Demonstration

ON

RECENT ELECTRO-THERAPEUTIC WORK,

WITH SPECIAL REFERENCE TO LUPUS, RODENT ULCER,
AND MALIGNANT DISEASE,

*Given before Members of the Glasgow Medico-Chirurgical Society
this Session, being the Third of a Series.*

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DURING the past three sessions I have had the honour of giving a demonstration to the members of the Glasgow Medico-Chirurgical Society, and upon each occasion have tried to convey some idea of the yearly progress which has been made in the treatment of lupus, rodent ulcer, and malignant disease. It is exceedingly difficult at any time to express an opinion upon methods which are still under consideration, involving as this does some attempt at comparative value between the different agents employed. While admitting this difficulty, and being fully conscious of the responsibility, I venture to give this demonstration for certain reasons; amongst others, the large number of workers engaged in experimental research in all countries, the conflicting reports which have been published, the importance of the subject, and last but not least, the interpretations of the meaning of results which have sometimes been misleading even to the extent of raising false hopes in those suffering from the severer forms of malignant disease.

In order to make my meaning as clear as possible, I shall divide the work in the following way: First, the theories involved will be considered; secondly, reference will be made to improvement in apparatus; and thirdly, the clinical aspect of the subject will be discussed.

THEORY.

In my previous demonstrations I have generally thrown some magic lantern slides on the screen, which were intended to represent the ordinary spectrum of light, then by way of comparison others more of a diagrammatic nature, such as those published in the BRITISH MEDICAL JOURNAL of June 6th, 1903. In these latter the relationship which exists between most of the forces we are about to consider could be seen. All these were merely intended to show that one could in a general way indicate a series of forces beginning with the so-called electric waves on the one hand, and passing successively through the heat, light, ultra-violet waves, and lastly the x rays, that is to say assuming them to be transverse waves in ether. The changes in thought brought about by the recent experiments with radium naturally cause us to reconsider some of the views which formerly, for practical purposes at least, were considered quite acceptable. For example, until very recently it has been customary to describe all these as transverse waves in ether, but, to quote Sir Oliver Lodge, every electric current is now believed to be a procession or torrent of negatively charged particles called electrons. Whether, therefore, we now accept the old classification or not, or whatever change our ideas may have recently undergone, it is quite evident that all the forces between these two extremes were not known, and, as has frequently been said when referring to the diagrammatic spectrum, certain gaps had to be filled in. Thus in the diagram above referred to, and published in this JOURNAL, a space was found for such rays as were known under the term Becquerel. Within the last year our ideas of these have expanded, and it is now believed that these are of three different kinds, alpha, beta, and gamma rays, the first of them probably being the only new ones. These three are given off by radium, whilst the alpha rays have as yet only been obtained from polonium, a fact which may become more important for therapeutic purposes.

As I have hinted, the advantages of the above-mentioned diagrammatic spectra may become less, although whatever the result be we must in some way or other group the different forces. Since last year two rays have been announced which are new to us: the alpha rays, which I shall consider when speaking of radium; the n rays, and these may here be considered.

The history of the n rays are exceedingly interesting; and M. Blondlot, in a series of papers (Paris Academy of Science, nine or ten in number during the year 1903), gave the results

of a large number of experiments from the physical aspect mainly. They were first detected amongst other rays coming from an excited x -ray tube, but it was soon discovered that they exist in sunlight and also in electric, gas, and other sources of illumination. Further, they have been discovered in substances such as hardened steel or other metals under severe molecular strain. The discoverer has shown that they are not all of one kind, and he has distinguished n_1 rays. In some respects the latter differ from the former, producing reverse phenomena when applied to substances which the ordinary n rays would increase in brightness. Both rays also seem to produce different results according to the manner or direction in which they fall upon the indicator. At first these n waves were supposed to be placed somewhere in the spectrum below the heat and near to the electric waves, but the most recent investigations would seem to show that they are more likely to be related to those near the violet rays, their mean wave length being something like one-tenth that of extreme violet light. The rays pass easily through aluminium, black paper, wood, and saline watery solutions, but they are arrested by water themselves. They are capable of reflection, refraction, and polarization, and the index of refraction has been determined by means of aluminium prisms. Another curious property is to be noted in the fact that there seems to be a storage or accumulation of the rays in some substances. They are said to cause increase in the length of an electric spark, increased phosphorescence in many substances, and M. Blondlot has described a photographic method of recording changes in the electrical phenomena and brightness of phosphorescence. Another curious statement made about the n rays is the power to increase visual acuteness, and the original discoverer was led to believe that they were capable of acting upon the retina. Other workers have confirmed and added to Blondlot's observations. Bichat has shown that the various n rays act differently when bodies are placed in their path, and he has shown a possibility of selective absorption by different metals. Macé de Lépinay thinks during musical vibration in such instruments as the tuning-fork or siren these rays are given out apart from the molecular strain. Jegou finds that they are given out during the passage of an electric current through wire. Charpentier seems to think they may be transmitted through a metal wire and excite phosphorescence upon a suitable screen at the other end of it, but he considers these are probably not ordinary n rays, and Bichat thinks that the conduction through a wire is much the same as that of light waves passed through a curved glass rod.

Professor Charpentier's studies and papers have increased medical interest in the physiology of the subject. Briefly summarized, he says that rays similar to the Blondlot rays are given out from the human body during muscular and nervous excitement. The rays produced resemble the Blondlot rays inasmuch as they increase phosphorescence, the length of the spark of a coil, the passage through certain solid bodies, and the reflexion and refraction and index of the latter seems to be the same as the n rays. There are various devices in the form of screens for demonstrating their presence. In a letter from Dr. Charpentier he writes to me saying that as a rule most observers prefer absolute darkness, others a relative darkness only, and that the screen should be suitably excited first of all in order to see if there is increase of phosphorescence before or during the application of the rays. He is confident that the rays are not the result of heat, because they develop in a few seconds, whereas the effect of heat takes much longer, and moreover he has satisfied himself that such waves are emitted from animals such as the frog, which may be kept at a temperature from 0° to 10° below that of air. He has studied their action upon phosphorescence of bacteria, which is said to be augmented. Not only are they found in the region of muscles during contraction, but compression of nerves gives the best results, and he selects certain regions, such as the spinal cord over the cervical and lumbar region, for special demonstration. Not only so, but he declares that over central convolutions such as Broca's augmentation takes place while one is speaking. Similar statements are made about other centres in the brain. Further, he declares that mental effect may be observed by others, and the experimenter himself, inasmuch as this causes the fluorescence to augment upon the screen. Lastly, he declares that the rays are complex in nature, and that difference may be got by filtration through different metals.

While many have been sceptical, there are others who have had no hesitation in confirming Charpentier's results. Hence we have Dr. Walsham and Leslie Miller in London stating

that they have been able to pass the rays through books and to discriminate between the result obtained when the muscle is in action and when it rests by the physical results or changes produced on the photographic plate.

From what has been said it will be seen that all investigators do not accept Charpentier's conclusions, and a great deal of sharp criticism and scepticism has been directed in the physical world to Blondlot's original experiments. Many experimenters, such as Schenk, Burk, McKendrick, and Campbell Swinton, have not been able to confirm the results of Charpentier. The last-named states that where he has been able to detect any such phenomena these are explained by other causes than π rays. Lummer of Berlin thinks it is a case of subjective phenomena, or, as he would have it, objective phenomena in the retina. McKendrick, assisted by an able staff of observers, cannot confirm Charpentier's results, and the explanation, he asks, may it to some extent be the result of a change in accommodation. He makes the suggestion that the mental condition of some observers may result in a reaction on the intrinsic muscles of the eye. While these suggestions and objections are interesting, what are we to make of the statement about photographic results? Walsham and Leslie Miller maintain that the difference in the brightness of a screen due to some force emitted during muscular contraction can be detected by the changes upon a photographic film. Having made a large number of screens and attempted to confirm most of the phenomena above described, and having had great difficulty in verifying some of the statements, I was exceedingly indebted to Professor Charpentier for a private communication and screen made by himself. Gaiffe of Paris has also sent me a number of screens, and likewise Leslie Miller of London. Professor Charpentier's letter to me leaves no doubt whatever as to the certainty in his mind of the facts above referred to, and after the demonstration I shall be pleased if some of you will attempt to confirm what has been said by trying the experiments yourself.

Whatever the outcome of these different opinions may be as to the cause or true value of the π rays, they are of sufficient interest to us as showing that there are many more forces or rays yet to be discovered, or, as has been said above, if we attempt to represent them diagrammatically, there are many gaps to be filled in; but many physicists and other investigators are evidently doing their best to discover these, and in time the whole series may be at our disposal.

It may not be out of place here in a general way to classify or indicate the different forces or rays, or whatever we may be pleased to call them, which are now being used in connexion with electro-therapeutics, the methods of demonstrating these, and the agents at our disposal for producing them. There are various forms of electrical or possibly cathodal rays—the alpha rays, which are new to us; the x rays, which many believe to be identical or similar to the gamma rays; heat, light, ultra-violet, and, it may be in the future, π rays. As we shall be discussing the question of apparatus, it is important to notice that the physician or surgeon has to consider a great many different methods or agents for producing these. Thus it may be matter in the form of radium and polonium, or it may be electrical agencies produced by the ordinary continuous battery or thermopile, or obtained from the main or alternating or continuous currents altered by passing through an intermittent coil, an alternating dynamo, some form of Tesla apparatus or high-frequency accompanied by the use of the alternating dynamo. In addition there may be the changes in condition wrought in some of these by means of the Leyden jar, the static machine, the vacuum tube; and, lastly, the ordinary arc lamp may be the source of energy.

All these agents may be made manifest to us by their physical properties outside the body, and under this heading we speak of the chemical, photographic, fluorescent, electroscopic and illuminative properties. Further, it is possible to obtain results upon living tissues such as micro-organic life, and hence we have the bactericidal aspect to consider. On the other hand, some of the most important properties are only seen when they are applied to the living tissues themselves, vegetable or animal, and hence we have to add the physiological. It may be the pathological, so well known to us in the form of reaction or burns, and lastly the therapeutic results.

The almost limitless range of study begins to dawn upon us when we take into consideration any single property above mentioned. Many of these agents, or forces, or rays, have properties which are common to others, yet some give certain results which are entirely absent in others. Again, where

different agents possess similar properties they may vary in degree. Thus a photographic plate may be more influenced by one agent than by another. Some of these agents, such as some of the rays from radium, discharge an electroscope, but heat, visible light, will not, and ultra-violet only does it indirectly. The bactericidal properties vary. Thus the ultra-violet waves, or some of those produced by radium, are strongly bactericidal, whilst others, such as the x rays, are doubtfully so. The importance of this from the therapeutic standpoint will be seen further on in this paper, because the same disease—say lupus—may be attacked, as Finsen does, basing his theory entirely upon the bactericidal effect upon the organisms in the tissues, while a similar result may be obtained by x rays or other agents which many experimenters believe cannot have any influence upon the pathogenic organisms unless indirectly through the agency of these forces which belong to the living tissues themselves.

Speaking from the theoretical standpoint, there can be no doubt that great results may be expected from the light which during the past year has been thrown upon many questions hitherto unexplained, and for this information we are largely indebted to the researches in connexion with radium. Whatever theoretical value this agent may have, we are in all probability destined to learn much about cathodal rays and x rays produced in the ordinary way by means of the static machine, transformer, or coil. For example, no question is of greater importance than the conditions of an ordinary x -ray tube, however, excited, as can easily be understood from the disastrous results which have followed from the application of x rays for photographic or other purposes. In fact, most of the phenomena taking place inside the x -ray tube have hitherto been very imperfectly understood. Let us take one example. If the cathodal stream be really a torrent of electrons travelling at a tremendous speed, the production of x rays, which are themselves probably not particles but waves or pulses in ether, can be much better understood as a result of the terrific impact against the anticathode. But, further, may these electrons not escape from the x -ray tube through the glass itself? That is a possibility which I have long had in view. We know that soft tubes are very apt to cause burns, and most physicists now look on the beta rays of radium as likely to correspond to the cathodal stream in the x -ray tube. In my paper to the BRITISH MEDICAL JOURNAL of December 12th, 1903, I gave my reasons for suggesting that most likely it was the beta rays from radium which caused the well known and destructive dermatitis with which we are all familiar, and not the alpha or the gamma rays. So much was I impressed with this possibility that I made a considerable number of experiments, with a view to distinguishing whether beta rays or cathodal stream could be detected in front of the ordinary x -ray bulb. In these experiments I was much assisted by Lord Blythwood and his assistant, Mr. H. S. Allen, but up till now the photographic results have been negative. The same attempts at magnetic deflection of the cathode rays in front of the tube were tried, as have been found successful in deflecting the negatively-charged beta rays which come from radium. With radium it is easy to demonstrate these phenomena photographically, but, as I have said, it is exceedingly difficult to get a similar result with the x -ray tube. However, we know that if one holds a charged electroscope near the bulb effects by way of discharging it will be got which would rather point to the escape of electrons through the glass. If this be definitely proved it would throw much light upon the burns or destructive effects known as dermatitis. Further, the same theories would explain largely the secondary and obscure rays which are got from the sides of the tube and elsewhere, and which to a certain extent destroy and hinder the fine detail which a photograph when it is mostly due to those x rays that come from the anticathode itself. And, lastly, there is the possibility that the course of the positively-charged ions which are passing in the opposite direction to the cathodal stream inside the bulb will be better understood, and hence greater exactitude in the construction of these, as well as the arrangements for controlling the vacuum, may be expected.

APPARATUS.

During the past year considerable improvement in apparatus has taken place, and this is of great importance. It is necessary to have every part of our apparatus under control of the operator, because he may require constant variations in any force, and the amount of required energy varies in degree and, it may be, in the same patient at

different times. Many operators have suffered from the fact that the apparatus placed in their hands was not at all suitable for constant and prolonged daily work. Hence it is that no part of our armamentarium can be overlooked. A constant source of trouble, for example, was the arranging and the fitting together of the different parts, and for this purpose switchboards were necessary. One of the best I know is that made by Trotter, of Glasgow, and the value of this particular form lies in the fact that, in addition to proper arrangements for measuring the voltage and ampérage of current, the operator has the choice of a great variation in the amount of current both for his coil and motor interrupter. Great improvement has also taken place in the construction of coils, the most important points being greater insulation, variations in self-induction, and means of regulating the condensers.

To those who prefer the influence machine it is interesting to know that improvements in the Voss type have been recorded by Schall and Gebbert. Gaiffe's latest productions for mechanical construction and great simplicity are specially to be noted. Where there is a difficulty in exciting the plates, owing to the damp atmosphere or other conditions, the Wagner micro-plate principle has proved a great boon, and some of their latest instruments, for mechanical construction and attention to details, would be difficult to surpass.

Improvements in interrupters have also been made. Isenthal has a new one called the film brake; Max Kohl and others have improved theirs; Wilkins has produced a good mechanical brake with rotary wheels, the advantage being that there is no mercury used; and the Sanitas Electrical Company has improved the mercury-jet interrupter (Wodals). Simple and in many cases efficient and economical forms of rectifiers for those who have the alternating current have been introduced, Woden's by modification of the Hewitt vapour lamp, and Chaplin lately showed a cheap and good instrument at one of the meetings of the Roentgen Society.

Many excellent forms of tubes have of late been introduced, and amongst those which I have found of value in electro-therapeutics are Siemens's and Halske's and Hirschmann's of Berlin, which will stand the strongest effect of most coils. Queen and Co. have produced most beautifully designed and finished tubes for the same purpose. Cox is also supplying excellent adjustable tubes. Some trouble was experienced in using Cossor's tubes, which he has produced specially for therapeutic work, and the great value of which is to obviate the necessity of masks to protect the surrounding tissues. For the last two years I have tried glass tubes made of English glass, and containing a large quantity of lead for the same purpose. Dean has patented a

similar arrangement within the last year, and Cox, at the suggestion of Dr. Martin of Cardiff, is advertising a similar contrivance.

Perhaps the most interesting developments of all have taken place in the construction of machines for high-frequency currents. Hirschmann, Dean, Isenthal, Cox, and others have made many improvements, and Dean has a large double resonator which is highly valued by many operators. Other makers, however, such as Leeds and Northup, have produced a new form of apparatus to which my attention has been called by Dr. Lenard of Philadelphia. The principle of this machine, like those which I am about to describe, is not that of the ordinary interrupter coil. My own experience has led me to think that the operator should have a greater quantity of energy than hitherto at his disposal, to be used with care, and only when required. Hence I made arrangements where, by means of oil condensers, I get at least 600 to 800 milliamperes.

An old method, but under new conditions, has appeared under the name of Koch's patent, and is sold in this country by Schall. The advantages claimed for the system are greater than when the currents are produced from spark coils with interrupters. The apparatus consists of a switchboard with choking coil, rheostats for the motor and transformer, with the usual accessories and instruments for measuring the currents. The transformer is wound like an ordinary spark coil and greater insulation is required. In addition, a rectifier is employed, so that the discharge from the tubes is uni-directional, and this part of the arrangement consists of a small synchronous alternating current. This is not required when

being used for high-frequency currents however. The alternating current is employed in this system, and when the continuous current is only at the disposal of the operator a dynamo is introduced. Messrs. Gaiffe, of Paris, have, however, also introduced a transformer, using the alternating current, but they require no rectifier. They claim that any possible danger to the operator or patient is entirely removed by properly constructed and insulated cases. As may be expected, the principle lies in using a step up-transformer. The current may be used so as to be in one direction only. There is little or no noise, great continuity of spark, steady illumination. They claim that the effluves from this apparatus are greater than any other, and what is as

important probably, the milliamperage can easily be raised to 1,000 or more at will. It is also said the dosage can be regulated and measured, because the milliamperage and voltage to the current in the tube can be accurately measured. The possibility of doing away with the troublesome interrupter will be a great gain, but I am doubtful, while the new apparatus may

Fig. 1.—Case of epithelioma of nose reported in the **BRITISH MEDICAL JOURNAL** of June 6th, 1903, radium failed to effect cure; result after 2 months' x-ray treatment.

Fig. 2.—Sarcoma of neck: radium introduced and left to act on tissues.

be of great use in high-frequency currents, if for x -ray work generally and more particularly rapid or instantaneous photography any of these will compete with the results obtained when a strong coil and a powerful interrupter like the Wehnelt is used. In all work of this kind great quantity of energy is the essential thing, a principle which I first laid down in 1896 to the Royal Society of Edinburgh, and nothing has caused me to change this view whether we apply it to photographic or therapeutic work.

RADIUM.

Everything to be said of the last agent, radium, and the forces to be obtained from it, is included in the history of its discovery and the researches in connexion with it since that event. Most of the physical properties will be found in my paper to the *BRITISH MEDICAL JOURNAL* of December 12th, 1903. Since then, however, our knowledge has increased, and I intend, therefore, to demonstrate most of the phenomena by means of which we are able to distinguish it. First of all, let me say that good specimens for therapeutic purposes are even more difficult to find than six months ago. I have brought here a large number varying in radio-activity from 40 units to 2,400,000, measured by means of Curie's instruments. The different effects of these from the physical aspect should always first be tested when a specimen is obtained, and for this reason I am showing you the effects of different more or less pure salts upon barium platino-cyanide, potassium platino-cyanide, Willemite screens. I consider the test of induced radio-activity upon sulphide of zinc screens of great importance, and likewise the penetration of a given specimen through wood and different metals, and these things I will now show you. Another test of these specimens, the most delicate of all, will be demonstrated by means of the magic lantern, namely, the discharge of an electro-condenser.

For therapeutic purposes it is important that we should refer particularly to the alpha rays, which may be small portions of helium, each weighing about 1 per cent. of the radium atom, and which are calculated to travel at least at the rate of 20,000,000 metres per second. Now, the important thing to note is the fact that they are easily stopped by air, thin layers of substances, such as mica; hence they are not likely to be the active agent in most of our therapeutic experiments. They discharge a condenser, are positively charged, and strong magnets cause deviation of them. Photographs of this phenomenon I have brought with me, and will show upon the screen. The beta rays are of still greater interest to us, because everything since my last paper tends to confirm the view expressed therein that these are probably the strongest rays for therapeutic purposes. They are much smaller than the alpha, are travelling at a greater velocity—100,000,000 metres per second, it is said; they are negatively charged, easily deflected by the magnet discharge condensers; but what is most important from our standpoint is that they possess great penetration. The gamma rays are by most observers considered identical, or at least resemble, the x rays. They are possibly produced by the beta rays or cathodal stream striking against the radium itself or surrounding objects. They possess the greatest penetration of all, carry no electric discharge, and cannot be deviated by the magnet. Inasmuch, however, as the quantity from a given specimen of radium is very small the question naturally arises, Do they have much effect physiologically or therapeutically?

Since the paper I referred to above we have learned much more about what happens to these radiations, and as the state-

ments about them possess a therapeutic value, let me sum it up in the following way: Rutherford and Soddy, while experimenting, got something luminous, which they were able to collect. This was found to be a gas, inasmuch as it could be condensed. Now Ramsay had long ago found helium in pitchblende, and he and Soddy collected this gas, removing the oxygen and hydrogen chemically. The gas which remained contained carbon dioxide, and this was frozen out by liquid air, and the resulting gas gave a spectrum corresponding to that of helium. This element is itself inert. It is not, however, to be found in radium, hence it must have developed. These experiments have given rise to all the statements bearing upon the splitting up of elements into simpler ones. The results from our standpoint are important, because it has been suggested that inhalations of radium or thorium may be used as inhalations in tuberculosis and other affections of the lungs. The apparatus for this I am now showing you in three different forms, one designed by myself, and the other supplied by Mr. Isenthal, and at present experiments are being conducted on these lines in the Royal Infirmary here.

There is nothing of great moment to be added to the physiological and therapeutic effects of radium referred to in my last paper, such as burns, the destruction of lower animals,

and the effects upon bacteria are still under consideration. Lord Blythswood has discovered the radio-active principles in Bath waters, and the Hon. Mr. Strutt has demonstrated the presence of radium itself. The question as to the possible difference between waters obtained direct from the spas and those preserved being due to the presence of such conditions in the one case and lost in the other, may here be noted.

In my last paper I gave the results obtained up till that date by a large number of workers in this country and on the Continent, and there would seem to be no doubt further experiment shows that some of the rays from radium possess therapeutic value. Moreover, the fact that it can so easily be introduced into cavities, and that it is simply applied, would fain lead us to hope that it would prove of greater value than has been found to be the case in the result so far recorded. As yet in my own experience, for reasons mentioned already in this paper, it is not likely meantime to displace any of the agents we have been referring to. In my last paper I

described a case in which radium had failed after a very fair trial, and this is reproduced here with a successful result after treatment with x rays (Fig. 1). There is another method of applying radium to which I shall now refer. It has been suggested that it might be possible to introduce the agent in small quantities to the interior of deeply-seated tumours, and with this object I made the following arrangements. An ordinary gold cannula was plunged into the tumour by means of a trocar, an aluminium rod with a slight cavity in the end and a suitable cap to it, so as to contain the small quantity of radium, was pushed through the cannula and left to act upon the tissues. The aluminium projected beyond the gold cannula a sufficient length to allow the full action of the radium upon the parts. The case is one of sarcoma of the neck, quite inoperable, and it has now been fourteen days in the tissues (Fig. 2). So far the result has been to cause some sloughing of the mass external to the radium. What the ultimate result may be I cannot say, but it will most likely be placed before you at some future time.

DIFFERENT AGENTS COMPARED.

While respectfully submitting the following opinions, I may in the first place refer to the question of radium. In

Fig. 3.—Lupus; before x rays applied.

the first place, there can be no doubt that many workers have shown that therapeutic results have been got in cases of lupus and rodent ulcer; but the use of radium for ordinary purposes, however, the agent is not in the meantime likely to displace those which I am about to mention. Whether we attribute this to the fact that the amount of energy at our disposal, even with a fairly large quantity of radium, does not anything like represent the energy to be got by the Finsen lamp or spark coil, or whether the specimens used have not been of sufficiently great radio-activity or not, the fact remains as has been stated. Many workers are now engaged in experiment, however, and we must wait for further results before attempting any comparison. For introduction into cavities it, of course, possesses an advantage.

Apart from radium we have the light treatment, high-frequency currents, and x rays to consider and compare. I intend to limit the discussion meantime to the application of these forces in the treatment of lupus, rodent ulcer, and malignant disease, as where one of these agents has been employed with benefit the other two can also be shown to have had some success. I shall first of all take up Finsen's method—the oldest. In order that I may be as just as possible in my criticisms to Finsen himself, let me first of all say that no one who has read his most recent work on the subject, and who has seen the magnificent results represented in the large series of photographs reproduced in his book, can fail to testify to the success of his treatment. I shall now throw upon the screen twelve photographs of these in order that you may judge of the results for yourselves. Unquestionably the main drawback in this treatment is the long time required to effect a cure. Notwithstanding all this, there is a tendency on the part of many to question any supreme advantage in this method of treatment over that of x rays. I find that in a large number of instances in this country where Finsen's treatment has been tried there is a great disposition to trust more to x rays, and sometimes to high-frequency currents, than to the arc light. Further, any one reading the reports of different societies—particularly where discussions have taken place upon skin diseases—will see that the results in many hands have not been so successful as in those of Finsen himself. Another strong feature to be noted is the fact that with a smaller lamp—such as the Lortet-Gounod—the results have not been as good as with the large lamps. On this point it may be of interest to quote a communication which I have had from Professor Finsen himself. He maintains that his results are better than others because of his large lamps, and that the only advantage of the small ones is cheapness. He gives longer sittings, and from all reports I think it should be added he gives greater attention to the details than some operators. For a single patient lamp he tells me that the Finsen-Reyn is almost as good as the large one. This opinion, when carefully looked at, simply means an expression of comparative merit between different apparatus employed for the production of light and the manner in which they are used, but it gives no opportunity of comparing the light treatment with others, such as the x rays. A most serious difficulty in connexion with his method will be found in an interesting paper by Dr. Hans B. Christianssen in the *Journal of Laryngology* for October last. This gentleman has been appointed oto-laryngologist at the Finsen Light Institute, and the necessity for such an expert will be seen when it is stated that he found three-fourths of a thousand lupus patients treated during the past six years to be suffering from lupus

vulgaris of the mucous membranes. Now, if this lupus should be anywhere near the orifice it is possible to apply Finsen's light, but the author says the light treatment can be used only in lupus of the mucous membranes of the anterior parts of the nose or mouth, and if not they are forced at Finsen's Institute to resort to other means of treatment. I am bound to confess to a certain amount of disappointment in reading his paper to find that the galvano-cautery is said to be their chief resource.

No reference is made to any attempt by Dr. Christianssen or others to apply high-frequency or x rays. In such hands and under the direction of Finsen himself most favourable comparative results might have been obtained. These two agents may have been tried, but the author does not say so. It seems rather strange that, whenever the disease passes beyond the region where Finsen's apparatus can be applied, he and his assistants should resort to the galvano-cautery, iodine, and other solutions—or in plain words to methods of treatment which were in vogue long before any of the newer methods. This is all the more extraordinary when we consider his own statement that three-fourths of the cases had disease in the mucous membranes of the nose and throat, and this statement is still more striking when we consider

that other operators have had a considerable amount of success with x rays and high-frequency in the nasal and buccal cavities.

I have made inquiry at the Glasgow Royal Infirmary, and find my colleagues in the electrical department are employing Finsen's light treatment less frequently than the other, and, as far as can be judged, with no appreciable loss or disadvantage to the patients. I have often used the light treatment, and in cases where the disease passed from the nares on to the face have had experience of both regions, internal and external. Perhaps for the reason that most of my work has been in a special department of surgery, and the most of the cases under my personal observation being lupus of the nose and throat, I have come to the conclusion that, for my purpose at least, the x rays are more useful. Sometimes the static machine or high-frequency currents have been selected instead.

When we come to the question of high-frequency currents, it seems difficult to get as definite statements as are quoted above when speaking

of light treatment. I am quite aware that many experimenters, many of whom probably have only one agent at their disposal, find high-frequency of great use in lupus and rodent ulcer. It is not to be forgotten, moreover, that high-frequency currents have been more in evidence before the public, at least in connexion with experimental research, in the therapeutics of malignant disease. Judging from these workers with whom I have come in personal contact, I should say that the most striking results in lupus, rodent ulcer, and superficial epithelioma have so far been obtained by means of the excited x -ray tube. Where an operator has asked my opinion as to the most useful of these agents in these three affections, and where he has only been desirous of selecting one, I have of late suggested x rays in preference to the other two. On the other hand, in hospitals and in fully-equipped private laboratories, remembering, as one must do, the magnificent results of Finsen above referred to, and the claims of those working with high-frequency apparatus, there is no reason for thinking that further experience can be dispensed with. Much requires to be done yet before any truly valuable comparison can be attempted. I will not here attempt to compare these three methods with surgical procedures, but I think it is only

Fig. 4.—Lupus; after treatment with x rays.

fair to say that in lupus many cases which had been operated on by surgeons with only temporary success followed by recurrence, have come under my observation, and been apparently cured by means of the *x* rays without recurrence for a longer period than by surgical procedure. I make no reference here to the after-effects for the simple reason that the cosmetic value of *x* rays is generally admitted. Speaking of rodent ulcer, there is one observation which I desire to make with regard to surgical procedure, and that is that I dread nothing more than taking up a case which has passed through the surgeon's hand. I will now show you a number of cases of lupus and rodent ulcer treated by me, leaving you to judge of the results, and the least successful are one or two rodent ulcers for which the surgeon had first operated. In two cases I have had absolute failure, and there the parts had been previously surgically removed. I deem it of supreme importance that those parts of the tissues which are necessary for the reproduction of epithelial structures should be as little interfered with as possible. Even in an ulcerated part there is often enough tissue left by nature to give a start to the new process; but where the skin, subcutaneous tissue, and it may be the bone below, have been completely removed, the results are most seriously interfered with. I shall reserve all reference to malignant disease until further on in this demonstration.

Probably no more important question can arise than that of recurrence, but of course this applies to surgical and all other procedures. In a large number of cases the word recurrence is a mistake. It simply means that the whole disease had not been removed before the patient was dismissed. In lupus and rodent ulcer the patients if at all possible, should be kept under observation for long periods after the disease is supposed to be healed, and they should be warned that if any other illness such as influenza or debilitating affection supervene, the diseased parts should be carefully looked after until all weakening constitutional effects have been removed.

CLINICAL RESULTS.

I shall first refer to the results obtained in lupus because they will not occupy much time. There can no longer be any doubt as to the value of Finsen light, *x* rays, and even high-frequency in this affection, whatever may be the preferences of different operators. The cases to which I referred in last year's demonstration have, after twelve months' further observation, confirmed all that was claimed for them a year ago. Similar results are being obtained in every centre where well-equipped hospitals have been carrying on experiments. Here at least there is a growing tendency on the part of medical practitioners to send their cases to our hospitals, and many who have hitherto preferred surgical interference are giving one or other of the newer methods a fair trial. Of this we have abundant evidence in the number of patients presenting themselves for treatment at the Royal Infirmary. In not a small number of these surgical aid has already been obtained. I will show you a series of photographs upon the screen to illustrate these, and will take one or two special examples to illustrate what I have been saying. The patient to whom I am specially calling attention had been nine years ill, had been operated upon several times, and you see the results after three months' treatment with the *x* rays (Figs. 3 and 4).

Passing to the consideration of rodent ulcer, let me again remind you of the importance of keeping such cases in a class by themselves. Special reference was paid to this in my paper to the BRITISH MEDICAL JOURNAL on June 6th last. By way of emphasizing this let me point out that during the

past year I have had an opportunity of collecting over 100 papers upon this subject, and in a large percentage of these it was abundantly evident that what the authors referred to as cancer, epithelioma, and carcinoma were really cases of rodent ulcer. In consequence it is impossible at present to classify the results in a satisfactory way. The whole history of the affection is so different from what is ordinarily termed cancer that it is unfair to consider it as such if we are to give the profession a genuine idea of the value of any of our recent electro-therapeutic methods. I will throw upon the screen a series of pictures of such cases, and will again select one of the face and nostrils as typical of the results of *x* rays (Figs. 5 and 6). The same remarks which I made about lupus apply to this affection. The results from different quarters are ever becoming more encouraging, and there is an increasing number of patients presenting themselves or being referred to the electrical departments by the medical advisers.

Passing to the much more serious question of malignant disease proper, let me first say that even here some more definite classification is advisable than some writers seem to think necessary. For example, epitheliomata of the face or superficial parts, or even recurrence after operation in parts

which the surgeon can reach by such means, are not to be placed in the same category as malignant affections deeply seated in the viscera of the thoracic or abdominal cavities. Of course there are regions within cavities, such as the nose, throat, and uterus, which do not quite come under either of these two classes, and which, occupying as they do a sort of intermediate position, may fall into the category of those which can be treated with some prospect of success, and those in which little or no good can be obtained. The effects in a number of these cases I will now show you. In the first of these, a patient aged 70, you will see the results of *x*-ray treatment carried on for five weeks. This patient refused surgical interference, and came specially for *x* ray treatment. I personally recommended him to allow me to excise the tumour, but he selected this agent. The disease had lasted for seven or eight years, but had only taken to rapid growth within the last twelve

Fig. 5.—Rodent ulcer of 20 years' duration.

months. The glands were not enlarged. Let me select another case from the photographs shown and one which was published from my former papers. In this case an undoubted epithelioma which occupied the whole interior of the nostrils, and was of three or four years' duration, has entirely disappeared. There was no glandular enlargement in this case either. My colleague, Dr. Riddell, recently showed a case of mine from the Royal Infirmary, Glasgow, in which a sarcoma rapidly growing and filling a large portion of the left nostril has entirely disappeared. I have more than once at this Society brought under observation several cases of malignant disease of the mamma in which recurrence had taken place more than once after surgical operation, and in which the neoplasms, undoubtedly malignant as diagnosed by the surgeons and after microscopical examination, had disappeared under *x*-ray treatment. Such cases are typical of those which have given rise to the hopes that one or other of these agents, more particularly *x* rays, would cure cancer, but another year's experience has more than confirmed what I have already said, that the serious deep-seated affections which in the public mind at least may be considered synonymous with the word cancer, have so far baffled us. The problem

remains to-day as great as ever. Many suggestions have been made whereby we may be able to try to pass the agent through the normal tissues without doing harm to them, and so attack the diseased tissues at a distance from the surface. For this purpose the penetrative rays alone should promise the best results, and probably by ionization. Considering that we know so little about how these forces act it is not to be wondered that the best agents to be introduced into the tissues are not easily named. If one were quite sure that in cases of superficial mischief the results were due in any way to ozonizing of the air, then the introduction of oxygen in gaseous or liquid form might be tried. Salts of quinine and other agents have already been tried, either by absorption through the alimentary canal or injection into the tissues, but all this work is so far experimental at present.

At this time all we can say is that however much we may regret it, complete removal of the disease at the earliest stage possible by the surgeon is the only safe and genuine recommendation to patients suffering from malignant disease at present. There is no reason, however, why in many instances this should not be followed up by treatment with the x rays, with a view to the prevention of recurrence.

When tumours, especially those that can be reached, have passed the aid of the surgeon, there can be no doubt in many instances of what I have previously stated in former demonstrations about palliative effects, the stimulation of ulceration to healthier conditions, the removal of bleeding surfaces, and offensive odour, and a general amelioration of the patient's condition. In a number of cases of affections of the throat, more particularly in the regions of the tonsil, from actual observation I am inclined to think that we are justified in claiming a prolongation of life. Of course it is only fair to state that just as in all other methods of treatment recurrence may take place, and permanence of beneficial results, even in superficial cases such as I have shown you to-night, cannot be claimed until more time has elapsed.

There is one supreme difficulty which all workers feel in experiments bearing upon the treatment of malignant disease, and that is the want of definite knowledge about its etiology. We have seen how much weight Finnsen gives to the presence of micro-organisms in lupus, and, whether we agree with him or not as to the possibility of directly destroying these organisms in the living tissues, and whatever his admirable results may be due to, the fact remains that there is a definite sense of satisfaction, when working with such an affection, as long as we accept a pathogenic cause. Unfortunately, the same cannot be said of malignant disease, and, when criticizing recent methods of treatment, some say the only satisfactory way to approach the subject is from the etiological standpoint, and to an extent it may be admitted this is true. The history of medicine, however, shows that we have in the past been forced to seek relief in many affections, such as syphilis and malaria, without a knowledge of cause. A careful study of the most recent work upon the etiology of cancer only shows us how little is at present known. One of the ablest contributions to this subject of late was the Bradshaw lecture delivered by Henry Morris, and published in the *BRITISH MEDICAL JOURNAL* of December 12th. In a masterly review of the most important theories he deals specially with the microbic theory. The schizomycetic, psorospermic, and blastomycetic theories are all advanced, but he dismisses the possibility of such in the following language: "In short, neither fission, fungus, yeast fungus, nor psorosperm—neither bacterium, blastomycete, nor protozoon—has up to the pre-

sent moment been satisfactorily shown, in spite of years of patient study by many skilled workers, to be in any sort of casual relationship to these diseases."

The same number of the *JOURNAL* contains a paper by Mr. Plimmer which shows that the last word has not yet been said about the possible parasitic theories involved, and this writer ably deals with the prevalence of the disease in certain districts due to possible local conditions. The writer closes with an able advocacy of all the views in favour of the parasitic theory and a description of certain bodies to be found in the tumours themselves. Mr. Henry Morris falls back upon the tumour-germ theory of disease for which we are indebted to Cohnheim and Durante, and so much is he impressed with it that he makes the following statement; "There is one theory which is more consistent than any other with all that we know about malignant diseases which fully explains the origin of very many non-malignant tumours, and is, I believe, destined to be accepted as the true explanation of the genesis of malignant new growths."

Curiously enough, practically at the time these words were being spoken a paper was offered to the Royal Society by Professor J. Bretland Farmer, F.R.S., J. E. S. Moore, F.L.S., and C. E. Walker. The whole value of their work depends

upon the accuracy of the observations made, and doubtless these will be tested and confirmed or otherwise by many observers in the future. Briefly stated, these gentlemen find that the malignancy of tumours is intimately connected with the conversion of the small somatic cells of the body into reproductive, and they describe the similarity existing between malignant tissues and what is found in the sexual reproductive glands, the terms gametoid and gametogenic are used. They first of all trace the changes which take place normally in the cell during proliferation. They describe the process of the somatic division and the heterotype, and come to the conclusion that in malignant disease the cells of tumours which resemble the reproductive elements are characteristic and are not found in benign tumours, but are due to the conversion of somatic cells as the result of a stimulus of a kind they admit is at present unknown. The authors make a special point of the fact that the cells which undergo these changes must in no sense be considered embryonic

Fig. 6.—Rodent ulcer after treatment with x rays for 2 months.

because they are somatic in character, the cells possessing the potentiality of the normal number of chromosomes and exhibiting them during division. There are some very striking sentences in their work. For example, they say it is a fact of the highest importance when once the heterotype division has supervened all the descendants of that cell retain the reduced number of chromosomes in normal cases. The importance of this in view of those who seek for the introduction of micro-organic life to produce the stimulus which brings on activity and by the reproduction of the organisms to continue that activity, or, in other words, to constantly reproduce the cause, cannot be overlooked.

According to these writers, "The essential features wherein this heterotype mitosis differs from those of the body or some of the organism (whether plant or animal) as well as those in the cell generations of the reproductive tissues that have preceded it, are as follows: (1) The period of rest and growth; (2) the chromosomes where they are formed from the resting nucleus are present in only half the number of those occurring in the rest of the dividing nuclei of the organism; (3) the forms exhibited by these chromosomes are strikingly different from those of other nuclei; they produce figures resembling loops, rings, aggregations of four heads, and so on.; (4)

their division on the spindle is transverse and not longitudinal.

The subject being of great interest the following explanation made to me by Professor Farmer himself is important. In a letter he says: "The conversion of somatic cells as the result of a stimulus of a kind as yet unknown. This is a familiar conception to botanists, by whom the sharp distinction between somatic and reproductive or gametogenic elements has never been recognized. Perhaps the reason why it has not been so admitted by many zoologists is due to the pathological consequences of its occurrence in animals in which the tissues are more definitely destined to particular ends than is the case with plants. Without committing myself to a definite formulation of an opinion, I might suggest that possibly all cells are potentially reproductive—as philogenetically they certainly are—and that the somatic characters impressed on the majority during ontogeny conceal, but do not entirely abrogate, this potentiality, which might thus be reawakened under appropriate conditions." The observation applies to carcinoma and sarcoma. If these observations be correct, then the need for explanation in an embryonic cause of tumours would disappear, because, amongst other reasons, if the ordinary somatic cells can undergo this reduction, then it is unnecessary to seek for embryonic tissues at the seat of the tumour, either by inclusion or post-natal processes.

In Mr. Plimmer's paper he says, in conclusion, that the only hopeful outlook in cancer would seem to rest on the ground of the parasitic theory. Without venturing into the realm of prophecy let me say that we would fain hope that malignant disease will one day be commanded whatever its cause be, parasitic or not. A careful examination of what is seen macroscopically as well as microscopically when treating malignant disease by means of the *x* rays tends in some small way to confirm this. In cases where I have examined the tissues microscopically, and even in instances where specimens have been sent without any history to the pathologist for confirmation of my own observations, I have received abundant evidence of a destructive influence upon the diseased cells, as evidenced by the disappearance of the nucleus, the body of the cell itself, degeneration and absorption to be followed by healthy tissues to fill in the gaps. Clearly, therefore, we have evidence of forces existing in the tissues which can cast out the neoplasms under certain conditions, whatever be the cause. We may also ask here what is the meaning of the inflammatory surroundings and other infiltrations which are not of the nature of the neoplasm itself, but which are so abundantly present wherever we have malignant disease invading healthy tissues. The very ulceration accompanying all this is evidence of some attempt to cast out the diseased part. A few years ago before the etiology of tubercle was under-

stood, who would have believed what is now known to be an accepted fact in connexion with the affection—namely, the large number of people who have been affected more or less in some of the tissues of the body at one time or another during life, and in whom nature has evidently been able to arrest the disease? May the same thing not possibly occur in malignant disease? If the true history of the human race were known, is

it impossible to conceive that infection may take place to some extent in a number of instances, and that this is controlled by the natural forces to which we are referring? In other words that those cases which come under the observation of the physician or surgeon are the cases in which, for some reasons at present unknown, resistance to the invasion of the disease has not been sufficient to arrest its progress.

In all the demonstrations which I have given here I have never claimed more than has been justified by the results. Notwithstanding the great work which is yet to be accomplished, I am more hopeful than ever that some day malignant affections will be commanded, and this view is largely founded upon what one can see from careful examination of the results even in the worst of cases, when patients are undergoing such treatment as we have been describing to-night.

Fig. 7.—Epithelioma of lip at beginning of treatment and one month after.

Fig. 8.—Epithelioma of lip after 2 months' treatment.

THE Health Bureau of Rochester, N.Y., has decided to treat pneumonia as an infectious disease, and to ask physicians to notify all cases. A new map is to be placed in the Health Office upon which are to be designated, by means of pins, all cases of pneumonia and the sanitary conditions accompanying them.

A TOOTH IN THE TRACHEA DURING ANAESTHESIA.—A case of interest in relation to the treatment of patients in difficulty under anaesthesia has been noticed in a German contemporary (*Salin, Zentralbl. f. Gynäk.* No. 11, 1904, p. 375. The original was in *Hygieia*, F. II, Jahrg. 2, 1902, October); it occurred in Sweden. A patient suddenly ceased to breathe during a supravaginal hysterectomy for fibroid. Artificial respiration and manual pushing forward of the lower jaw proved ineffectual; the anaesthetist therefore opened the mouth forcibly with a wooden spatula. Something was heard to snap, but no broken tooth could be found. The patient began to breathe well, and the operation was concluded. For a few days all went well, then the patient discovered that she had lost a tooth. On mention being made to her of the acci-

dent, she declared that she could feel the tooth in her throat. Later on she thought it had stuck in her chest. On the sixteenth day after the operation she left her bed. On the nineteenth the temperature went up to 102.2°, and coughing set in. At length during a violent paroxysm the missing tooth was coughed up. The fever and coughing at once ceased.