound. Many sections of the tissue were examined but no colonies could be found.

CASE II. W. C., age forty-five, entered Out-Patient Department, August 29, 1899. Two months ago stuck a toothpick under his tongue, and could not remove the whole of it. One week after this the submaxillary region began to swell. The swelling varied at different times; no pain; tenderness slight; no interference with talking, eating or swallowing. There was an indefinite swelling about the size of a lemon in the submaxillary region on the left side. The skin was somewhat edematous. At the bottom of the swelling was a small area where fluctuation could be made out; over this the skin was slightly reddened. There were no glands in the neck. Under cocaine a small incision was made. Seropus escaped, with a few grayish granules, which proved to be actinomycetes.

On the following day a more extensive operation was done under ether. Incisions were made about the involved skin, and the whole submaxillary region thoroughly cleaned from below upward. The submaxillary and a few lymphatic glands were removed with the mass. Just under the jaw a dense fibrous

cord was found, extending upward to the floor of the mouth. Within this connective-tissue tube lay the remains of the toothpick lost two months before. This was removed, the flaps loosely sutured, and an iodoform wick placed to the top of the wound. Under daily packings and iodine the wound healed solidly in five weeks, without evidence of recurrence. This case shows well the common connection of actinomycosis with some foreign body.

CASE III. F. L., age sixteen, schoolboy, entered Out-Patient Department, November 9, 1899. Teeth have always been bad; has had five removed from upper jaw. Second left molar decayed for some time; two months ago a small lump appeared inside mouth about root of this tooth; this gradually grew in size, without pain, and appeared on the outside of the jaw ten days ago as a reddened semifluctuant swelling the size of a quarter, surrounded by a hard and firm border. Inside the mouth a distinct induration could be detected, as of a connective-tissue sinus leading from the tooth to the external swelling. There was moderate trismus; no pain; tenderness slight; no glandular enlargement. A small incision revealed several granules of actinomycosis. Under ether the edges of this wound were excised and the walls of the cavity cut away with scissors; the base thoroughly curetted and painted with iodine. No sinus could be found connecting with the tooth. The wound granulated slowly, but was healed by December 7th, when there appeared on the outer side of the scar a small fluctuating area. This was opened and curetted. In the pus no colonies could be found after very careful search.

December 20th. The induration within the mouth still persisted, but by January 2d this too had disappeared, and there was then no sign of recurrence.

At operation many granules were obtained, which varied in size from a pin head to three times that size. There was considerable soft, cheesy-looking material in the wall of the cavity. Pure cultures from this case were finally obtained by Dr. Wright.

CASE IV. W. W., age thirty, entered Out-Patient Department, November 13, 1899. Five months ago noticed lump inside mouth opposite last molar teeth on right. This grew larger, and becoming very painful he went to Emergency Hospital, where it was lanced, with immediate relief. In another month abscess reformed and face swelled to the eye. After lancing no further trouble until three weeks ago, when he noticed a "pimple" on outside of jaw about the middle of horizontal ramus; this grew larger, with much swelling and pain. On entrance, the whole right side of the face and eye were much swollen; trismus was well marked; over the centre of the jaw was a reddened, fluctuating lump, the size of an English walnut. The surrounding tissues were very hard and brawny. This induration ended very abruptly and gave place to general edema; within the mouth was well-marked induration from first molar to wisdom tooth.

Under cocaine the external abscess was opened and very numerous granules, a hundred or more, poured out in thin seropus. Some of these were unusually large, almost the size of a very small split pea. Under ether the infected skin was freely removed, with the base of the cavity down to sound muscular tissue. Again no sinus connecting with the teeth could be found. Closer to the jaw a small cavity was found containing thick, yellow, stinking pus. The

wound was dressed as before. Within three days the swelling had much diminished and the trismus was much less.

December 10th, almost a month after the operation, the face suddenly began to swell again. Under ether an abscess to the outer side of the upper jaw was evacuated within the mouth. The pus was foul and contained many soft, yellow granules, appearing somewhat like actinomycosis, but under the microscope proved to be masses of mouth bacteria and leptothrix buccalis. Just back of the scar of the first operation a "crater" was found, which when opened allowed the little finger to enter nearly to the lower jaw outside of the last molar; the sinus was lined with very dense connective tissue and contained foul pus. Here one or two disorganized colonies of actinomyces were found.

January 5th. In three weeks the swelling and most of the induration had gone; the sinus was healed and the patient in much better condition.

March 20th. Patient reported; no signs of recurrence; no induration; mouth opens normally; about the wisdom tooth there was some exuberant gum.

In this case the focus of the disease was probably not reached until the last operation, and mixed infection undoubtedly played an important rôle. Pure cultures were finally obtained by Dr. Wright from the granules in spite of the contamination.

CASE V. H. G., age twenty-two. On October 10, 1899, five weeks ago, without toothache or external wound, a small swelling formed below the middle of the right lower jaw; there was little pain. It had grown considerably in size within the past few days. The skin was hardly reddened over it, but fluctuation was evident. From the upper part of the tumor a firm cord runs upward for half an inch; the whole mass was movable and seems rather superficial. Temperature 101° ; pulse not elevated; teeth not carious. Incision showed the streptothrix colonies. Under ether the diseased skin was excised and the whole mass removed, with a small portion of the submaxillary gland, which was adherent to it. No trace of sinus leading to mouth could be made out. The excised mass showed a central cavity surrounded by dense tissue, here and there infiltrated by small areas of grayish-red granulating tissue, containing the pearly granules; some of these show slightly darker centres. In the contents of the cavity were several black bodies, which under the microscope were seen to belong to some beetle. Whether this entered through the floor of the mouth and gradually worked down, or came from the tonsil or esophagus, is not clear. A man could hardly get the body of a beetle into a wound of the face without knowing it. No history of any external wound could be obtained. Evidently the fungus entered with the beetle. The wound was soundly healed in two weeks.

CASE VI. M. C., age twenty, laborer, entered Out-Patient Department, November 14, 1899. Three years ago patient had similar lump in the same place, which broke and went away. This swelling began a week ago as a little round, painless lump. Below horizontal ramus of right jaw was an oblong red swelling, size of a peanut, which fluctuated in the centre. From this to the level of the lip the tissue was firm, swollen and boggy. There was also some swelling over and about the submaxillary gland. Trismus was well marked; could barely open mouth one-fourth

inch. On opening the small superficial abscess, a thin, seropurulent discharge appeared with several colonies; at a deeper level 3 drachms of foul pus was found, without actinomyces colonies. Apparently diseased tissue; eurented thoroughly and cavity drained after painting with iodine. In a week the edema had disappeared and the trismus was much less. Examination of the mouth showed that the three right molars were all carious. In three weeks wound soundly healed; normal motion of jaw.

March 18th. Two months afterwards another abscess rapidly formed, which Dr. Balch opened and Dr. Wright found to contain two typical granules.

March 25th. Dr. Balch kindly asked me to see the case again. Trismus was well marked. At the site of the old scar was a small sinus from which a little bloody serum came. The scar was dense and firmly adherent to the anterior edge of the masseter. Under ether I excised the mouth of the fistula with the surrounding skin. The wall of this sinus was surrounded by very dense connective tissue, which ended abruptly at the cavity, which was lined with soft, flabby granulations. Following along this sinus an inner cavity was found, the inner wall of which was formed by the periosteum of the jaw. From this another small sinus could be traced backward for an inch and a half to the base of the second molar tooth. The whole sinus and cavity was excised and the three carious teeth removed; iodine and gauze drainage; few stitches. In the centre of the second molar tooth a fairly characteristic granule was found, but on microscopic examination this proved to be a mass of mouth bacteria. The sections have not yet been examined. The case is now entirely healed.

CASE VII. J. S. six months ago broke left lower jaw just anterior to masseter muscle. The bone healed, but whenever he got drunk he had soreness and swelling at the point of fracture. Once a little pus was discharged into his mouth. He came to hospital with a small fluctuating abscess just under the skin. On opening this the typical granules were found. The abscess cavity was thoroughly excised; no bare bone was found. In two weeks the wound was healed. There has been no recurrence. The natural diagnosis was necrosis after fracture; yet no dead bone was found, and thorough excision stopped the spread of the disease.

CASE VIII. P. S., age forty (Dr. G. W. W. Brewster's case). For two years has had trouble with left molar teeth, which are carious. Had had several small abscesses opened inside the mouth. In January left side of face swelled and large abscess was evacuated. Since then there had been intermittent purulent discharge into the mouth, and jaw had been sore. Patient entered on April 15th. The left side of the face was much swollen; he could hardly open the mouth; in front of the masseter muscle, over the horizontal ramus of the jaw, was a reddened fluctuating abscess, the size of a walnut. This was opened and found to contain the granules.

Under ether the abscess cavity was dissected out and a sinus found leading back to the second molar tooth; here a small piece of dead bone was found. The sinus passed between the jaw and the masseter muscle, which was also involved in the disease. The whole cavity was thoroughly eurented and cauterized, and the bad tooth extracted. In ten days the patient had

only a small sinus left, which was granulating in a healthy manner.

This case is a good example of the recurrent abscesses which occur until the disease has been thoroughly removed.

The infection seems to enter most frequently near a carious tooth, or is carried in by a foreign body through the mucous membrane of the mouth or pharynx. The process is essentially subacute or chronic, and the disease tends to advance by a sinus towards the skin. Infection is rarely pure, but is usually mixed with ordinary pyogenic organisms or mouth bacteria. It is rarely painful and the accompanying pain, when it occurs, is due, I think, to the mixed infection. Clinically and under the microscope the disease is characterized by the formation of an unusual amount of dense connective tissue, which ends more or less abruptly at the periphery and infiltrates the adjacent muscle or fat. In the jaw the bone itself is rarely involved in human actinomycosis, though it may be thickened from periostitis.

It would seem that this surrounding connective tissue could later become infiltrated by the growth of the streptothrix and break down. In all the cases I have examined the inner wall of the cavity shows a clearly cut line of demarcation between the connective-tissue wall and the lining—flabby, soft, grayish-red granulating tissue. Glandular enlargement was conspicuous by its absence, and when present seemed to be due to mixed infection. Metastasis seemed to occur through the blood current and not by way of the lymphatics. In serious cases the disease may progress down the neck, into the antrum or through the base of the skull. Though a definite connection cannot be always demonstrated, it would seem that a sinus at one time leads from the original site to the superficial abscess. In M. C.'s case, for example, at the last operation such a sinus was found leading directly to the carious tooth.

Trismus, though often present, is no more characteristic of this disease than of other inflammatory affections, though if the masseter were involved in the dense connective tissue, the jaw would probably remain stiff for a long time.

It is rarely possible, I think, to make a clinical diagnosis of actinomycosis; recurrent abscesses, without necrosis, chronic, painless, subcutaneous abscesses, about the jaw, evidently not connected with tubercular glands, would lead to a suspicion of this disease. If these fluctuating areas were surrounded by especially firm and hard connective tissue, and a sinus could be felt under the skin, if there was little edema and swelling, perhaps a probable diagnosis could be made.

Examination of the discharge is of great assistance, but the mere presence of the so-called "sulphur granules" is not by any means conclusive, and no case should be considered as one of actinomycosis without competent microscopic examination. Small, round masses of fibrin or tubercular debris sometimes simulate a colony, in the mouth or adjacent regions. Round masses of mouth bacteria, or leptothrix buccalis, occasionally appear very like a true colony. Even under low powers the resemblance is very similar. Dr. Wright has kindly photographed for me one of these masses, removed from M. C.'s tooth. It presents a radiating arrangement, but under a higher

power is seen to consist of vast masses of bacilli and the large, thick, non-branching filaments of the leptothrix buccalis.

In examining for actinomycosis, gauze sponges which absorb the discharge should not be used. All bleeding, when possible, should be stopped before opening the abscess wall. Unless badly contaminated, actinomycosis pus appears usually as a clear, perhaps blood-tinged, slightly syrupy seropus. Placed on a cover glass, the granules vary in size from a millet seed to the head of a large pin. They are usually round with a clear-cut periphery; the color is gray or grayish yellow, often suggesting a small pearl; the centre is not rarely somewhat darker. The surrounding pus is non-adherent and the granules can be readily removed alone. Fluid should be examined *at once*, for these granules are found with great difficulty when the blood has clotted.

With reference to treatment, two facts speak strongly, I think, for the self limitation of the disease in the majority of cases:

(1) Though it cannot be a rare affection, few cases enter the hospital with advanced actinomycosis of the jaw, and it seems therefore certain that many recover after simple incision of the abscess, and even through a natural rupture of it.

(2) It is surprising to find, on microscopic examination of sections, how infrequently the colonies are found in the walls of the abscesses, though the pus contained many granules. The surrounding connective tissue probably proves an effective barrier to the spread of the disease.

Simple opening, curetting and drainage have proved sufficient in many cases; though recurrences may be frequent, healing eventually takes place. Where possible, excision of the inner half of the abscess wall or sinus is the best treatment. The danger from swallowing the granules, where the discharge empties into the mouth, is hard to estimate. Certain cases of generalized disease in the lungs, intestinal tract, liver, etc., occur in which the organism gained entrance through the food, or was swallowed, and therefore the surgeon should aim at making *external* drainage. This question is often a difficult one to decide. On the one hand, he wishes to avoid a scar on the face, especially in women; on the other, he wishes thoroughly to eradicate the disease; for with recurrence the scars would probably be worse than from a single, thorough and clean operation. The individual case and the severity of the infection must determine the choice between curetting and cauterizing the cavity with tincture of iodine or carbolic acid and a more radical excision. Iodide of potash, in doses of 20 grains three or four times a day, has distinctly influenced some cases for good, and should be used in connection with the local treatment.

Finally, I trust that when your attention has once been called to actinomycosis of the jaw, you will be enabled, through this brief paper, to make an early diagnosis of the disease, and I feel sure that a careful examination of chronic alveolar abscesses will show that the streptothrix actinomycetia is the cause of perhaps one-eighth or one-tenth of them.

PLAGUE IN GLASGOW.—On September 10th an additional case of bubonic plague had been reported in Glasgow. The total showed 16 cases and 112 persons under observation.