An Address

ON

SCIENTIFIC OBSERVATION.

INTRODUCTORY ADDRESS DELIVERED AT THE LONDON SCHOOL OF TROPICAL MEDICINE.

BY

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I AM conscious that the address which I have been invited to deliver at the opening of the session of the London School of Tropical Medicine is not expected to be like those addresses which are delivered at the various medical schools in London, where many of the students are entering for the first time upon the course which admits them to their profession. I am aware that I have the honour to address those who are for the most part advancing in their career, and who come here to perfect themselves in the latest developments of a comparatively new and very difficult branch of medicine. Consequently, I am addressing those to whom it would be an impertinence for me to give advice as though they were ordinary students, and for whom my views concerning the pursuit of medical studies could scarcely possess either interest or authority.

On the other hand, I cannot be expected to devote my address to any subject connected with tropical medicine, for I have no knowledge of this branch of study—or, indeed, of any branch of study directly connected with the profession of medicine.

Perhaps I may claim to have a certain personal reason to understand the value and importance of your studies, for both my grandfather and father passed a great part of their lives in South America, and I myself was born there; so that I have heard much from my relations of the ravages of yellow fever, and was the better able to appreciate the remarkable story of the suppression of the fever in Rio de Janeiro as narrated in the first South American supplement of the *Times*.

But I take it that I am asked to address you because I happen to be Principal of the University, and I have to think how I can best say something useful to you in that capacity.

Now, the University of London is charged with the duty of organizing higher education and research in the London area, and, in the attempt to discharge this duty, is brought into close contact with your profession in all its branches and in many of its aspects.

I think that the universities have a very special duty in relation to the professions—whether of engineering, law, or medicine. For these professions they cannot hope to supply, and it is not their duty to supply, the complete educational course. The engineering student and the legal student can no more dispense with the practice of the engineering shops and the law courts than the medical student can dispense with the clinical practice of the hospital. It is the first duty of the university to provide the introductory scientific training in each profession, which will be supplemented and completed by this practical training and experience. Further, in these professional subjects it is of the greatest importance that the university teaching should be in intimate association with the practice. Only under such conditions will the university be able to keep in touch with the latest developments, to appreciate the problems of most pressing importance which claim investigation, and to keep itself properly equipped for these purposes. It is, after all, only at a university that a class of man exists who has the requisite professional and scientific knowledge as well as the leisure and opportunity to conduct such investigations; and at the university he is sufficiently aloof from active and exacting professional work to be able to take a wide scientific survey of the subject. Moreover, he is there in an intellectual atmosphere among the teachers and investigators of other subjects, with whom he can compare methods and discuss results, whom he can interest in his problems, and from whom he can often obtain most valuable assistance.

This co-operation of workers in different subjects, whether merely by advice and criticism, or by direct collaboration, should be one of the most valuable and effective features of university work, and one which can scarcely be secured under any other conditions. I think it is a strange and most unfortunate fact that on the whole so little use is made of their colleagues by university investigators, considering what opportunities lie to hand.

The professions should, I think, more consistently and systematically take their problems to the universities for solution, and more frequently claim the interest and assistance of university workers. For it is also the duty of the university to encourage that advanced work and investigation which cannot be conducted in the courts, the shops, and the hospital. There will always be much such work to be done, for in places which are devoted to practice there is little time or opportunity to carry on researches of which the practical outcome is not evident, and yet a great deal of the most important investigation is of this character. Nothing can be more desirable than the development of departments of research at the hospitals and in the engineering shops, as, indeed, in all manufacturing and business establishments where the practical applications of science are conducted; but these will never diminish the necessity of similar departments in the universities, even from the point of view of the practical requirements of industry and commerce.

No work can better engage the energies of a university in the various branches of science than pioneer work of which the outcome is uncertain, but which frequently turns out to be in the end the most fruitful of all. One cannot expect professional men or professional institutions to devote much time to such work, for it would lead them too far from the track of their professional duties. But let such pioneer work, involving new problems, new methods of research, trial trips into the unknown, be undertaken by ardent and sanguine young men in the university laboratories, and it often develops in a short time into results of the greatest possible importance for the professional man, and becomes part of the regular practice of the hospital, the engineering shops, and the centres of manufactures and industries.

Let me only quote, confining myself to things with which I have some acquaintance, such work as the microscopic study of rocks and metals, which have revolutionized the sciences of geology and metallurgy. They could scarcely have been taken up and pursued successfully in their initial stages except by university professors and investigators, but they have now, under the name of metallography, become part of the regular work of practical and professional engineers. Many of the most prominent of recent discoveries, such as the rare earths used for the incandescent gas-light, the x rays, radium, and radioactivity, etc., have resulted from researches which could scarcely have originated except in universities. There must be numbers of similar examples in the range of medical science.

And so the closer the connexion which is maintained between professional and technical institutions on the one side and the universities on the other, the greater will be the benefits secured both by pure science and professional practice. Their two intimate points of contact, to which I have already called your attention, being the general scientific education which the university provides for professional men at one end of their university career and the research to which it invites them at the other.

If, however, the investigations at the universities are to be carried on by men who are subsequently to be leaders in their profession—and this is much to be desired—it is clear that there is the greatest need for such provision as will enable those who have completed their university course to stay on for one or two years engaged upon this work in the university laboratories before they become absorbed by their professional duties. If we are to maintain a high order of advanced work at the universities and to supply the professions with men who have learnt to know the meaning and the method of such work while they are still able to learn, nothing can be more useful than scholarships and fellowships for advanced study and research which will enable students to remain for a post-graduate period.

In the medical profession I am glad that opportunities are now being provided to an increasing extent, and fore-

most among these we have to acknowledge the great debt which the profession—and, indeed, the whole world—owes to Mr. Otto Beit for the noble benefaction which he instituted early in the present year in memory of his brother. I believe that that and similar schemes are destined to play a tremendous part in the intellectual advances and the professional development of our country; the universities in whose schools the Beit Fellows will carry on their researches will also receive a great impulse, which will enable them to fulfil more adequately their duty to higher learning and investigation.

I venture to hope that the London School of Tropical Medicine, a school whose energies are so largely devoted to special and advanced study, values its connexion with the University of London, and derives real and substantial benefit from an intimate association with the university.

These considerations all point to some aspect of scientific research as the subject to which I should devote this address. Although it is difficult to find anything new to say on so well worn a theme, and although my own work has been carried on in a very different field, and one in no way related to medical science, I feel that, in accordance with what I have said about universities and the desirable intercourse between teachers and researchers, it is possible that views which I have been led to form as the result of my own experience may be of use to you; even if what I have to say may prove to be only an elaboration of what has been said before.

Let me, then, direct your attention to an aspect of scientific research and of training in scientific investigation which seems to me in danger of escaping notice.

In proportion as research has become more and more highly organized, and the various departments of knowledge have become more completely and systematically mapped out, so have investigators been continually compelled to fix their eyes upon more definite and restricted problems. It is now, more than formerly, true that workers know what they want, that they bring trained intelligence to interpret what they expect, and trained eyes to see what they are looking for. In the early days of scientific research the new methods and the new instruments were powerful resources of unknown capabilities which could be exercised in any field and without any definite plan. The telescope and microscope, for example, could be turned upon almost anything in the hope of discovering new and suggestive fields of study. Scientific experience consisted largely in the effort to interpret the thousands of new objects of inquiry which crowded themselves upon the attention of the investigator. Alertness of sense and intelligence ready to exert themselves in any direction were required, and the best scientific workers were those who were quick to follow any trail into the unknown region.

But under the present conditions scientific research is seldom pursued save by those whose object is clear, and whose minds are concentrated upon a special line of investigation in which they are alive and alert to the exclusion of any distracting side issues. As in a modern railway, the objective is fixed, the route is surveyed, the materials are prepared, and the energies are concentrated, and we congratulate ourselves that we are no longer in the position of the old pioneers venturing without certain plans and ignorant of the goal towards which the ill-equipped caravan was venturing.

All this means that each new discovery is pursued with ever-increasing rapidity, and with a system which is fruitful in results; the searchlight of investigation is turned with mechanical precision upon every new problem, and it would appear unlikely that anything of importance should be overlooked.

But I think that teachers and investigators do not sufficiently bear in mind two possible dangers that beset them under modern conditions of work. It is inherent in our senses and our intelligence, first, that those whose attention is too minutely fixed upon one thing will fail to perceive other things which are equally discernible and equally important; and, secondly, that those who look or listen too intently for a thing may actually see or hear that which they desire, even though it be not there.

Let me illustrate what I mean by one or two homely examples. The conjurer and the spiritualistic performer know well the need of concentrating the attention of their audience upon an unimportant thing if they wish to render

them blind and deaf to those actions which would betray the trick. In fact, every illusion depends for its success upon the distraction of the attention from one thing by the simple artifice of concentrating it upon another. The person who is best able to see through the illusion is the trained conjurer, who is in the habit of noticing everything in order that his victims may notice nothing. One of the most fascinating chapters in the autobiography of the famous conjurer, Robert Houdin, is the account of the manner in which his father trained him to observe with rapidity every possible detail in passing through a room, so that the knowledge thus instantaneously acquired could be used afterwards to confound those ordinary folk who only see what interests or attracts them, and do not observe trivial details. And this training was undergone not with the object of understanding the illusions of others, but of deceiving them with illusions that depended for their success upon the insignificant details so absorbed. And then Houdin further narrates how he was always educating not only his sight, but his touch and the other senses, in order that they might constantly be on the alert.

Baden Powell's book on scouting, the rapid growth of the boy scout movement, the vogue of Sherlock Holmes and of detective stories in general, in which the unsuccessful detective notices the obvious things and fails to observe the essential details, all indicate that the public have become keenly aware of the principle of which I am speaking, and are vastly interested in it. Everyone is familiar with the fact that absent-mindedness is generally the result not of a wandering mind, but of one concentrated upon some absorbing object, and that what is true of the senses is also true of the intelligence: concentration may induce temporary mental blindness.

And then there is the other defect which I have mentioned, and may illustrate by two examples of which I read at the time of their occurrence, and which indicate that expectation may deceive the senses and actually create impressions of what does not exist. One of these is quoted by Carpenter in his *Mental Physiology*. When the French airship, *La Patrie*, was blown from her moorings and drifted derelict across England, her passage across the Bristol Channel was witnessed by a number of persons who, in the early morning light, were able to identify her, and naturally assumed that she was being navigated across the country. They were not only able to read her name, but persuaded themselves that they could discern two aeronauts on board, and could see them sending out carrier pigeons.

Again, when the tropical annexe of the Crystal Palace was burnt down, a large concourse of people witnessed the conflagration, attracted by the extraordinary spectacle of the streams of molten glass. It was known that a number of animals—parrots and monkeys—were kept in that annexe and were burnt to death. One ape had escaped to the roof, where it clung for a long time unable to escape, and was literally roasted to death before the eyes of the agonized spectators, who were not only witnesses of its contortions but also heard the poor creature's screams. After the conflagration it was found that the object which had excited such interest and compassion was a piece of tarpaulin.

This defect also belongs not only to the senses, but to the intelligence. It frequently happens that an acute and eager mind is so obsessed by some idea which distorts the judgement that the victim of it is led to explain everything in the light of the fixed idea, and to ignore other possibilities. In fact, many of the mistakes of investigators are made in this way.

Now, I do not venture to suggest that scientific men are often deceived by their senses to see and hear what does not really exist, or be blind and deaf to phenomena that play an important part in their experiments or observations, though I do think quite seriously that this may sometimes occur; but I wish to remind you of the danger that scientific training and experience may quite easily predispose both the senses and the mind to this weakness. So far from being a good training for mental receptivity and alertness of sense, so far from fitting the observer to notice and interpret every trivial detail that may have a significance, the training of scientific observation both in the laboratory and in the field, unless wisely conducted and corrected, may easily unfit the student for this very

purpose. In science, as elsewhere, familiarity may breed contempt for important details. He who is practised in a certain line of observation may, in proportion as his senses and his intelligence become more acute in the appreciation of the events or the objects for which he is watching with expectant attention, become less and less able to appreciate properly anything else. I speak from some experience, for I have noticed both in myself and many of my pupils this failing. A mineralogist like myself, although quick to notice in laboratory experiments on minerals and crystals the slightest indication of the result that he expects, so that he sees things that would not be visible to the untrained observer, and although quick in the field to notice the minutest specks of the mineral for which he is searching—specks which would not be discerned by the unpractised eye—may be in other respects a deplorably unobservant person, and fail to see the most obvious things. How far may this be partly the result of cultivating observation of a special sort?

The fact is, I think, that the faculty which is cultivated by much of our scientific training and work is not readiness and certainty of observation so much as specialized memory. If I walk down a street and force myself to notice things which would otherwise escape my observation, I find that I have forgotten most of them next day, and am unable to recall them; and it would only be by repeating the process several times that I could fix them with any permanence. But if I walk through a mineral collection, the specimens which attract my attention will impress themselves on my mind, and remain there without any effort on my part. I daresay that most persons who have made a special study of any subject can confirm this experience.

Let me illustrate my meaning by an example from fine art. The power which enabled the archaeologist Furtwängler to make so many remarkable discoveries and identifications was not so much quickness of observation as an extraordinarily accurate memory of all the antique statues which he had seen in the various museums, so that he could recall their details and compare them without the necessity of seeing them beside one another. He, of course, also possessed a remarkably quick perception.

In science, the work of systematists and those who are mainly occupied in identifying old species and determining new ones does cultivate a special memory and lead to a profound knowledge of characteristics, but I do not think that this should be confused with the faculty of observation.

Taken as a whole, I do not think that scientific men are better general observers than other people, though some among them undoubtedly are. It has been too often assumed that scientific training has a special value as developing the general powers of observation, and that because students have been exercised in special observations they have become practised observers of things in general, whereas the reverse may be nearer the truth, and in many instances certainly is so.

For example, I am inclined to believe that the senses of a boy may be better fitted to perceive minute and unexpected details by practice in field sports than by the special practice of a laboratory; and that the alertness of mind and eye cultivated by active country life is an excellent training in all-round observation. Indeed, I do not know why one should limit this suggestion to life in the country, for any one who is really compelled to exercise his observation in the rapidly changing scenes of a busy town may possibly have his wits and his senses still more successfully sharpened. But how small a part of education is devoted to the cultivation of these general powers!

I would not have you to understand me to mean that any such training should be substituted for laboratory and field observations in scientific education; I only wish to suggest that some practice in all-round observation should be incorporated in the training of the specialist if we are to have our students quick to observe details that do not form part of their conscious exercises; neither should they be led to suppose that because they have been practised in observing one thing they are therefore good observers of everything else. To him who has eyes to see, the most trivial detail may be the germ of an important discovery. Our laboratory training gives the student his eyes, but does not always teach him to use them widely or wisely. These are the days in which the importance of uncon-

sidered trifles is beginning to be realized, and neglected details, like the traces of moisture in a chemical reaction, or of foreign metal in an alloy, are found to be the really important factors.

Although scientific men do not like to confess it, a great number of discoveries are made by what is commonly called accident or chance. While looking for one thing the observer lights upon something else which proves to be really more important. He may think this beneath the dignity of a scientific researcher, and may endeavour to persuade both himself and the world that this discovery was made by a most logical process. But I believe that, if the discoveries thus made by a lucky chance were summed up, they would be found to be considerable both in number and importance. Of course, they are not really matters of chance—the same trifling detail may have been seen by hundreds of eyes before, the same little variations of an idea may have occurred to hundreds of minds before, but because they were intent upon some other quest the real significance of the trifle was not appreciated by them. Familiar examples of such chance discoveries are those associated with the names of Hævy, Malus, Galvani, and Oersted. Many persons before Galileo must have watched the swing of a hanging lamp, although they did not see its interpretation. Other observers before Sir William Ramsay saw the spectrum of helium in pitch-blende, but they failed to recognize it. The fullest credit is surely due to those who possess the readiness and alertness of mind and sense, the quickness of interpretation, to see what others miss, and we do wrong in calling this chance. The story of Newton and the apple is, I suppose, to be regarded as an exploded myth, but it nevertheless remains true as an allegory.

One of the most remarkable things about all discoveries is that there were so many people who might have made them, but just failed to do so; how often it appears afterwards that the failure was due to the mistake of passing by a new thing and assuming that it was a familiar one! Analyse this mistake, and you will see that it is often due to the two causes which I have mentioned: the observer not only failed to notice some distinguishing feature, but also, owing to his familiarity with the known object or event, actually supplied in his mind certain missing details. Every one knows that trivial misprints or other errors in a proof are more likely to be passed by an author than by any one, for he, knowing what he meant or what he intended to write, fails to observe that something is missing, or actually sees something different from the print.

What we need is the continual cultivation of the power of keeping the mind and the senses open, ready for all impressions, and prepared to interpret them—the power of divesting ourselves of expectation or preconceived notions in scientific work, so that we may be neither ready to accept the obvious nor prone to ignore the obscure.

It always seems to me that in this, as in so many other respects, Charles Darwin presents an example to be followed by all scientific workers; for, although all his observations were illuminated by the great idea which made him quick to see in everything the working of the process which he was tracking, yet he always kept his mind open to see with an equally clear vision the exceptions, the apparently negligible details, the trivial features which might militate either for or against his own view, and was always prepared to consider these as carefully and as honestly as those more obvious facts which supported his theory, and which he was prepared to see because he was searching for them.

Now I take it that the studies and researches which are specially cultivated in your school are, as much as any, dependent on obscure and apparently negligible minutiae, that many of the microscopic objects which have played a most important part in bacteriological discovery might have been seen by others than those who first saw their significance, and that nowhere are the qualities to which I have referred more needed than in your science.

No doubt, in the field of microscopical work which concerns you so closely, the photographic record has greatly reduced the risk of mistakes of the eye, though I doubt whether it has entirely removed that risk; and I suspect that in experiments and observations relating to living organisms it is not wise to rely too confidently on the photographic record alone. For though the photo-

graph does not share the errors of the human observer to which I have called your attention, it fails in that critical and expectant attention which only the human observer can exercise, and which, if it sometimes leads him into error, yet makes him more efficient than any mechanical recording apparatus.

You cannot afford to ignore any detail, you have to be on the alert for every trifle, you have to be quick to interpret anything that is new. I may, therefore, hope to be pardoned for reminding you that these qualities may be actually deadened by a too rigid adherence to the methods by which we identify and study what is known. I sometimes feel that many scientific workers and teachers forget that advance is made not so much by studying the known as by seeking the unknown, and that it is the differences, the novelties, the eccentricities if you like, which characterize the new thing, that should excite our expectations. The object of studying a known form with minute precision is not only that we may recognize it again when we see it, but also that we may distinguish from it the new form when it presents itself, however closely it may resemble the known; and, unless this object is constantly kept in view, we may fall into the error of either noticing the resemblances more than the

differences, or of attaching undue importance to differences that are inessential but easily discernible.

I feel that it is somewhat presumptuous on my part to make such suggestions in regard to a science of which I know nothing; but I am so fully conscious of their validity in the history of mineralogy, a science with which I am familiar, and it is so probable that the ways of discovery and of error are the same in all the sciences, that I have little doubt that what I say is also applicable to bacteriology and to the subject of tropical medicine.

Those who are students here come, I understand, with the object of acquainting themselves with the best and newest methods of research, and their further studies are pursued in distant parts of the world, where they have not the advantages of the elaborate equipment and excellent opportunities which are afforded them in this school. Many will be doing pioneer work under difficult and novel conditions, in which, far more than in a well-equipped hospital or school, new problems are to be expected, and the faculty of observation is on its trial.

In all scientific work we should be on our guard; not let our knowledge get the better of us; but be on the alert for something new even in that which is most familiar, and in the routine study of that which is best known.

An Address

ON

CERTAIN INTRACRANIAL DISEASES ASSOCIATED WITH NASAL, AURAL, AND LARYNGEAL SYMPTOMS.

DELIVERED AT THE CENTRAL LONDON THROAT AND EAR HOSPITAL ON OCTOBER 17TH, 1910.

BY

PURVES STEWART, M.A., M.D., F.R.C.P.,

CONSULTING PHYSICIAN TO THE HOSPITAL; PHYSICIAN TO THE WESTMINSTER HOSPITAL AND TO THE WEST END HOSPITAL FOR NERVOUS DISEASES.

My first duty is to offer my sincere thanks for the honour that has been done me in inviting me to address you to-day, and to express the pleasure with which I accepted that invitation. At the same time I cannot help recognizing that my task is difficult, not only in view of the distinction of the orators who have preceded me in former years, but also from the character of the audience that I now see before me.

Of late years the study of diseases of the throat, nose, and ear has made great advances—advances in which many of yourselves have played an important part. To the average practitioner of medicine the special domains of laryngology, rhinology, and otology may well seem a labyrinth to which only the chosen few can hope to possess the clue. My object to-day, however, is not to illustrate the importance of rhinology, otology, and laryngology to the expert. I would rather indicate the value of an elementary knowledge of these special branches to the general physician or surgeon, and more especially to the neurologist.

In a hospital such as this you have to deal usually with patients who come to you complaining of symptoms which they themselves associate with the ear, the nose, or the throat. A certain small proportion of these cases is associated with intracranial complications—as, for example, temporal or cerebellar abscess, meningitis, lateral sinus thrombosis, etc., secondary to ear suppuration; frontal brain abscess or cavernous sinus thrombosis, secondary to nasal infection, and so on. With cases of this sort I do not propose to deal. I propose to direct your attention to some primarily intracranial diseases, where the aural, nasal, or laryngeal symptoms only transpire incidentally, as it were, in the course of the malady, and where, nevertheless, the recognition of symptoms connected with the special domains of rhinology, otology, and laryngology is of the utmost importance for a correct diagnosis.

I trust you will forgive me if I recall to your memory a few of the more important points in the anatomy of the nerve tracts which are in special relation with the nose and ear.

The olfactory nerves ramify in the mucosa of the upper and back part of the nasal septum, and over the surface of the upper turbinal body in the outer wall of each

nasal fossa. They perforate the cribriform plate of the ethmoid bone. Piercing the dura mater, they reach the superjacent olfactory bulb of the corresponding side. The olfactory nerves are enclosed in lymphatic spaces which are directly continuous with the subarachnoid space, so that the lymphatics of the upper nasal mucosa can readily be injected from the cranial cavity by means of substances such as Prussian blue introduced into the cerebral subarachnoid space. Notwithstanding this free communication, it is

curious how relatively rare it is for intracranial infections to arise from nasal as compared with aural conditions.

From the olfactory bulb the olfactory tract or peduncle

Fig. 1.—Diagram of connexions of olfactory nerves.