in view equally with the destruction of cells actually malignant. Herein lies the weak point of all burying methods. If a single tube be inserted into the centre of the growth, its activity at the circumference is too feeble; whereas if other tubes be buried near the periphery, the effect on the surrounding parts cannot be accurately gauged. The literature of the radium therapy of cancer contains numerous instances, on the one hand, of failure to destroy outlying portions of a neoplasm; and, on the other, of injury and sometimes massive destruction of healthy cells. It may be argued that unless some vital organ is injured such destruction is not a very serious matter, as the wound will ultimately heal, while the outposts of the cancer will certainly be annihilated. The matter is, unfortunately, not so simple as this. For while it is true in general that gamma rays, in common with x rays, destroy cancer cells in doses which not only do not hurt, but may even stimulate normal cells, yet there is reason to believe that here and there, in accordance with the biological law of variation, malignant cells occur which are not killed, but only paralysed for the time being. These, recovering after a few days or weeks, and finding only damaged tissues to oppose them, multiply and spread more rapidly than if no treatment had been applied.

With our present knowledge of radium it is impossible to be reasonably certain of doing no harm to normal structures; but sufficient experience has already been accumulated to enable us to give an x -ray dosage which shall depress cancer cells, while at the same time aiding the resisting power of the body. So far from seeking to limit x -ray dosage to the tumour itself, we should endeavour to bring as wide a surrounding area as possible into the field of irradiation. As there is practically no limit to the quantity of x rays which we can produce within a reasonable exposure time, it is possible to suspend the Roentgen bulb at least a foot above the skin. A large area is thus affected, and, so far as spreading is concerned, the loss of activity below the surface is trifling. For practical purposes the beam may be considered as consisting of parallel rays. Such diminution as occurs is due almost entirely to absorption in passing through the tissues. For instance, one half the activity may be gone at a distance of between one and two inches. In most cases, however, this difficulty may be got over by using two or more "ports of entry"—for example, a tumour of the lung may be attacked simultaneously from in front and from behind. In the case of radium, loss by absorption may be disregarded, owing to the extraordinary penetrative powers of the gamma ray; but loss by divergence is so enormous as to outweigh entirely the advantages of relative hardness.

Whatever risks may be involved in the treatment of inoperable cancerous growths by radium tubes are naturally very much increased when we are dealing with pre-operative or prophylactic post-operative raying. In the latter case we are dealing with normal structures in which we fear a few scattered malignant cells may be lurking; and our object is to stimulate the tissues to expel the enemy, rather than to attack him directly. Again, the treatment must include all organs which experience teaches are likely to be invaded, thus rendering a very extensive irradiation necessary. If we are going to irradiate previous to operation we must be careful to do nothing which shall interfere with the quick healing of the wound. The effects of radium on normal tissues are so little under control that its use is quite unjustifiable for either of the above purposes.

It must be admitted frankly that many of the advantages of x rays over radium would vanish if the latter could be obtained in bulk. But there appears to be no immediate prospect of any great increase in the world's radium supply, and it behoves medical men to be very careful that patients are not denied the advantages of radio-therapeutic treatment because radium itself is not available. The technique of deep Roentgen therapy has made enormous strides of late years, and many independent observers—for example, Professor Bumm—are of opinion that x rays, properly applied, will in most cases give results as good as those of radium itself.

"Cures" of cancer by x rays are now seldom reported, while descriptions of the wonderful results of radium treatment are frequent. Experience over a number of years has taught x -ray workers to look for temporary improvement as a matter of course. In breast cases, for

instance, anything from one to three years' prolongation of life is so usual as to be almost the rule. One is accustomed to seeing recurrent growths disappear in a few weeks, with apparent complete restoration to health. Such results, when produced by radium, are looked on as marvellous, chiefly because they are now seen for the first time by men who had no previous belief in the efficacy of radio-therapeutics in any form. The surgeon can himself obtain and bury a tube of radium, and, if he is lucky, may get a brilliant result. But true progress can come about only by the co-operation of the surgeon and the professional radiologist. I have tried to show that radium therapy is only a part of the great subject of radio- and electro-therapeutics—a subject which is in itself already almost too wide to be compassed by any single mind. Workers who are spending their lives in this study, and finding it every day more complex, are sometimes appalled at the light-hearted manner in which experiments are made and rules laid down by men whose specialities avowedly lie in other directions.

SUMMARY.

In early cases, whether for pre-operative or post-operative irradiation, the Roentgen bulb is to be preferred to the radium tube.

When surgical removal is impossible, a tube of radium should be buried in the centre of the tumour, but x rays should be used, in addition, to the surrounding area, and to any organs where a metastasis is likely to occur. This combined treatment may result in some actual necrosis in the immediate neighbourhood of the radium, but so long as this is confined to the interior of the neoplasm, no harm will result.

Finally, radium therapy is the method of choice in cancer of the vagina, uterus, and rectum; but even here x rays form a useful adjunct, so far as adjacent parts are concerned. Also, in practice one finds that one has to wait at least three or four weeks to obtain a supply of radium. Nothing less than 50 mg. is of much value, and the market price of this is £800 to £1,000. Consequently, most people have to hire their supplies, and pending their arrival x rays should be used vigorously in all cases. Even uterine, rectal, and oesophageal cancer can usually thus be held in check during the unavoidable period of waiting.

There are to-day thousands of cancer patients who believe, and whose friends believe, that they are being left to die because sufficient radium is not available to treat them. This belief adds greatly to their mental distress, and I have endeavoured to show that it is for the most part erroneous.

The Roentgen rays skilfully applied are of service in relieving pain, preventing ulceration, and causing the shrinkage or disappearance of external growths. Active life can be prolonged almost always for months, and sometimes for years. In pelvic cancer the insertion of a radium tube appears to be of greater value; but there is as yet little evidence to show that the results of the new therapy are, on the whole, more lasting than those of the older method.

PAINFUL SHOULDERS AND THEIR TREATMENT BY PHYSICAL MEASURES.

BY

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THE subject of painful shoulders is one of abiding interest to those who suffer from them. For more years than I like to think of I suffered on occasions from pain in the left shoulder. This came on after walking a few miles, and more particularly after standing about, but not at games or any active exercise, except walking. It began with a few slight twinges and progressed to severe pain, which increased until I was compelled to sit down, when it was relieved in a few minutes.

I consulted various people about it and had various treatments. At Rotorua, New Zealand, I had massage with the constant current and the Rotorua douche, a combination of the Vichy and Scotch douche, on alternate days, with marked temporary relief. Two years ago I had

it treated with the static wave current and static sparks by Dr. W. B. Snow, of New York. This treatment immediately brought out the fact that there was a definite point of tenderness in the supraspinous fossa about opposite the junction of the spine of the scapula and the acromion process, and I now regard the cause of my trouble as a chronic neuritis of the suprascapular nerve.

I have detailed my own experience because, while the symptoms are unusual, the position of the tender point is very unusual. Indeed, if a patient comes to me now complaining of a painful shoulder I look for a tender point, and always find it in one of four places—namely:

1. At the posterior fold of the axilla over the interval between the two heads of the triceps, through which the circumflex nerve passes to the back of the limb.
2. Over the infraspinatus muscle, due here to neuritis of the suprascapular nerve.
3. Over the supraspinatus, as above mentioned.
4. Over the deltoid muscle.

While nearly all cases that I have treated present these tender points, the causation is undoubtedly not the same in all. There are cases showing marked muscular degeneration and tenderness of peripheral skin areas, with partial or complete loss of function. These are cases of neuritis of the nerve trunk, and are slow of recovery. Others have the same signs combined with joint changes, and are cases of rheumatoid arthritis. In others, again, the prominent symptoms are pain and loss of function, the latter due to the former, without muscular degeneration, though wasting from lack of use may be considerable. In still others pain is the only symptom. The last two varieties are possibly due to neuritis of scattered nerve terminals, possibly due to fibrositis or to the subinfection described by Professor Adami. Finally, chronic inflammation of the subacromial bursa will cause a tender point over the deltoid, with wasting of shoulder muscles indistinguishable from that due to neuritis. The dense shadow of the thickened bursa may be seen on a skiagram, and fluctuation can often be detected. The treatment of these cases is surgical.

In a few cases there are no tender points, and these, for want of knowledge of their true cause, I attribute to neuralgia. I have treated two such cases lately. In both the pain was not confined to the shoulder and arm, but radiated over the chest and neck. In both no tender point could be found even after the most careful searching. In both there was no real improvement. They thought that they were better, but the improvement was not maintained.

During the last twelve months or so I have had under treatment 12 cases, each presenting one or more tender points. All improved, one only very slightly. Nine got completely well. The following notes of some of the more severe or more chronic cases will give an idea of the conditions treated, and the results obtained:

CASE I.—Male, aged 51. Glycosuria fifteen years. Restricted movements both shoulders, and grating (rheumatoid arthritis). Pain in right arm and wrist, and particularly at deltoid insertion and biceps when the forearm was placed behind the back and the hand lifted as to button braces, etc. Cannot play billiards, his only game, because of pain. Tender point over circumflex nerve. He had pyorrhoea very badly; it was treated, and got quite well. His pain was much better, and he had more use of his arm after some twelve treatments. One day he told me he played 400 up at billiards without pain or fatigue. He moved into the country, and discontinued treatment. He did very well at first, and then remained stationary. Whether his improvement was maintained I do not know. His was not a promising case at any time.

CASE II.—Male, aged 71. Had rheumatism in left shoulder two months. Not very bad, but always there and annoying, sometimes quite painful. A tender point over deltoid muscle. Complete relief in three treatments; maintained since (about eleven months).

CASE III.—Male, aged 40. Acute attack of pain in right shoulder when crossing Atlantic. I saw him the day he arrived, and not more than five days after the beginning of the attack. Exquisitely tender spot over circumflex nerve. Wasting of deltoid and infraspinatus already obvious. In ten days he was much better, but not well. He left for Scotland, where his improvement continued.

CASE IV.—Male, aged 43. Rheumatic since age 20. Rather bad rheumatism during last two months. Lumbago. Pain in thigh and now in left shoulder, which he attributes to riding a pulling horse two months ago. Two tender points, one over circumflex and the other over suprascapular. He had twenty treatments altogether. Improvement lasted well. I saw him four months after treatment was stopped, and he said he had been quite free from any recurrence and was feeling very well.

CASE V.—Male, aged 60. Had a very bad attack of neuritis involving musculo-spiral and median nerves, with great pain in the shoulder. When I saw him he was recovering, but still had pain in shoulder and could not flex the index and middle fingers, while the skin over the terminal phalanges was very tender. Tender point in position 1. Pressure on this point caused a tingling down the back of the arm to the wrist. After ten treatments, he could bend the second finger perfectly and the index very much better. Pain much better and sleep better. He had been very sleepless. He could not find time to continue treatment, but wrote me a week or so after he had stopped that improvement continued, especially in the recalcitrant finger.

The other cases all did well with comparatively few treatments. The tender points are sought out with a vacuum tube attached to one pole of the static machine, using a spark gap of 1 in. or thereabouts. The patient will promptly point them out when tested by this method if they are superficial. Deeper points may be sought for by putting a metal plate about 3 in. square connected to one pole of the static machine on the part suspected and using a slowly interrupted spark gap of about $\frac{1}{2}$ in. to begin with, gradually increasing the length to 3 or 4 in. This method takes time, but does not alarm the patient, as the following method may: The insulated platform on which the patient is seated is connected to the negative side of the static machine. The positive side is grounded. Another ground chain is connected to a ball electrode held by a vulcanite handle in the hand of the operator. If the ball electrode be now approached to within 2 in. of the suspected point, a spark will leave the patient at the point. This is very searching and will disclose tender points not found by the vacuum method, but, as the sensation is unpleasant, it cannot be used on every one.

Treatment consists first of exposure to the rays of the 500 candle power lamp for thirty minutes if the condition is very acute, or for about twenty minutes if it is chronic. The lamp I use is a single lamp in a reflector with a carbon filament, as this gives the largest amount of the violet and ultra-violet rays at present obtainable combined with the smallest proportionate amount of heat rays. The skin becomes reddened and pain is relieved, whether owing to counter-irritation or to some other effect I cannot say. I think it probable that the immediate effect is due to counter-irritation, but the ultimate effect is due to absorption of light by the deeper tissues where it is converted into heat, leading to hyperaemia in them and an increased flow of lymph so that plastic exudates are carried away.

Next the patient is seated on the insulated platform of the static machine. The pliable metal electrode before referred to is moulded over the tender point and kept in good contact, otherwise sparking from it to the skin will give rise to pain and irritation. This electrode is connected to the positive side of the machine and the negative grounded. Opening the spark gap very gently a point is reached where at each crossing of the gap by the spark the patient feels a sensation like a gentle tap on a bruise. It is not advisable to increase the strength of the current beyond this point. At each treatment the spark gap can be widened until at last a gap of 5 or 6 in. may be tolerated, the break causing contraction of all the muscles in the neighbourhood of the electrode. When this point is reached or before it the patient has generally lost his pain and regained the complete use of his arm.

If there is any limitation of movement due to pain or stiffness, I usually ask the patient to put the arm in the position which causes the pain, and apply a few static sparks to the painful spot. After a dozen or so of such sparks the patient will generally find that his movements are freer and more comfortable, and, though the sparks are not very pleasant, he will often ask to have them repeated, pointing out suitable places for the application.

Treatment is usually given daily until substantial improvement is shown, then three times a week until it can be discontinued.

The rapid alternation of contraction and relaxation, about 200 times a minute, in using the static wave current doubtless causes increased blood circulation through the part, leading to resolution of exudates and recovery.

A few accessory measures are sometimes adopted. For instance, Case v had the whole arm treated with the vacuum tube current used as described in testing for tender points. This was to exercise the muscles, while the tender finger-tips were treated with the static brush discharge.