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MODERN ACTINOTHERAPY

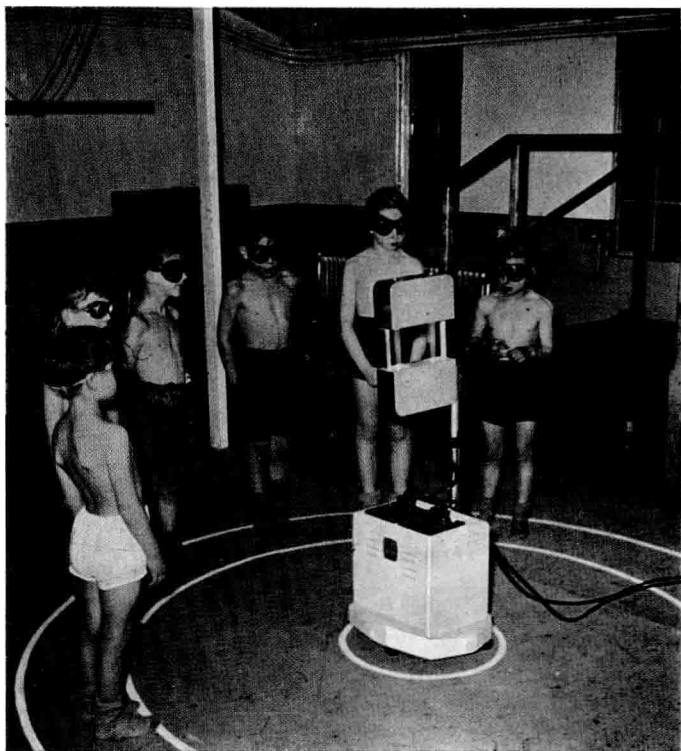
**A review of the literature, giving an
outline of indications and technique**

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Children receiving group irradiation with ultra-violet rays.

(Photograph by kind permission of King Edward VII Hospital, Windsor, and staff.)

[Frontispiece.]

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R. H. B.

PREFACE

- " From inability to let well alone ;
 - " From too much zeal for the new and contempt for what is old ; cleverness before common sense ;
 - " From treating patients as cases ; and from making the cure of the disease more grievous than the endurance of the same ;
 - " Good Lord deliver us." (Sir Robert Hutchison, Bart.)
-

Progress in medicine, as in other forms of human activity in which scientific research is a part, is dependent upon specialization, co-operation and team work. It is not possible for any one individual to follow in detail the development of science in more than one, or possibly two, subjects. A book, or periodical, which is restricted to a limited speciality has both an advantage and a disadvantage. The main disadvantage is that usually it is written by a specialist, is read only by a small number of people and its contents, even if of real value, usually do not become as widely known as one which reaches a wider public.

The main advantage is that, for anyone who wants to keep up-to-date with research and development within this field, such a book, or paper, saves time as well as money providing, as it does, a useful digest of much that is of special interest to him. It was Hughling Jackson, the great neurologist, who said there is no harm in studying a special subject, the harm is in doing any kind of work with a narrow aim and a narrow mind. The power to apply judiciously knowledge, old and new, requires clinical judgment and clinical wisdom.

Actinotherapy is a specialized subject. Raymond Beckett is a modest man but an enthusiast with a mission. He is a specialist who sets out in his book to discuss the value of light in treatment or, in the more technical terms that he

uses, "the therapeutic use of non-ionizing radiations similar to those found in sunlight but produced by artificial sources." He describes his work as a review of the literature and an outline of indications for, and technique of, treatment.

That physical medicine has not only been accepted as a speciality within general medicine but has been welcomed by the leaders of medical thought and practice as a young and dynamic partner was demonstrated clearly at the first International Congress of Physical Medicine held in London in July 1952 with the late Lord Horder as President. Actinotherapy is one of the many methods of treatment prescribed by the physical medicine specialist and used in physical medicine.

In this book, there is much to interest the general physician and surgeon. The specialist, namely the physician interested in dermatology, psychiatry, traumatic surgery, pediatrics and rheumatology and other specialities will find chapters devoted to his particular aspects of medicine. Physiotherapists will also be able to study the detail of the technique that they use or should apply to their daily work. The family doctor, and those interested in preventative as well as curative medicine, the school doctor and the industrial medical officer, will be among those who will be intrigued by the clear picture of the part that this important, even if small, branch of physical medicine can play in modern medical practice.

FRANCIS BACH.

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CHAPTER I

THE CASE FOR ACTINOTHERAPY: AN INTRODUCTION AND HISTORICAL OUTLINE

The purpose of this book is twofold: to show those who are not already familiar with the techniques of actinotherapy just how valuable they can be, and to provide a working tool for those, doctor and physiotherapist alike, who practice it. It is not intended that it should replace the existing works of reference, but it attempts in some measure to epitomize their contents, and to lay down the general lines of technique. These will need adaptation to the requirements of each case individually, since the physician is treating patients, and not diseases, and (in the words of Saidman) "there are as many techniques as patients."

By the term "Actinotherapy" we understand the therapeutic use of non-ionizing radiations similar to those to be found in sunlight, but produced by artificial sources, and dealing particularly on the one hand with ultra-violet radiations of a wavelength less than 3,200 Angstrom units, and on the other with infra-red radiations greater than 8,000 Angstrom units up to 40,000 Angstrom units.

Artificial light therapy had its inception in Neils Finsen's classical experiments of 1893 at Copenhagen, showing that the ultra-violet or chemical rays of sunlight have stimulating and bactericidal effects on the lower organisms, and the vast amount of literature which has been published on the subject since that date, bears witness to the very great interest which has been taken in it. However, following the end of World War II, there has been a tendency in certain quarters to decry the value of actinotherapy on the grounds that previous findings were mainly empirical, and based on clinical impressions, and were not properly supported by scientific evidence.

Present-day medical opinion appears to show many grades of thought, from the frankly antagonistic to the wildly enthusiastic. Midway between these two extremes there is a vague scepticism which comes largely from ignorance, since there is apparently no room in the overburdened medical curriculum for the mention of actinotherapy and hardly any for physical methods as a whole. This book will therefore try to present a balanced view of the value of actinotherapy in medical practice, and the best way in which it can be applied. While avoiding the excesses of the enthusiast, it will seek to show the uninitiated and convince the sceptical that here is a method, another weapon in the medical armoury, which is effective in a variety of conditions, and worthy of further investigation. Since no measure will be thoroughly effective unless it is properly applied, considerable attention will be paid to technique, and where, as is often the case, concomitant measures are desirable, or even necessary, the fullest possible details are given.

Since artificial sources of solar radiation were developed as a substitute for the natural product in temperate climates and smoke-bound cities, it is natural that a statement of the case for actinotherapy should begin by an examination of the history of heliotherapy. It is significant that Æsculapius, the god of Medicine, was also god of the Sun, and that the great health temple erected in his honour at the time of Hippocrates served for the administration of light and water to cure disease, as well as for the pursuit of physical and mental culture. Hippocrates himself prescribed sunbaths for wasted muscles, while another Greek surgeon, Antyllus, recommended sunbaths for the reduction of obesity, and for the treatment of slow-healing ulcers. The Romans made extensive use of solaria, and the dictum of the great natural historian, Pliny "Sol maximum remediorum est," is well known.

As a result of its association with the pagan cult of sun worship, and in company with the whole structure of classical medicine and hygiene, heliotherapy fell into disuse during the early Christian era, and throughout the middle ages, although the Italian proverb "Dove va il sole

non va il medico” probably dates from this period.

The next we hear of sunlight therapy is in the year 1774, when Faure published a work “*L’usage de la Chaleur actuelle dans le traitement des Ulcères*,” in which, among other things, he exposes extensive open ulcers of the leg to the warming rays of the sun.

In 1795, Hufeland recommends the therapeutic use of sunlight in his work “*On the Nature, Knowledge of, and Healing Factors in Scrofula*,” and a year later the University of Göttingen offered a prize for an essay on the following: “*Quaenam, sit lucis in corpus humanum vivum efficacitum noxia tum praetor eam partem, quam in visu agit, utilis ac salutaris.*”

From the year 1815, the number of works dealing with sunlight increased appreciably, and although most of the authors touched only on the empirical side, in 1816 Doebereiner, Professor of Chemistry in Jena, published a work in which the question of light baths is treated for the first time from a physical and scientific point of view.

This book contains some of the fundamental ideas of modern light therapy and a distinction is made for the first time between the effect of light on the one hand, and heat on the other. The following quotation shows an understanding of the principle well known to-day that luminous heat, that is infra-red radiation close to the visible spectrum and accompanied by visible light, is more penetrating than the longer “black body” radiation:

“The sun’s heat is always accompanied by light, and is thus so to speak more ‘inspiring’ and ‘enlivening,’ and therefore more stimulating and penetrating than artificial heat. Sunlight is almost wholly changed by coloured, especially by black, fabrics, so that if one wants to give a heat bath in the sun, it is best to clothe the body in black garments.”

On the purely physical side, it had already been discovered by Herschel in 1800 that at one end of the visible spectrum there are radiations which are not perceptible to the human

eye, but which cause an elevation of temperature demonstrable by a thermometer, while in 1801 Ritter had demonstrated the existence of rays beyond the violet end of the visible spectrum, which could be detected by the changes they produce in silver chloride. These invisible radiations were, aptly enough, named infra-red rays and ultra-violet rays respectively.

In the year 1877, Downes and Blunt made the important discovery that light, especially the rays of shorter wavelength, could kill bacteria, and it was upon this knowledge that Finsen, in about the year 1890, founded his original theory of actinic therapy, using at first natural sunlight. He soon found, however, that it was impossible to rely on sunlight in northern latitudes, and he began to experiment with arc lamps. From experiments carried out in Copenhagen Central Electric Power Station, with the somewhat reluctant co-operation of the Station Manager, the apparatus was developed which for the first time in history was to give hope to sufferers of the hitherto incurable lupus vulgaris.

In 1902, Bernhard,¹ who had already been treating surgical tuberculosis by climatic and dietetic therapy, was moved by Finsen's work and results to conceive "the idea of using the pure mountain air and direct bactericidal powers of the ultra-violet rays so rich in our mountain sun, chiefly for surgical therapy. The immediate cause of this was a large wound with unhealthy granulations and much discharge, which resisted all treatment. The result after a few exposures of the sun's rays was so good that I at once applied sunlight treatment to wounds of all kinds, including at first open and then closed surgical tuberculosis. Here the results were so astonishing that I uninterruptedly busied myself working out the method of scientific foundations."

In the following year, Rollier, at Leysin, began work on parallel lines, which has served as a model for similar work throughout the civilized world. The results achieved by these earlier heliotherapists were so impressive that many practitioners unfortunately working in less favoured climates and geographical situations wished to emulate

them, and thus considerable impetus was given to the search for artificial sources of the solar radiation, particularly the bactericidal and biologically important ultra-violet rays, and much time and thought was given to the exploitation of this new weapon in the treatment of other conditions.

The open carbon arcs originally employed by Finsen were found to be too cumbersome and expensive to maintain to be taken into general use, and as their spectra contained only a small proportion of the sought-after ultra-violet light, very long exposures were required to produce the desired photo-biological effects. An iron arc, which was richer than carbon in the ultra-violet region, was introduced into therapeutics, and a number of variations on the simple carbon arc employing different metallic cores to the carbons were employed.

Arons in 1892 discovered that an arc giving a peculiar bluish-green light could be obtained in a vacuum tube between mercury poles, and subsequently Cooper-Hewitt, an American engineer, constructed the first useful mercury vapour lamp. This produced abundant ultra-violet rays, but they could not be adequately applied as the arc was enclosed in a glass envelope which was only slightly transparent to the ultra-violet. Attempts were made to obviate this defect by using special glasses, but it was not until 1905 that the problem was solved, when Kűch succeeded in fusing crystal quartz into clear pieces, and the first quartz mercury vapour lamp was produced at Hanau in Germany by the Quarzlampen Gesellschaft. The radiation from this lamp is intensely rich in ultra-violet, the spectrum extending to 1,850 A.U. In 1906 the same company introduced the first water-cooled quartz lamp, to which the dermatologist Kromayer has given his name, and during the next few years this was used almost exclusively in surgery, and in treating skin diseases, according to the methods stated by Finsen.

The use of general artificial ultra-violet radiation, particularly that produced by the quartz mercury vapour arc, dates from 1911, when the Alpine Sun Lamp, designed by Bach,

was introduced. This lamp was to become the standard equipment for the general irradiation of the body with ultra-violet rays, and in its most modern form fitted with a high-pressure electronic discharge arc tube, in place of the cumbersome tilt-type burner of the early models, is still in use in the majority of British hospitals, as well as countless others throughout the world.

The Kromayer lamp for local treatment has undergone similar modernization and improvement, and other lamps operating on the same basic principles have been introduced in recent years for special purposes (e.g. the Centrosol lamp (Hanovia) for collective irradiation).

Side by side with the technical development of equipment, an enormous amount of work has been done since the beginning of this century on the medical side, both from the point of view of clinical application and investigation of the fundamental effects of ultra-violet radiation on the human body. An up-to-date library of actinotherapy contains some 4,000 items dealing specifically with, or making significant references to the subject, and harbours some very distinguished names.

Bach, H.,² in his classical work "The Quartz Lamp," first published in 1915, refers to some 130 conditions treated by him with ultra-violet radiation, and the book had run into the twenty-first edition by 1929. By 1933 Laurens,³ in his "Physiological Effects of Radiant Energy," was able to give a comprehensive survey of no less than 926 works of scientific interest dealing with the effect of solar and artificial radiation directly upon the skin, and indirectly upon the functioning of the human body as a whole.

There is considerable variation in the value of these works from a scientific standpoint. Some of the observations made and results obtained have been confirmed by later work, while others have been completely negated, and there is still a great deal of room for further work of reassessment and confirmation. For instance, very recent work⁴ indicates that our whole concept of the nature of erythema caused by ultra-violet radiation will have to be reviewed. This, how-

ever, is not to deny the excellent clinical results which have been obtained by the use of ultra-violet therapy up to the beginning of World War II, and which are still being obtained to-day, though possibly in a more narrow field.

Reference to the works of Russell,⁵ Saidman,⁶ Humphris,⁷ Hall,⁸ and the anonymous symposium "Actinotherapy Technique,"⁹ with a foreword by Gauvain, will show the extent of the claims made for actinotherapy in its early years. Many of the ailments mentioned by these writers can now be more quickly and efficiently treated by the antibiotics and modern chemo-therapeutic substances, but many others in which good results were reported remain as a constant problem to the general practitioner and specialist alike. In certain cases actinotherapy is still the treatment of choice, but in others, largely it would seem because of the prevailing climate of opinion, light therapy has fallen into disuse. It might well be worth somebody's while to take the trouble to look further into these early claims, using the techniques of modern statistical research, in order not only to test the worth of the remedy itself, but also to establish the most effective way of applying it. It is the habitually vague prescription where physical measures are concerned which has probably done more damage to the case for actinotherapy than any other single factor.

A reaction from enthusiasm often takes a violent swing in the opposite direction, and in an age when a spirit of "debunking" is manifestly abroad, there are those who would propagate the view that because a measure cannot possibly be good for all the conditions where benefits have been claimed in the past, it is therefore good for none of them. This is an outlook which, in another sphere, produced the preposterous cult of Baconism. How much, after all, do we know from a scientific standpoint about the effect of aspirin, but what doctor would deny the relief from pain that this remedy can give on the grounds that its use is simply empirical, and that the results cannot be judged objectively, or would deny its value to the rheumatic because it is ineffective against migraine?

The aspect of actinotherapy which has probably caused the

most controversy in recent times is its use as a tonic or prophylactic and there have been many expressions of the view that any effect which ultra-violet can have in this direction must be purely psychological. The negative results obtained by Colebrook,¹⁰ in elaborate experiments carried out in 1944 under the auspices of the Industrial Health Research Board, are often cited in support of this view, yet what in fact did this report prove? This elaborate investigation, involving 3,000 subjects, included one cardinal error which, in the eyes of many experienced actinotherapists,^{11, 12} made the results worthless. In the words of Lehmann,¹³ "To avoid injury and possible overdose, there is an inclination to employ with group irradiation only relatively low intensities and dosage. Such action may lead to a symbolic, ineffectual action." In establishing the dosage that was to be employed, Dr. Colebrook standardized on an exposure which would have been biologically ineffective in all except the most sensitive subjects, the proportion of which would have been small. And then consider the experimental criteria—reduction in absenteeism and incidence of colds. Could anything less capable of objective assessment, and less important from a scientific standpoint have been chosen? Anyone who has had anything at all to do with industrial relationships could have told the investigators that the elixir of life itself would not prevent a vast amount of unwarranted absenteeism. To quote from *The Lancet's* leading article¹⁴ on the subject, "In brief, these findings are that artificial sunlight used in this particular way in this particular population has no appreciable effect on health, as judged by the criteria in this study. They in no way imply that ultra-violet therapy is useless in other conditions, or when more intensive methods are used."

It is a pity that so much time, energy and public money could not have been employed in conducting tests designed to show the more fundamental effects of U.V.R. on human health and physical performance, on the lines of those which Lehmann and Szakall¹⁵ were carrying out on German miners almost simultaneously with the Colebrook experiments. There is indeed a great need for properly con-

ducted investigations into the fundamental effects of U.V.R., so that its use in medicine can be placed upon the scientific footing that present-day thought demands, but let us have experiments that are more specific in their aims, and in which the establishment of an optimum dosage for the individual subject is regarded as of primary importance.

“Official” pronouncements upon the subject of actinotherapy generally seem to be influenced by the results of the Colebrook experiments, but it is interesting to note that while the *British Medical Journal's* expert,¹⁶ in answer to a reader's question on the value of ultra-violet radiation, can say, “In short, the use of ultra-violet irradiation is tending to be confined to dermatology,” authorities like Bach, F.,¹⁷ and Kiernander¹⁸ are still recommending the use of general U.V.L. for its tonic effect in the rehabilitation of spinal injuries and in pædiatrics respectively, and in Glasgow¹⁹ and Manchester²⁰ alone, in the year ending July 30th, 1953, over 34,000 light treatments were given to children for a variety of conditions, of which skin complaints comprised only a small proportion.

No discerning person would to-day claim that actinotherapy is the panacea that an uncritical reading of past literature might make it seem, and like most other methods, it has its contra-indications. Nevertheless, it has not deserved the neglect into which it has fallen in certain quarters, and it is worth while as a close to this chapter to quote the following words addressed by Dr. Charles Cameron²¹ (1951) to a meeting of the Tuberculosis Society of Scotland:

“I wonder how many of you were interested in the development of treatment by artificial light and I wonder how many of you have read Rollier's fascinating book on heliotherapy—this is its title—and know that it was the visit of Axel Reyn of the Finsen Institute to the annual meeting of the British Medical Association in 1923 which started a great wave of enthusiasm for the ultra-violet light treatment of tuberculous conditions. In this country summers are short and sunshine is uncertain. The easy applicability of the artificial product made an instant appeal, and the demand for lamps at first out-