domestics, but do not encourage other immigrants except nominees—that is, those who have friends already in the country prepared to assist them.

Where the medical profession might do great work for the Empire is by encouraging a suitable type of youth to emigrate, one with a good family history, of good physique, ambitious, and above all, with a will to work. Dr. Stewart Mackintosh's observations¹ suggest that readiness of adaptation to change argues an ancestry derived from many and varied stocks, such as are usually bred together by urban influences. One result of the rapid transition from an agricultural to an industrial nation has been the disintegration of rural communities, their aggregation in new centres, and the extraction by a severe process of natural selection of types that could adapt themselves to industrial exigencies, and climatic and other conditions. The New World has drawn some of its most hard-working labourers from limboes of despair, men who develop a surprising physique and energy as soon as they can enter environmental conditions at all conformable to their physical needs. Professor Karl Pearson emphasizes "that it is essentially the man who makes his environment, and not the environment which makes the man." We have chosen to make ourselves an industrial nation and allow our agriculture to decay; we have offered industrial work to those who made their living on the soil, luring them into the cities and into environments differing in many respects from those in which they were brought up.

A few sons of medical men have come out to Australia since the war, received some training at the Hawkesbury Agricultural College, and, in some cases, are doing well on the land to-day. If anyone cared to organize a batch of sons of medical men, it would not be difficult to arrange for them to be met on arrival and have them distributed to sheep and cattle station owners or farmers in Australia and New Zealand on similar lines to the Big Brotherhood Movement. Certainly if they came out with the intention of settling and marrying, the Australian girls, who are even a finer type than the men, would give them a hearty welcome.

REFERENCE.

¹Mackintosh, J. S.: The Effects of Intra-Migration on National Health, *British Medical Journal*, 1912, ii, p. 367.

RADIUM TREATMENT OF EPITHELIOMATA OF THE SKIN.*

BY

ROY WARD, M.B., B.S.,
THE RADIUM INSTITUTE, LONDON.

In this opening paper I propose to deal mainly with the subject of basal-celled epithelioma or rodent ulcer, and to touch briefly on the question of squamous epithelioma, believing, as I do, that this disease has a surgical rather than a radiological aspect.

RODENT ULCER.

Radium is undoubtedly the best treatment in most cases of rodent ulcer; it is in this condition that the most striking and permanent results of radium therapy are obtained. Excision is equally effective in some cases, but, owing to the difficulty in excising completely even a small growth from the situations most commonly affected, radium is to be preferred. Cosmetically it gives results which cannot be obtained by any other method, the resulting scar being supple and the skin almost normal in appearance. X rays will cure a number of these lesions, but the treatment is tedious, and the action of the rays cannot be limited with such great accuracy. Recurrences are more frequent, and permanent healing is not so certain.

Clinical Varieties.—A rodent ulcer usually begins as a smooth, waxy, semitranslucent pearly nodule, which grows very slowly, often assuming the form of a rosette of nodules with a raised margin and depressed centre. A growth such as this belongs to the early hypertrophic variety, and frequently shows cystic degeneration. More nodules may

appear and coalesce, thus forming a larger hypertrophic growth, or, owing to some slight trauma, the growth may break down, with the formation of a brownish scab. Gradually there develops a superficial ulcer with a gelatinous base, and the raised pearly margin which is so characteristic of the disease. The ulcerated area may heal over in one part, leaving a smooth atrophic scarred area, while in another part the disease continues to advance. This is known as the superficial flattened cicatrizing type, which has a characteristic braided margin. Both the hypertrophic and superficial ulcerative types may reach a considerable size, but generally remain limited to the surface. The disease may, however, extend deeply to reach the underlying tissues, penetrating muscle and bone, thus giving rise to deep irregular cavities. Such lesions of the deeply ulcerative variety seldom have the typical rolled edge; the margins are usually indurated and sharply cut, with a well-marked inflammatory zone surrounding the ulcer. Although there may be extensive local destruction of tissue, these growths never give rise to metastases unless they assume the clinical and histological appearances of a squamous-celled epithelioma. It is very important to recognize this transitional type. The relative frequency of the various types can be shown from an analysis of 1,773 consecutive cases treated at the Radium Institute, London:

Type of lesion.	Relative frequency.
Hypertrophic (small and large)	51 per cent.
Superficial:	
Ulcerative	30 "
Cicatrizing	3 "
Deeply ulcerated	16 "

The following shows the results for each group:

Type.	Apparently cured.
Hypertrophic	91 per cent.
Flat	77 "
Deeply ulcerated	38 "
All cases	77 "

Many of the last group were such that healing was out of the question, owing to extensive involvement of bone and cartilage.

Sites.—Rodent ulcers are most common on the face. The most frequent situations are the nose and cheek, as shown in the following table:

Nose	468	Chin	36
Cheek	377	Mastoid	22
Inner canthus	193	Trunk	21
Lower eyelid	151	Neck	20
Temple	141	Upper eyelid	19
Forehead	98	Lower lip	17
Ear	84	Eyebrow	12
Outer canthus	56	Scalp	10
Upper lip	47	Hand	4
Preauricular	37		

Etiology.

The disease is more common in men than in women—953 patients were males and 820 females. The youngest patient in the series was a girl who was first seen at the Radium Institute at the age of 19. She was sent on account of a deeply ulcerative lesion which affected the inner canthus, and had started as a nodule at the age of 12. It will be seen that the disease is most common between the ages of 60 and 70.

Age.	Frequency.
10-20	1
20-30	11
30-40	63
40-50	218
50-60	394
60-70	484
70-80	334
80-90	82
90-100	2

Multiple lesions are more common than is usually supposed. There were 94 cases in this series; 55 were in men and 39 in women. In one case a woman, aged 28, had as many as nineteen different lesions treated with radium.

Previous Treatment.—A number of patients had been operated on once or several times, and many had received treatment by x rays or radium at other hospitals. The disease had either recurred or had become resistant to

* A paper read in opening a discussion in the Section of Radiology at the Annual Meeting of the British Medical Association, Winnipeg, 1930.

repeated x-ray treatments. It is interesting to note that of the 240 patients whose lesions had previously become refractory to these rays, 102 were healed as the result of radium treatment, 32 were improved, while the remainder did not show any improvement or the results were not recorded.

Transitional Type.—Occasionally, as already pointed out, an undoubted basal-celled growth takes on the characteristics of a squamous-celled epithelioma. When this occurs the disease progresses extremely rapidly. There is early involvement of the lymphatic glands, and death occurs from cachexia and septic absorption. There were 40 such cases in this series; in 25 the lesions were situated in the neighbourhood of the ear, and in 11 of these they actually started in the pinna. It is interesting to note that all these patients had received repeated exposures of radium, and 11 had had previous x-ray treatment. In all there was marked secondary infection, no doubt an indication of lowered resistance.

Diagnosis.—The clinical diagnosis of a rodent ulcer is comparatively easy. Since there is a possibility that biopsy tends to activate a growth, it is our custom to confirm the diagnosis microscopically only in doubtful cases.

Treatment.—The fundamental principle, in this as in other conditions, is to estimate the dose sufficient to bring about the death of all the malignant cells without impairing the vitality of the surrounding normal tissue, so that healing will take place satisfactorily. The more radio-sensitive types may be treated successfully by various techniques, and this probably accounts for the similarity in the results obtained at various radium centres, although the methods adopted are in many cases quite different. In discussing treatment it is advisable to consider each variety separately; the technique employed is determined by the type of lesion and the structures affected.

SMALL HYPERTROPHIC GROWTHS.

Growths extending only a little beyond the surface and mobile on the underlying structures should be treated by surface radiation. Exposure to the unscreened full strength applicator is the method of choice. This apparatus is a solid plaque containing 5 mg. of radium element per square centimetre; the whole of it is covered with thin rubber tissue to prevent contamination by discharges. All crusts must first be removed, and it is wise to protect the surrounding skin by rubber-covered lead sheeting in which a hole has been cut a little larger than the lesion, so that any outlying groups of cells may be treated. The apparatus should be applied for one to two hours, according to the thickness of the lesion.

The applicator emits a strong intensity of beta rays, which are sufficiently penetrating to reach all parts of the tumour. As a result of the beta radiation an erythema is noticed in about ten days, reaching its height in about three weeks. Over this inflamed area a crust forms, which dries and falls off towards the sixth week, leaving a soft and supple scar. When it is necessary to limit the irradiated area on account of the proximity of especially sensitive organs, it is advisable to use buried radium in the form of screened seeds.

LARGE HYPERTROPHIC GROWTHS.

It is particularly important in these cases to adopt a technique which will result in a homogeneous distribution of the rays to all parts of the tumour under consideration, so as to avoid any stimulating action which may be produced at the limit of the zone of action. It is therefore necessary to use screened apparatus. Probably the most useful procedure is to employ needles buried in and around the growth. The needles most commonly employed have walls of 0.3 mm. of platinum, and contain 2 mg. of radium per centimetre of active length. As a rough guide to the technique it may be stated that no part of the growth should be further than one centimetre from a source of irradiation, and it should be remembered that more massive doses should be placed at the periphery in order to obtain a homogeneous distribution. If needles were placed at the same distance throughout the growth, the centre, being irradiated by its own foci as well as those adjacent, would be exposed to a greater dose than the periphery.

Various modifications of this technique are employed with equally good results. Some authorities prefer a comparatively large dose for a short time, while others advocate exposures for ten days, and sometimes even as long as thirty days. It has been the practice at the Radium Institute never to increase the time factor beyond seventy-two hours' continuous treatment. So radio-sensitive are these tumours that equally satisfactory results are obtained by either method. It is the rule for complete cure to ensue even in advanced cases, providing they are of the purely hypertrophic type.

The Superficial Ulcerative Variety.—These are at first small hypertrophic growths which have ulcerated superficially at the centre, leaving the remainder of the growth as a rolled edge. Their treatment is similar to that of the hypertrophic growths from which they originate. In the case of small ulcers, which are mobile on the deeper structures, an unscreened applicator should be used for one and a half to two hours. A cure is almost invariably obtained. Larger ulcers in which there is much subjacent infiltration must be treated by other methods. By using a light screen, such as 0.1 mm. of lead, the less penetrating rays, which only act near the surface, are absorbed, leaving a more penetrating but weaker radiation, which must be employed for a correspondingly longer time. The full strength applicator, thus filtered, should be applied for two to four hours, according to the amount of infiltration present.

The Superficial Cicatrizing Variety.—This type should be treated in the same way by unscreened radium plaques. It is necessary to irradiate a considerable distance beyond the visible margin of the growth as outlying columns of cells are undoubtedly present in these situations.

The Deeply Ulcerative Variety.—This is the most severe form of basal-celled epithelioma and the most difficult to treat. Gamma radiation must be used; beta radiation with unscreened or lightly screened radium is not suitable. The method of employing Columbia paste plaques for prolonged periods of two to three weeks has been advocated for this form of rodent ulcer. The results are usually unsatisfactory and frequently disastrous, for, although in the course of these long applications the rays have more chance of finding the neoplastic cells at the moment of their greatest fragility, it is no less certain that the normal cells of the surrounding tissues are also affected adversely. The prolonged irradiation of the normal cells, and those already debilitated by the spread of the disease or by secondary infection, may result, not only in a radium necrosis, but in increased activity of the neoplasm. It is therefore advisable, in order to avoid the disadvantages of prolonged exposures on the one hand, or insufficient screenage on the other, to employ much larger amounts of radium screened through a minimum of 2 mm. of lead or its equivalent for a comparatively short period. In addition, means must be found to absorb the secondary radiations, and sometimes this is done by the interposition of Columbia wax or sorbo rubber, a measure which also provides a more homogeneous dose, by the distance which is created between the radium and the lesion. With this technique the duration of treatment varies between forty-eight and seventy-two hours. If the time is increased beyond a total of seventy-two hours, damaging effect may be produced, especially in old people. Although, of course, it is desirable to destroy all the neoplastic cells to avoid recurrence, this should never be done at the expense of destroying the adjacent tissues, the integrity of which is so necessary for satisfactory repair. Recently the use of needles or screened seeds has in some cases replaced or supplemented surface treatment. Needles are either inserted into or laid along the growing edge. In many of the more extensive lesions better results have been obtained by using this form of treatment than with a plaque of uniform intensity. Such are the lines along which the deeply ulcerative type should be treated when limited to the soft tissues. If, however, bone or cartilage has been invaded, an even shorter exposure will be advisable, since these structures, especially when devitalized by the invasion of the neoplasm, have a great tendency to radium necrosis. The results in this class of ulcer are not so good as in the former types. About one-third of the cases treated become healed, but many cases show

little or no improvement. Should no improvement be noted within two months, surgical treatment, such as excision with the diathermy knife and subsequent skin grafting, should be considered. In the more advanced cases it is exceptional to obtain a cure, but a large proportion show improvement with temporary arrest of the disease.

REPETITION OF IRRADIATION TREATMENT.

There is no doubt it is best to give a maximum dose at the first treatment, for after each successive dose a rodent ulcer becomes more refractory to treatment. It is supposed that repeated treatments cause some degree of radio-vaccination. On the other hand, a growth which has proved refractory to beta radiation will often respond to gamma radiation. A second exposure in those cases in which no healing has been obtained is usually of no use, and may only aggravate the condition. If, however, complete healing has not occurred, but a definite improvement is noted and there is still some induration left, a second treatment with a thicker screen may be required to affect the deeper limits of the lesion. Previous treatments produce an avascularity of the tissues, rendering them more susceptible to radium necrosis.

Radium should never be employed within six weeks of any previous treatment. When it is decided to give a renewed treatment, it is important to know whether a patient has had previous x-ray treatment. The age of the patient, the details of the previous dose, and its subsequent reaction, must all be taken into consideration. It is important to estimate the dose so as to avoid a "radium burn." Infection readily takes place, and an intractable ulcer forms which may take months or even years to heal. The term "radium burn" is often used incorrectly, being applied to the simple vesication and ulceration which follow upon an unscreened radium exposure, and which are an essential part of the reaction. In these cases a destructive reaction has been deliberately produced for a definite purpose, and satisfactory repair can be anticipated. The term "radium burn" should be reserved for the few instances in which the dosage has been excessive. The resultant ulceration may be extreme in degree; pain is severe and persistent, and repair is always slow.

PROGNOSIS.

This depends on the age of the patient, the type of growth, its position, and the extent of the disease when treatment is commenced. In old people there is less resistance offered by the surrounding tissues to the advance of the disease. Ulcers of the hypertrophic group usually respond exceedingly well to irradiation. The flattened cicatrizing type shows a tendency to recurrence, and ulcers of the deeply ulcerative group are not so suitable for treatment; in fact, the value of radium in very advanced cases is doubtful, the patient's resistance to the disease is poor, and the power of repair is deficient. When the lesion is small radium treatment is usually successful. It is only when the disease extends to the deeper tissues, and infiltrates underlying bone or cartilage, that the prognosis becomes grave.

Ulcers in certain situations, such as the forehead, ear, and inner canthus, have a serious prognosis. When a mucous membrane is implicated, the condition also proves more resistant, and is often only eradicated by free excision. When an ulcer becomes secondarily infected it often responds poorly to radium. In some cases the sepsis appears to be aggravated by treatment, thereby only adding to the patient's discomfort.

SQUAMOUS EPITHELIOMATA.

Squamous epitheliomata of the skin differ from rodent ulcers in their more rapid growth, and in their formation of metastatic deposits in the neighbouring lymphatic glands. These lesions are susceptible to the rays of radium, although not to the same degree as the basal-celled growths. The warty type in particular may be readily destroyed by irradiation, whereas ulcerative lesions prove more resistant. In the early stages of the disease, the results of excision are so good that radium should be reserved for the more extensive cases. In patients treated

with radium a high percentage of cures has resulted; nevertheless the growth should be excised in operable cases, and this should be done with the diathermy knife.

When radium treatment is considered advisable gamma radiation must be used, interstitial radiation being the method of choice. Needles of low content should be employed with walls of 0.6 mm. of platinum, and containing 0.5 mg. of radium element for each centimetre of active length. They should be introduced into the healthy tissue in the immediate vicinity of the growth, and allowed to remain in position for a week. By the end of six to eight weeks the resultant reaction subsides, and the growth gradually disappears, leaving a smooth scar. The primary growth should not be regarded as apparently cured unless the treated area is perfectly soft. Any residual induration should be excised, as this may be the nucleus of a rapidly growing recurrence. Prophylactic doses of radium to the neighbouring lymphatic areas are of doubtful value.

When the glands are definitely invaded, the prognosis is very grave. In these cases needles or Columbia wax plaques may be employed. The immediate result is often encouraging, but the permanent disappearance of infected glands is exceptional. Much can be done to relieve symptoms and prolong life, but in its later stages the disease proves resistant to all forms of treatment.

THE TREATMENT OF LATE SYPHILIS.

BY

THOMAS FERGUSON, M.D., F.R.C.P.Ed., D.P.H.,

FORMERLY MEDICAL OFFICER IN CHARGE OF VENEREAL DISEASE
DEPARTMENT, DARLINGTON GENERAL HOSPITAL.

DURING the past six years I have made increasing use of bismuth preparations in the treatment of late cases of syphilis. It had been my usual practice to treat such cases with bismuth intramuscularly, and with mercury and iodide orally, during the first three months, continuing thereafter with combined bismuth and arsenical therapy. Finding that in a considerable number of cases the Wassermann reaction became negative after the first three months' course, I decided to try the effect of more prolonged bismuth treatment instead of exhibiting the arsenicals.

The bismuth preparation used in this series of cases was neotropol, of which 1 c.cm. is equal to 0.08 gram bismuth; 2 c.cm. of it were given weekly, so that in the normal three months' course each patient received 2.08 grams bismuth, together with 1,260 grains potassium iodide and 210 grains hydrarg. cum cret. One month's rest was given between each course, and the number of courses given ranged from two to six.

Records are available of 45 consecutive cases treated on this plan. The Wassermann reaction of 24 of these had proved resistant to previous arsenical treatment, while 22 had had no previous treatment whatever.

Clinically, the results were striking. Only two cases—one of central nervous system syphilis, and the other an advanced heart lesion—failed to respond, and the amelioration of symptoms was so marked that it was difficult to persuade many of the patients of the need for further treatment.

The influence of treatment on the blood Wassermann reaction, if less dramatic, was notable. In 30 cases (65.2 per cent.) the Wassermann reaction was rendered negative; in 13 cases (26.1 per cent.) the strength of the positive reaction was reduced, and in only 4 cases (8.7 per cent.) did it remain unaltered. Of the 30 cases in which the Wassermann reaction became negative, 9 did so after the first course, 7 after the second, 4 after the third, and 4 after the fourth. Of the 13 cases in which the strength of a positive Wassermann reaction was reduced, 5 received only two courses of treatment and 5 had three, while of the 4 cases in which the Wassermann reaction was uninfluenced, 2 had two courses and 2 had three.

The results in the cases which had resisted arsenical treatment differed little from those obtained where no