worked out in the Anti-gas Department was the small box respirator—a replica of the large one with certain improvements. It was composed of some thirty-five component parts, requiring for their assembly a multitude of operations and for their production an immense number of different trades; and when one considers the absolute necessity of a high uniform standard of perfection for the finished respirator—for even a pin-hole leak might mean the death of the wearer—it is seen what a gigantic task the organization of production became. Colonel Harrison was greatly helped by Sir Howard Spicer and many others, and by the introduction of a system of supervising by military inspection officers in each factory, and with technical assistance of the most expert kind, he was able to secure from the moment of its first issue the very high standard of perfection which won for the box respirator that faith and reliance on the part of our armies which is a true measure of its wonderful success.

It is difficult to realize the large amount of work involved. There was the cutting out and sewing of the mask, the making of the eye-pieces and nose-clip, the doping of the mask, the making of the tins, of valves, and the flexible rubber tubes, known as "Gorman" tubes, the expanded metal divisions, filter pads, and so on. Under the general direction of Colonel Horrocks, during less than a year from the autumn of 1915, the box respirator had been conceived, designed, submitted to field tests, accepted, and its manufacture established on the very large scale of an output of some 20,000 to 30,000 a day. Harrison may be said to have been the leading spirit of the small box respirator rather than its inventor; an opportunity which gave him the scope he needed was presented, and he made the fullest use of it. His success lay not merely in his personal achievement, but in inspiring and co-ordinating the powerful efforts of many others with his own. The work had grown immensely when Colonel Starling, who had been for a large part of the time in charge of this department, left it, and Harrison succeeded him. In the period which followed the chemical, physical, and mechanical tests which each box respirator had to meet were elaborated and improved. Every part was tested and inspected for weaknesses and leaks. Means were devised for proving their effectiveness in meeting every one of the gases employed by the enemy. The output was brought up finally to a daily supply of 50,000 respirators, and in all some twenty millions were supplied.

A great feature of the respirator was the large capacity of the box containing the absorbents which could be varied at will. Assisted by the Intelligence Services and by a large scientific staff carrying out chemical, physical, and physiological research, Harrison and his colleagues were able so to modify the contents of this box that the complete success at first attained was continued until the end of the war. Indeed, after the first few months of gas warfare the enemy never used a gas against which our troops were not amply protected. Among the absorbents employed the principal was a chemical granule composed of an alkaline mixture consisting of lime, caustic soda, and permanganate, which had been invented and worked out by Bertram Lambert at Oxford. Harrison with great enthusiasm worked on this conception and produced a convenient formula for such a mixture. It was necessary that the granule should be porous, yet quite free from dust, and free also from any tendency to disintegrate into dust when submitted to vibration. Harrison produced such a granule in the laboratory, and the formula was transmitted to Messrs. Boots at Nottingham, who, in co-operation with Harrison, modified it to make it suitable for large scale manufacture. Great difficulties had to be overcome owing to the exathermic nature of the reaction and to the instability of permanganate under the conditions involved.

Another important constituent of the respirator was charcoal. Animal charcoal was at first employed, but later wood charcoal, prepared under certain special conditions, was found to be more suitable. The method of manufacture of a hard and efficient wood charcoal worked out in the Anti-gas Department, was installed on a large scale, and at the time of maximum output involved the charring of 300 tons of wood per week. The canister, when complete, had the following contents, arranged in the order given:

A wire gauze dome,
A thin layer of cotton-wool over the gauze,
A layer of mixed granules with charcoal,
A layer of cotton-wool,
An expanded metal diaphragm,
A second layer of granules and charcoal,
A layer of cellulose wadding,
A second expanded metal diaphragm,
A third layer of mixed granules and charcoal,
A piece of towelling to prevent dust entering the breathing tube,
A piece of expanded metal, and
Two springs to hold all the contents in place.

In addition to meticulous scrutiny of the several parts before they were assembled as a complete apparatus, the respirators were continually being tested, both in the laboratory and on men, to determine their resistance against gases, vapours, and smokes. Those who have been spared all the risks and horrors of war will not wish me to omit reference to the intrepidity with which, in the ordinary routine of testing the apparatus, men have daily entered chambers containing high concentrations of lethal substances—such, for instance, as phosgene—and remained there for a great length of time until the respirator had begun to fail. An idea of the improvements effected may be gained from these tests; they were first carried out in concentrations of 1 in 10,000; this proportion was raised in 1916 to 1 in 1,000, and in 1917 to 1 in 100. When this last stage was reached, a change of method grew imperative, as the concentrated gas proved very irritating to the skin, and the clothing of the wearers became rotten. The arrangement then adopted was to place the respirator in the gas chamber, passing the breathing tube through the wall of an ante-chamber in which the subject sat. But, in addition to these trials, standard laboratory tests were established which in many ways were to be preferred, because they eliminated certain variable factors, such as the irritability of the respiratory tract and the rate and depth of breathing of the individual. For this purpose, and for use during gas attacks, simple tests for identifying the gases were devised after much research, and the results obtained have been of great service, especially in the laboratories, for it was only by the discovery of such simple means of detecting the presence of traces of gases, and of roughly estimating their concentration, that the standard laboratory tests referred to were rendered possible. As an example, a test paper was devised for detecting phosgene and chlorine at dilutions of one in a million. This paper is rendered sensitive by a mixed solution of p. dimethylamino benzaldehyde and diphenylamine. In summarizing Harrison's achievements we have especially to acknowledge the co-ordination of pure scientific work, technical effort, and manufacture, and withal his wonderful personal influence in gaining from every section of the various workers concerned, and notably from each individual of his staff, the highest possible standard of emotional effort. This is the essential quality of a great organizer; Harrison possessed it in a remarkable degree. In him it was combined with a rare and conspicuous courage—a combination which truly made him a great soldier. In 1917 he was promoted to lieutenant-colonel and awarded a C.M.G. At the end of this year the department concerned with offensive gas warfare was linked with the Anti-gas Department. Harrison's organizing powers were given an even wider scope, for the offensive had grown to immense proportions, and he was made deputy controller. His services in this critical period were of immense value; he became the acknowledged leader of chemical warfare, and finally was made its director. Shortly before his death he learned the news that he was to be promoted to the rank of brigadier-general, and also that he had been awarded the French Légion d'Honneur. For a chemist who had joined in the ranks thus to climb to one of the highest positions in the army was a truly remarkable achievement.

THE TEACHING OF MEDICAL HISTORY.

ENGLAND is almost the only country where there is no adequate provision for the teaching of medical history. In France, the United States, Switzerland, Norway, Holland, and Canada, chairs of this subject have long been in existence; in Germany and Austria not only are there several professorships of medical history but, in Leipzig as in Vienna, there are fully equipped institutes for its more detailed study. Great activity in the same direction has been exhibited in Denmark, Portugal, Belgium, and especially in Italy. In this country the subject has been ignored by all our universities except Edinburgh, where a part-time lectureship has been established.

Yet the advantages to be derived from an acquaintance with the history of medicine are many, while the burden which it places on the curriculum is *nil*. Dogmatism, the current foible of the working scientist, finds in history its best antidote. Formlessness and diffuseness, the literary dangers which threaten to crush progress by making

scientific literature unreadable, and therefore inaccessible—these find their natural remedy in the study of the great models of the past. If we reflect that William Harvey compressed the greatest of all medical works into fifty-two pages, and that William Gilbert needed hardly more space to detail twenty years' magnetical experiments, while to-day the International catalogue of the mere titles of scientific papers fills seventeen annual volumes, the urgent need of better literary form may be realized.

The thought of our age is separated from that of the time that went before us by the fertilizing doctrine of evolution. It is a presentation of truth which has done as much to stimulate the studies of the historian as it has to guide the researches of the biologist. Living things, as Theophrastus tells us, must be studied not only and not so much for what they are as for what they are becoming, and to understand what they are and what they are becoming we must know what they have been. The whole of evolutionary teaching may be summed up in the phrase that organic products are the outcome of their history, and can only be understood when their history is known. Yet is there anything more truly organic than ideas? Can any doctrine be comprehended in its entirety until we know how it came to be what it is? Still less can any great system, such as that of modern medicine, be understood without reference to its past. The history of medicine, like other evolutionary studies, gives an interest to present phenomena that can be obtained through no other channel. It brings into practice and into research the only effective counter to the cynicism of the middle years when the eagerness of youth is passed and the mellowness of age is not yet upon us. It forms a real foundation of that happiness in his work and pride in his profession that is the chief guarantee of the doctor's efficiency.

There are those who think that medical history is best left in the hands of amateurs and to the spare time of men who have the leisure and literary gifts for its pursuit. This view is partly true, though it also contains a fallacy. No one interested in the history of medicine would or could wish the solace of study removed from those who love it, for whom it is a real *re-creation*. But only those who have spent years in historical research—and there is no form of research that makes greater claims on time and energy—only those can realize the amount of fruitless labour and the endless disappointments that await the unequipped labourer. To make the efforts of the casual historical worker effective and fruitful it is before all things necessary for him to have experienced guidance. Historical research, like every other form of research, has its own technique, and a technique very laborious in the acquisition. Even properly to find one's way about a great library needs months of experience. But for a localized and limited field of investigation an efficient guide may help the worker to acquire his technique with comparative ease and rapidity, while without such aid he may wander long and then abandon his task in despair or produce immature and imperfect results.

For a generalized interest in history and effective work along historical lines the first need is the establishment of two or three chairs to be held by men who would devote their lives to the task of setting forth the history of medicine as a continuous whole. Such duties might well be combined with the task of delivering short courses of historical lectures in the various medical schools. There is no reason why one such lecturer should not be shared by a number of schools and his course, instead of further overburdening the curriculum, would do something to lighten it by giving it meaning and connecting its various parts.

The second thing needed for the adequate study of medical history is the establishment, preferably in London, of a special institute. It need only consist of a couple of rooms near one of the great libraries, in which would be collected all the reference books most important for medical historians. These works number some seven thousand, and only when they are placed together is it possible for the student to realize the scope and method of his subject. The collection in one place of all these books would save an immense amount of the researcher's time and would help him to place his work in proper relation with that of others. The institute should be in no sense a museum or collection of old books, but a place where all the necessary aids to research are brought together. To such an institute the researcher might bring his manuscripts, his transcripts, or his discoveries on the one hand, or his inquiries, his needs, or his difficulties on the other, and be met by an expert able to help him.

Those who are best acquainted with the work done in other countries for the history of medicine will have no doubts that the introduction into this country of a systematic treatment of the subject will do much to raise the educational standing and with it the self-respect happiness, and efficiency of the medical profession as a whole.

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PORTRAIT OF SIR CLIFFORD ALLBUTT.

WE publish below a further list of the names of subscribers to the Fund for presenting Sir Clifford Allbutt with his portrait. It will be seen that some subscriptions have recently been received from India and America. As it is intended shortly to close the Fund, the Treasurer requests all those who wish to take part in the presentation, but who have not yet notified their intention, to send their subscriptions without delay. The amount is limited to one guinea. Cheques and postal orders should be made payable to the "Sir Clifford Allbutt Presentation Fund," crossed London County, Westminster, and Parr's Bank, and addressed to the Treasurer of the British Medical Association, 429, Strand, London, W.C.2.

After the portrait in oils has been painted it is intended to commission a mezzotint engraving from it which subscribers to the Fund will be able to purchase for their own collections.

Dr. Arthur C. Alport (Johannesburg)
Dr. W. Armistead (Cambridge)
Dr. Elizabeth Bell (Belfast)
Lieut.-Gen. Sir C. H. Burtchaell, K.C.B., A.M.S. (India)
Dr. F. G. Chandler (London)
Dr. James Craig (Congleton)
Surgeon Lieut.-Colonel Decimus Curme (Bournemouth)
Dr. F. Deighton (Cambridge)
Dr. G. A. Ferraby (Nottingham)
Captain W. F. T. Hamilton, O.B.E., M.C., R.A.M.C.
Dr. F. A. Hepworth (St. Albans)
Dr. C. Courtenay Lord (London)
Mr. J. Y. W. MacAlister (London)
Dr. J. C. McVail (Edinburgh)
Colonel A. Martin-Leake, V.C., F.R.C.S. (Calcutta)
Dr. A. P. Moore-Anderson (London)
Dr. W. D. Newcomb (Cambridge)
Sir R. Douglas Powell, Bt., K.C.V.O. (London)
Dr. David Reisman (Philadelphia)
Dr. Robert Sevestre (Leicester)
Sir StClair Thomson (London)
Captain E. B. Verney, R.A.M.C.
Dr. H. Wales (Gargrave, Leeds)

ROYAL MEDICAL BENEVOLENT FUND.

AT the meeting of the Committee held on July 8th twenty cases were considered and £200 voted to fifteen of the applicants. The following is a summary of some of the cases relieved:

Widow, aged 52, of L.S.A.Lond. who died in 1914. Receives £2 10s. per week from the sale of the practice, and £2 from children. Has five children, only the two eldest working, the third at home, and the two youngest at school. Requires help owing to the increased cost of living. Relieved four times, £35. Voted £10.

Widow, aged 39, of M.D.Durh. who died in 1917. Was left totally unprovided for with seven children, now aged 17 to 3 years. Only the eldest is working, and she helps all she can. Applicant receives £150 from dividends and about £52 by letting rooms. Brother-in-law pays rent, and relations help a little with education. Relieved twice, £30. Voted £12.

Daughters, aged 48 and 47, of M.R.C.S.Eng. who died in 1892. They live on the West Coast and take in paying guests, and during the last twelve months have made £70. Rent and rates, £79. They find it necessary to apply for help owing to the very short season in 1918 and the increased cost of living. Relieved six times, £60. Voted £10.

Widow, aged 53, of L.R.C.P.and S.Edin. who died in 1893. Applicant suffers from ill health, and is unable to work. Has two sons who are both in the navy, and help whenever possible. Pays £6 a year rent. Relieved sixteen times, £161. Voted £18 in two instalments.

Subscriptions may be sent to the Acting Honorary Treasurer, Dr. Samuel West, at 11, Chandos Street, Cavendish Square, London, W.1.