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SOME PHYSICO-THERAPEUTIC METHODS IN DERMATOLOGY.*

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FROM the outburst of inventiveness which recent years have witnessed, medicine has profited not less than other arts, and no branch of medicine more than that of dermatology. In electro-therapeutics, in actino-therapy, in radio-therapy, more recently in radium-therapy, and most recently of all in the employment of extreme degrees of cold, valuable additions have been made to the dermatologist's armamentarium. The serviceability of these measures in the treatment of certain benign new growths, of lesions which are the result, directly or indirectly, of inflammatory processes, and in the relief of itching, admits of no dispute. Their usefulness in the treatment of malignant growths, except as palliatives or as auxiliaries of surgery, is less unquestionable. That exaggerated claims have been made in favour of certain of the new methods, and that a reaction against them has thus been provoked, may at once be conceded. My aim has always been to hold an even balance between the old and the new, and it is in this spirit that I attempt an estimate, based upon my own experience, of the true place of the new physical agents in dermatological therapeutics. The methods I propose to discuss are the X-rays, the Finsen light, radium, and carbon-dioxide snow; and it will be convenient to consider them first in connection with the conditions in which they have been most used, beginning with the more serious diseases and passing on to affections of lesser gravity.

With regard to growths of a high degree of malignancy, such as

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cutaneous epithelioma, sarcoma, and Paget's disease, I am not of opinion that we can rely upon any physico-therapeutic method sufficiently to dispense with the knife. Five years ago, in a little book entitled *Light and X-ray Treatment of Skin-diseases*, written by myself and Dr. Dore, it was remarked that in malignant disease the rays had "fallen short of the expectations formed of them, and their effect is chiefly palliative or only temporary," and of carcinoma in particular it was said that the method "has on the whole proved disappointing." Later experience has but confirmed that estimate. Nor, in my opinion, can a much higher claim be established in favour of radium. It is still true that, in dealing with the growths I have mentioned, wherever operation is not counter-indicated by the situation or extent of the disease, nor by the age or health of the patient, the counsel which ought to be given to him is that he should submit to excision or amputation. Other methods may, indeed, precede or supplement surgery. They may be employed in advance to diminish the activity of the malignant process, or to consolidate the tissues after the growth has been removed, but they should not be allowed to replace surgical removal. In inoperable cases, of course, no question as between operation and other methods arises. In such cases the X-rays or radium, singly or in combination, are clearly indicated. In some cases of this group in which the growth is deeply seated, surgery may be employed as an auxiliary to radium, by making channels through which radium tubes can be introduced so as to act directly upon the growth. Even if resolution does not follow the use of radium or the X-rays, there can be no question of the efficacy of these agents as palliatives which mitigate suffering and prolong life. With inoperable cases may be bracketed those in which the patient, from fear of the knife it may be, refuses to submit to operation, though strongly urged to do so. These cases are inoperable in a moral sense, and in dealing with them the surgeon has no option but to do the best he can with physical methods.

Finally, there are the cases in which excision involves grievous disfigurement or disabling mutilation, such as would render the patient's life miserable and almost intolerable. I speak of cases of malignant growth in the face, on the penis, etc. In such cases, assuming that there is no evidence of gland infection or of dissemination, the question as between excision and physico-therapy might, I

think, be left to the patient's decision. The case should be put before him beyond the possibility of misunderstanding. He should be plainly told that while excision cannot indeed give a guarantee against recurrence, it offers better promise of a cure than any other procedure. Should he then elect not to undergo operation, I should be sorry to maintain that it is the surgeon's duty to decline the responsibility of treating the case on other lines. Confronted with so dire a choice, the patient has the right, I think, to demand that his decision be respected, even though he does not choose the path of greatest safety.

A case of mine belonging to this last group may be briefly cited. The patient, a man, aged 61 years, came to me from the Antipodes in June, 1909, with epithelioma near the frenum of the penis of six months' duration, following leucoplakia. There was no history of syphilis, and the Wassermann reaction was negative. Advised to submit to amputation, he had declined. On July 12th he had one hour's exposure to radium (25 mg.) with an aluminium screen of $\frac{1}{16}$ mm. On the 13th and 14th I gave him similar exposures with a lead screen (4 mm.), and another on the 15th with the aluminium screen. Thus, adopting the milligramme-hour unit suggested by Dr. Dawson Turner—*i. e.* the product of the strength of the preparation and the length of the exposure—the patient received altogether 100 milligramme-hours. On August 19th the tumour had almost disappeared, and on February 14th, 1910, no trace of it was left. A year later, however, the surface was excoriated, with a slight tendency to ulceration, but with no thickening. In February, 1911, I gave four further exposures (25 mg.) of an hour each, with the lead screen, and the applications were repeated three times in March and eight times in May, at some of the sittings for an hour and a half and for two hours respectively. The result of this vigorous treatment was that the ulcer healed. Slight leucoplakia, however, remained, and it is too early, of course, to say whether the growth has been finally got rid of.

In another case of epithelioma, in a man, aged 82 years, operation was out of the question on account of the patient's health. The growth, situated in the cheek, was oval in shape, measuring 2·7 by 2 by 5 cm., with an ulcerated apex, and there were numerous small nodules of carcinomatous material in the surrounding tissues. The

patient, whom I sent to the Radium Institute, had two exposures—one of 80 mg., with an aluminium screen of $\frac{1}{100}$ mm., for two hours; the other, four weeks later, of 30 mg., with the same screen, for $1\frac{1}{2}$ hours—altogether 205 milligramme-hours. Seven weeks after the second exposure the growth and the surrounding infiltration had completely disappeared.

These cases illustrate the power radium undoubtedly possesses of checking the progress of disease which is in a high degree malignant. But there is one form of malignant growth in which radium alone, or in combination with X-rays, may, if the disease be not too far advanced, be invoked as a curative, and not merely a retarding or a palliative agency, namely, the form of cancer which in the British Isles is known as *rodent ulcer* or rodent carcinoma, but on the Continent is more commonly styled superficial carcinoma. I may briefly recall the peculiar clinical characters of this neoplasm. Persisting for years as a small, hard papule, which occasions no pain or inconvenience, it may presently begin to ulcerate, slowly extending in area and increasing in depth, destroying the surrounding skin and the underlying structures, not even sparing bone, but never infecting the lymph-glands, and never disseminating, nor, as a rule, unless a sensitive structure, such as the eyeball, be attacked, causing considerable suffering or cachexia, until it is near the end of its baleful course. Its malignancy consists in its progressive destruction of the surrounding tissues. Under the microscope the papule is found to be an epithelial new growth beneath the epidermis, of which the continuity is not destroyed. Examination of a section shows the growth to be formed of masses of epithelial cells, most of them elongated or of irregular shape, but those nearest the stroma forming a layer of columnar cells. The cell-nests or "epithelial pearls" which characterise squamous-celled carcinoma are absent, for the cells do not undergo keratinisation. Whether the growth originates in the skin, in the sebaceous or sweat-glands, or in the hair-follicles, is not certainly known, but the majority of pathologists are of the opinion that while it most frequently begins in the basal layers of the epidermis or the hair-follicles, it sometimes has its origin in the sebaceous or sweat-glands. Its place of election is the face, within an area bounded by a line drawn from the top of the pinna to the root of the nose, and another drawn from the lobule of the ear to

the columella of the nose; but it has been met with elsewhere—on the trunk, and at least in one instance on the back of the hand. As a rule single, it is occasionally multiple, and in one recorded case there were as many as twenty separate growths.

The course of this anomalous neoplasm may be divided into three stages. In the first, it is a small button-like growth, with a depressed centre and a hard, raised edge; it is sometimes cystic, but is always superficial. In the second stage the subcutaneous tissue is involved; there is ulceration in the centre of the growth, the edge remaining raised and hard. In the third stage the growth has become a deep cavernous ulcer, and the underlying structures, including periosteum and bone, are involved in the destructive process. Now in the first of these stages, experience warrants me in saying that, as a rule, if no mucous surface be involved, radium may be confidently relied upon to destroy the growth, and to do it expeditiously, so that no trace of it will be left in a period varying from eight to twelve weeks. In cases in this first stage where the area of the lesion is more extensive, frozen carbon dioxide may first be tried, radium being employed if the growth should not be entirely destroyed. The importance of recognising rodent ulcer in this first stage is indicated by the admission I am constrained to make, that the second stage demands surgical treatment. If, however, this be impracticable, on account of the site, or the patient's advanced age or state of health, the ulcer should be treated with X-rays, while radium or carbon dioxide should be applied to the edge. In the third stage all treatment is most unsatisfactory. The case has passed beyond the reach of surgery, while from radium or the X-rays nothing more can be hoped than that the destructive process may be temporarily checked and the pain relieved.

When rodent ulcer occurs on the cheek or in any other situation where there is no cartilage or mucous membrane to be implicated, it is more likely to yield to radium than when it arises on the eyelid or in one of the canthi, on the nose, or on the lip. In one of my cases, that of a woman, aged 60 years, who came to me on February 2nd, 1909, with a rodent ulcer on the right cheek, the growth was of fifteen years' duration, had been twice operated upon, and had been treated with the Finsen light. On February 18th she had one hour's application of radium (25 mg.) with a screen of aluminium and one of india-

rubber, and on the following day another application of the same duration—altogether 50 milligramme-hours. On April 22nd the ulcer had almost disappeared, and on June 10th there was no trace of it and the scar was quite smooth. So far as my knowledge goes there has been no recurrence.

Of the greater difficulty of dealing with this form of carcinoma in the other situations mentioned I have had many examples. In one case the patient, a man, aged 72 years, was sent by me to the Radium Institute. The ulcer, situated in the left ala nasi, was of twelve years' standing; it had been excised, but had recurred, and was then treated with radium, apparently with success; but there was quick recurrence. The ulcer had burrowed between the left cheek and the ala nasi and perforated into the nostril, attacking the mucous membrane. The external portions of the ulcer have healed under the treatment, but the disease is still active in the nasal mucous membrane. Altogether this patient has had as much as 157 milligramme-hours' unscreened radium.

In another case, the patient, a woman, aged 75 years, had a typical rodent ulcer in the inner canthus involving both eyelids. When she came to me, on February 11th, 1909, it was of three or four years' duration, and had been in active ulceration for three or four months. On February 16th I gave an hour's application of radium (25 mg.), screened with aluminium ($\frac{1}{10}$ mm.), and on the following day a similar exposure. On April 28th the ulcer had disappeared, but a small excoriated surface was left which had not healed. On July 3rd the patient had an hour's application, of the same strength to the inner angle of the eye, with a screen of lead (4 mm.). On October 14th there was still a small rodent at the inner canthus, and on the 22nd of that month she had a similar dose with an aluminium screen. On November 2nd there was a small scab. On February 23rd and 24th, 1910, radium was again applied, in the same strength, to the affected canthus for an hour on each occasion. On August 3rd the surface was quite sound, but in November there was a fresh nodule on the edge of the upper lid. On March 7th and 8th, 1911, there were two applications of radium to the nodule, each 25 milligramme-hours as before. On May 3rd a small growth still remained on the edge of the upper lid, which required a further exposure. The case was an inoperable one, in which radium was

clearly indicated, but it cannot be counted among the successes of this method.

I have had cases of rodent ulcer in this situation, however, which have proved less obdurate to radium. I may briefly mention one in which the rodent, a typical one of ten years' duration, in a man, aged 42 years, was deep in the inner canthus of the left eye and implicated both lids. It had been treated with the X-rays and with argenti nitras. On February 13th, 1909, radium was applied for one and a half hours (25 mg.). On the 19th there was a little inflammatory reaction and scaling, and on the 25th a slight scab without redness. On March 10th there was a large scab with profuse epiphora and a slight discharge. On September 23rd the ulcer had healed, and the only trace of the reaction was a small red point, nothing more than vascular, on the inner surface of the lid.

In the cartilaginous part of the ear, again, I have had both success and failure with radium. One case, that of a woman, aged 71 years, who had a rodent ulcer in the concha, was disappointing. After two applications of radium, each 25 milligramme-hours, on June 9th and 10th, 1909, the ulcer entirely disappeared, and for two years there was no sign of recurrence. Then, however, the growth began again, very insidiously, at the edge of the scar. Another case yielded less easily to the remedy, but has not up to the present relapsed. The ulcer was inside the right ear and on the margin of the meatus. Two applications of radium, each 25 milligramme-hours, with screens of aluminium and lead, were given on July 21st and 22nd, 1908. On October 14th the inner part of the ear was not quite sound, and I gave a further exposure of one hour with the same screens. On December 1st and 2nd radium (25 mg.) was again applied for an hour at each sitting with aluminium and rubber screens, in consequence of a slight relapse in the upper part of the growth, and on December 20th, 1909, there was a good scab, with no disturbance of surrounding parts. Since then no further treatment has been required.

In another form of malignant growth, Paget's disease affecting the umbilicus, I have seen the neoplasm completely removed by radium. In one of my cases, that of a woman, aged 35 years, the disease was of four and a half year's duration; it had been treated with ointments, X-rays, and a little radium, but without effect, and was steadily increasing in size. There was a roughly circular patch with well-defined

margin, 5.5 cm. in diameter, with the centre at the umbilicus; it was covered with a flaky yellowish crust, which, when detached, left a reddish, slightly ulcerated surface; there was very little infiltration. The patient had a patent urachus. At the Radium Institute, on August 21st, 1911, she was given one exposure to a plate containing 70 mg. of pure radium bromide for one and a half hours, without a screen; five weeks after this energetic treatment (=105 milligramme-hours) she was perfectly well.

In one of the most hopeless forms of malignant disease, *Mycosis fungoides*, the X-rays have in some cases produced marked improvement, and although recurrence has taken place, radio-therapy is still the best treatment to apply to this most rebellious condition.

In *leprosy* I have found the X-rays of some service. In the tuberculate form of the disease the considerable improvement effected has not been maintained, but in macular leprosy with elephantiasis of long standing, I can report more satisfactory results.

In *Lupus vulgaris* we have one of the greatest triumphs of physico-therapeutic methods. In non-ulcerating lupus of small extent the Finsen light gives the best results. In cases where the lesions are quite superficial, as well as limited in extent, carbonic acid snow may be employed. The nodules seldom disappear under this treatment, although in one of my cases in which there were two nodules, both were completely destroyed by a single application. When the disease is rapidly spreading, even the Finsen light is quite insufficient to keep pace with its advance, and it is necessary to have recourse to the X-rays, which can be applied to the whole or a large part of the affected surface. In some cases, whether the Finsen light or X-rays or both are used, the treatment has to be reinforced by the employment of caustics, such as salicylic or pyrogallic acid. I would range physico-therapeutic methods, in their relation to *Lupus vulgaris*, in the following order of serviceability: First (for small areas), the Finsen light; second (for large areas and ulcerated surfaces), the X-rays; third, the cautery; fourth (for quite superficial lesions), carbon dioxide snow; fifth, radium.

In *tuberculosis of the skin* and *tuberculous glands* I have had excellent results with the X-rays. Radium also is most useful in the latter condition if the glands are small. In one case in which glands affected with tubercle had been thrice removed without permanent

benefit, long exposures of the glands in succession, two hours a day for six hours, with the intervention of a lead screen of 2 mm., brought about their total disappearance.

Lupus erythematosus may be claimed as another of the great successes of physico-therapy. If radium be used, it must be applied in full doses, with only slight screening. But in this affection, for chronic patches, neither radium nor any other method of treatment is comparable with carbonic acid snow. It has been said that zinc ionisation gives better results. With that opinion I cannot agree. I have never used carbon dioxide in this affection, so refractory to ordinary measures, without finding at least substantial improvement, and I have had many chronic cases in which it has caused the total disappearance of the lesions. As a rule only moderate exposure is necessary, and in my experience several short applications with moderate pressure are better than one long one. In *Lupus erythematosus* it is specially desirable to go rather wide of the lesions, so that no morbid tissue may be left as a starting-place for fresh lesions. That the disappearance of the lesions is final it is too early to assert. If, as there is ground for holding, *Lupus erythematosus* belongs to the rapidly growing group of toxic dermatoses, the possibility of recurrence, either on the same or on another site, must be reckoned with. But even so, frozen carbon dioxide is to be regarded as a distinct advance upon the older methods of treatment of this disease, except, indeed, in the early stages, where the lesions are acutely erythematous. In all such cases it is still necessary to employ tincture of iodine or evaporating lotions.

Carbon dioxide snow is helpful in dealing with chronic *X-ray dermatitis* with keratosis, and, as might have been inferred from its usefulness in *Lupus erythematosus*, it has proved to be of distinct service in *rosacea* and *rhinophyma*. In these conditions the X-rays are also beneficial. It has been suggested that CO₂ might give good results in such chronic conditions as old-standing *eczema round the anus* and *chronic patches of psoriasis*. In my own opinion, however, the X-rays or radium are more suitable. The X-rays also have their place in the treatment of ordinary *eczema* and *psoriasis*, in which, the lesions being quite superficial, small doses answer better than large ones. They are also, like radium, most suitable in the *lichenification* which follows many itching forms of dermatitis. In one very refrac-

tory case of lichenification which I sent to the Radium Institute remarkable improvement followed. The patient, a woman, aged 36 years, had suffered for seven years from intolerable irritation originating in a severe nervous attack; she was unable to sleep and was emaciated and neurotic. The lichenified area was roughly triangular in shape, with the apex at the nape of the neck and the base line connecting the spines of the scapulæ. The skin was thickened, rugose, and quadrillated; the margin of the patch was clearly defined. An apparatus, 4 by 4 cm., containing 80 mg. of pure radium bromide, was shielded with $\frac{1}{100}$ mm. of aluminium, and applied for ten minutes to successive patches until the whole area had been treated; the exposures were twice repeated at intervals of four weeks. Under this treatment the lichenification disappeared save for a very small patch at the nape of the neck, the patient's general condition greatly improved, and she gained 7 lb. in weight.

Cheloid (including hypertrophic scar) and *hypertrophic Lichen planus* I have found to be very amenable both to the X-rays and to radium. For cheloid which is in process of formation, or which has but recently formed, radium is the more suitable of the two methods; for large cheloids the X-rays should be used first and radium later. The effect produced by radium in extensive cheloid of the face and hands is illustrated by a case of mine treated at the Radium Institute. The cheloid was a sequel of burns with petrol; the cheloidal tissue was very dense, prominent, and cherry-red in colour. On the face it occupied the position usually picked out by *Lupus erythematosus*; both ears and the right side of the forehead were also affected, and there were large cheloidal patches on the dorsal surfaces of both hands. The treatment was given once every month for five days at a time. At the end of the fourth month the face was almost cured, except for two bands, one on either side of the nose, while the patches on the hands flattened out and became nearly normal. In all the patient received 13,700 milligramme-hours with a screen of 1 mm. of silver.

Pruritus, which is so often the despair of the dermatologist, is frequently beneficially affected by radium, especially localised pruritus, and most of all pruritus ani. In another most rebellious condition, *leucoplakia*, whether syphilitic or idiopathic, I find that radium sometimes benefits when everything else has failed.

The usefulness of the X-rays in *Tinea tonsurans* and *Tinea barbæ* is

too well established to require discussion. But where complete epilation is necessary, as in most cases of ringworm it is, I hold the Kienböck-Adamson method to be far preferable to any other. Five equi-distant points are taken, and in each area the rays are so directed at right angles to the direction of irradiation of adjacent areas, and towards the outer margin of the area, that where overlapping occurs the raying is still only just sufficient to produce epilation. No cylindrical or lead-foil localisers are therefore necessary, an even radiation is secured, the whole scalp is effectively rayed in about an hour and a half, and no unfallen hairs remain as evidence of insufficient exposure. There is no resulting erythema, and re-growth is normal over the whole scalp. In *coccogenic sycosis* and in *Acne necrotica*, again, I have found that radio-therapy yields good results, as it does also in a condition for which it might not seem to be specially indicated, namely hyperidrosis of the axilla. In a nurse whom I treated with the rays for this affection after it had failed to respond to other measures they answered admirably, and when I saw her some months afterwards she was still free from the trouble.

Horny warts may be destroyed by radium, but there is no reason to resort to this method when they can be effectively treated by so simple a measure as the galvano-cautery. If for any reason this treatment is not desirable, they may be got rid of by an application of carbonic acid snow. For a moderately large wart an exposure of sixty seconds is required, a narrow border of healthy tissue being included in the application. A little induration may remain after the wart has become detached, but this as a rule is gradually replaced by normal tissue, and the site of the wart almost ceases to be distinguishable. It is not desirable, in my opinion, to employ the X-rays for warts, owing to the danger of telangiectases and X-ray burns.

For *multiple flat warts* of children, too, carbon dioxide snow may be used, short exposures of about sixty seconds sufficing. I have had good results also with what I may call *tropical warts*, that is, warty growths in a skin which has undergone degeneration from long exposure to the sun in hot climates. Such warts are prone to become malignant, and it is important that they should be got rid of without delay. CO₂ is less suitable for *clavus*, owing to the pain which would be caused by pressure upon the corn, and to the difficulty which might be found in walking until the burn had healed.

Nævi are amenable to quite a number of physico-therapeutic methods—carbon dioxide snow, puncture with the galvano-cautery, electrolysis, fulguration, Finsen light, X-rays, and radium. The least advantageous methods are Finsen light and X-rays, the former because of its tediousness, the latter because of its liability to produce unsightly telangiectases. Radium is effectual in removing the growths, in my experience with but slight scarring; but on the whole I consider the application of cold the method of preference, except in stellate or spider *nævi*, which from their shape and size are not suited to treatment by freezing. For these, electrolysis or the galvano-cautery is the more appropriate; but for the majority of *nævi* freezing is superior to the cautery, electrolysis, the high-frequency current, or radium. It answers better for cavernous than for flat *nævi*, and for cavernous *nævi* of average size than for very large ones. In a case of cavernous *nævus* on an infant's scalp, which I thus treated, three applications were sufficient to cause the entire disappearance of the lesion. The same remedy is suitable for *pigmented* and *hairy nævi*; but if there is much hair the X-rays should first be used, not only for epilation, but also to increase the susceptibility of the tissues.

Having considered frozen carbon dioxide, the Finsen light, the X-rays, and radium in connection with the conditions which they are capable of favourably influencing, I may now make some general and comparative observations upon these methods, beginning with *carbonic acid snow*. The first form in which refrigeration was used for the treatment of cutaneous affections was that of liquid air. Of this nothing further need be said, for the difficulty of obtaining and preserving liquid air made the cost of this method prohibitive, and it never came into extensive use. The substitution of carbonic acid spray for liquid air was proposed and practised by Juliusberg, of Breslau; but it was Pusey, of Chicago, who gave practicability to this method by using the substance in the solid form. Liquid air, it is true, has a much greater freezing power than solid carbonic acid, the temperature of the one being -250° , and of the other -79° (Centigrade); but the intensity of cold in the latter is quite sufficient for all therapeutic purposes. Its advantages are these: that it requires neither a cumbrous and costly apparatus, nor the use of a general anæsthetic, that the duration of its application is measured in seconds, that it rarely causes sloughing or ulceration, that it leaves an excellent scar

and no hypertrophy. Its only disadvantages consist in the severe pain which in a few cases it inflicts, and the inconvenience resulting from the inflammation and blistering that attend the reaction. The pain, however, which varies with the sensibility of the patient and the nature of the lesion treated, in many cases amounts to little more than discomfort, and on the whole is sensibly less than that occasioned by the galvano-cautery.

Being a destructive, not a healing agency, CO_2 is not usually applied to ulcerating surfaces, although it can be used for removing the hard edge of a rodent, or the hypertrophic tissue of an epithelioma. It can be applied also to mucous surfaces when they are accessible. It is specially suitable for small lesions such as warts, moles, limited nævi, lupus nodules, and early rodent ulcer, but not for very minute lesions, since a small point of solid carbonic acid melts directly it is applied. Inasmuch as the effective application of the remedy depends to some extent upon the degree of pressure applied, this method is less mechanical than the other measures under consideration, and there is more scope for the surgeon's judgment and skill. In treating lesions of irregular outline I am not in favour of using a sheet of lead shaped to the individual lesion; on the contrary, it is usually desirable, in my opinion, to go fairly wide of the morbid tissue. Nor do I see any advantage in employing a mixture of ether and carbonic acid snow, for, with Pusey, I doubt whether the skin is frozen more quickly by the mixture than by pure CO_2 . As to after-treatment of the frozen area, nothing more is required than the puncture of the bleb if it should feel tense, and the application of a mild antiseptic dressing. The less after-treatment the better.

Coming next to the *Finsen light*, its advantages are that it requires no anæsthetic, that it leaves no bad scar and causes no disfigurement, and that its effects may be definitely calculated. These are conspicuous merits. But one has to set against them the occasional pain felt during the application, the discomfort and pain involved in the continual inflammatory reaction, and, still more, the almost intolerable tediousness of the treatment, and the heavy expense of outlay and working. These drawbacks are indeed so considerable that, except for non-ulcerating lupus of limited extent affecting the face, other methods are to be preferred.

We may pass on, therefore, to what I regard as the most important

addition which science has made to the surgeon's resources during my professional life, the X-rays. The service rendered by them in diagnosis would alone entitle them to that distinction. But it is with their virtue in treatment that we are more particularly concerned. The difficulties which Schiff and Freund, of Vienna, the pioneers of this method, had to encounter have now, for the most part, been overcome. The ingenuity of Holtzknecht, and afterwards of Sabouraud and Noiré, has taught us how to measure the dosage. There is still, however, risk of pigmentation or atrophy of the skin, and the formation of telangiectases, with the possibility of subsequent epithelioma, where strong or oft-repeated exposures are necessary. Even now it is not possible to measure less than half a Sabouraud's pastille dose by the pastille, on account of the difficulty of appreciating slight differences in tint. Holtzknecht's chromo-radiometer measures fractional doses by a colour scale, but the material of which the pastille is composed is secret, and it is not much used in the British Isles. No milliamperemeter gives an absolutely accurate rendering of the amount of current passing through the tube, and the estimation of doses by the number of impulses is of little service. However, when less than half a Sabouraud's pastille dose is required, time-measurements are sufficiently accurate for ordinary purposes. Filters, such as aluminium, or various solutions, are sometimes used, with the object of cutting off the shorter rays and allowing the penetrating rays to reach the deeper tissues; and it is said that in leukæmia, for example, larger doses can be given without injury to the skin by interposing several layers of felt or some such filtering material. In the treatment of cutaneous lesions, however, I doubt whether filters are of much utility, for a medium tube probably gives all the rays required for superficial conditions, and the interposition of a filter simply necessitates a longer exposure. There are those who hold that when filtration has been placed on a scientific basis, the rays may be so employed as to exert an effective inhibitory action on malignant disease in the internal organs. That is a speculation with which, as dermatologists, we are not immediately concerned. If, as I have said, the rays have not justified the expectations of ardent and sanguine minds in the treatment of the graver forms of malignant disease of the cutaneous surface, it is scarcely possible to exaggerate the service rendered by them in inoperable and hopeless cases. There

is assuagement of pain, there is frequent retrogression, and, in the case of malignant ulcers, a diminution of discharge and of fœtor. Not seldom, too, infected glands and subcutaneous nodules clear up. In such circumstances the general health is improved and life prolonged.

What more I have to say respecting the rays will be said in connection with *radium*. I must not omit to pay a passing tribute to the brilliant woman of science to whose patient investigations as a fellow-worker with her late husband we owe the extraction of this wonderful element, and whose later labours, in conjunction with M. Debierne, have been rewarded by the isolation of the pure metal. Nor must I fail to acknowledge the valuable experimental work of Dr. Louis Wickham in yoking radium to the service of therapeutics. He it is who, by his methods of filtration, has put radium-therapy on a scientific basis, and it is to his acumen and ingenuity that we are indebted also for what he felicitously terms the cross-fire method.

In the volume to which I have had occasion to refer, an attempt was made to estimate the comparative advantages of X-rays and of the Finsen light. Now, the comparison lies rather between X-rays and radium. Speaking generally, the points in favour of radium are these: (1) It is small and portable, while the X-rays involve a cumbrous apparatus. (2) It lasts indefinitely, while the X-ray tubes require renewal. (3) It makes no noise, unlike the X-ray installation, which may alarm children and even adults. (4) The alpha, beta, and gamma rays can be used separately by means of filtration, whereas in X-rays, filtration, as I have said, has not yet been systematised. (5) The cutaneous reaction it produces is more constant than that of the X-rays. (6) It can be inserted into cavities, tumours, etc., and produce deep action, especially by the cross-fire method, and can be left *in situ* for long periods without requiring constant attention, while the X-rays are not easily applicable to sinuses, canthi, or mucous membranes, and require unremitting supervision. (7) Its reaction is easy to control, while that of the X-rays, even under a skilled operator, may lead to sloughing and necrosis. (8) It is less likely than the X-rays to be followed by telangiectases, pigmentation, atrophy, or epithelioma. (9) The quality of the reparative tissue after the application of radium is superior to that after the application of the X-rays. The advantages of the X-rays over radium are: (1) That the outfit is less expensive; (2) that a larger area can be treated;

(3) that they have a more marked influence over mucous membrane lesions; and (4) that they are more efficacious in causing ulcers to heal, whereas radium tends to produce marked serous exudation.

Without pursuing further the comparison between the two methods, two positive advantages may be claimed for radium: one, that it causes no pain, the other that by its selective action it accomplishes its purpose without destruction of surface. I have seen it urged that radium exercises no real selection—that morbid tissue is influenced simply because it offers a feebleness of resistance to the action of the rays than healthy tissue. To me that appears to be an explanation rather than a refutation of selective action. The fact remains, that under the influence of radium certain morbid tissues undergo retrogressive changes and are beneficially modified, while healthy tissues through which the rays have to pass in their journey to the seat of disease remain unaffected. In certain conditions, for example, fibro-sclerotic cicatricial bands, the destructive power of radium may have to be invoked, but in others, diseased tissues can be modified by a reaction which falls short of visible inflammation. That radium, like the X-rays, has not justified all the claims made in its behalf by enthusiastic advocates it would be foolish to deny; but it would be at least as foolish to assert that its therapeutic possibilities have been exhausted, and that nothing is to be hoped from further investigation and experiment.

In conclusion, I would epitomise the earlier paragraphs of this paper by remarking that, either singly or in combination, the physico-therapeutic agencies under consideration, *i. e.* the X-rays, radium, Finsen light, and freezing, are serviceable in the highest degree in early rodent ulcer, in Tinea tonsurans, Tinea barbæ and favus, in Lupus vulgaris and small tuberculous glands, in Lupus erythematosus, in certain kinds of nævi, and in scars and cheloid. In these affections they are superior to medicine, to the knife, or to any other form of surgical treatment. They are serviceable in a somewhat lower degree in later rodent ulcer and in superficial carcinoma. They are also of service, in varying degrees, in coccogenic sycosis, in hyperidrosis and hypertrichosis, in chronic eczema, pruritus and lichenification, and in papilloma, while they have marked alleviative influence in such grave conditions as Paget's disease, deep-seated Carcinoma, Sarcoma, Mycosis fungoides, and Leprosy.