An Address

ON

WAR LESSONS FOR RADIOLOGY.

DELIVERED BEFORE THE ELECTRO-THERAPEUTIC SECTION
OF THE ROYAL SOCIETY OF MEDICINE.

BY

C. THURSTAN HOLLAND,

HONORARY MEDICAL OFFICER, ELECTRICAL DEPARTMENT, ROYAL
INFIRMARY, LIVERPOOL, ETC.

WHEN war broke out so suddenly in 1914 no one recognized the strain it was going to impose on every branch of the service. The rapidity with which one event followed another upset all calculations, so that measures taken to deal with conditions as they arose rapidly became obsolete, and others had to be improvised to take their place. In July, 1914, the schedule of army x-ray apparatus was practically that which had been in use during the Boer war, and few or no army medical officers were expert in x-ray work. No extra pay was granted for such work, and there was no special organization in the medical branch of the War Office to deal with it.

While it has been easy to criticize War Office administration adversely, it should be remembered that there had been nothing in previous wars, nothing in the army work during peace, and nothing done by any radiologist in this country to suggest to the authorities that an elaborate department should exist. The radiologists themselves had not realized what would be the necessities of x-ray work in a great European war.

Criticism of the War Office, though it found expression early, was more justly directed to want of action at a later date. Long before 1917 it had become evident that x-rays were a prop on which much of the successful war surgery was being built up. Surgeons, especially the younger ones, were everywhere realizing that efficient x-ray work was essential to them; and yet, down to this time, and indeed even later, nothing had been done officially to ensure that the x-ray work, equipment, and organization should be controlled by an expert board or committee, and that the whole control and management of this branch of medical work should be in expert hands. It is in this direction that the permanent medical staff of the War Office failed badly. I recognize of course that my friend Sir Archibald Reid (Captain Reid then) had been attached to the War Office in an advisory capacity as early as November, 1914, and that later on certain physicists were called in to help him, and a small committee was formed. I recognize also very fully the splendid work he did for so many years, and rejoice in the honours which have been conferred upon him; but this does not alter what I consider to be the fact, that the expert radiologists of this country, as far as giving advice and helping to organize and control x-ray work, were entirely ignored.

It is possible that the War Office chiefs were not alone to blame. At that time many of the older surgeons were almost the only members of the profession who were consulted as advisers. Many of us are well acquainted with the attitude of many eminent surgeons towards radiology—it exists, in London especially, even to-day—the attitude which may be summed up as follows: "All we want is a good radiograph; this can be taken by a layman quite as well as by a medical expert, even better perhaps; give us this and we can read the plates ourselves, make our own diagnoses, draw our own conclusions." The committee of eminent surgeons which met at the War Office never had associated with it even one expert radiologist, and Reid did not sit upon this committee. In other words, advice on x-ray matters was a question for surgeons, and for surgeons alone. It is an open secret that the consulting surgeons reported to the War Office that "all was well with the x-ray work throughout the Home Commands." I have no doubt whatever that if, at this time, the expert x-ray men working in army hospitals at home had been asked to report, certain grave defects in the x-ray work, then existing, would have been pointed out. Most certainly if I had been asked—to make it a personal matter—my own experiences of the early years would have given me ample grounds for proving that things were anything but satisfactory. I will give some examples.

During the first year of the war an Army Order came to the hospital to which I was attached instructing me to receive two young students of physics, to give them one week's x-ray training, and then to report upon them as to their suitability for x-ray work. I would emphasize the fact that they were physics, and not medical, students. They spent a week with us—wrecked several tubes, and incidentally the temper of the sister-in-charge. I then reported that I found them pleasant and intelligent students who had put in a week's work in the department. I did not commit myself further than this. Very shortly afterwards I received two letters of grateful thanks from two young gentlemen who had been appointed to take charge of two hospital x-ray departments at a salary of £250 per annum each.

A similar instance illustrating the official attitude towards x-ray work was that in which an elderly medical man came to me with a request for intensive instruction, as he had been ordered to take charge of the x-ray work on a very large hospital ship. For all practical purposes he knew nothing about x-ray work. There was no time to give him any instruction of value before his ship sailed; the day before it sailed the x-ray equipment arrived and was dumped on board. I saw this equipment at his urgent request; it was as beautiful as elaborately polished wood and metal work could make it; on the other hand, I do not know to this day what some of it was meant to be used for, and I am equally certain neither does the gentleman placed in charge. He had also been supplied with about £20 worth of 15 × 12 plates, and no dishes in which they could be developed.

Appointments of these kinds were common, and their direct results can be illustrated by the following:

1. I saw a man who had a large healed operation wound, 6 in. in length, to the left of his sternum and directly over his heart. He told me that he had been x-rayed, and that a bullet had been seen and located, and the surgeon had attempted its removal. As a matter of fact the said bullet was exactly one inch deep in the muscles of the back.
2. I saw another man who had been trephined after an x-ray examination had shown a small foreign body inside the head. The man told me that he had had no symptoms whatever except a slight headache, and that at the time of the operation the original wound was quite healed. Now it seems to me fairly certain that no surgeon would have attempted such an operation if the x-ray report had been to the effect that the piece of metal, very small, was two inches deep in the frontal lobe, which was where it was.
3. An officer I once saw had a fairly large foreign body behind the upper part of the left lung; he had no symptoms calling for its removal; the wound was healed; we were not certain whether it was just inside or outside the pleura. Later on I saw this officer again, and this after an eminent surgeon, who had made his own screen examination, had decided upon the anterior route by means of a large incision in front just below the collar bone. I need hardly say that he did not find and remove the foreign body.

These are merely examples of what we were all of us more or less frequently seeing. They were inevitable under the circumstances, but they show quite clearly that all was not well with the x-ray work at the time when so favourable a report was furnished to head quarters. Later, in 1918, x-ray experts were appointed to the various commands as advisers to the D.D.M.S.'s, a sufficient acknowledgement of error, inasmuch as it showed that at this period the War Office had become alive to the fact that x-ray work should be organized and officered by experts, who should be responsible for the x-ray work to the heads of departments. I look upon this change of attitude, tardy though it was, as a very distinct recognition of the claims, which had all along been made, as to the status of radiology in the army.

This recognition was due to two causes—the sympathy extended towards x-ray work by Sir John Goodwin, and the support which the three surgical members of the advisory board (Sir Berkeley Moynihan, Sir Harold Stiles, and Sir Robert Jones) gave him in this matter. We radiologists owe a very great deal to these four men, more, perhaps, than many may be aware of.

These expert appointments—the addition of several experts to the War Office X-Ray Committee; the grading of all R.A.M.C. officers as regards their x-ray knowledge and abilities—came too late, for it was well on in 1918 before any of them became effectual, and events moved so rapidly from this time onwards that no great amount of reconstruction or reorganization was possible; still the

recognition of important facts will undoubtedly have a distinct bearing on the future.

Some recollection of what happened to ourselves in the first few years owing to the attitude of the authorities are not devoid of interest. Most of us older radiologists were, when the war broke out, *à la suite* Territorial officers, others joined up in a similar capacity as it became evident that there was a great deal of *x*-ray work to be done. Many of us were too old to go abroad or had already been damaged by *x* rays to such an extent as to make this impossible.

I joined in 1908, when the Territorial hospital staffs were first appointed. I took the junior rank of captain, looking upon it as merely honorary, and on the distinct understanding that I should, if ever required, perform such duties in a military hospital as I performed in civilian hospitals. Mr. Macpherson, then Under Secretary of State for War, in November, 1917, in the House of Commons, to all intents and purposes admitted that this assurance had been given; qualifying it only by saying that the "clinical" duties should not necessarily be identical. He further stated that he was not aware of any case in which *à la suite* officers were compelled to perform duties other than clinical, and later on that he was not aware that any of these officers were called upon to inspect hospitals administratively.

As he seemed to be so ignorant of what we all knew was going on in every Territorial hospital in the country, I wrote him the following letter in December, 1917:

"Sir,

"I beg to inform you that officers of the *à la suite* staff have been ordered to perform duties other than either clinical or medical. Ever since the war began many officers on the staff of the 1st Western General Hospital have been ordered to do (1) orderly duty, (2) inspect auxiliary hospitals.

"Consulting hospital physicians, specialists, such as physicians attached to general hospitals in the capacity of throat specialists, skin specialists, anaesthetists, *x*-ray specialists, and even dentists, have been detailed for these duties. Most of these men may be described without prejudice as well known leaders of the profession in their various lines—most of them men of about 50 years of age. These men, for the most part, took their commissions with a view to being able to offer their country skilled professional services of the most valuable kind in the event of national emergency. They were willing and anxious to render these services. They accepted the junior rank of captain to enable them to perform these services.

"(1) Orderly duty consists in, amongst other things, re-classifying wounded and sick discharged from the attached hospitals and already classified by the medical officers attached to these hospitals. In admitting cases sent to the base hospital by other hospitals. In signing railway warrants and the letters of the O.C. and the registrar of the hospital. In doing odd duties of all kinds.

"(2) Inspecting auxiliary hospitals they are instructed to report on the keeping of books, the condition of ashpits, the condition of kitchens, and many things entirely apart from clinical work.

"I would most respectfully point out that these officers were, and are, entirely ignorant of, and quite incapable of reporting on and doing much of the work required, and that in these respects much of the work they have done is absurd. Additionally, the waste of time valuable to the army and to the general community is obvious"—and so on.

I suppose I was fortunate to get any reply at all, but the fact remains that I did get one—from "the great man's" secretary. It read as follows:

Dear Sir,

I am requested by Mr. Macpherson to acknowledge your letter of the 18th instant.

What has been the Effect of the War on the Production of X-ray Apparatus, on the Invention of New Instruments, etc.?

The only outstanding advance in apparatus has been the American production of the standard mobile transformer unit with its radiator type of Coolidge tube. This may be said to be the direct result of the war, and it marks a distinct advance in apparatus. An *x*-ray generating outfit of this kind, working from a petrol engine or a lighting circuit, constructed to work at practically a fixed milliampère through the tube, almost fool proof—and this notwithstanding the recent lamentable accident to our French colleague—capable of doing all the work required at casualty clearing stations, advanced hospitals, and, indeed, most base hospitals, would have been invaluable had it been available at the

beginning of the war as a standard apparatus for general use. An outstanding fault of our equipment, and a fault it appeared to be impossible to remedy, was that no standardization seemed to be possible. At the beginning the shortage was such that it was necessary to take almost any apparatus which the instrument makers could supply. Many attempts were made later on to get some of the things standardized; but the difficulties in manufacturing and the difficulties of labour, which got worse and worse as more and more men were called up, made such ideals impossible. Though the outbreak of war found out the weak points in our home *x*-ray industry, on the whole our manufacturers met the situation splendidly; and as far as concerned coils, interrupters, couches of various kinds, and most, if not all, of the minor accessories, the supply was reasonable and the quality very good.

Under the direction of the War Office Committee the petrol engine sets, chiefly for use abroad and in places where an electric current supply was not available, reached a high level of excellence and efficiency. Later the mobile car units were turned out in good numbers, and were remarkably useful and efficient. Their design and equipment left little to be desired, and they accomplished a great deal of most useful work, especially at casualty clearing stations. Plates and printing paper suffered somewhat in the earlier years. In the later part of the war both were excellent. Tubes threatened at first to be a serious question. We all know to what an extent we had relied upon Germany for our tube supply. The difficulty, however, was overcome, and whilst importations from America helped to a considerable extent, our own manufacturers rose to the occasion. Taking into consideration the position of the home industry in 1914, the glass difficulty, and the almost entire absence of any skilled tube makers, the results obtained were tremendous, and great credit is due to all those who took this matter in hand.

It is for us all, I think, to see that we give all possible support to our own manufacturers in the future, and do not buy foreign-made tubes. At the same time my personal experience is that some makes of home-manufactured tubes have not been so good or reliable during the past six or eight months as they were during the later years of the war. The faults I have had to complain of are: (1) An undue tendency to puncture, (2) a liability of the cathodal terminal inside the tube to loosen, and in some cases to break off, and (3) the very serious fault of the regulating device being quite inefficient. A word of warning to the manufacturers may be uttered that such faults must be overcome if we users are not to be driven by bitter experience, at a cost to both our pockets and our tempers, to buy in other markets. I have said that the plates and printing paper rose to a high degree of excellence during the war, but here again, and especially during the past six or eight months, *x*-ray plates, in my opinion, have undergone a serious deterioration in quality. I have been finding it necessary to increase times of exposure very considerably, and even then have not been able to obtain the same quality of negative as I did before the war. It is not only slowness but loss of quality of which I personally complain. Complaints to the makers produced at first only lame excuses, but eventually some improvement was noticeable.

What has been the Effect of the War on X-ray Work and on X-ray Workers?

Those who were already experienced in *x* ray work were not taught very much by the war; they gained great experience of the localization of foreign bodies and had many opportunities of perfecting the *x*-ray examination of bone injuries, but, without claiming to make a complete list, I may say that the following classes of cases seem to me to be those in which radiology proved of very great advantage, and in which the science and art of radiography was advanced:

I. In diaphragmatic hernia, a condition recognized occasionally before the war as within the scope of *x*-ray diagnosis, owing to the comparative frequency with which this condition has been seen following wounds of the diaphragm, our *x*-ray knowledge of the appearances, and of the methods of examination, and the diagnostic points has been advanced.

II. In "gas gangrene" an entirely new x -ray advance was made. The possibilities of x -ray diagnosis in this condition were first of all established by my friend, Dr. Morrison, when serving with the Liverpool Merchants' Hospital (1915). Later, radiology became of great importance in the diagnosis and prognosis of gas gangrene, as is well shown in a masterly paper by Miss Ivens (1916).

III. The opportunities of examining cases of tropical abscess of the liver by x rays have increased enormously, as men returning from the East who have had dysentery, and have apparently completely recovered, later on develop these abscesses, in which an x -ray examination is often very definite.

IV. In therapeutic work the treatment of keloid condition by both radium and x rays has been much advanced, and the depilating power of x rays has proved of the utmost value after plastic operations on the face following war injuries. I would especially mention the work of our colleagues, Robert Knox, and Stevenson of Dublin.

I do not intend to say much about localization and the many and various instruments elaborated in its cause. Some little bits of apparatus were invented or designed with a view to facilitating either actual localization or the operations for the removal of foreign bodies; but when we come down to bedrock it is as well to pause and consider the position. In a paper by Dr. Remy of Paris in the *Archives of the Röntgen Ray* in August, 1900, and published still earlier in France, he showed the method of screen localization from below up by means of a tube shift—that is, the triangulation plan nearly all of us have used as the basis of our methods. Remy also used metal directors from above to indicate the paths of the x rays, and to point to the spot where the foreign body actually was—the forerunner of the Hirtz compass and all similar devices. Localization work during the war has been interesting; it has brought out much ingenuity, but I do not consider that it has brought about any real great advance in the science and art of radiography.

The Great Effects of the War on X-Ray Work.

The war brought radiology into very great prominence, and this notwithstanding the attitude of the authorities during the early years.

The enormous number of laymen and women who became interested in, and who took part in the work of, our war hospitals, both abroad and all over this country, altogether apart from the enormous number of wounded who were radiographed, means that the eyes of the general public have been very much opened to the importance of x -ray work in medicine and surgery, and in the large home hospitals the cases were by no means limited to war injuries.

The effect of this will tell in many ways. It will mean a large increase in x -ray work, as members of the lay public either themselves, or on account of the advice of friends, will increasingly insist upon having x -ray examinations made.

The whole of the medical profession also has had the same thing impressed upon them. It is really only within the last twelve years or so that the x -ray position as regards the kidneys, the stomach, and the thorax has gradually become firmly established. To the majority of the general practitioners scattered all over the country this work was not well known. All of them have now served in war hospitals at home or abroad, or have been intimately associated with the work in these hospitals, and they have been able to see and to realize the advantages to themselves and to their patients of an x -ray examination conducted by an expert. Thus, again, the direct result of the war will mean a great increase in x -ray work.

Surgeons and physicians, especially perhaps the former, have had it forcibly impressed upon them by what they have seen day after day—"the importance and scope of radiology." This again means increased work.

We may therefore in the future—indeed, I know from my own work, both hospital and private, that this is the case now—look forward to a greatly increased use of radiology for diagnostic purposes, and also to a demand that this work shall be of the very best quality.

There is, however, an important fact which should not be overlooked, whilst medical men generally—who do not intend to practise radiology—have seen for themselves the value of x -ray work, from two other classes of workers there is a possibility of harm resulting.

In the first place a very large number of lay assistants,

males and females, have learnt a smattering of x -ray work; some of these have become really very efficient, but for the most part this is very far from having been the case. Many of them, however, efficient or otherwise, have a very exalted idea of their capabilities, and there is a danger that a certain number of these people may set up as unqualified practitioners to carry on the "art" of " x -ray photography." It is for the medical profession generally to see that, if this happens, success shall not be the result.

In the second place—and, to my mind, this is even more serious—a large number of qualified medical men have learnt certain parts of x -ray work very well. They have become very efficient at looking after coil outfits, in taking and interpreting radiographs of injuries to bones, in the localization of foreign bodies; but as to their general knowledge of radiography and its interpretation as regards the kidneys, the thorax, the abdomen and its contents, bone diseases and x -ray treatment, their knowledge is so small that they may rightly be described as knowing nothing whatever.

It is also quite evident, from some of the communications recently published, that many of them know nothing of the past literature of the subject. Some of them have already, I believe, started work as x -ray specialists; others are contemplating such a step. I would utter a word of warning and of advice. The University of Cambridge has published the syllabus of a comprehensive course in radiology and electro-therapeutics. At the end of six months' teaching an examination will be held and a diploma issued to those who are successful in passing it. My strong advice to all those who have learnt their x -ray work during the war is to take up this course of instruction, and to obtain the diploma, before starting on their x -ray careers. The six months sacrificed in learning will be as nothing; the advantages to themselves and to their future clients will be enormous. They will not then learn their x -ray work at the expense of much anxiety to themselves and of much harm to their patients, whether hospital or private.

This Cambridge diploma has been instituted at a very opportune time, and it should assist materially to raise the status of x -ray work and of x -ray workers.

CONCLUSIONS.

Let me briefly sum up the chief points.

In the first place, the war has taught us the tremendous value of radiographic work in war—that war surgery depends very largely for its success on efficient x -ray work which must be directly controlled by expert medical radiographers; that such work should be recognized by the army as expert work; that it has shown most conclusively that there is a necessity for a permanent staff at the War Office to organize (1) the teaching of x -ray work to officers, (2) the teaching of trained nurses and orderlies who should be available as assistants, (3) the standardization of army x -ray equipments; and with this goes the further point, that such equipment should be kept well abreast of the times.

In the second place it is our duty to see that in the future the teaching of radiology is put on a proper basis in all our medical schools; that not only should post-graduate work be firmly established, and that all who wish to practise as experts should of necessity be forced to undergo special training and take a special diploma, but that in addition a certain knowledge of x -ray work should be part of the ordinary curriculum of medical students; that teaching should be organized in view of this, and that in the examinations qualifying for practice x -ray work should not be ignored.

CHADWICK naval and military prizes, each of £100 and a gold medal, were presented by Sir William Collins, chairman of the Chadwick Trustees, on March 8th. The naval recipient was Surgeon Commander Edward L. Atkinson, who was a member of the Scott Antarctic Expedition. In 1914 he was one of an expedition sent by the Admiralty and Colonial Office to investigate diseases occurring in river gunboats in the tropics, and later introduced a system of electrolyzing sea water for use as a disinfectant. In 1915 he was appointed a health officer to the Royal Naval Division ashore. The army medal was presented to Brigadier-General W. W. O. Beveridge, C.B., who was assistant director for sanitation, and responsible adviser to the D.G.A.M.S., France, on all matters connected with sanitation and the prevention of disease. He is a permanent delegate for Great Britain to the Inter-Allied Sanitary Conference.