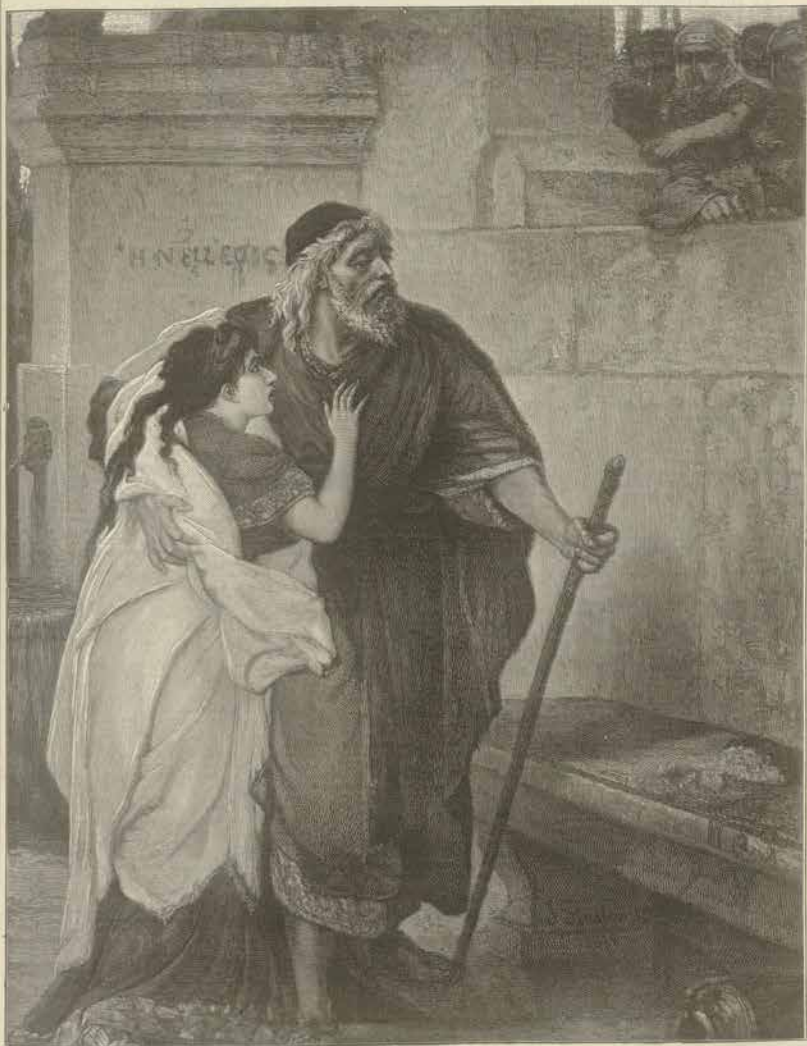


THE BRITISH WORKWOMAN.



lot for anatomy, physiology, botany, zoology, mineralogy, geology, and medicine, it has now become a necessity.

Its name is derived from two Greek words—*micro*, small, and *scopos*, I see. Its early history is involved in obscurity, but in its simplest form it was probably known before the Christian era. The first compound microscope, the parent of the present form, is said to have been invented by one Zacharias Janssen, a Dutchman, in 1600; this was a very imperfect instrument, hithering all objects, and colouring the edges with the purple of colour. For many years the microscope was looked upon more as a toy than a useful scientific instrument. It was not until the invention of the achromatic lens—that is, a lens free from colour—by Hall and Dollond, and its application to the microscope by Lieber and his contemporaries, that it attained to the position which it now holds, not only as an aid to all scientific investigations, but as a source of wonder and delight to the uninitiated possessor. It is to these amateur observers that we particularly desire to address ourselves.

First of all, a word about the microscope itself. Many people appear to be possessed with the idea that it is necessary to expend a considerable sum of money in the purchase of an instrument, being chiefly guided in their ideas by the elaborated and expensive specimens which they see exhibited in the show-rooms of opticians. Such are those who are not for beginners. A very good microscope, with two object glasses, may be bought for about thirty shillings, sufficient for all purposes to which a beginner can put it. The simpler the instrument the better; the most essential thing to observe in choosing is that you get good glasses. They may be tested by their power of showing minute markings; and be particular to notice that the outside of the field of view is not tinged with colour, and that the object magnified is as clear at the edges as in the centre. It is much better to begin with low powers, so that a two-inch and a one-inch object glasses will be best. A glass shade to keep it under is necessary, and is better than a case, as it obviates the necessity of taking it to pieces when done with; and if interrupted you may easily get the objects you are working and all under it without the trouble of making anything away with. For manipulating the various objects a pair of forceps, some needles fixed in handles, and some camel's-hair pencils are necessary, as well as a sharp knife, or better still, a razor ground flat on one side, for making sections. Some oblong pieces of glass, and their circles or covering glasses, will complete the apparatus. We shall say something about the mounting of specimens later on.

And now let us take a few common objects, such as are always ready to the hand of the student, and try to look at them with the eyes of the amateur who is using them for the first time. For instance, let us look at the various parts of this fly which we have just immolated on the altar of science. We will take first that which is the most obvious to the microscope. We plain shiny skin is in reality covered with minute stiff, dark hairs, and the black network of lines, which may be seen under a low power, are elastic, horny tubes, over which the cutaneous membrane is stretched, like the skin over the rim of an umbrella. If we have carefully removed the wing from the main body, we may examine the residue under the lens, and we find to the throat; it is of the same size all through, and, compared with the size of the insect, of immense power. It has been computed that the fly makes six hundred strokes with its wings every

second, and, if started, can fly a distance of thirty feet in that time.

But let us remove the wing and place under the microscope what is, perhaps, the most wonderful part of the fly, the structure of the mouth. This little insect lives entirely by suction, and is provided with what we may correctly call a trunk or proboscis, which is as essential to the tiny fly as to the colossal elephant. A portion of this trunk is sucked and stiffened by an elbow joint, as you may easily see if you watch the little robber feeding in the sugar basin. Within this miniature trunk is a beautiful arrangement of muscles which work in the manner of a pump; as particles of sugar are sucked up and retained by the valves, these muscles contract, raising the sides of the pharynx, or upper portion of the trunk, to stifle, thus creating a vacuum into which the fluid rushes, the muscles

The foot of the fly is so perfectly arranged that it allows the insect to walk on the ceiling with the greatest ease. Several theories have been advanced to account for this. First it was stated the feet were suckers, and the phenomenon might in this way be explained, as was by means of suction and atmospheric pressure; they walked. This idea was afterwards rejected, and it was said that the feet were a sort of grappling iron which hooked itself on to microscopic atoms by means of the wrinkle hooks. Then the fact was proclaimed that the feet were similarly like a glass rod, and resembled a natural gum, giving the foot to the ceiling at every step. But let us look at the feet for ourselves. At the end we shall see there are two hooks or spines; above these are the pulsi or ciliae; to grooves, then, which no doubt were the original suckers; and this part is also furnished with a number of hairlets, that exude a sticky fluid, so, as frequently happens, in scientific observations that are made known in sections we find a large mass of trash, in each of the foregoing hypotheses.

All insects are furnished with little breathing holes, called spiracles—oval disks visible in little pits on the sides of the body, a white centre, situated in various parts of their bodies. The entrance to these spiracles is differently defended, but all are provided with some contrivance to prevent the ingress of dust and dirt. Some have a trap door, some are covered with a gauzy net, while others have an arrangement like a column. In the fly the entrance is defended by minute hairs which cross each other and form a kind of mesh. The largest are situated in the thorax, or middle part of the insect, and some others, much smaller, in the under part of the abdomen.

We have now examined most of the external parts of a fly, we next come to the internal organs, and this is a rather more difficult operation, requiring a little practice and some patience before we can hope to perform it successfully. It may be facilitated by first making the fly in spirits for a short time, which hardens the vessels and nerves and renders them easier of manipulation. Perhaps many of our readers may have seen a dissecting knife, a veritable crop and gizzard, which may be easily traced under the microscope. If we open the fly carefully we shall find that the alimentary canal commences at the base of the trunk, passing round the brain it enters the middle part of the insect, or thorax, this portion forming the gizzard. It then divides, and the food, coming down the gizzard, travels along one fine branch which leads to the crop. After remaining there for a time it is brought up again, and passes into the other branch of the gizzard where it is digested. The gizzards of some insects are furnished with several rows of teeth, but as the fly lives entirely upon suction they are not needed and are consequently absent.

The beginner must not be disappointed if at first he is unable to see all we have stated respecting the fly; at least, we have indicated the chief possibilities for which he should seek. It will doubtless be some little time before he is able to make a satisfactory dissection under the microscope, but the objects are only such as may be overcome by ordinary perseverance. One thing that will better him at first, is that the object is presented in a wrong end; in other words, the object is always the reverse of what is looking through the microscope to what it is when looking at with the eye only; the right side becomes the left, and the left side, but in a little while the observer becomes accustomed to this.



A WOMAN'S TEACHING.

them relax and the food is passed on to the gizzard.

Every one must have noticed how quick the fly is in detecting the approach of danger, which may be accounted for by each of its eyes being divided into several parts, each of which is a perfect eye. If we look at the eye through the microscope we shall see that it is divided into minute hexagons, like a piece of Swiss cheese. Getting closely together a mesh of transparent membrane which forms the front part of the crystalline cornea. There are said to be about 2,000 of these in each eye. If we are desirous of proving that each of these hexagons forms, as they are called, is a perfect eye, we may easily do so by placing a portion of the eye under the microscope, and passing a small object between the stage and the mirror, when, by a little adjustment, we may obtain a reflection of it in all of the eyes.

