Rhizobium

Plants and animals need nitrogen compounds to grow but nitrogen compounds are limiting in many environments. Our atmosphere is 80% nitrogen gas but plants and animals cannot use gaseous nitrogen, that's where the microbes come into the picture. Many microbes are able to perform **Nitrogen Fixation**. Nitrogen fixation is a process where nitrogen gas is converted into nitrogen compounds that can then be used by microbes for growth. The nitrogen compounds made by the microbes can then be recycled and used by plants and animals. Prior to the introduction of man made fertilizers microbes were the largest source of combined nitrogen on the Earth.

Many plants take advantage of the ability of certain microbes to fix nitrogen. Plants like soybeans and clover are able to form symbiotic relationships with microbes called **Rhizobia**. The plants and the microbes interact to produce specialized structures on plant roots, these structures are called root nodules. The plant feeds the Rhizobia that are in the nodule and in return the Rhizobia provide the plant with nitrogen through nitrogen fixation. Plants that form this type of symbiosis with Rhizobia are able to live in soils that are very nitrogen poor. Farmers can increase the fertility of a field by planting nitrogen fixing crops such as soybean.

You will note that root nodules tend to have a reddish color, this color is caused by **leghemoglobin** a compound that the plant produces to carry oxygen to the Rhizobia. Leghemoglobin is very similar to the hemoglobin that is carries oxygen in your blood and that makes your blood red.

How to observe and grow rhizobia

1) find a clover plant that has root nodules
2) pluck off the nodules with tweezers
3) place the nodule in 5 ml clean water and shake thoroughly
4) repeat step 3 several times with new water
5) place the nodule between two clean microscope slides and crush it
6) place a drop of water on the nodule
7) take an inoculating loop full of the material and view with a microscope
8) take an inoculating loop full of the material streak a yeast extract plate (the rhizobia will grow after several days to a week at room temperature)

(Yeast extract media for growing Rhizobia: 1 liter water, 1 g yeast extract, 0.1 g NaCl, 15 g agar)