LOOKING AND SEEING.

(MOVEMENTS AND FIXATION OF THE EYES.)

By GORDON HOLMES.

I MUST first express my appreciation of the honour done me in inviting me to give the John Mallet Purser Lecture, for of the many eminent and popular teachers of past generations in this School few have enjoyed the affection and respect of its students in a greater measure than he to whose memory this Lecture has been established. Many of us cherish remembrances of his sympathy and kindly advice when sought, and particularly of his painstaking and lucid instruction. If he has not left behind him a large record of scientific research, of which few were more capable, it is only because during the many years in which he taught here the "Institutes (or Fundamentals) of Medicine," he devoted himself wholly to the instruction and training of his students. To me personally it has always seemed that the essential feature of his teaching was insistence on basic principles, on getting a grasp of the simpler problems and developing fuller knowledge from them.

When old students of your School exchange reminiscences one of the most frequent questions is: "Do you remember Johnny Purser's exam? He always started off by asking: 'What is urine? or what is bile? or some other embarrassingly simple question.'" But Purser realised that such apparently simple problems are the only sound foundation of knowledge.

I have selected for this Lecture a subject which would, I feel sure, have appealed to Professor Purser. I can imagine him asking an unwary student: "How do you look at and see that object?" But even this simple question entails the consideration of many problems, most of which are in their essence unsolved. The essential nature of visual perception, as of every other activity in which mind is concerned, is obscure, but some fifteen years ago I was able to put before you in the Montgomery Lectures the results of investigations which indicated the portions of the brain through the agency of which we see, and those by which we can localise in space objects seen.

It is on only one aspect of this subject that I intend to speak

* Being the Sixth John Mallet Purser Lecture delivered at Trinity College, Dublin, June 4th, 1936.
to-day; it is: "How do our eyes move to obtain accurate vision of an object, and how do we keep the object in distinct vision?"; in other words, "How do we look at an object and arrange to see it distinctly?" The answer might be given: "I move my eyes by an effort of will as I would move my arm, and I keep the object in central vision by appropriate muscular contractions as I would if it were grasped in my hand." But the matter is not quite so simple as this. It is true that the eyes are moved by the contractions of muscles which obey the same laws as those which bring about purposive movements of the arm, but only a small proportion of the ocular movements are voluntary or purposive, and it is certainly not merely by an effort of will that our eyes can be kept fixed on an object that interests us.

The subject is so complicated that it is only by breaking it up into its simpler components that we can obtain an insight into it. Experimentally this can be done by removing one or more of the components and then observing how the simpler mechanism works; this is one of the methods of physiology. But in certain researches our fellow beings, who can co-operate with us in our investigations, are more suitable subjects than the experimental animal, and the observations we make can be interpreted more easily and more directly, particularly when we are dealing with the more highly evolved functions of the nervous system. Clinical investigations designed to throw light on normal functions, however, present more difficult problems than those of the laboratories, for the clinician must accept the conditions as they occur; he cannot arrange for them to happen as the experimentalist may do, nor can he at will repeat the experiment which disease has performed. The fact that chance has thrown in my way the opportunity of making certain observations bearing on fixation and the reflex movements of the eyes is my excuse for venturing into the physiological field.

I must preface my remarks by a review of certain facts known to you all. Each eye is roughly a sphere, the posterior part of which is covered by a receptor organ sensitive to light, the retina. A ray of light falling on any portion of the retina can produce in consciousness a sensation which is referred to the corresponding point in the field of vision; but in each eye there is a small area of more acute vision, known as the macula, on which we arrange for the rays to fall if we wish to see most distinctly the object from which the rays are reflected. This we do by movements of the eyes so that the visual axes are directed to that object. But as we employ two eyes it is necessary that both should work together, that the images received by both should fall on corresponding points of the two retinæ and, further, that the peripheral apparatus for accommodating the eyes should be called into play in order that the images formed on the retinæ should be sharp and distinct. A nervous mechanism in the lower portions of the brain, actually in the midbrain and pons Varolii, is responsible for assuring the accurate co-operation and accommodation of the two eyes, whether they are employed reflexly or voluntarily. The organisation of this mechanism requires no further reference here.