NIBBLING ON EINSTEIN'S BRAIN
The Good, The Bad and the Bogus in Science

by Diane Swanson

Genre: Non-fiction, science

Themes: Information literacy
Media awareness
Scientific method
Science and nature
Problem solving
Environment
Math connections

Suitable for: Grades 4 – 8

Nibbling on Einstein's Brain

Although most of us don't realize it, science affects every part of our lives. But there's lots of phony research and it's difficult to discern what science is good and what is false or misleading. How can we equip kids to judge the difference? The first step is to examine how good science works—and there is plenty of it out there.

Nibbling on Einstein's Brain demystifies science by leading children through the steps necessary to arrive at a sound scientific conclusion. They learn about winning strategies and fun ways to determine whether the information they receive is reliable or not. There are sidebars with facts, experiments, and quotes from scientists and philosophers, plus a glossary of terms, an index, and a bibliography. Distinguished by a kid-friendly text, amusing illustrations, and a strong undercurrent of humor, this book offers readers a fun approach to becoming enthusiastic science watchdogs.

THE FOLLOWING ACTIVITY IDEAS …

… are only a start. There are many possibilities for helping students construct meaning from text. Comprehension activities:

- help readers to extend their general knowledge from prior experience
- develop reading strategies for comprehension
- bring relevance to the act of reading
- foster discussion and reflection through response to the text

BEFORE STARTING THE BOOK:

Activities to build the context and introduce the topic of the book, and to establish prior knowledge and interest and develop predictions of what the text will be about.

A1. As an introduction to the concepts in *Nibbling on Einstein's Brain*, have your students research the discovery of Brontosaurus or Piltdown Man. A report on the history of these discoveries should include a description of the mistaken conclusions or misinformation, as well as the later, corrected interpretation. Brainstorm the questions other scientists or the public should have asked to avoid these inaccurate reports.

A2. Brainstorm current controversial areas of science and discuss the possible consequences of bad science for our decision making. Examples could include:

–fish farming on the west coast
–cod stocks and reopening the fishery on the east coast
–global warming
–genetically modified foods
–cloning
–antibiotics

What questions should we ask as consumers and citizens to help make choices in these areas? Record the questions on chart paper to refer to later when "Baloney Busters" are discussed.

WHILE READING THE BOOK

Activities to check on comprehension, stimulate interest, involve readers in reflection as they read, and encourage consideration of other readers' reactions.

CHAPTER ONE: "BEWARE OF BAD SCIENCE"

Teach the steps of the "scientific method" (pages 6–10): development of theories, gathering of a body of information, peer review, and establishment of a body of facts. Discuss the possible detours or pitfalls in each step.

B1. ***General Characteristics of Good Science.***

• Find an example of the development of a well-known scientific theory and have students draw a cartoon showing each characteristic. For example: Galileo's theory that the earth revolves around the sun. The first cartoon could show Galileo reading previous theories, investigating the math and developing a new theory. The second cartoon could show him measuring the angle of the sun using his newly developed telescope. In the third, Galileo realizes inconsistencies betwen his findings and Ptolemy's theory. He also realizes consistencies with Copernicus's theory. In the fourth cartoon,

Galileo repeats his measurements each over a period of time. And in the fifth, Galileo publishes his theory while his fellow scientists look over his data and observations, and make comments.

• Go back to Brontosaurus/Piltdown Man discussion. Review how following the "Good science checklist" would have led to more accurate information. Use this model to confirm steps for every new science topic discussed in class.

CHAPTER TWO: "SCIENCE WATCH"

B2. The Internet is often seen as a source of "facts"—often for cures for medical disorders, for instance. Questioning the reliability of these facts is an important skill for students. Have your students search google.com for "Cure for warts." Look at the sites and ask, "Who is the author/authority?" "What do we know about the research conducted for these cures?" "Can we rely on this information?"

This is an example with much folklore connected to it, but does it tell us anything about more serious questions, such as cures for cancer?

B3. Have students watch the newspapers and bring in clippings about any new or debated areas of science. One recent newspaper had articles on:

–new theories about galaxy formation
–the controversy regarding farmed salmon and the effects of sea lice on the wild stocks
–the debate over the importance/value of flu shots
–the differing opinions about the Kyoto Accord's consequences on the environment.

• As a class, look over the articles and record the amount of information given, any charts or statistics used, opinions stated, and the bias of the people holding those opinions. Repeatedly ask, do we have enough information to make an informed choice?

• Keep a scrapbook or bulletin board display for each story, and add related articles as they appear.

• Form "Expert Teams" and have each one choose a new or debated area of research. The team is responsible for bringing in information about the topic and maintaining a scrapbook or bulletin board display. Their investigation could include information from documentary-style TV shows, newscasts, science journals, and Internet articles, as well as articles from a variety of newspapers. During the search, have students identify e-mail or postal addresses, 1-800 numbers, and/or web sites that can be used to find more information.

• As the class works through the Baloney Busters, have each Expert Team identify at least five salient questions to be asked about their topic. Have students phone or write to ask for answers.

•Bring in science journals (*Scientific American*, *Nature Magazine*). Have students identify current research topics.

B4 •To practice and reinforce the concepts of questioning and sampling in research (Baloney Busters, #4–14), have the students conduct research studies in the school.

–Design questions to demonstrate the pitfalls: "What is your favorite TV show?" "What is your favorite flavor of ice cream?" "Which is your favorite ice cream, chocolate or vanilla?" "What is your hair color?"
– Have the class anticipate problems with the questions before conducting their research.

•Assign students to conduct different mini research projects. Begin by questioning two students in another grade in the school. Chart the results. As a class, discuss what conclusions can be drawn. Increase the number of students and chart the results. Ask students in many different grades. Chart the results by grade as well as the overall results. Look at the results and decide what conclusions can be drawn, bearing in mind the Baloney Busters: What population was studied? Does the sample represent the population? Was there a large enough sample?

• Ask the math teacher if he/she will devote a lesson or two to the analysis of research data. If possible, provide data from science research that students have chosen to study.

•Have Expert Teams apply the results of the above exercises to their topics.

CHAPTER THREE: "MEDIA WATCH"

B5. •Have the Expert Teams use the Media Alert Checklist as they work through their topics' articles and information. Each team should choose one or two examples of poor reporting and informative reporting.

•Plan an integrated unit on media literacy with the English teacher and, if feasible, the art teacher. A study of ads can involve the use of language as a tool for persuasion, visual literacy with a focus on impact, and the science behind the claims. A multidisciplinary unit would have a wide-reaching impact on your students.

•Have a class representative phone the managing editor of the local newspaper. As a class, come up with questions you would like to have answered about the reporting of scientific studies. For example, "How much time does a reporter generally spend researching a story?" "How can a reader find out more about the unreported details of a study?" If the managing editor agrees, arrange for him or her to visit the class to explain the process of reporting scientific stories to the public.

CHAPTER FOUR: "MIND WATCH"

B6. •Brainstorm commonly held opinions that must have research to back them up.

For example:

–chocolate causes pimples
–consumption of sugar causes hyperactivity
–the earth is warming
–smoking causes cancer
–aluminum causes Alzheimer's disease
–teenagers cause more accidents than any other age group
–echinacea cures colds
–Aquarians are friendly

Ask for a show of hands for agreement or disagreement, then challenge students to ask themselves how they came to their opinion. Which of the items on the "Mind Trap Checklist" apply to many of our commonly accepted opinions?

•Have Expert Teams identify which of the "Mind Trap Checklist" items might be of relevance to their specific topic.

CHAPTER FIVE: "WINNING STRATEGIES"

B7. • Create posters for the school hallways with favorites from the checklists in *Nibbling on Einstein's Brain*.

• Hold a "Science Watchdog" afternoon and invite parents to look over the results of the Expert Teams' study. Have students prepare displays incorporating the related articles, questions, the results from phone calls and e-mails, and students' final comments following their study.

• Ask for a booth in the school or local science fair and have your students make a display related to their study of "The Good, the Bad, and the Bogus in Science."

•Write letters to the editors of local newspapers with students' conclusions and requests resulting from their study. This can be done as part of the English class.