



Quarrybrook

EXPERIENTIAL EDUCATION CENTER

Program Title: **Survival Science**

Audience: 6th-8th grade students

Program Theme: Sensory receptors respond to environmental stimuli and send messages to the brain that support the survival of an organism in a cold environment.

Program Goals: We will explore how sensory receptors respond to stimuli, sending messages to the brain that support the survival of an organism. Students will witness the effects of extreme cold on soft tissues by freezing fruit slices and investigating any damage caused by prolonged exposure to the cold. We will then explore the winter woods, learning about overwintering adaptations in plants and animals, and be challenged to build snow shelters. This field class requires a minimum of 2.5 hours to complete and should be held during winter.

Next Generation Standards:

MS-LS1-8 Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories.

MS-LS4-4 Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing in a specific environment.

Objectives:

- **What are the objectives?** Students will understand that sensory receptors respond to different stimuli and input is transmitted to the brain along nerve cells. They will understand that these signals are processed by the brain and result in an immediate physical response by the body. Students will know how this manifests in cold environments. Students will be able to identify three to five adaptations of plants and animals for managing extreme cold. Students will know the main stages of hypothermia and how to prevent it.
- **How will they be measured?** Students will conduct cold experiments on fruit slices, using microscopes and recording their before-and-after observations. Students will go on a woods walk to identify the overwintering strategies of plants and animals. Students will be challenged to build a snow shelter. Students will be asked to verbally draw connections between all activities, justifying the importance of sensory receptors and brain response.

Program Outline:

Activity 1: OPENING DISCUSSION (20 min.) – Using helpful visual aids, we will lead a group discussion on the primary functions of sensory receptors, their relationship to the brain, and the brain's corresponding signals to the body. We will introduce the four main classifications of sensory receptors in the body and their particular functions. To help illustrate the science, we will identify several examples of sensory-

response/brain-signal relationships, such as touching a hot stove, a bright flash of light in the eyes, and other common scenarios that we face in daily life. This will lead to our guiding question, “Why is this receptor-to-brain relationship so important to survival and where can we see this playing out in nature during the cold winter season?”

Activity 2: FROZEN FRUIT LAB - Part 1 (40 min.) – Students will conduct an experiment to investigate the effects on soft tissues of prolonged exposure to the cold. Students will be asked, “What would happen to us if we had to spend the night outside in this cold weather?” Without offering a direct answer or confirming any of their hypotheses at this point, we will move into the first part of an experiment using fruit to represent the soft tissues of plants and humans. In sub-teams, students will cut very thin slices of fruit and examine them under a microscope. They will then be asked to draw an image of what they see on a datasheet. Following this, the groups will place their fruit samples outside in the snow to let them freeze over the next hour. We will conduct Part 2 of this experiment following Activity 3.



Teachers will need to divide students into sub-teams, depending on the number of microscopes available that day. Quarrybrook instructors will set the stage and explain the details of the experiment. Each adult will help guide a sub-team through the steps of the activity, and ensure that students are recording their findings on their datasheets. *We will **not** mention the subject of frostbite at this point!* That will come up in the next activity and we will make connections to the fruit samples after the students have had a chance to view their frozen specimens. We want them to uncover the symptoms of frostbite as they go and then be able to identify it themselves in Part 2 of this experiment.

Activity 3: CONSTRUCT A QUINZEE (70 min.) – On our woods walk we will explore winter ecology, identifying the adaptations and behaviors of plants and animals that keep them alive. Students will participate in a challenge expedition scenario in which they learn some basic strategies and skills for surviving a night outside in winter. Quarrybrook instructors will share a few well-known stories about famous expeditions to some of the world’s coldest locations and talk about the challenges faced by the explorers involved. Making clear connections to our theme, this discussion will lead to a team activity in which the students will be challenged to build a snow shelter called a quinzee. Once constructed, we will take the temperature of the outside air and compare it to the ambient temperature inside the quinzee, discussing the differences between air temperature and wind chill and how that difference affects living things.



Teachers are always welcome to make connections to the learning that’s been happening back in the classroom. Instructors will present the shelter challenge to the entire group and model the quinzee construction on a small scale. Each adult will then lead a sub-team of students through the construction of their team’s quinzee.

Activity 4: FROZEN FRUIT LAB - Part 2 (20 min.) – We will head back to the lab to conclude the fruit investigation by examining our samples to see if exposure to the cold has caused any visible changes. Students will draw illustrations and record their team’s concluding statements on their datasheets. Students will then have the opportunity to share their findings with the entire group. We will form a consensus on the outcome of this experiment and how it relates to the main theme of the lesson. At this point, instructors will explain frostbite in detail and share some tactful visuals to show other examples of

frozen tissue. This activity will illustrate the cause-and-effect relationship of exposure to extreme cold and justify the brain's early pain responses.



Adults will continue working with their sub-teams, guiding students through the final steps of this experiment. Teachers are welcome to draw connections with their students and the material being explored today.

Conclusion/Wrap-up: Reflection will take place during the final group discussions in Activity 4, as we draw conclusions and make connections between all of the day's activities.