Assessing Toxic Risk: Intended Learning Outcomes

Skills: Students will be able to

- Conduct scientific research, starting with well-defined protocols and progressing to open-ended research projects
- Work collaboratively to design experiments, interpret results, and critically analyze ideas and conclusions
- Define a toxicological research question, then plan and carry out an experiment to address this question using bioassays with one or more types of organism
- Analyze data and draw conclusions about toxicity and risk
- Identify sources of variability in data, including potential sources of bias
- Write a concise and accurate summary of methods, results, and conclusions
- Use commentary from fellow students to revise or justify research reports and presentations
- Critically analyze summaries of other students' research to determine whether each study was based on good experimental design
- Provide constructive criticism of fellow students' data analysis, interpretations, and conclusions

Concepts: Students will understand that

- Toxicology is the study of harmful effects of chemicals on living things
- Toxicology involves interactions between biology, chemistry, environmental science, and human health
- Dose/response bioassays provide a measure of toxicity
- Chemical risks are relative, and every chemical is toxic at a high enough dose
- There is no such thing as "zero risk." Setting environmental standards requires both scientific data and human judgment to determine what level of risk is acceptable to society
- Science is multidisciplinary and related to societal concerns
- Clear presentation of research results is an integral part of the scientific process
- Scientists work both individually and collaboratively, reviewing each other's work to provide feedback on experimental design and interpretation of results. These "peer reviews" are used to make decisions about what research gets funded and what results get published in scientific journals
- Scientific understandings are tentative, subject to change with new discoveries. Presentation and peer review of research results are key aspects of the process through which scientists sort genuine discoveries from incomplete or faulty work