# APPENDIX

## TABLE OF CONTENTS

# MASTER GLOSSARY

**Absolute stupidity:** A complete lack of knowledge or understanding of a given topic.

**Advocacy group:** An interest group working on behalf of a particular cause.

**Applied research:** Research that relates to human health care in the form of treatments or cures of human diseases. Applied research is often conducted by for-profit companies.

**Basic research:** Research that furthers general scientific understanding of how the natural world works. This is often academic research.

**Belmont Principles:** These Principles inform and guide researchers working with human participants. They are:

- ***Respect for Persons:*** Respect for individuals and their ***autonomy***; obtain informed consent.
- ***Maximize Benefits/Minimize Harms:*** This stresses "doing good" and "doing no harm" by minimizing all potential harm(s) and maximizing potential benefit(s) to the subject as well as potential benefit to society.
- ***Justice:*** Be fair in distributing the benefits and burdens of research.

**Blinded study:** A study in which researchers do not know which samples are from patients with a disease (in this case, CFS) and which samples are controls from healthy individuals.

**Chromosome:** A strand of DNA and associated proteins that contains genetic information.

**Clinical trials phases:** Clinical trials are conducted in three or four phases. Each phase has a different purpose to help researchers answer different questions. Following is an overview of each phase:

- **Phase I**—An experimental drug or treatment is tried on a small group of people (fewer than 100). The purpose is to evaluate its safety, potential dosage, and identify any side effects.
- **Phase II**—The experimental drug or treatment is administered to a larger group of people (several hundred) to further assess safety, and to address issues such as optimal dosing and frequency of dose administration.
- **Phase III**—The experimental drug or treatment is administered to large groups of people (several thousand) to determine its effectiveness, further monitor safety, and compare it with standard or equivalent treatments.
- **Phase IV**—After a drug is licensed by the FDA, researchers track its safety, seeking more information about its risks, benefits, and best use in "real-world" settings.

**CML:** Chronic Myelogenous Leukemia. A specific form of cancer that affects white blood cells.

**Collaboration:** Working together to create something, solve a problem, or answer a question.

**Communication:** Sharing information with others.

**Diffusion:** The passive movement of molecules from an area of high concentration to an area of lower concentration.

**Discretionary:** Available to be used as needed or desired; discretionary spending refers to the fraction of the budget that Congress can spend as it chooses each year.

**Enzyme:** A protein or molecule that speeds up a chemical reaction in a living cell.

**Graduate student:** A person who has earned a college degree and is pursuing additional education, such as a master's degree or PhD.

**Hypochondriac:** A person who is convinced he or she is ill, or will become ill, even though there is no disease.

**Integrity:** Honesty and truthfulness in one's research; avoiding cheating and plagiarism.

***In vitro:*** "In glass," referring to an experiment done in a test tube or an artificial, non-living system.

**Leukemia:** Any cancer that affects normal production of blood cells.

**Lobby:** To attempt to influence public officials and legislators to promote a specific cause.

**Objective:** Not influenced by personal feelings or opinions when considering or representing facts.

**Oncogene:** A gene that contributes to the production of a cancer; usually a mutated form of a normal gene.

**Orphan disease:** In the U.S. an orphan disease, or rare disease, affects fewer than 1 in 1,500 people. They are mostly genetic conditions passed on from parent to child.

**Peer review:** The evaluation of scientific work or findings by others working in the same scientific field.

**PhD student:** A person pursuing a doctorate degree, the highest degree awarded for graduate study.

**Polymer:** A molecule or compound made up of several repeating units.

**Productively stupid/Productive stupidity:** The attribute of realizing how little one knows in order to develop good questions.

**Randomization (randomized):** The process of assigning study participants to two or more alternative treatments by chance, such as by flipping a coin or rolling a dice.

**Relative stupidity:** Willful indifference to becoming informed or enlightened, especially in relation to others who make the effort to read, learn, or think about important material.

**Repeatable trials:** A feature of a valid scientific experiment, meaning it can be performed multiple times and produce the same or similar results.

**Replicate:** To reproduce or duplicate; to achieve the same study results by following the same study protocol.

**Retract:** To formally take back or withdraw a statement as invalid.

**Retrovirus:** Any of a group of viruses that store genetic information as RNA, not DNA. HIV is an example of a retrovirus.

**Skepticism:** A doubting or questioning attitude or state of mind.

**Serendipity:** The phenomenon of making fortunate discoveries by accident, or discovering valuable things while looking for something else.

**Study design:** A strategic approach to carrying out medical research, often involving "blinding" researchers and participants, randomizing samples, and using placebos (fake "sugar pills") when applicable.

**Subjective:** Based on or influenced by personal feelings, tastes, or opinions.

**Translational research:** The process of connecting basic research to applied medicine or treatment; sometimes described as "From Bench to Bedside."

**Translocation:** Movement of a fragment of one chromosome to a different chromosome.

**Transparency:** The quality of a scientific experiment or other process that allows others to easily see what actions have been performed.

**Undergraduate student:** A person studying at a university or college after high school with the goal of earning a bachelor's degree. This is usually a four-year degree.

**3 Rs of animal research:**

- **Replacement:** Replacing conscious, living vertebrates with cell or tissue cultures, computer models, simulation models, and/or less developed animal species.
- **Reduction:** Using the fewest number of animals possible in a research project to gain valid results.
- **Refinement:** Using any technique or procedure that minimizes distress or enriches the life of an animal used in research.

# CRITICAL ANALYSIS TOOLS

## INTRODUCTION

This section contains two supplementary student handouts that support students in the review and analysis of resources. They can be used at any time during this unit or during the school year, independently or together. Some teachers suggest that students review and analyze articles before beginning *The Social Nature of Scientific Research* to become more comfortable with formulating and criticizing arguments.

Student Handout—*Media Review and Analysis* can be used to support students in analyzing media for purpose, perspective, assumptions, claims, and impact. This handout can be used in any subject and for most types of media. An optional section on ***scientific process*** can be used for students analyzing scientific articles. Students are further supported in thoughtful analysis by using Student Handout—*My Evolution of Thought*, which helps students identify their attitude toward a subject before and after analysis. These tools help students explore the importance of scientific literacy in a world impacted by mass media.

## KEY CONCEPTS

- It is important to understand an author's purpose, perspective, assumptions, and claims to fully analyze and evaluate an article.
- Science is a human endeavor and, as such, can be done poorly and can be misused. Science is subject to bias, and unconfirmed claims can be presented as "scientific fact."
- When done well, science is critically assessed by the community, where findings can be strengthened and/or errors, oversights, and fraud exposed.

## LEARNING OBJECTIVES

***Students will be able to:***

- Use critical thinking tools to analyze and evaluate science stories in the media
- Question information, conclusions, and points of view.

***Some common student misconceptions include:***

- If a science story is presented in a media source, it must be factual.
- All sources with titles of MD or PhD are trustworthy.
- Most media sources are equally credible.
- Stories about science are not biased because they are based on fact.

## PROCEDURE

1. These student handouts can be used in a variety of ways, as best determined by the teacher. One or both handouts could be used to help students evaluate:
   - Newspaper articles
   - Articles from popular magazines
   - Scientific journal articles
   - TED talks
   - Claims found in dietary supplement advertisements
   - Claims found in cosmetic advertisements
   - A series of articles supporting or refuting one topic (i.e., global warming)
   - Websites or written information from advocacy groups
   - Pro/con videos on a subject found on YouTube or other multimedia source
2. Using discretion, it can be helpful to print out selected reader/viewer comments from the media source used. These comments can be cut out and given to individual students. Working in teams or as a class, students can work to identify facts that may be missing, alternate viewpoints on the issue, faulty claims, social significance, and perspective. Readers often have a hard time recognizing "what is missing" until it is pointed out by other readers. Of course, the reader comments themselves can be evaluated and analyzed as well.

RESOURCE

## STUDENT RESOURCES

Many teachers ask students to analyze newspaper or magazine articles or current events. The following resources support student analysis or provide student-accessible science articles.

- NWABR's ***Consumer Awareness*** curriculum contains a lesson in which students discuss the importance of sources of information and talk about the criteria for evaluating scientific papers. Students also identify information sources to refute or support the science behind advertising claims for cosmetic products. *Lesson Four* of the Consumer Awareness curriculum can be found under the *Teacher Tab* at http://nwabr.org.
- An interesting short video set on the use of animals to help cure breast cancer can be found here:

  **Jen's Story—The original video (1:00 minute)**
  http://www.youtube.com/watch?v=NT4lLIDsjGA

  **Jen's Real Story—The parody (1:29 minutes)**
  http://www.youtube.com/watch?v=lcyshYXdtRI
- Student-accessible science article can be found at:

  **LiveScience**
  http://www.livescience.com

  **ScienceDaily**
  http://www.sciencedaily.com

## TEACHER RESOURCES

This lesson is rooted in the concepts and tools of critical thinking. The Foundation for Critical Thinking has distilled the concepts of critical thinking into a very useful 20-page pocket guide, *The Miniature Guide to Critical Thinking: Concepts and Tools*, available at:

**The Critical Thinking Community**
http://www.Criticalthinking.org

The ENSI (Evolution and the Nature of Science Institute) website has a wealth of helpful information on the nature of science.

**ENSI—What is the Nature of Science?**
http://www.indiana.edu/~ensiweb/nos.html

RESOURCE

# STUDENT HANDOUT

## Media Review and Analysis

Name_____ Date_____ Period_____

| BASIC INFORMATION |
| --- |
| Article Name |
| Author(s) |
| Source (book title, website address, magazine name, etc.) |
| Location (page number, issue, etc.) |
| Date Accessed |

| BASIC ANALYSIS |
| --- |
| 1. What claims were made in the source? |
| 2. What ***scientific*** facts/concepts does the author use to support this claim?<br><br>3. What is the significance and relevance of these facts/concepts? |
| 4. What ***social*** facts/concepts does the author use to support this claim?<br><br>5. What is the significance and relevance of these facts/concepts? |
| 6. What inferences (explanations based on observation) does the author make to support this claim? |
| 7. What assumptions (thoughts/ideas we take for granted and do not question) does the author make to support this claim? |

HANDOUT

| PERSPECTIVE |
| --- |
| 8. What points of view are presented in this source? Does this present any concerns about the validity of the article's claims? Why or why not? |
| 9. What points of view are ***not*** presented in this source? Does this present any concerns about the validity of the article's claims? Why or why not? |
| 10. Who is the intended audience for this source? Does this present any concerns about the validity of the article's claims? Why or why not? |

| APPLICATION TO SOCIETY |
| --- |
| 11. Do the claims presented in this source have ***social*** value (do they impact you, your family, your community, etc.)? Why or why not? |
| 12. Do the claims presented in this source have ***scientific*** value (can they lead to more research or discoveries)? Why or why not? |
| 13. What consequences are likely to follow if people read this and take it seriously? |
| 14. What consequences are likely to follow if people read this and ***do not*** take it seriously? |

HANDOUT

| SCIENTIFIC PROCESS *(Only complete if this source refers to scientific research or advancement)* |
|---|
| 15. What process was used to collect the data that were used to support the claims made in this source? (If the process is unclear, explain what that means for the validity and/or reliability of the claims presented.) |
| 16. Are there any problems and/or concerns with the process used to collect the data that are presented? Why are these problems and/or concerns? |
| 17. How were the data analyzed? Does this fit with accepted scientific practice concerning the treatment of data? |
| 18. Does the process presented minimize risks and increase benefit in an ethically justifiable manner? Why or why not? |
| 19. Was this research reviewed by multiple third parties? What does this mean for the validity and reliability of the claims presented in the source? |
| 20. If this research included human subjects, did researchers get informed consent? How well informed were the subjects? |

| FINAL ANALYSIS |
|---|
| 21. Is this a valid and reliable source for your use? |
| 22. Why or why not? (Be specific using the analysis you performed above!) |

HANDOUT

# STUDENT HANDOUT

## My Evolution of Thought

Name_____ Date_____ Period_____

### ARTICLE REVIEW

1. This article is about _____. ***Before*** reading the article, answer the following questions:

   a. What do you know about this topic?

   b. What are your current thoughts and/or feelings about it?

   c. How do you think science is involved?

   d. What point or claims do you think this article will make?

   e. Why do you think that? (Be specific!)

2. Read the article through once without making notes or highlights. Simply read it and then answer the following questions:

   a. What are your initial thoughts and feelings about the subject of this article?

   b. Why do you think and feel that? (Be specific!)

3. Read the article through a second time, this time using the following technique:

   a. Underline any part that identifies or discusses the scientific process used in the research.

   b. Circle any part that identifies the author's point of view or opinions.

   c. Box any part that identifies potential ethical considerations and write a quick two or three word note to help you remember why this concerns you

HANDOUT

# CREATING DISCUSSION GROUND RULES

## INTRODUCTION

The study of ethics involves considering moral choices and dilemmas about which reasonable people may disagree. Since a wide range of positions is likely to be found among students in most classrooms, it is especially important to foster a safe classroom atmosphere by creating some discussion ground rules. These ground rules are often referred to as "norms." An agreed-upon set of ground rules should be in place before beginning the *Social Nature of Scientific Research* curriculum.

## LEARNING OBJECTIVES

***Students will be able to:***

- Create and agree to classroom discussion norms.

## PROCEDURE

1. Ask the students, "What can we do to make this a safe and comfortable group for discussing issues that might be controversial or difficult? What ground rules should we set up?"
2. Allow students some quiet reflection time, and then gather ideas from the group in a brainstorming session. One method is to ask students to generate a list of ground rules in small groups and then ask each group to share one rule until all have been listed. Clarify and consolidate the ground rules as necessary.
3. Post norms where they can be seen by all and revisit them often. If a discussion gets overly contentious at any time, it is helpful to stop and refer to the ground rules as a class to determine whether they have been upheld.
4. Some possible student ground rules/norms could include:
    - A bioethics discussion is not a competition or a debate with a winner and a loser.
    - Everyone will respect the different viewpoints expressed.
    - If conflicts arise during discussion, they must be resolved in a manner that retains everyone's dignity.
    - Everyone has an equal voice.
    - Interruptions are not allowed and no one person is allowed to dominate the discussion.
    - All are responsible for following and enforcing the rules.
    - Critique ideas, not people.
    - Assume good intent.

RESOURCE

# SOCRATIC SEMINAR BACKGROUND

## BACKGROUND ON THE SOCRATIC SEMINAR

In a Socratic Seminar discussion, the participants carry the burden of responsibility for the quality of the discussion. Good discussions occur when participants study the text closely in advance, listen actively, share their ideas and questions in response to the ideas and questions of others, and search for evidence in the text to support their ideas. The discussion is not about right answers; it is not a debate. Students are encouraged to think out loud and to exchange ideas openly while examining ideas in a rigorous, thoughtful manner.

In a Socratic Seminar, there are several basic elements:

- A text containing important and powerful ideas (it could be an article, film clip, etc.) that is shared with all participants. It is helpful to number the paragraphs in a text so that participants can easily refer to passages.
- A distinctive classroom environment; seating students in a circle and using name cards helps facilitate discussion. The students should have a clear understanding of the discussion norms, which should be prominently posted.
- An opening question that requires interpretation of the text and is genuine (one where there is not an easy, predetermined answer). For example, "What is the most important passage?" or "What is the author driving at in the text?" Recommended questions can be found in the *Procedure* section of the lesson plan

## PROCEDURE

**Before the Socratic Seminar**

1. Introduce the seminar and its purpose: to facilitate a deeper understanding of the ideas and values in the text through shared discussion.
2. Have students read the article(s). It is important that every student reads the text, since the quality of the discussion depends on contributions from each participant. It may be helpful to allow time in class for students to read the article(s).
3. In addition to the classroom discussion norms you may have already set, it is important to include the following norms:
   - Don't raise hands.
   - Listen carefully.
   - Address one another respectfully.
   - Base any opinions on the text.

**During the Socratic Seminar Fishbowl Discussion**

4. To create the discussion groups, divide the class in half and form two circles (an inner circle and an outer circle). The inner circle is engaged in the discussion, and the students in the outer circle are listening to the inner circle discussion. Students in the outer circle take notes and write down ideas or comments on what they hear in the inner circle discussion. After approximately 10 minutes (or another appropriate time period), the circles flip so that students in the inner circle and outer circle trade places.
5. To begin the discussion, the teacher/facilitator may pose the guiding question(s) or the participants may agree upon questions to begin the discussion.

   ***Sample questions to serve as the key question or to interpret the text:***

   - What is the main idea or underlying value in the text?
   - What is the author's purpose or perspective?
   - What are the ethical concerns raised by the text?
   - What does (a particular phrase) mean?
   - What is the most important word/sentence/paragraph?

RESOURCE

***Sample questions to move the discussion along:***

- Who has a different perspective?
- Who has not yet had a chance to speak?
- Where do you find evidence for that in the text?
- Can you clarify what you mean by that?
- How does that relate to what (someone else) said?
- Is there something in the text that is unclear to you?
- Has anyone changed her mind?

***Sample questions to bring the discussion back to students in closing:***

- How do the ideas in the text relate to our lives? What do they mean for us personally?
- Why is this material important?
- Is it right that…? Do you agree with the author?

6. The teacher can choose to facilitate the discussion by asking clarifying questions, summarizing comments, and highlighting understandings and misunderstandings. Teachers can restate the opening question if the conversation gets off track, or ask for different ideas if it stalls.
7. Later in the discussion, questions that refer to the experiences of the students and their own judgments can also be used. For example, "Is it right that….?" or "Do you agree with the author?" or "Has anyone changed his mind?" These do not require reference to the text to be answered.

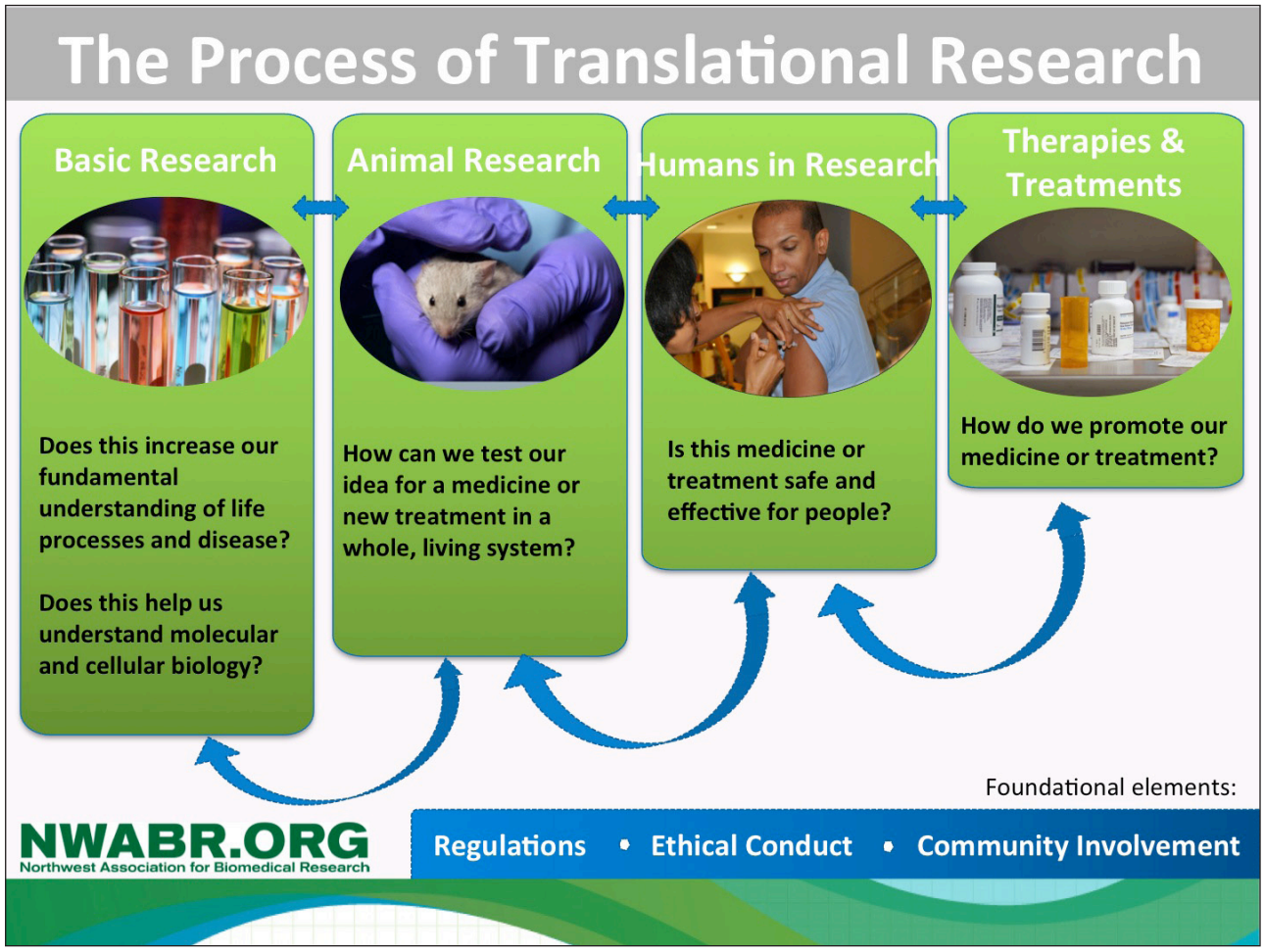
**After the Seminar**

8. Ask everyone questions such as: "Do you feel like you understand the text(s) at a deeper level?" and "What was one thing you noticed about the seminar?"
9. Share your experience as a facilitator.

## CREDIT

Based on materials shared by: Walter Parker, PhD, University of Washington; Paula Fraser, Bellevue PRISM program, Bellevue, WA; Jodie Spitze and Dianne Massey, Kent Meridian High School, Kent, WA. We also gratefully acknowledge the influence of the Coalition of Essential Schools and the National Paideia Center.

RESOURCE




RESOURCE