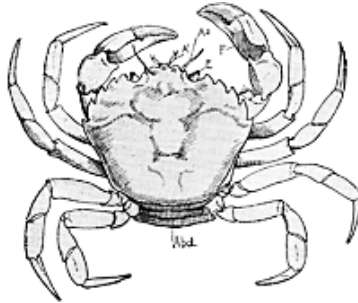


Speedy Science

Program Overview

The Race to Inquiry lab is a 50-minute inquiry-based program for 3rd-12th grade students designed to introduce them to the Scientific Method and related concepts using shore or hermit crabs which are common to rocky intertidal areas. In this lab, students will observe live crabs and how they move as they participate in crab races, then design experiments to test factors they believe influence the crabs rate of movement. As part of this process, students will develop a question, form a hypothesis, setup and run experiments, collect data, and form conclusions to be shared with the class. Data collected can be taken back to the classroom and further analyzed.

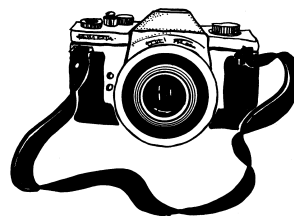
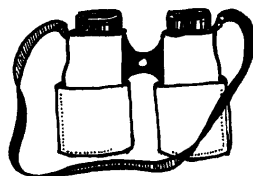
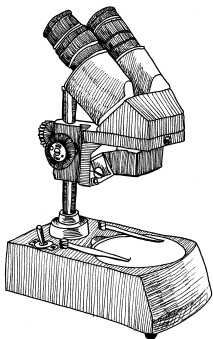


Shore Crab

The Scientific Method

The Scientific Method is an integral part of life and the learning process. It is the way scientists learn and study the world around them, the basis of which is observing and gathering background information, asking a question, forming a hypothesis, and then trying to come up with the answers by collecting and analyzing data. It's not just "scientists" that use what is referred to as the Scientific Method. We all use the scientific method in everyday life to make predictions and discover answers to problems.

The process we refer to as the Scientific Method begins with **observation**. Good scientists are observant and curious about what is happening around them. Researching and studying what others have done and learned in the past is also an important part of this step. Students, like scientists, should spend time observing and exploring before coming up with a question to investigate. The question raised must have a simple, concrete answer that can be obtained by performing an experiment. Once a question has been selected, a **hypothesis** or prediction is created. A hypothesis is an educated guess, a tentative answer to the question based on observations and explorations, that can be tested by conducting an **experiment**.



Common equipment used for conducting observation, the first step in the Scientific Method.

Once a hypothesis is formed, an experiment is designed to test the hypothesis. Only one thing or **variable** should be changed in each experiment and every experiment should have a **control** for comparison. **Data** from the experiment should be carefully collected and recorded. Observations should include written descriptions or pictures of changes that occurred during an experiment, including any problems encountered.

When an experiment is completed, all data collected during the experiment is analyzed and the results are summarized. Results can be conveyed by creating a table of numerical data, producing graphs, or through a written statement of what occurred during the experiment. If the experimental data does not support the hypothesis, it is rejected and another hypothesis may be developed to be tested. Sometimes problems with the experimental design are discovered and the experiments are modified or repeated. The Scientific Method is not a strictly linear process but really a cycle that we use to help us better understand the world around us.

Suggested Pre- or Post-Visit Activities and Resources

Rolly Polly Lab introduces students to the steps of the Scientific Method:

<http://www.teachersnetwork.org/ntol/howto/science/isopodlab.htm>

How Science Works poster: <http://geology.about.com/b/2009/03/04/how-science-works-the-poster.htm>

Correlation to Oregon Science Education Standards

Grade 3

3.3 Scientific Inquiry: **Scientific inquiry is a process used to explore the natural world using evidence from observations and investigations.**

3.3S.1 Plan a simple investigation based on a testable question, match measuring tools to their uses, and collect and record data from a scientific investigation.

3.3S.2 Use the data collected from a scientific investigation to explain the results and draw conclusions.

3.3S.3 Explain why when a scientific investigation is repeated, similar results are expected.

Grade 4

4.3 Scientific Inquiry: **Scientific inquiry is a process of investigation through questioning, collecting, describing, and examining evidence to explain natural phenomena and artifacts.**

4.3S.1 Based on observations identify testable questions, design a scientific investigation, and collect and record data consistent with a planned scientific investigation.

4.3S.2 Summarize the results from a scientific investigation and use the results to respond to the question being tested.

4.3S.3 Explain that scientific claims about the natural world use evidence that can be confirmed and support a logical argument.

Grade 5

5.3 Scientific Inquiry: **Scientific inquiry is a process of investigation based on science principles and questioning, collecting, describing, and examining evidence to explain natural phenomena and artifacts.**

5.3S.1 Based on observations and science principles, identify questions that can be tested, design an experiment or investigation, and identify appropriate tools. Collect and record multiple observations while conducting investigations or experiments to test a scientific question or hypothesis.

5.3S.2 Identify patterns in data that support a reasonable explanation for the results of an investigation or experiment and communicate findings using graphs, charts, maps, models, and oral and written reports.

5.3S.3 Explain the reasons why similar investigations may have different results.

Grade 6

6.3 Scientific Inquiry: Scientific inquiry is the investigation of the natural world based on observation and science principles that includes proposing questions or hypotheses, and developing procedures for questioning, collecting, analyzing, and interpreting accurate and relevant data to produce justifiable evidence-based explanations.

6.3S.1 Based on observation and science principles propose questions or hypotheses that can be examined through scientific investigation. Design and conduct an investigation that uses appropriate tools and techniques to collect relevant data.

6.3S.2 Organize and display relevant data, construct an evidence-based explanation of the results of an investigation, and communicate the conclusions.

6.3S.3 Explain why if more than one variable changes at the same time in an investigation, the outcome of the investigation may not be clearly attributable to any one variable.

Grade 7

7.3 Scientific Inquiry: Scientific inquiry is the investigation of the natural world based on observation and science principles that includes proposing questions or hypotheses, designing procedures for questioning, collecting, analyzing, and interpreting multiple forms of accurate and relevant data to produce justifiable evidence-based explanations.

7.3S.1 Based on observations and science principles propose questions or hypotheses that can be examined through scientific investigation. Design and conduct a scientific investigation that uses appropriate tools and techniques to collect relevant data.

7.3S.2 Organize, display, and analyze relevant data, construct an evidence-based explanation of the results of an investigation, and communicate the conclusions including possible sources of error.

Grade 8

8.3 Scientific Inquiry: Scientific inquiry is the investigation of the natural world based on observations and science principles that includes proposing questions or hypotheses and designing procedures for questioning, collecting, analyzing, and interpreting multiple forms of accurate and relevant data to produce justifiable evidence-based explanations and new explorations.

8.3S.1 Based on observations and science principles propose questions or hypotheses that can be examined through scientific investigation. Design and conduct a scientific investigation that uses appropriate tools, techniques, independent and dependent variables, and controls to collect relevant data.

8.3S.2 Organize, display, and analyze relevant data, construct an evidence-based explanation of the results of a scientific investigation, and communicate the conclusions including possible sources of error. Suggest new investigations based on analysis of results.

High School

H.3 Scientific Inquiry: Scientific inquiry is the investigation of the natural world by a systematic process that includes proposing a testable question or hypothesis and developing procedures for

questioning, collecting, analyzing, and interpreting multiple forms of accurate and relevant data to produce justifiable evidence-based explanations and new explorations.

H.3S.1 Based on observations and science principles formulate a question or hypothesis that can be investigated through the collection and analysis of relevant information.

H.3S.2 Design and conduct a controlled experiment, field study, or other investigation to make systematic observations about the natural world, including the collection of sufficient and appropriate data.

H.3S.3 Analyze data and identify uncertainties. Draw a valid conclusion, explain how it is supported by the evidence, and communicate the findings of a scientific investigation.