TWO LECTURES

ON THE

STUDY OF ANATOMY AND ITS APPLICATION TO
THE PRACTICE OF MEDICINE AND
SURGERY.*Delivered at Guy's Hospital*

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LECTURE I.

GENTLEMEN,—I must confess to a feeling of the greatest diffidence in commencing this course of lectures on anatomy, since I cannot but recognise my want of ability to do such justice to the subject as I know it deserves. You are provided with elaborate textbooks on anatomy, each of which vies with the other in bulk. It would obviously be useless for me, in these lectures, to dispense to you in dribble portions of the contents of these works, since they can be studied to much greater advantage in the dissecting room by the dead body with the invaluable assistance and instruction which you will receive from the demonstrators, or in the museum, or at home. The question that perplexes me is what I am to talk to you about.

There is, however, one very important point that I cannot impress on you too strongly, and which I hope you will remember and act upon—namely, that the habits you acquire in the dissecting room will inevitably follow you into the wards, and into the subsequent practice of your profession, to your advantage or to your disadvantage. I refer particularly to the manner in which you learn what goes by the name of anatomy.

If you are satisfied to absorb such anatomical information as is provided for you in your books in the same way that a dry sponge takes up water, you will, after a time, become big with this form of knowledge, and it will stand you in good stead at the examination table where, under the influence of the pressure made upon you by the examiner, a proportion of the material you have soaked up is expressed in a more or less unchanged form. If you are successful the examiners, your friends, and possibly even your own conscience, may smile on you and congratulate you, and I think there can be no doubt about it that you deserve a certain amount of credit for your perseverance and assiduity in having imbibed so much information. It is sad to consider that knowledge of anatomy absorbed in this manner is of comparatively little service to you in the future, and that not only does very little real good to yourself and others result from it, but in many cases the habit of acquiring such knowledge and accepting it unhesitatingly merely to be enabled to reproduce it as little changed as possible at a subsequent date, creates a permanently depreciating influence on the mind, and damages your individuality. I think that there is little doubt that in proportion as the brain absorbs and stores up facts so does its power of considering such facts become less, and the reverse would seem to be equally true. It is not your fault that such a state of things exists. You are the victims of a method of differentiation by a very unsatisfactory process that is called the examination system. It is a perpetuation of a method of education which was begun on your mother's lap and was continued at your preparatory schools, and if you are not sufficiently determined now to break off the vicious habit it will stick to you through your hospital career, and after that it is very difficult indeed to discard it. I would, therefore, advise you as far as is in your power, and even at the expense of only moderate success at the examination table, to avoid this method of absorbing anatomy. Regard the information supplied by the textbooks very critically, and accept nothing unless it appears perfectly clear and obvious to you. Consider the manner in which these anatomical works are prepared, and you will see at once how little reliance is to be placed on them. Each author or editor copies wholesale the work of his predecessors and only acknowledges the source from which he derives his information when he is in doubt as to its accuracy; otherwise he

palms it off as a statement of fact, every detail of which he is supposed to have carefully considered and verified. Absorb the information supplied for you to your utmost capacity, but before it is permitted to occupy space, which is of infinite value to you, in your brains, see that it is carefully digested, that part which bears the stamp of truth upon it being retained and the rest thrown aside. The proportion borne by the latter to the former you will find to increase largely with your experience, which, in other words, means your capacity to differentiate what is true from what is stated to be true—two very different things. Train your powers of observation to the utmost, and as years pass by the anatomy which your fellows will have forgotten will be a source of the greatest strength to you, quite apart from the immense benefit which you will have derived from habits of research for which the dead body in the dissecting room will afford you a supply of material practically without any limit.

You will undoubtedly be much struck when reading your books on anatomy by the very scanty attention which the functions or the physiology of the several parts and structures have received, and a little observation and thought will soon lead you to the conclusion that a considerable proportion of what is stated on the subject is often incorrect or unintelligible. You will find that the details of the structures of bones, muscles, and joints are often very fully described, I would say much too fully, when one takes into consideration their relative importance as compared to other things which the student ought to know, and how damaging they would be to him later in life if he were not fortunate enough to forget them, and to stock his brain cells with more remunerative material. Such descriptions as I refer to make no great demand upon the intelligence or originality of the author. Consequently the textbook presents them to the student in large, and as a rule, good type, but when he looks for the functions of the structures, their physiology, or in other words, the parts they play in the relationship of the organism to its surroundings, he finds them described in the most imperfect and inaccurate manner, if they are described at all, in the smallest of print, tucked away in obscure corners of the book and occupying the least possible space. Of what the student wants to learn in order that he may obtain a scientific grasp of the principles of surgery he can discover but very little in anatomical works.

Here, gentlemen, you will find an endless field for research. I need not tell you that if the impression you obtain of the anatomy of a part is false, the pathology and surgery based upon it are equally so, and the last especially, namely, the application of the principles to the unfortunate patient is, when incorrect, too often very capable of harm.

Having considered all these things I have decided to let you depend on your books and on your demonstrators for the descriptions of the several structures, while I will discuss with you such points in the physiology of anatomy as have interested me and which I trust may be of some slight service to you.

Let us first consider the structure and functions of a bone, and here I would warn you that anatomical works speak of bones as if they were identical in form in different persons. This you will shortly find not to be the case, and if you train your powers of observation you will, after a time be able from an examination of a bone to determine the mechanical life-history of the individual. After hearing what I have to tell you you will agree with me that if so much can be learnt by an observer in a comparatively short period in the dissecting room, the amount of detail which would become familiar and intelligible to him who can afford to devote a lifetime to the study would be very remarkable indeed.

The functions of a bone are—

1. To transmit weight.
2. To sustain strain.
3. To shelter organs.

It is these which determine its form and also the deviations which arise from the common or average shape which is spoken of as normal.

At first sight it would appear that the function of sheltering organs was comprised under the transmission of weight or the support of strain, but this is not entirely the case, since the relative importance of the organ to the vitality and economy of the individual bears a varying influence to the

form and texture of the bones sheltering it. In other words, the character of certain bones may vary in accordance with a law which is somewhat less simple and mechanical than it is in the case of others. I will attempt to explain what I mean. This I can do much more readily by appealing to some of Nature's experiments, since under these physical conditions the law which I wish to demonstrate is illustrated on a larger scale than it is in healthy active adult life.

In extreme old age as well as in less advanced adult life when the nutritive capacity of the individual has been exhausted by great mental distress, frequent childbirth, etc., there is developed occasionally a state of the skeleton which is called *mollities ossium*. The bones of the body become wasted, thinned, and softened. For instance, in specimens of long bones which are affected in this manner, the cancellous and the greater part of the compact tissue have been removed so that nothing but a fragile flexible shell remains. A similar change takes place in the bones of the trunk, and the pelvis, thorax, and other parts of the skeleton alter in form very materially, since the softened bones are no longer able to transmit the pressure or sustain the strain they are of necessity exposed to without altering in form. I must point out to you that while such bones when in the moist and recent condition are soft and pliable, when they are allowed to dry they become hard and rigid like this pelvis, which can therefore give you no clear idea of the physical conditions as they existed during life. At the points of greatest stress there ensues not uncommonly a more remarkably rapid process of decalcification, so that a condition which simulates closely an ununited fracture is developed in consequence, the portions of the bone which are no longer rigidly united being capable of a varying degree of movement on each other. Examine a section of the vault of the skull of such a patient and you find that, unlike all the other bones, it is considerably thicker than normal, and on looking at it more carefully you readily see that there has been deposited upon the softening vault a quantity of imperfectly developed bone, chiefly fibrous in structure, and containing but a very small portion of earthy salts.

A little consideration of these various conditions will enable you to arrive at the conclusion that there must exist somewhere, probably in the brain, a centre which is able to arrange the manner in which new material is deposited, and that this organ being infinitely more sensitive to injury than any other uses up what material it can to ensure its own safety even to the detriment of other less important structures in a manner that is not so simply mechanical as it is in the rest of the skeleton.

I will illustrate the truth of the above still further. If young children are improperly fed, and amongst the poor who provide the very large proportion of such cases the condition results from too frequent feeding rather than from unsuitable food, the skeleton suffers from an imperfect supply of material, and as in the case of the subject affected with *mollities ossium* the deficit in the lime salts is the most important factor. This condition is spoken of as rickets. In consequence of this imperfect nutrition the bones are softer than normal, and the distinction between the compact and cancellous tissue is ill defined. The compact tissue is very loose in texture, and deposited upon its outer aspect is a quantity of very imperfectly developed soft bone. The epiphysial lines display remarkable variations from the normal. Instead of the narrow white sharply defined line which exists in the normal skeleton, the line in the advanced rachitic subject is much increased not only in depth but also laterally, so that it forms a prominence of considerable thickness projecting beyond the surface of the bone. This prominence of the epiphysial line is spoken of clinically as beading, and in the case of the epiphysial lines in the anterior extremities of the ribs the sequence of lumps is so conspicuous that it suggested the term of ricketty rosary to the clinical observer. Again, besides the great increase in depth and breadth of the line, there is a remarkable irregularity of its planes and of the arrangement of its component parts. Its margins are no longer sharply defined and parallel to one another, but are instead very irregular. The regularity of the changes which take place in the normal line is absent, and there is in its place a condition of extreme irregularity, portions of cartilage remaining unchanged considerably beyond the limits of the

line, and islands of imperfectly formed bone existing in the zone of what ought still to be cartilage. The skeleton is too soft to perform its normal functions without undergoing change in form, since the material deposited is unable to offer sufficient resistance to the pressure to which the bones are subjected. Examine a vertical antero-posterior section of a spinal column obtained from a ricketty infant, and you will see that it shows exceedingly well the manner in which the soft spongy bone yields at the seat of greatest pressure and deformity results. It is quite obvious to the observer what all this means. The organism does not obtain by absorption from the disordered digestive track enough lime salt to build up the skeleton of its normal strength. It however recognises the necessity of rendering its skeleton as strong as possible, so it endeavours to do so partly by the hurried and imperfect formation of bone at the growing lines and partly by the formation about the shaft by the periosteum of a sheath of material which is deposited abundantly where it is most required—namely, along the concavities of curves and at such other parts as transmit a greater proportion of weight. All this is done very hurriedly and irregularly with very soft and imperfect material, and although the result may not seem to you mechanically very satisfactory, it is infinitely better than it would be if the organism made no effort when in such difficulty to ensure itself against disaster. Most of what is recognised clinically as a disease called rickets is really the effort made by the organism to render the ill-nourished skeleton able to bear its normal mechanical relationship to its surroundings. Except for this effort on the part of the organism life could not be carried on.

Let us examine into the condition of the vault of the skull. Here, again, the bones are softened and their structure altered, but the degree of activity displayed by the organism in meeting this condition in the rest of the skeleton is enormously increased here, and very much more satisfactorily and efficiently. Look at such a vault, and observe how effectually Nature makes the best possible mechanical application of the very imperfect material it has at its disposal. The skull is rendered relatively enormously thick by the deposit of a more or less completely decalcified material upon its outer surface, which is arranged in the form of pillars or supports at right angles to the surface of the bone so as to resemble velvet pile in appearance and arrangement. This is distributed over the vault, and is most abundant in the places where it is most required. In the young infant you notice that a portion of the vault—usually the back part—is uncovered by this sheltering deposit and is quite soft and yielding. The cause of this is readily explained. The child's skeleton is too soft and feeble to allow it to sit up, and it lies constantly in the supine posture, with the back of its head pressing upon the floor or upon a pillow. This constant pressure is sufficient to oppose more or less completely the deposit of bone upon the outer surface of the skull, so that over this area of pressure you find the vault of the yielding character it would be in its entirety were it not for the support offered by the abundant periosteal deposit described. It is fortunate that the portion of the skull which remains unsheltered by any external support covers an area of brain which is comparatively unimportant to the well-being of the infant.

In the feeble old subject affected with *mollities ossium*, and in the ill-nourished infant suffering from rickets, you see the same determined and effective attempt on the part of the organism to shelter the brain at the expense of everything else. If there were not this elective function in the department concerned with repair of bone it is obvious that in neither condition, if advanced, could the patient survive long, and the causes of death would in most cases be very different from those which usually terminate the lives of these patients.

Another condition of the skeleton which develops after middle life, and which is called *osteitis deformans*, serves to demonstrate still more clearly the elective claims of the brain upon the fund of reparative material at the disposal of the organism for keeping the skeleton in a satisfactory mechanical condition of repair.

Osteitis deformans, like *mollities ossium* and rickets, appears to be a state of imperfect nutrition of the skeleton, but it differs from them in the degree in which the softening and deformity of the bones is met by the deposit of a

very imperfect form of osseous material which to the naked eye closely resembles mortar in appearance. The long bones show the alteration in their form due to a yielding, the normal curves being exaggerated. The shaft is rendered very thick by abundant deposit on its surface, and especially along the concavities of the curves. In order to oppose the progress of the deformity as effectually as possible. The other bones of the trunk and extremities undergo similar changes in form and structure, but the vault of the skull is altered disproportionately by an enormous deposit of this mortarlike, imperfectly-developed osseous material upon its surface. The increase in the size of the head is very marked in the living subject, and is often conspicuous long before any change is observed in the form and thickness of the other portions of the skeleton. It is not infrequently the first symptom by which the disease is recognised, the latter calling attention to it.

Here, again, under what are very analogous mechanical conditions to those existing in rickets and mollities ossium, the brain reserves for its greater security more than an average share of the material at the disposal of the organism.

We will pass on to the consideration of the manner in which the bones of the skeleton perform their functions of transmitting weight and of the way in which they are especially constructed with that object. Examining a number of bones in section you see that they vary enormously in structure, some being constructed almost entirely of cancellous tissue, while others contain hardly any of it. What does this mean? Or in other words what are the several factors which determine the structure of a bone? If you examine a section of such a bone as the femur you see that wherever force is constantly transmitted in one definite direction, there compact tissue is used for the purpose, and that the density and thickness of the compact bone vary directly with the relative amount of weight transmitted through it in different subjects and at different periods of life. For instance, along the concavities of curves the bone is much thicker than along the convexities, and where it is possible the additional support is afforded by a strong ridge of bone in such situations, as, for example, the *linea aspera*. For obvious mechanical reasons the cylindrical form is used in preference to that of the solid rod of bone, since by this arrangement greater strength is obtained, and a larger surface is afforded for the attachment of muscles. When, however, a portion of the bone is exposed to great variations in the directions in which pressure is applied to it, as, for instance, in the extremities of the femur, there you observe that cancellous tissue is used, covered only with such a thin layer of highly elastic compact bone and articular cartilage as is necessary to distribute the pressure somewhat over the cancellous tissue and to protect it from injury. The arrangement of the minute plates of bone forming an endless series of arches and pillars is such as to transmit force in the various possible directions in which it might be applied as perfectly as possible, and, aided to some extent by its association with soft material in its spaces, it forms a combination which deadens the abruptness with which the force is transmitted in the case of sudden impact. You also see that in proportion as the transmission of force in a certain direction is more frequent and more considerable, so the structure of the cancellated tissue is arranged to meet it. What can be more variable than the directions in which force is transmitted through the head of the femur and through the condyles in the several positions which the body can assume, yet the lines along which the force is transmitted through the shaft practically hardly differ in direction.

Now in the case of the upper end of the femur the directions in which force may be applied are much more variable than in that of the lower end, consequently the arrangement of the cancelli is more complicated in the former. In the vigorous adult the arrangement is sufficiently strong to render fracture of the neck of the bone very difficult indeed to produce. By a very heavy fall or blow on the trochanter the neck may be driven into the upper end of the shaft, splitting and expanding it. If you examine such a specimen in section, the structure of the head and neck is unchanged, the latter having broken at its junction with the shaft. Such a fracture you will find described as extracapsular in your surgery books, because it lies more or less completely outside the attachment of the capsule of the joint. As old age

approaches, which it does at an earlier date in the female than in the male subject, the range of movement in the hip-joint becomes limited. Movement of abduction and extension are lost, while those of flexion and adduction are especially performed. In consequence of this a very considerable wasting of the cancellous tissue of the head and neck results, and especially of the portion whose existence is dependent on the habitual transmission of force in certain directions. Because of such alteration in the arrangement and the considerable removal of the cancellous tissue of the head and neck this portion of the femur becomes weakest where the compact layer is thinnest, namely, immediately below the head, so that a comparatively small amount of force transmitted abruptly upwards along the shaft of the femur is sufficient to break through the neck at this point, the head remaining in the acetabular cavity and the stump of the neck being displaced upwards. This fracture is described as an intracapsular fracture of the neck of the femur because it does not extend beyond the attachment of the capsule. Like the extracapsular variety it is not so much a fracture of the neck but of the neck at its junction with the head.

This is further illustrated by a similar condition which results during childhood. During that period the cancellous tissue of the neck of the femur is very efficient in its mechanical arrangement, but, as you know, the epiphysal line of cartilage exists at its junction with the head, and the absence of continuity of the cancellous tissue of the neck with that of the head renders this part mechanically weak. Consequently the application of sufficient force upwards along the shaft of the femur results in what is called separation of the epiphysis, or, to speak more accurately, in a fracture through the junction of the neck with the epiphysal cartilage. In the fracture of the old subject union of fragments but rarely takes place but in the young subject in whom the condition often escapes recognition at the time the injury is sustained, union results though usually in imperfect position, limitation of movement at the hip joint resulting.

There is another fracture which illustrates the function served by cancellous tissue very clearly, and in a manner very similar to that seen in the upper end of the femur. The lower end of the radius is large and bulky and in vigorous adult life it consists chiefly of cancellous tissue, the arrangement of which is very complex for the reason that the articular surface is exposed to force whose general direction is upwards but its possible obliquity is very considerable. Perhaps the direction of greatest pressure is that which exists when the hand is pressed flat on the ground. The hand in this position is extended and abducted upon the radius so that the line of force transmission to the radius is upwards, backwards and outwards; in other words, a breaking strain is exerted by it in this direction upon the radius. If a section is made through the lower end of the radius in this direction the mechanical arrangement of the cancelli to oppose this strain is readily observed. In a fall upon the hand this is the position assumed and the breaking strain may be sufficient to fracture the radius in this manner. The lower fragment is forced upwards, backwards, and outwards, the hand accompanying it, and great strain is exerted upon the internal lateral ligament, the styloid process not infrequently yielding to the strain. This fracture is named after the surgeon who first described it and is called Colles's fracture. It is one which you will meet very frequently in practice, and its treatment will occasionally tax your ingenuity to the utmost. In active adult life such a fracture presents a sharply defined outline, the lower fragment being rarely comminuted, so that it can be readily and accurately united to the shaft by silver wire. Those surgeons who assert that they are able to establish accurate apposition of the fragments in this or in other fractures of long bones by measures other than operative have now at their disposal in the Roentgen rays a ready means of verifying their statements. Till such evidence is produced they cannot command our credence. Those who believe that it is possible by manipulation and splints to restore to its original form a long bone that has sustained an oblique fracture are so many, and such fractures are so common, that there can be no excuse for their continuing to occupy a position which, in my opinion, is a false one, and utterly discreditable to surgery of the present

day, without affording us undeniable proof of the evidence upon which their assertions are made.

In old age the hand occupying more or less continually positions of flexion and adduction, those of abduction and extension being avoided, that portion of the cancellous texture of the lower end of the radius which is dependent for its perfection upon the habitual transmission of pressure in the latter direction wastes at a disproportionate rate even beyond the general wasting associated with diminished function of old age. The abrupt transmission of even moderate force in the direction of extension and abduction of the hand results in a fracture of the lower end of the radius, the line of fracture being irregular, the lower fragment being comminuted, usually smaller than is the case in active life, and therefore not capable of being easily wired on the shaft.

Again in childhood the presence of the epiphysal cartilage causes the fracture as in the femur to take place at the junction of the shaft and line, the displaced lower fragment being intact.

INTRODUCTORY ADDRESS

ON

PRELIMINARY EDUCATION.

Delivered at the Royal College of Surgeons, Ireland, on November 2nd, 1896.

By WILLIAM THOMSON, F.R.C.S.I.,

President of the Royal College of Surgeons in Ireland; Direct Representative for Ireland on the General Medical Council.

WE begin to-day another winter session of the School of the Royal College of Surgeons of Ireland. It is a day full of interest to many of you, for you are entering upon what is to be the work of your lives. Some may have come to look upon these annual proceedings as tiresome and meaningless, but as to the majority—I hope you still retain some of the freshness of those impressions which you first received as students, and had words of welcome addressed to you—there are few events in one's life more serious than the choice of a profession. If you have not realised this, you may be sure your parents have anxiously discussed the question as to the pursuit which will give you the best chance of success. The decision is sometimes wise, sometimes unwise, and sometimes the want of a little judgment, and the putting of a boy into a profession for which he is entirely unsuited are followed by those tragedies of failure which not seldom press themselves upon our notice. One of the greatest mistakes which is made is to leave the boy's own feelings out of consideration. How often do we see the square block pushed into the round hole, and all the consequences of it, simply because parents think that their son will make a good doctor when he would make a much better lawyer, or attain to a position of eminence and wealth in some branch of commerce.

But if you have come to the profession following your own instincts, I can say there is still room for you, if you are determined to be diligent, and if you will set before yourselves the highest ideal of professional success and honour. On the other hand, for those who have no desire for work it would be much better that they should seek some other career. I know of no profession the attainment of which is so laborious, and the practice of which is so full of anxieties. Unlike the law, it has no prizes comparable to the comforting judgements to which a man may look forward as the reward of industry and eminence. Disease and broken bones have no Long Vacation. A patient whose life is in danger will not look upon you kindly when you tell him that you must go upon your holiday on a particular date, and so you must let your humanity govern even your own necessities when rest is almost an essential to the preservation of your health. Therefore I say to you that if you come to the profession with an idea that your life will be one of delectable ease, that you will be your own master instead of the servant of your patients, that there are highly-paid offices in which you may pass the evening of your days in placid comfort, go somewhere else; you will not find these things in medicine.

And, still further, I would advise you that if you do not

develop an interest in your work, if you hate it after a time, or if you grow slothful, you should leave us. There is much in the study of medicine to repel; there is great risk to life of which the public have little knowledge; and it demands no little determination to overcome these deterrents at the first. But they can be overcome; and when the vast field of investigation begins to open out before you, you will find instead a fascinating attractiveness if you will only yield yourselves to it. For the slothful there is no place in medicine. They have certainly mistaken their vocation, and they only go to swell the band of chronics who are the contempt of their hard-working fellows. We have no beds for these sluggards, and they would do well to seek their ease elsewhere.

There has been much outcry lately in England on the overcrowding of the profession, and many suggestions have been made with a view to checking the influx of students. The competition is very keen there, and in the search for practice methods are often adopted which only serve to degrade the profession into a low trade.

There is no doubt, further, that there is still a distinct inequality in the examinations of some licensing bodies, and that the entrance is made as ample and inviting as decency will permit. It has been urged again for the fiftieth time that the only way of getting rid of this inequality of tests is to establish the single portal system—a way through which all pupils should pass. I do not sympathise with this view when it is put forward as a means of limiting the entrants; but I entirely approve of it when its object is to get rid of any competition in the lowering of standards and in creating cheap manufactories of doctors. For years we have been engaged in elaborating the professional courses, and we have now an overwhelming list of subjects to be made up in the five years' study. But that these do not keep students away is shown by your own daring in venturing to attack them. I do not doubt that most of you will do so successfully. But while I am not prepared to say that any one of these subjects ought to be omitted, I think that some of them might be referred to the entrance examination. It would give the student more time to devote to his heavier and more strictly professional work. But I should like to go a little further in this question of preliminary examination. In my opinion it is entirely inadequate. At present the course is of the slightest dimensions, and presents no suitable preparation for subsequent study. Of course I do not refer to the Universities, which demand an Arts course before admitting to a degree in medicine. But I speak of the preliminary tests which the General Medical Council provides for entrance to the several licensing corporations. They have got rid of Greek; it has been proposed to abolish Latin, and the other subjects are a fragmentary knowledge of mathematics, of English, and of a modern Continental language; it is only a backward schoolboy's knowledge. I assume that you have a great deal more, but I merely put it that the standard demanded is low enough to permit the entrance of boys quite unprepared for the work they have to do.

Now what I should like to lay down is that we have in medicine a study more extensive and complex than in either divinity or law. It is partly based upon scientific methods which are constantly developing, and it daily presents problems for solution which demand the highest forms of mental training. Mr. Teale, in a speech at the last General Medical Council, urged, with all the cogency and power for which he is remarkable, that there ought to be an investigation into the number of rejections at the various professional examinations. Well, I lay a great deal of blame on the preliminary education. How can you expect a student to grasp easily the intricacies and complex problems of physiology or pathology whose reasoning powers have been prepared on three books of *Euclid* and the solution of simple equations? I am ready to admit that there is much mental exercise in the construction of a Latin sentence, or indeed in the application of any grammatical principles, but this is only an accident of the study. He knows nothing of the rules which govern reasoning, of the forms which it must take, and you bewilder him if you tell him that he cannot argue from a particular to a universal. Yet you will find that there is no conclusion which you arrive at in a medical or surgical case in which you have not to study evidence and estimate its value. You may say that everyone has the power of judg-