EVIDENCE AND EXPLANATIONS IN SCIENCE

Key Vocabulary

Data. Factual information, such as observations, measurements, or test results.

Evidence. Data that help answer a question, form an explanation, or disprove an explanation.

Explanation. A non-fiction evidence-based story about how or why something in the natural world appears or happens. A scientific explanation must connect data or phenomena with accepted scientific knowledge.

Models (physical or mental) are also explanations. A scientific model shows something that can't be seen directly in the natural world. It explains why or how something happens, and can often be used to make predictions. Food chains, food webs, food pyramids are all examples of models based on evidence and used by scientists to come up with explanations and/or predictions.

Useful Criteria for Evaluating the Strength of Evidence in Making an Explanation

- **Quantity of Evidence.** Something that has been observed one time by one person is not as strong evidence as something observed multiple times by one person, or multiple times by many different people. Increasing the amount of data often makes patterns and important details more clear. The more evidence collected through reliable sources, the more certain we can be about an explanation.
- **Size of Assumption.** This refers to the conceptual leap required to connect the evidence with the explanation or conclusion. Making a smaller assumption indicates that the explanation is more probable, and that the evidence is stronger. Evidence that includes a lower amount of assumptions supports an explanation with a higher level of certainty. With students you might want to call "size of assumption," terms such as, "explanations that have stronger connections to evidence than others," "explanations that are closer to the evidence," "stronger evidence," or "evidence that leaves the least doubt."
- **Quality of Source.** The higher the quality and reliability of the source, the more sound the evidence, which results in a higher level of certainty. If you have a lot of evidence from a lower quality source, it may not compare favorably with having less evidence from a higher quality source. If you have a small size of an assumption, but a low quality of source it may not be convincing.

Scientists use reasoning to weigh all three criteria in order to evaluate an explanation. These are some of the BEETLES student activities that focus on making explanations from evidence: ***NSI: Nature Scene Investigators, The Case of the Disappearing Log, Bark Beetles Exploration, Structures & Behaviors***, and ***Tracking*** .

Questions that encourage explanations from evidence and arguing from evidence:

- What do you notice? What's happening here?
- Do you agree with that observation?
- What questions do you have about it?
- What might have happened here?
- What is an explanation for that? What's a different explanation for it?
- What are some pros and cons for those explanations?
- What's the evidence for that explanation?
- Do we have evidence against that explanation?
- What evidence would you like to have to be more certain of that explanation?
- What's your source for that? Does it seem like a trustworthy source for science information?

Sentence starters that encourage language of uncertainty:

- "Maybe…"
- "I think…"
- "I wonder if…"
- "The evidence seems to show…"
- "I'm not sure, but I think…"