Now there is, as I have said, only one condition under which an incomplete operation might cure the cancer, namely, when the carcinoma is confined to the mammary gland, and has not yet infected the lymph vessels or lymph glands. I have notes of 7 cases in which the cancer was in the substance of the mammary gland and had not infected the lymph system. All of these patients had the complete operation performed, and are alive and well after the lapse of

Over 12 years	...	...	...	...	2
Over 10 years	...	...	...	...	1
Over 7 years	...	...	...	...	2
Over 6 years	...	...	...	...	1
Over 5 years	...	...	...	...	1

Eight cancers in seven patients, because one patient is well more than seven years after the complete operation on the left side and more than five years after the complete operation on the right.

More of these satisfactory cases will be forthcoming when the fallacies of clinical diagnosis are recognized, and when tumours of the breast are submitted to an immediate histological examination. The longest period of life that I know of after an incomplete operation done by myself has been seven years, and I doubt whether any that I ever did has escaped recurrence.

A Report of the Work

CARRIED OUT AT

THE RADIUM INSTITUTE, LONDON, IN 1913.

BY

A. E. HAYWARD PINCH, F.R.C.S.,

MEDICAL SUPERINTENDENT.

(Published with the authority of the Committee.)

This report deals with the cases which have presented themselves at the Radium Institute from January 1st, 1913, to December 31st, 1913, inclusive.

The experiences of the past year tend on the whole to confirm the conclusions set forth in the report of the first seventeen months' work, published in the *BRITISH MEDICAL JOURNAL* of January 25th, 1913, p. 149; but some few additional facts have been noticed, which serve to increase our knowledge in respect of the prognosis and treatment of various diseases.

TABLE I.—Summary of Cases.

Examined, but not treated	...	...	...	...	112
Recently treated, and results not yet noted	...	...	...	...	176
Received prophylactic irradiation only	...	...	...	...	30
Apparently cured	...	...	...	...	56
Cured	...	...	...	...	18
Improved	...	...	...	...	341
Not improved	...	...	...	...	152
Abandoned treatment	...	...	...	...	50
Dead	...	...	...	...	37

972

EPITHELIOMA.

The results obtained in the treatment of epitheliomata affecting glabrous surfaces call for no fresh comment, and in suitable instances removal of the growth by radium may be confidently anticipated.

Epitheliomata of the buccal, lingual, and pharyngeal mucous membranes still prove both refractory and disappointing in their response to radium, but a new method of treatment has recently been devised, which in instances of cancer of the tongue has given distinctly encouraging results; it consists in the burying within the carcinomatous nodule of a very small but intensely powerful radium emanation tube possessing an initial activity equivalent to that of 80 to 100 mg. of radium bromide enveloped in a screen of 1 mm. of silver or 0.3 mm. of platinum, and giving an exposure of twenty-four hours' duration. A fairly severe reaction follows, and in some cases the nodule ceases to grow and becomes replaced by dense fibrous tissue.

Several cases of epithelioma of the oesophagus have been under treatment, but unfortunately the majority of these have been in so advanced a stage as to preclude all hope of success. In those instances, however, in which complete occlusion had not occurred, and it was possible to introduce radium actually into the lumen of the

growth, distinct, though temporary, benefit has resulted, and that this effect is not merely mechanical, due to the dilatation of the stricture by the apparatus, is evidenced by the fact that the improvement in the power of swallowing has persisted for six or even nine months after the termination of the treatment.

CARCINOMA.

Carcinoma of the Uterus.

Uterine cancer still continues to yield most gratifying results, and the effects of radium treatment in inoperable cases are far in advance of those obtained by any other known medical or surgical methods. The local manifestations of the disease are benefited in the most striking fashion, and the complete disappearance of fungating growth, arrest of haemorrhage and discharge, healing of ulceration and relief from pain are phenomena of almost daily occurrence. In favourable cases, moreover, the treatment appears to exert a distinctly retarding influence on the dissemination of deposits, and thus to arrest the progress of the disease. It is not possible, however, to speak of "cure" even in these latter instances.

Great care must be exercised in the treatment of recurrences, which make their appearance within six months of the performance of a Wertheim's operation. The functions of the trophic nerves of the pelvis seem often to be seriously impaired by the extensive and elaborate dissection which is associated with this method of hysterectomy, and for this reason the amount of radium used should be small, not exceeding 50 mg., the screening not less than 1.5 mg. of lead, and the total exposure not longer than twenty hours spread over four or five days. Unless these precautions be observed a severe and extensive destructive reaction may follow the application of radium.

In all cases in which radium has been applied within the vagina the patient should be instructed to douche freely night and morning for at least six weeks after the termination of the treatment; as unless this be done an adhesive vaginitis not infrequently occurs. In some extremely susceptible subjects a transient proctitis has been noted to follow upon intravaginal treatment.

The screening employed in cases of carcinoma of the uterus is either 1 mm. of silver or 2 mm. of lead, but the thinner screening should only be adopted when the cervical canal is patulous and the tube can be introduced into its cavity.

Carcinoma of the Breast.

The number of patients with this disease applying for treatment far exceeds that of any other malignant condition.

The policy of declining to treat operable cases is still rigidly adhered to—unless the patients have absolutely refused to submit to operation—and radium is used as a last resource.

Many patients exhibit a great susceptibility to radium; the primary growth becomes smaller, infected glands and subcutaneous nodules lessen or perhaps even disappear. Little or no effect appears to be exerted in the prevention of metastatic deposits, though the treatment does not, at any rate, hasten their dissemination. Some cases in which pleurisy, dependent upon carcinomatous invasion of the pleura, has been present have shown remarkable improvement, and the application of powerful apparatus screened with 2 mm. of lead over the affected pleura, after a preliminary paracentesis, has effectively prevented the further formation of pleuritic effusion.

A few patients have been under treatment at intervals of three or four months since the opening of the institute in September, 1911, and it has been noted that a stage in their treatment is reached sooner or later at which the response to radium fails, and the benefit derived becomes negligible.

Small isolated recurrent nodules, inoperable by reason of their attachment to the sternum, clavicle, ribs, or rib cartilages, are best treated by burying a small powerful emanation tube screened with 1 mm. of silver in them for a period of twenty-four hours.

Carcinoma of Thyroid.

Encouraging results have been obtained in the few instances that have come under notice, the progress of the disease has been arrested, and a decrease in the size of the

TABLE II.—CLASSIFICATION OF CASES.

Disease.	Examined but not treated.	Results not yet noted.	Prophylactic Treatment Only.	Apparently Cured.	Cured.	Improved.	Not Improved.	Abandoned Treatment.	Dead.	Total.
CARCINOMA, squamous-celled—										
Glabrous skin...	1	—	1	2	—	4	4	1	—	13
Buccal, oral, lingual, and pharyngeal mucous membranes	6	10	6	—	—	9	15	3	4	53
Oesophagus...	5	—	—	—	—	4	4	1	—	14
Larynx...	1	2	—	—	—	1	—	—	—	4
Vagina and vulva...	—	—	1	1	—	3	1	1	1	8
Uterus...	—	2	2	—	—	27	8	1	2	42
Penis...	—	—	—	—	—	—	1	—	—	1
Bladder...	—	—	—	3	—	3	—	1	2	9
CARCINOMA, spheroidal-celled—										
Breast...	11	22	11	2	0	40	19	11	12	128
Liver and gall bladder...	—	—	—	—	—	1	—	—	—	1
Thyroid...	—	—	—	—	—	3	—	—	1	4
Paget's disease...	—	—	—	1	—	—	—	—	—	1
CARCINOMA, columnar-celled—										
Large intestine...	1	4	2	—	—	—	—	1	1	9
Rectum...	9	9	1	—	—	23	16	—	6	64
Stomach...	—	—	—	—	—	1	1	1	—	3
Ovary...	—	2	—	—	—	—	1	—	2	5
Prostate...	1	—	—	—	—	4	—	—	—	5
Kidney and suprarenal gland	—	1	—	—	—	—	—	1	—	2
Parotid...	—	—	—	—	—	—	1	—	—	1
RODENT ULCER...	4	21	2	40	—	34	7	3	—	111
SARCOMATA—										
Spindle-celled...	1	—	1	1	—	8	4	1	1	17
Round-celled...	1	—	—	—	—	1	—	—	1	3
Melanotic...	—	—	1	—	—	—	1	—	—	2
Myeloid sarcoma...	1	—	—	—	—	1	—	—	—	2
Lymphosarcoma...	—	1	—	—	—	2	—	—	—	3
Endothelioma...	—	2	2	—	—	2	2	1	1	10
Lymphadenoma...	—	—	—	—	—	4	2	1	—	7
Malignant glands...	1	1	—	—	—	4	2	3	2	13
Parotid tumour...	—	—	—	—	—	—	1	—	—	1
Abdominal tumour...	—	—	—	—	—	—	1	—	1	2
Mediastinal tumour...	—	1	—	—	—	4	—	1	—	6
Villous tumour of bladder...	—	—	—	—	—	2	1	—	—	3
Polypi of vagina...	—	—	—	—	1	—	—	—	—	1
Adenoma of thyroid...	1	2	—	—	—	—	—	—	—	3
Fibromata...	3	—	—	—	—	1	3	—	1	10
Fibroid disease of uterus...	—	1	—	—	—	—	6	—	—	7
Leucoplakia...	2	—	—	1	—	—	2	—	—	5
NAEVI—										
Capillary...	—	4	—	—	—	1	19	1	—	25
Cavernous...	1	1	—	—	—	2	8	2	—	14
Moles, warts, and papillomata	1	2	—	—	—	8	6	1	—	18
TUBERCULOSIS—										
Glands...	—	—	—	1	—	—	2	—	—	3
Skin...	1	—	—	—	—	—	5	—	—	6
Conjunctiva...	1	—	—	—	—	—	—	—	—	1
Spring catarrh...	—	—	—	1	—	—	1	—	—	2
Chronic inflammations...	1	1	—	—	—	2	3	—	—	7
Chronic ulcerations...	1	—	—	—	—	1	6	1	—	9
SKIN DISEASES—										
Keloid and vicious cicatrices	2	2	—	2	—	10	1	—	—	17
Lupus erythematosus...	—	—	—	—	—	6	—	—	—	6
Psoriasis...	—	1	—	—	—	4	2	—	—	7
Pruritus...	—	2	—	—	—	2	2	2	—	8
Chronic eczema...	—	—	—	—	—	3	1	—	—	4
Lichenification of skin...	—	—	—	—	—	—	1	—	—	1
Mycosis fungoides...	—	—	—	—	—	—	1	—	—	1
Roentgen-ray dermatitis...	—	—	—	—	—	—	1	—	—	1
Telangiectasis...	—	—	—	—	—	—	1	—	—	1
Hypertrichosis...	—	—	—	—	—	—	1	—	—	1
GENERAL DISEASES—										
Arterio-sclerosis...	3	1	—	—	—	2	1	1	—	8
Exophthalmic goitre...	1	1	—	—	—	4	—	—	—	6
Myelogenous leukaemia...	—	—	—	—	—	1	—	—	—	1
Myasthenia gravis...	—	—	—	—	—	—	1	—	—	1
Neurasthenia...	1	—	—	—	—	2	—	3	—	6
Neuritis...	6	5	—	—	—	5	3	—	—	19
Neuralgias...	—	2	—	1	—	2	1	—	—	6
Gout...	—	2	—	—	—	3	—	2	—	7
Rheumatism...	3	2	—	—	—	1	—	3	—	9
Arthritis deformans...	41	69	—	—	—	47	39	8	—	204
Totals...	112	176	30	56	18	341	152	50	37	972

existing growth has been obtained, the general discomfort and dysphagia when present being greatly relieved. The line of treatment employed has been the use of numerous powerful applicators screened with 2 mm. of lead and so disposed over the surface of the growth as to obtain the maximal cross fire irradiation. Burying of emanation tubes within the growth has not yet been adopted owing to the great tendency of these growths to fungate if any breach be made in the investing skin.

Page's Disease.

The superficial lesion in this condition is usually speedily cured by one hour's exposure to a half strength plate unscreened, but the underlying induration and affection of glands, if present, require prolonged treatment with heavily screened applicators if any real benefit is to be obtained; in cases in which the patient is willing to submit to operation this procedure should always be adopted.

Carcinoma of Rectum.

This disease displays much variation in its response to radium therapy, and numerous factors have to be considered in prognosis. Speaking generally, the soft annular and vascular type of growth is much more favourably affected than the flat, hard, non-annular plaque with much subjacent induration. In the treatment of this latter class of growth the action of the gamma rays (which it is impossible to prevent) on the healthy rectal mucous membrane opposite the plaque produces a proctitis, which though generally transient, sometimes proves both persistent and severe, and adds greatly to the patient's discomfort. In the treatment of the former type, if the radium tube be of proper dimensions and introduced accurately within the lumen of the growth, little or no healthy mucous membrane is affected by the gamma rays, and no proctitis occurs.

Growth situated in the upper half of the rectum

appear to be more amenable to treatment than those in the lower, though this may be due to the fact that tenesmus is always more constant and severe when the growth is near the sphincters.

The performance of colostomy before radium treatment is often advisable, as the constant passage of faeces over a surface that is reacting to radium frequently causes much pain. Idiosyncrasy is sometimes responsible for curious results. Some patients are extremely susceptible to the action of radium, and proctitis appears quickly, is very severe, and persists for a long time. With others the reaction sometimes takes six or eight weeks to develop, proceeds exceedingly slowly, and does not disappear for two or three months.

The routine method of treatment consists of a thirty-hour exposure—five days of six hours each, with a tube containing 100 mg. of radium bromide, screened with 2 mm. of lead and 3 mm. of rubber, and applied in actual contact with the growth, the series of exposure being repeated at the end of six weeks. If the patient prove extremely susceptible smaller doses are given at shorter intervals. In the most favourable cases the carcinomatous material shrinks and becomes replaced by dense fibrous tissue. In instances where the original growth has been of the annular type a fibrous stricture will result, which will need frequent and regular dilatation.

Carcinoma of Prostate.

The number of cases of this condition which have been treated up to the present is not very large, but benefit has been noted in all of them. Haematuria, when existent, has been either diminished or abolished, pain has been greatly lessened, and the size of the growth decreased. Various methods of treatment have had to be adopted according to the nature of the case. When catheterization can be well tolerated, a 50 mg. tube of radium bromide in a "window" screen of 1 mm. of silver and 1 mm. of lead is introduced per urethram, and maintained in actual contact with the growth for a period of two hours a day on five successive days, and its action is supplemented by another tube of 100 mg. in a screen of 2 mm. of lead, introduced into the rectum for six hours a day on five successive days.

When catheterization is not practicable or advisable, the action of the rectal tube is reinforced by a powerful flat applicator screened with 2 mm. of lead, and placed either on the perineum or over the pubes.

Carcinoma of Bladder.

Nine cases of this disease have been treated, and in six instances the results have been most gratifying. The haematuria, cystitis, and all subjective symptoms have disappeared, and cystoscopic examination has shown that the size of the growth has been greatly lessened, and any ulcerated surface has become covered with healthy epithelium.

The treatment has consisted of the introduction of a 50 mg. tube of radium bromide in a "window" screen of 1 mm. of silver and 1 mm. of lead inserted per urethram, and maintained by means of a pliable silver wire in such a position that the window side of the apparatus is in actual contact with the growth. If the lesion be on the base of the bladder, a second tube screened with 2 mm. of lead is placed in the vagina in female, or in the rectum in male patients; but if on the anterior bladder wall, a flat applicator, similarly screened, is fixed over the pubic region. The usual length of exposure is ten hours intravesically in five days of two hours each, and thirty hours with the vaginal, rectal, or pubic applicators spaced over the same number of days.

RODENT ULCER.

But little has been added to our knowledge of the treatment of this condition, but when dealing with the question of prognosis it appears justifiable to divide rodent ulcers into two definite clinical types:

1. The hypertrophic nodular type, with slight superficial ulceration of a scaly character. This class responds extremely well to radium, and yields most satisfactory results.

2. The excavating type, with undermined and overhanging edges and a gelatinous base. This not infrequently

proves very intractable and repair is most difficult to effect.

Whenever the size and situation of the ulcer permit, it is best to give one powerful unscreened exposure, a full-strength plate being applied in actual contact with the ulcer for one, two, or three hours, according to circumstances. One such treatment usually suffices to produce an apparent cure. Exposures of short duration repeated at frequent intervals are not nearly so effectual, and instances have been met with in which the adoption of this procedure appears to have been responsible for the development of an epithelioma on the site of the original ulcer.

Rodent ulcers attacking cartilage, bone or mucous membranes are very refractory, though an exception should be made with regard to the orbital mucosa, which is generally very amenable to the action of radium.

SARCOMATA.

Speaking in general terms, these growths, if taken in their early stages, and before dissemination has occurred, do very well under radium treatment. The burying within the growth of tubes of radium salts or radium emanation should be resorted to whenever practicable, and the action of these tubes may be much helped by the external application of radium plates heavily screened.

It is important to use a large quantity of radium, and to give a heavy dosage. Small doses should be avoided, as they exert a distinctly irritating effect and stimulate the growth of the tumour. The best results are obtained in sarcomata of the tonsil and post-nasal space, and the results in many such cases are amazing, the growths completely disappearing within six weeks of the treatment.

Lymphosarcomata also give excellent results.

Melanotic sarcomata are not influenced by radium, and in the few cases that have been treated no benefit has been observed.

LYMPHADENOMA.

When the disease is localized and confined to one or more small superficial areas the disappearance of the enlarged glands is frequently brought about by the use of radium, and the progress of the disease is thus arrested. When, however, the condition is generalized, the employment of numerous large and powerful applicators becomes necessary, and this heavy dosage is almost always followed by severe systemic disturbance, with high temperature and general malaise. After the reaction has subsided considerable improvement is often apparent, but this is only temporary in character, and the condition sooner or later returns with increased severity.

MEDIASTINAL TUMOURS.

In almost every instance that has come under observation the rate of growth has been very markedly checked by the use of radium, and in one or two cases a definite decrease in the size of the tumour, as seen by x-ray screening, has undoubtedly occurred.

If the condition be accompanied by an accumulation of fluid in the pleura, and paracentesis be performed, radium appears to exert a very remarkable action in lessening the tendency to the production of further effusion.

In these cases the use of a very large quantity of radium (400 to 500 mg.) is indicated. The applicators should be screened with 2 mm. of lead, and disposed in such fashion over the chest wall as to procure the maximum "cross fire" irradiation.

Treatment must be very persistent, a total exposure of not less than thirty hours should be given, and the series repeated at the end of four weeks. This heavy dosage is almost invariably followed in two or three days by a feeling of great fatigue and exhaustion, but this condition passes off completely in about a week's time.

FIBROID DISEASE OF THE UTERUS.

Radium exerts a most beneficial action upon the distressing symptoms menorrhagia and metrorrhagia, which are the almost invariable concomitants of this condition, though it seldom produces any very great diminution in the size of the uterus. As the cervical canal is rarely sufficiently patulous to admit a screened radium tube without previous dilatation, and patients are often averse from this, the treatment may be carried out by the

introduction of a tube containing 100 mg. of radium, screened with 2 mm. of lead, into the posterior fornix, and applying a plate of from 80 to 100 mg. similarly screened over the fundus uteri.

The total exposure should be between thirty and sixty hours, spread over from five to ten days, and the series should be repeated after six or eight weeks. The first effect noted is the checking of the metrorrhagia, and this is followed by a progressive decrease of the menorrhagia until the flow becomes normal, or sometimes ceases altogether.

LEUCOPLAKIA.

Leucoplakic patches on the tongue, cheek, or vulva, are speedily removed by radium, but they tend to recur sooner or later. Half-strength plates screened with $\frac{1}{10}$ mm. of lead should be used, and exposures varying from one to three hours' duration, according to the thickness of the lesion should be given. A slight superficial reaction takes place and the patches disappear.

NAEVI.

Flat Superficial Naevi, Capillary Naevi, "Port Wine Stains."

Before expressing an opinion as to the possibility of radium treatment effecting an improvement in any particular instance, it is advisable to subject the lesion to diascopy. If blanching is readily effected by gentle pressure, the result of the treatment will probably be satisfactory; but if it be found impossible to produce blanching except by great pressure, it is unlikely that radium can do much for the condition.

Infinite patience is necessary in the treatment of superficial naevi, and the utmost caution must be observed. The effect of each exposure should be most carefully studied, as too frequent treatments or excessive dosage may result in the production of troublesome telangiectases. It is best to use quarter or half strength applicators screened with $\frac{1}{10}$ mm. of aluminium, and to start with short exposures of from fifteen to twenty minutes' duration, gradually increasing the length of the same until a satisfactory reaction has been obtained. So soon as the lesion has assumed a salmon-pink colour, the screening should be altered to $\frac{1}{10}$ or $\frac{3}{10}$ mm. of lead, and the length of exposure increased to one, one and a half, or two hours.

Cavernous Naevi.

These do excellently under radium, especially when of such shape that "cross fire" radiation is possible. Half strength applicators screened with $\frac{1}{10}$ mm. of lead should be employed, and the exposure should be from one to three hours' duration, spread over three successive days. Little or no surface reaction is produced by this method of treatment, and the naevus shrinks gradually and steadily. If, on palpation, the presence of a pulsating vessel is appreciable, the case is not likely to prove completely successful unless the vessel be first ligated.

WARTS AND PAPILLOMATA.

Warts and papillomata yield readily to short exposures of from twenty minutes to one hour's duration with half strength apparatus unscreened. The reaction is but slight and the resultant scar scarcely noticeable.

TUBERCULOSIS.

Tuberculosis of Glands.—In cases in which surgical measures have been declined for cosmetic reasons, radium often proves of considerable value, either when used alone or as an adjunct to vaccine treatment. Heavily screened exposures of thirty or more hours' duration should be resorted to and an effort made to secure "cross fire" irradiation where practicable. If the glands be caseating, radium treatment is of very little use.

Lupus Vulgaris.—As a routine treatment for this disease Finsen light is greatly to be preferred to radium, but where it fails to effect a cure or improvement radium sometimes proves of great use. Unscrened exposures of one or two hours' duration must be given and a destructive reaction produced. The resultant scar is usually firm, smooth, supple, and inconspicuous.

SPRING CATARRH.

In this condition the employment of radium is strongly to be advocated, as it will often cure the most intractable

cases. Personal idiosyncrasy is, however, a very important consideration, and it is essential to proceed with great caution, giving short unscrened exposures at intervals of a fortnight, and carefully noting the reaction. If the dosage be accurately adjusted, the granulations on the orbital conjunctiva gradually disappear, there is no marked inflammation, and no resultant scarring of the mucous membrane. A special form of applicator should be used which can readily be introduced into the conjunctival fornices. It should be of full strength, and the first exposure should not exceed fifteen minutes' duration. No screening is employed. If the effect be not satisfactory the length of the exposure may be increased to twenty, twenty-five, or thirty minutes until the desired result is obtained.

SKIN DISEASES.

Keloid.

This condition continues to give most excellent results when treated with radium; and a great improvement, if not complete cure, can be safely predicted. In tender and painful keloids the anaesthetic effect of radium is generally very marked, and appears very early in the treatment.

Screening with 1 mm. of silver is almost always employed, and an exposure of from eighteen to thirty hours spread over from three to five days, according to the size and thickness of the lesion, is given. This brings about a gradual absorption of the keloidal tissue unaccompanied by any surface irritation.

Lupus Erythematosus.—This very intractable and puzzling disease often responds favourably to radium, even after all routine methods have failed. Short exposures with half or quarter strength apparatus lightly screened and repeated at intervals of four weeks give the best results.

Psoriasis and Chronic Eczema.—Both of these conditions generally yield readily to short unscrened exposures of from two to five minutes' duration, given on three successive days, the series of exposures being repeated at intervals of a fortnight. The patches quickly disappear after a slight superficial reaction, and in eczematous cases there is but little tendency to recurrence. With psoriasis, however, the disease almost invariably reappears after a time, though with some patients the interval that elapses may be of many months' duration.

Lichenification of the skin, with its attendant intolerable itching, is quickly relieved and often completely cured by one exposure of ten or fifteen minutes' duration to a half-strength applicator screened with $\frac{1}{10}$ mm. of aluminium. Some very obstinate cases which have hitherto defied all the usual methods of treatment have responded most favourably to this procedure, the lesions have disappeared and have not recurred.

Pruritus.—The analgesic effect of radium is often of the greatest use in this disease, and short unscrened exposures frequently produce a degree of relief which is unattainable by any other measures. This is especially noticeable if the pruritus occur in association with a definite lesion such as leucoplakia or hyperkeratosis. If the dosage be carefully considered and the treatment repeated at fortnightly intervals until the skin is restored to its normal condition, complete and permanent cure may result. If, however, the condition be a neurosis, the prognosis is not so hopeful, and the benefit derived, if any, is not likely to be of very long duration.

EXOPHTHALMIC GOITRE.

Few patients suffering from this disease have as yet been treated at the institute, but the results obtained are sufficient to justify a trial of radium when other treatments have failed to produce any result. Prolonged exposures of thirty or more hours' duration in all should be given, with heavily screened apparatus containing 200 or 300 mg. of radium, the apparatus being so disposed as to cover as much as possible of the gland surface.

Three or four weeks usually elapse before any effect is appreciable, but from that time on a gradual diminution in the size of the gland, with slowing of the heart's action, lessening of tremor and of the degree of proptosis, may be looked for.

The series of exposures should be repeated at intervals of three or four months.

ARTHRITIS DEFORMANS.

The daily administration of 250 c.cm. of radium emanation solution of a strength of not less than 1 millicurie per litre to patients suffering from this obstinate and painful and crippling disease is sometimes attended by very remarkable results. It is difficult to predict with certainty the degree of improvement likely to occur in any particular instance, but the cases which appear to derive most benefit are those in which the disease is of relatively short duration, and the changes are periarticular in type and multi-articular in distribution. The age of the patient also exerts some influence, those under 40 responding more quickly to the action of the emanation. Cases with a definite gouty history sometimes experience an acute exacerbation of all their symptoms within the first week or ten days of their treatment, but this disturbance is quite transient, and is usually followed by a distinct change for the better.

Little or no improvement can be looked for in instances where cartilaginous or osseous changes are predominant, and the radium emanation solution is powerless to bring about the absorption of osteophytic growths or the loosening of fibrous or bony ankylosis.

When limitation of movement is due to periarticular fibrous thickening, considerable increase of mobility often follows on the taking of the radium water and enables patients to perform actions, such as feeding themselves, brushing their hair, shaving, etc., which they may have been powerless to do for some months or even years.

Other favourable effects of the treatment are the lessening or disappearance of the muscular and articular pains, the grating of the joints on movement is not so marked, the muscles regain much of their lost tone, and the patient's general health is much improved. This is especially noticeable when the patients are suffering from anaemia, the haemoglobin index being rapidly increased.

Much research work has yet to be undertaken to enable an accurate opinion to be formed of the manner in which radium emanation solution produces these results, as its action appears to be a multiple and highly complex one, but the reinforcing of the body ferments, the increase of tissue oxidation, and the dissolving of uric acid are undoubtedly factors which contribute to its success.

I desire to express my indebtedness to my assistants, Dr. J. E. A. Lynham and Dr. A. Burrows, for the valuable help they have given in the compilation of this report.

The opinions recorded are the result of our joint observations, as treatment has in many instances been planned and carried out entirely by them.

APPENDIX.

REPORT OF THE CHEMICO-PHYSICAL
LABORATORY.

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SINCE the publication of the last report, the laboratory staff has been almost wholly engaged in attending to an ever-increasing demand for emanation applicators and for radio-active water.

Emanation Applicators.

These applicators have a very great advantage over applicators containing fixed radium salts, inasmuch as it is possible to concentrate the activity per unit area to a very high degree.

Since the emanation is in equilibrium with 1 gram of metallic radium only occupies a volume of 0.59 c.mm., it is easy to see what advantages can be obtained by the saving of space compared with the relatively bulky radium salt. For example, the tubes containing 100 mg. of radium bromide used in the Institute measure 40 mm. long and 2.2 mm. in diameter, while it is quite easy to make an emanation tube equal in activity to them, but measuring only 6 mm. long and 1.3 mm. in diameter.

Improvements in the construction of the apparatus used have resulted in the production of these emanation tubes

of very small calibre, the latest achievement being the charging of iridium-pointed platinum needles (3 cm. long, 2 mm. diameter, and 0.3 mm. thickness) with emanation in capillary glass tubes for insertion into malignant tissue. These needles, the suggestion of the medical staff of the Institute, appear to be easy to use, and if certain principles are observed are not difficult to fill with emanation.

The larger emanation tubes have been standardized in dimensions—that is to say, they have been constructed to fit certain standard screens; these screens are of the following dimensions:

An "A" screen is 2 centimetres long.
A "B" " " 3 " "
A "C" " " 4 " "

All of them with an internal diameter of 2 millimetres.

These screens vary both as to material (lead or silver) and as to thickness of wall, thus giving considerable latitude in the treatment of special cases.

With the improvement of the apparatus the rate of production of these tubes has enormously increased; two tubes are frequently made at the same time from one piece of capillary tubing, and are separated by means of a mouth-blow pipe, a constriction being made in the middle of the tube before the introduction of the gas.

It has been urged against the use of emanation tubes that their initial activity, which is often considerable, is rapidly lost; and that their residual activity, which is small in amount, but of long duration, cannot be made use of.

The answer to the first point is, that a treatment rarely exceeds twenty-four hours, and that an emanation tube can so be made that its average strength during that period shall be the strength required (the loss during twenty-four hours being only 16 per cent.).

As regards the second point, when emanation applicators are returned after use to the laboratory they frequently possess considerable residual activity. As a rule the individual tubes are no longer sufficiently powerful to be of any therapeutic value, but an apparatus has been devised whereby the tubes are crushed and the emanation extracted, several tubes of low activity being utilized to make a tube of high activity.

The stock of radium salts available for emanation production has been subdivided for the sake of safety into units, each of about 200 mg. of radium bromide. Each unit has been attached to its own pump, and has been mounted separately on the walls of the iron safes in the basement. All the pumps and glass work have been made by the laboratory staff, considerable time having been spent in their construction.

During the year 241 emanation tubes and applicators have been made (as compared with 44 in 1912), and the activity of these applicators was equal to that of over 19 grams of radium bromide. These applicators were sent by post as required to various places in the British Isles.

Radio-active Water.

The output of radio-active water has also been largely increased during the year, over 3,600 litres being made in 1913 as compared with 400 litres in 1912. New apparatus has been constructed which permits of 150 bottles being dispatched daily by post to patients as directed by their medical attendants. The strength of the water remains the same as for last year, that is to say, approximately 1 millicurie per litre.*

The emanation used for the production of this large volume of water is equal in activity to about 6.5 grams of radium bromide.

Radium Applicators.

During the year there has been a considerable demand by medical men and by other institutes for the preparation of radium applicators similar to those used in the Institute. Applicators have been prepared for several of the London hospitals as well as for institutes in Germany and Denmark. The number of these amounts to 55 (as compared with 4 made in 1912).

In addition 15 specimens of radio-active material were received from various sources for analysis, a branch of the laboratory work which shows signs of increasing since the acquisition of an International standard.

* 1 millicurie of emanation is equivalent to 2,670,000 maché units.