

down 30 feet into the earth, and those of some trees 100 feet, you will quickly see that it is not very likely that you have ever seen all the roots of a plant. So if you would know all you could about them, you should grow some plants in your own rooms. Take some bean,



Fig. 13. Showing root hairs on seedling of a bean plant. (a) natural appearance; (b) some magnified.

pea, radish, or other seeds and place them between folds of moistened black cloth or flannel. Be sure to keep the cloth moist. In a few days the seed will have germinated and the stem and roots will each be an inch or two long. Now notice that, about a quarter of an inch from the tip the root is covered with a fringe of delicate whitish hairs. So delicate are they that if you touch them you will destroy them. These are known as root hairs and they are the feeding organs of roots. It is very difficult to see them in a plant pulled out of the soil, because they have been destroyed by the pulling out. However, if by the greatest care, you can pull out a plant without destroying them you will find these little root hairs near the tips or new parts of all the roots. As the roots grow, the root hairs keep falling off the older parts and new ones grow

on the newer parts. Hence you will see that it is at the ends of their roots that plants take in food and water from the soil, and that the older parts merely serve to carry these up to the stem. How many of you have ever watered trees growing on your lawn or in the garden, and in doing so have poured the water just close to the trunk or stem of the tree where the old parts of the roots grow? If you have, do not forget the lesson you have just learned; and the next time you water trees, pour the water a little further away from the stem or the trunk, so that it may quickly soak in to where the tips of the roots are growing.

Take one of the little bean plants when the root is about $\frac{3}{4}$ of an inch long, and make small marks upon the root about $\frac{1}{16}$ of an inch apart with a pen dipped in India ink. Wrap the bean in damp cotton wool, allowing the marked root to be free. Fill a small bottle with water and place over its mouth a piece of card board with a hole in it. Hang the bean plant through this hole leaving the root free in the water. Allow it to grow in a dark place two or three days. Take it out and notice the position of the marks on the roots. You will find that the marks near the tip are now at unequal and greater distances apart, whereas those farther back are little changed in position. This shows you that the region of growth is near the tip of the root. This is of great importance in the root growth of plants, because it gives the roots the power to push their way in and out among the particles of the soil,



Fig. 14. Showing at (a) the marks on the root of the bean plant. (b) The same marks after 2 days, thus showing the region of growth.