

Roots

The Main Function of the Root

Materials: Chart E, demonstration

Preparation ahead of time: the demonstration: charcoal, potting soil in glass dish – one-fourth of pan from edge plant a row of fast-growing seeds (radish, cress, etc); toothpicks are placed at end of planted row. Water just part of the dish. Keep watering until sprouts are showing; move the toothpick further down and water there for a few days; continue until the toothpicks are at the end and all watering is happening there. Should take about 2-3 weeks.

Pre-requisites: Needs of the plant (but not the one with chemicals)

- **Story** (2 variations dependent on work with leaves):
 - Where does the water come from that the leaves need to make food for the plant? It is absorbed by the roots. So you could a plant eats with its head and drinks with its feet.
 - How do plants drink? Well, they drink with their feet.
 - The roots suck up the water from the ground. Water is taken in by the roots and it is carried up to the rest of the plant so that food can be made. Since the roots have to find water, they find a particular sensitivity to it. Wherever there is water in the ground, the roots of the plants will seek it out.
- **Show the demonstration:** It is like you see here. **Take one seedling and carefully pluck it out, showing that the roots have gone where the water was placed – sometimes the roots can be seen from underneath.**
 - **Point out:** back here, where there was no water, there are no roots.
 - It is like you see here: **Show the chart.**
 - Here we have water – and here we have the roots. The roots are growing towards the water. In this way, roots help to drain water from the ground. In areas where there are not a lot of plants and a lot of water, the area becomes very swampy because there are no roots to suck the water out of the ground.

NB This makes a connection between biology and geography.



Parts of the Root

Material: Chart F; same demonstration as above, adding a stone (could plant the first with stone, or create two, one with a rock); demonstration 2: jar of seeds; magnifying glass

Preparation ahead of time: both demonstrations

2) corn seeds or large bean seeds; straight jar; blotting paper along the inside circumference just as tall as the ringed section; filled with sand to just below edge of blotting paper; place seeds between the blotting and paper and glass; finish filling the sand; water – but not overly so (tendency for mold); wrap black paper around the outside of the jar

- When the root is busy doing its job seeking out water, sometimes it runs into an obstacle (**point to the rock**). The root is looking for that water. It searches this way and that way – here and there. And when it hits an obstacle, it will just go around it.
- **Show a root that is growing towards the rock, gently pulling it up to show that it has gone around the rock.**
- It is the tip of the root that guides the root to water – the **root tip**.
- **Chart F:** Here is a root that has come upon an obstacle – and it has just grown around it. It has just grown around it as it is searching out water. But sometimes, the obstacle is too big to grow around and so the tip of the root secretes a little acid and that acid helps to break down that obstacle. It is like you see here: we have the tips of the root doing just that. It seems like they're just chipping away at this large obstacle.
- The root tip is almost like the brain of the root because it knows where to go and it knows what to do to get there. If you cut the tip off the root, it can't find water – it will just keep growing straight. Well, to protect this precious tip there is a **root cap** and the parts of the root that absorb the water are called the **root hairs**.



Children's exploration:

- Children can also look in books for further pictures of roots.
- Utilize microscope and magnifying glasses both.

Collaboration between roots and leaves

Materials: Charts G, H, I;

Preparation ahead of time: the demonstration: charcoal, potting soil in glass dish – one-fourth of pan from edge plant a row of fast-growing seeds (radish, cress, etc); toothpicks are placed at end of planted row. Water just part of the dish. Keep watering until sprouts are showing; move the toothpick further down and water there for a few days; continue until the toothpicks are at the end and all watering is happening there. Should take about 2-3 weeks.

Pre-requisites: Needs of the plant (but not the one with chemicals)

- **Story:**

There is a special collaboration between roots and leaves – they work together. It seems as if the leaves are directing the water from the rain right down to the ground where the root-hairs are that need to collect the water.

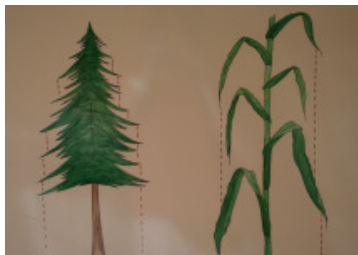


Chart G: You see the leaves – as if they are saying “go that way, water!” Plants are very clever – they are always using different ways to do what needs to be done. They are not always doing things in the same way.

Chart H: Until it goes down in into the ground where the roots hairs are there to absorb it. But look at this plant; it directs the water right down the the stem. The roots might be right down here somewhere.



Chart I: And look at this one: have you ever been caught in a rain storm and you’ve gone under this kind of tree? Look where it directs its water. Right under the tree, it is still dry – we can thank the arrangement of the leaves that direct the water down to where the roots are.



Other Functions of the Root

Materials: Charts J & K; demonstration; small potted plant

Demonstration: corkboard, pencil, 3 knotted strings with pushpin at the end.

Roots hold the plant to the ground:

Because the roots stretch out so much because they are so thirsty, roots actually create a network of roots under the ground which helps to hold the plant to the ground. Otherwise, on windy days, plants would just be blown over.



Chart J: Here we see a network of roots holding it tightly to the ground. So this plant won't blow over in the wind.

Demonstration:

Without roots to hold the plant to the ground, the plant would just blow over (hold pencil and let it go). Now watch. Connect strings to the bottom of the pencil at looped end, connecting the other end to the corkboard with pushpins. Show the children. Look at this! It stands! The strings are like the network of roots that hold the plant to the ground.

Demonstration 2:

Go out into the garden or have examples of potted plants in the classroom that can be pulled up – something very small. Tug and tug very dramatically until pulling up a root. I'm tugging and tugging and really fighting and it's fighting back. It is really holding the plant back. But I finally got it out, but it was a fight.

Roots prevent erosion

There is quite a network of roots underground as they are seeking out water. This network of roots helps to hold the soil because the soil attaches to the network of roots. This helps the soil from being washed away on a rainy day, so we can say that roots help to prevent erosion.

Chart K: Can you see how the network of roots is holding the soil and helping to keep the soil from washing away? These roots are helping prevent erosion.



Demonstration: Find appropriate plants to pull up and observe how they hold onto the soil.

Children's work: Pulling up weeds, working in the garden.

Types of Roots

Materials: prepared demo of bean and corn seeds

- We've been talking about roots and there are two kinds of roots. This kind of root (**show the corn**) grows out like a bundle. It is called a **fasciculate root**. It comes from the Latin word fascis which means bundle.
- There is another kind of root called a **tap root**. (**show the bean seed**) The tap root is one that grows straight down.
- So we have tap roots and we have fasciculate roots – show both the roots side by side.
- **Invite the children to go to the garden to find tap roots and fasciculate roots.**
- **Upon their return, they can do a simple classification exercise with tickets, pictures, nomenclature material and whatever they have collected.**

Other sensitivities of roots

Materials: demo for roots dislikes light; place where a basket can be displayed; jar of bean seeds

Materials for 2nd set: bean seeds from previous demonstrations

Preparation ahead of time: demonstration with hanging plant in wire basket, container into which the basket fits; line the basket with sphagnum moss misted for moisture; plant fast-growing seeds placed all around the surface of the moss, keeping it moist but not too wet; when roots are growing out the bottom a bit, it is ready.

Roots dislike light

- **Story:** We know that roots are attracted to water because they need to supply the leaf with water and the water is found under the ground where it is dark. Where it is light, there is little water to be found, so roots dislike light.
 - There are lots of roots here. Let's see what happens with these roots when I hang this basket up. Keep an eye on those roots.
 - **In about an hour, the roots will make a u-turn and go back into the dark.**
 - Look at these roots! They don't like the light – they are going back where it's dark.

Roots grow toward the ground

- Just as roots grow towards water and dark, they seem to have another rule that they follow. Roots grow straight down to the earth and the only time that command is broken is when water is not found straight down.
- **Demonstration:** **Show the first bean-seed planting – pointing out that the seeds were placed in different orientations.** We can see that the root is always growing down – it didn't matter which way we placed our bean seeds – the root always grew straight down.
- **Later:** This is an example of a tropism. This particular sensitivity of roots is called geotropism, coming from the Greek word geo for the earth and tropos which means to turn.
 - The children have also experienced hydro-tropism.
 - The children have also noticed that leaves are photo-tropic, turning in response to light.
 - Roots are also photo-tropic, turning in response to light, but away from it.

Varieties of roots

Materials: available specimens showing characteristics: aerial (tropical plants such as philodendron, bromeliads), climbers (ivy, trumpet vine, poison oak and poison ivy), pillar (botanical gardens and pictures of banyan trees), prop (corn, mangrove trees, bald cypress), swollen roots (tray of vegetables: carrot,

Preparation ahead of time: gather specimens and photos

Aerial Roots

- In some parts of the world there is a lot of competition for underground water, but in these parts of the world there is a lot of water in the air and some roots have decided to take their water from the air. We call these types of roots **aerial roots**.

Root Climbers

- Some roots have taken on another job in addition to find water – they help the plant climb up to find the sun. These roots have produced suckers so they can attach to something else to help pull the plant upward. They are called **root climbers**.

Pillar Roots

- In some plants, the branches are very heavy and it is hard for the plant to hold the branches up. In this case, some roots have dropped from the branches to support the branches and they are called **pillar roots**.

Prop Roots

- Some roots have decided they want to help the plant to stand. These come out right above the ground from the stem – they are called **prop roots** because they help the plant prop itself up.

Swollen Roots

- Some plants have taken up the task of storing up food. These roots are called swollen roots.
- **Show the tray.**
 - Here is one (**the carrot**) - this particular root is a conical root – it looks a bit like a cone.
 - Here is another swollen root (**the radish**) – this type is called fusiform – it is shaped like a spindle and that is what fusiform means, coming from the Latin fuis which means spindle.
 - Look at this swollen root (**the rutabaga**) it is called napiform – which comes from the Latin word napa which means turnip. A turnip is a napiform root.
 - Here is another type of swollen root (**the sweet potato**). It is called a tuberous root.

Follow-up activities:

- Contact with natural environment
- Going out: farmer's markets, botanical gardens, grocery stores
- Continue explorations in books
- Botany nomenclature material
- Be open to possibilities