

Program 27 - THE EARTH'S GREEN MANTLE - April 7, 1941
(Sunlight and Chlorophyll)

SOMETHING TO DO AND TALK ABOUT FIRST

This broadcast stimulates appreciation of the return of spring, and the renewal of activity in the leaf. Plant life sustains the living world: grass to mutton, mutton to wool, wool to the coat on our backs. No matter in which direction we look for energy, we come back to plants. All our vast machinery, except waterpower and windmills, is run by plant energy. Coal, gasoline, and oil are the products of plant life. The energy of boys playing on a football field; or bird's singing; the speed in the hoof of a fleeing deer; the thoughts in your minds right now, all come from plants. Where do plants get this energy? They capture it from the sun. The trap that captures it is the green leaf pigment called chlorophyll. So chlorophyll is the link between the sun and life. Illustrate this concept to the children with a diagram on the blackboard. Draw the sun's rays hitting a leaf and a boy eating an apple, to show the importance of chlorophyll. Or draw a picture of a cow eating grass and a girl drinking a glass of milk.

DO YOU KNOW THESE WORDS?

chlorophyll

energy

carbon dioxide (CO₂)

LISTEN FOR THESE IDEAS

1. Trace back to chlorophyll the energy Ranger Mac is spending talking to you.
2. Many of you came to school in a bus. Trace back to chlorophyll the energy stored in gasoline, that brought you to school.
3. Your school is warmed with coal or possibly with wood. Can you trace this heat energy back to chlorophyll?
4. Why can we call chlorophyll the link between the sun and life?
5. What does chlorophyll do? What does it take from the air? Where do the water and minerals come from?
6. Why can we call the leaf the world's food factory?

SOMETHING TO DO AND TALK ABOUT LATER

1. Where do plants that have no chlorophyll get their food?
2. Name some of them.
3. In what way are all animals like them?

Wisconsin School of the Air
Afield With Ranger Mac
April 7, 1941.

THE BARK'S GREEN MANTLE

Hello Boys and Girls:

Up! - let us to the fields away,
And breathe the fresh and balmy air;
The bird will soon build in the tree,
The flower will open to the bee,
And health, and joy and peace are there.

These are truly your days - Springtime! For spring is the season of young things - of seedlings, buds, and blossoms, of tadpoles, nestlings, puppies and young lambs. It is Easter time, the time of new beginnings and promises. It is a time when all the world of Nature is young. It is a time of marbles, and kites and roller skates, and rope-jumping. Sure, this is your day, so let's be up and away!

Our trail today leads us to the most important substance in all the world. It may bring a new word to many of you, but it should not, for Ranger Mac has mentioned it many times on these jaunts, and before we come to the end of today's trail, it should be a part of your vocabulary, you should be able to spell it, you should know how important it is to us. Important, did I say? I mean absolutely necessary. That word is chlorophyll. Chlor is a Greek word which means green; phyll is another Greek word meaning leaf or pertaining to a leaf. So chlorophyll means the substance that gives the green color to the leaf. We could call the substance leaf-green, but chlorophyll is not too hard a word for us, so chlorophyll is the name we are going to use. I remember when I was a student how I extracted chlorophyll from a leaf, using alcohol and some other chemical, then with this substance in a test tube allowed the different colors of a prism to fall upon it. You know that when a beam of white light from the sun passes through a prism of glass it breaks up into the primary colors, like a little rainbow. Now when these colors from the prism - this little rainbow - were allowed to fall on the test tube containing this chlorophyll, all of the different colors were absorbed except the green. It was the green light that

came through the test tube clearly. The important thing about that experiment is that chlorophyll uses all the light from the sun except green, and that color it sends away, and in sending it away, it falls upon the retina of our eye. That is a simple explanation of why plants look green. So now when you see, as you soon will see, the earth covered with a mantle of green, you will know that this substance called chlorophyll, contained in the leaves, catches the beams from the sun, absorbs all the colors contained in those beams except the green, and reflects that color back to our eye. This is an interesting thing, but it is not the most important thing to remember about chlorophyll. When that chlorophyll absorbs those light and heat rays from the sun, it becomes a factory, a chemical factory, by which all plant food is made. It is the only substance in the world that can make plant food. That is why chlorophyll is the most important substance in the world. It is able to take the energy from the sun's rays and make the food upon which every living thing upon this planet of our depends. The sun supplies the energy - the heat and light - and the chlorophyll in the leaf converts the raw materials into food. These raw materials are water, carbon dioxide gas, and a few minerals. Common things about us, all of them, but chlorophyll takes them and with the help of the energy from the sun converts them into plant foods. We eat this plant food stored away in root, fruit, or seed, and it supplies us with the heat and energy we need to live, work and play, study and think. Or we eat the flesh of animals that lived upon this plant food. No matter in what direction we look for energy, we come back to plants, to chlorophyll which captures the energy from the sun, packs that energy in delicious packets for all living things, in leaf, in root, in fruit and in seed. That's way chlorophyll is the most important substance in the world. It is the link between the sun and life. From grass to mutton, from mutton to wool, from wool to the coats on our backs. The blood, bone, sinew, and flesh of our bodies can all be traced back to the activity of this chlorophyll. The coal or wood that heats your school, that runs the machinery in factories can

be traced back to chlorophyll, for long ago these were green things too. The energy of boys playing on a football field, or a bird's song; the thinking you are doing right now; the energy used in talking to you now - can all be traced back to chlorophyll.

Now let's see what takes place. It is all done in the leaf. The leaves have little openings called stomata. There are thousands of them on the underside of each leaf. The air containing carbon dioxide gas passes into the leaf through these minute openings. Carbon dioxide gas is always present in the air. We expel it from our bodies when we breathe, it is given off to the air when substances burn, or when vegetation decomposes. It is a poisonous gas to us, but it is raw material out of which chlorophyll manufactures the food the plant needs in order to grow and develop its seeds. But carbon dioxide gas is only one of the raw materials. Water is another and some minerals. Water with some of these minerals in solution is taken in by the roots and carried to the leaf. In the leaf the chlorophyll using the energy of the sun's rays performs the miracle of converting these two common substances, water and carbon dioxide, into sugar. This sugar is carried to all parts of the plant and is changed into starchy compounds for the growth of the plant or the development of the seeds or fruit. But it is the light of the sun hitting the leaf that supplies the energy that causes the chlorophyll to do this work. A plant placed in a dark room cannot live. It actually starves to death. No matter how much water and plant food you supply it, it starves to death just the same. The reason is that chlorophyll cannot work without sunlight, and chlorophyll is the only factory in the world that can manufacture the food that the plant needs. Ah, I can hear you say, why do we put fertilizer in the ground? The answer is that the fertilizer supplies some of the minerals or mineral salts that seem necessary in order to help the chlorophyll do this work of producing food. Chlorophyll needs the sun's energy in order to work, but it must have the sun in order to exist at all. You have looked under a

board that has lain on the grass for some time. How sickly, how bleached out the grass looks. Or you have seen the sprouts of potatoes in a dark cellar. The bleached out appearance of the sprouts and grass is due to the lack of chlorophyll.

In a little while now, when the sun gets a little higher and the rays a little warmer, there will be plants springing up in woods and meadows which have no green parts. There is something uncanny and mysterious about plants that have no green parts; they seem like people without blood. These plants we call mushrooms, toadstools, puffballs, bracket fungi, and the like. They are not green because they have no chlorophyll, and because they have no chlorophyll they cannot manufacture their own food. Still they grow and thrive, and so we may safely say that they must get their food in some other way. All of these plants are called fungi. They get their food by either stealing it from the cells of living plants, or they live on such food material as remains in dead wood, withered leaves, or soils that contain the remains of dead plants. You have heard the word parasite. That's a plant that steals its food from the cells of living plants. There are some bracket fungi that are deadly enemies of living trees, but most of the fungus growths that we see ordinarily live on dead vegetation. These are called saprophytes. They are a great benefit to the world, because they bring about decay. Without them our forests would be choked with the fallen trunks and limbs and leaves of trees, and hikes thru forests would be impossible. These fungus growths, which have no chlorophyll, help bring about decay, and decay is simply a way that these plants, which have no green parts, live by feeding on food stored away in dead vegetation. Part of decaying vegetation goes into the air as carbon dioxide gas and the remainder mingles with the soil, and we call that humus. So you can see that plants or some plants which have no chlorophyll have a part to play in the great plan of nature, but you can see, also, that even these plants must depend on chlorophyll in other plants to manufacture food for them.

The other day I removed the marsh hay that covered by tulip bed. The tightly folded leaves were a couple inches above the ground, yellowish in color. Now, after a couple days of exposure to the light they have become green. You notice now the seed leaves in sprouting seeds. How white they are upon coming from the seed cases, but how soon they turn green upon exposure to the light. At first they live on the food stored in the seed case, but when the leaves turn green the plant is ready to earn its own living.

Well, this has been a rather rough trail for you to follow, but Ranger Mac thought that with the flush of life returning to tree and bush and flowering plants, Spring might mean a little more if we took a peep into the miracle of plant life where the leaf is a factory, chlorophyll the machinery that traps the sun's rays, the sun's rays the power to set the machinery in motion, the raw materials are taken from the air and water, and the food produced is sugar and starch.

And as the leaves unfold, notice how they arrange themselves to catch as much sunlight as possible. A good sized maple tree will expose to the sun about one half acre of leaf surface. A tree might be a little more interesting to you when you think of it as a sugar and starch factory covering half an acre.

Good luck until next week.

May the Great Spirit
Put Sunshine into your Heart
Today, and forever more,
HEAP MUCH!