

**Grant Proposal for the Pennsylvania Institute for Children's Environmental Health
Advanced Educational Advisory Board – extended deadline June 1, 2009**

Children's Environmental Health Issues in Biology for Non-majors

A. Applicant's Name and Department

Applicant's Name: Angelika Antoni

Department: Biology

B. Course for which content related to children's environmental health will be developed.

Course: Introduction to Biology for Non-majors, BIO 010 section 040, 96 students

C. Projected calendar of activities:

1. Course content will be developed July and August 2009
2. Content will be implemented Fall 2009 semester
3. Evaluation of content and implementation will occur at the end of Fall 2009 semester

D. Description of project:

Children's environmental health issues are relevant to a non-majors biology course

Non-biology majors are students of all backgrounds and all interests. 1700 students each year take the Introductory Biology course for non-majors and the numbers are likely to increase as enrollment increases. These non-majors are the students who will be mothers and fathers, voters and lawmakers, average citizens. Issues in children's environmental health are important for every citizen to understand. Children's environmental health is inherently a biological topic. The issues of exposure, metabolism, health effects, research studies, children versus adults, and government regulations are all rooted in biology and biological chemistry. The biological impact of chemicals in our environment is enormous. It is highly appropriate that a course in biology for non-majors will include issues important in children's environmental health.

Incorporation of material concerning children's environmental health will enhance student education

My main goals for students when I teach Introductory Biology for non-majors are 1) that they understand what science can and cannot do and how scientific research is conducted and analyzed, 2) that they become interested in various topics in biology, 3) that they can find reliable answers to questions in biology, and 4) that they feel confident in their abilities to ask and find reliable answers to their own questions in biology – skills that will serve them well for the rest of their lives.

Incorporating the content developed with the help of a PICEH-AEAB grant will enhance student education because the case studies will enable the students to reach all four of these very important goals. Prior to beginning the case studies, students will have an introduction to science and the scientific method. They will be aware of the limitations of science and the

importance of conducting controlled scientific experiments. They will be instructed how to locate and evaluate scientific research publications. This information by itself can be a little dry and seem over their heads. But then, when they carry out and complete the case studies that will be developed, they will implement what they have learned, integrate the tools of proper evaluation, read and synthesize scientific data and form their own conclusions. The method of teaching with case studies in science courses allows hands-on understanding of science and its uses in everyday lives.

Finding topics that interest students enough to encourage them to seek out information for themselves is one of the most difficult tasks educators face. Most students will undoubtedly be interested in the science regarding environmental exposures of children to chemicals and in how medical research is conducted in regards to children's medication. They will be interested because they were children only recently and because many of them have younger siblings or would like to have children of their own. The issues surrounding children's environmental health will be a great inducer of student enthusiasm and perhaps even encourage them into action politically.

Content to be developed: Case studies in children's environmental health for non-majors biology

Controlled Research Studies - Children vs. Adults Case Study

A case study involving the design, ethics, implementation, analysis, reporting and regulation of controlled medical research studies involving children will be developed. The case study will begin with a lecture designed to orient the students into thinking about the design and conduct of ethically and scientifically sound medical research studies. There will be a story concerning children, depression and suicide. Students will explore the differences in medical experimentation involving children versus adults. Students will then be asked to work in a group and design a controlled medical experiment to determine if anti-depressants are effective and safe for administration to children. This will allow them to find the difficulties in trying to design experiments that will determine the effectiveness and safety of a medication while not causing undue harm to the young and vulnerable test subjects. Ethical issues will be discussed in-class at length.

Once the students have designed their own experiments, each student will be instructed to read a series of research articles which will include reports that in 2004 led the FDA to issue a warning that anti-depressants may lead to increased risk of suicide in children and adolescents (e.g. Olfson et al., 2006). Also included will be a follow-up comprehensive review of research studies that indicates the benefits of treatment outweigh the risks of suicide in children and adolescents with severe depression or anxiety (Bridge et al., 2007). Students will evaluate the evidence and form their own conclusions. Then students will be instructed to read several articles concerning the lack of disclosure by pharmaceutical industry personnel who knew of the increased risk for suicidal behavior in children but didn't report those findings until after the

information began to leak to the public (resources can be found at <http://www.biopsychiatry.com/antidepressants/controversy.html>).

Students will then be asked to work in groups to develop a list of regulations and procedures they believe all companies and researchers should have to follow when they develop drugs or test drug effectiveness and safety in children. Students will be instructed to find existing laws and regulations concerning research involving children as test subjects and the use of adult data by the FDA to approve drugs for children. Students will be asked to write a report summarizing the regulations and comparing them to the lists they proposed. Students will be asked guided questions throughout the case study and will be expected to interpret what they read, incorporate the information into conclusions they draw, and write coherent statements of their findings.

Lawn Care Chemicals and Childhood Exposure Case Study

A case study concerning chemical exposure in children, regulation of chemicals by the EPA, health implications of chemical exposures and our ethical obligations will be developed. Prior to conducting the case study, students will learn about the environment and human impacts on the biosphere. The case study will begin with a story concerning lawn chemical exposure in a toddler and the health consequences. Students will then be shown a video in class concerning legislation proposed in 2008 called the Kid-Safe Chemicals Act (<http://video.yahoo.com/watch/4414655/11837407>). The video was produced by the Environmental Working Group (<http://www.ewg.org/>) and discusses research they have conducted on the levels of over 400 chemicals found in the the umbilical cord blood of ten newborns, many of them neurotoxins, carcinogens, and/or endocrine disruptors. The video will help students to realize that the chemicals we use are not benign agents that are contained within the materials we use and that they can impact our health and that of our children.

Students will then be instructed to find out which chemicals are used on the lawns they typically walk through or play on. For lawns on campus, one group will be asked to find the information and post it for the rest of the class. For lawns surrounding off campus houses or parks, students will be expected to contact landlords (or parents) and township administrators to collect the information. If a lawn service is used, students will be instructed to get a complete list of chemicals used from the website of the agency, or they must contact the service to get a list. Once the lists are compiled, students will be instructed how to find, read and interpret MSDS sheets. They will also be instructed to read a scientific review of the health effects of common home, lawn and garden pesticides (Karr et al., 2007).

Each student will be asked to choose the five chemicals they feel are of most concern to their health and they will be instructed how to find laws and regulations concerning exposure limits for these five chemicals. Students will be asked to write a report concerning the health effects of these chemicals, levels commonly used in lawn care, and regulations concerning exposure limits. They will also be asked to find laws and regulations concerning exposure limits for these five chemicals in children. They will undoubtedly not find the information concerning children. This will lead to in-class discussions concerning regulations regarding exposure limits

in children, whether exposure health concerns should be the same in children as they are in adults, and whether lawn use and therefore chemical exposure is different for young children than it is for adults. This will lead to questions as to how and why children and adults differ.

Students will then be asked to develop a list of regulations they deem important in controlling the levels of chemicals to which children, born and unborn, are exposed. Students will then be asked to read a summary of the Kid-Safe Chemicals Act (S.3040, and H.R.6100; <http://www.opencongress.org/bill/110-s3040/show>) and write an evaluation of the proposed legislation in comparison to the list of regulations they proposed. Students will then be instructed to identify their Senators and Representatives and write letters to them concerning their feelings on the proposed legislation. Whether students mail the letters will be entirely up to them. Students will not be graded on their opinions expressed in the letters, only on the completion of the letters.

Implementation of the case studies

The case studies developed with the PICEH-AEAB grant will be implemented during the Fall 2009 semester. Before the case studies are conducted, students will be instructed on the scientific method and how to find and evaluate scientific literature through the use of classroom lectures and a homework assignment. The Controlled Research Studies - Children vs. Adults Case Study will then be conducted. After an additional period of time during which students will learn about the environment and human impacts, the Lawn Care Chemicals and Childhood Exposure Case Study will be conducted. The case studies will involve in-class lecture presentations, in-class group work, and out of class individual work that must be completed by specified deadlines.

Evaluation of the case studies content and their implementation

A series of questions will be developed that will assess student understanding before and after the implementation of the two case studies. Students will be asked a series of questions to determine their level of understanding and their opinions about specific subjects regarding the case studies.

For the Controlled Research Studies - Children vs. Adults Case Study, the questions to be developed will ask opinions such as whether medications that have been tested and shown to be effective and safe in adults should also be considered safe for use in children. The same opinion questions will be asked at the beginning and after completion of the case study. Students will not be graded on their responses, they will either receive credit for completing the questions or no credit if they fail to complete the questions. This information will be used to determine the impact of the case study on student opinion.

Students will also be asked questions, at the beginning of the case study, to determine their level of understanding of the scientific process, ethics, regulations, and controlled research experimentation. These same questions but in an altered format will be asked after completion

of the case study. Students will not be graded on their responses, they will either receive credit for completing the questions or no credit if they fail to complete the questions. This information will be used to determine the effectiveness of using the case study to meet the stated goals.

In addition, there will be factual content questions taken from the readings and questions regarding the research process and regulations that will be included on exams for which students will be graded on their responses.

For the Lawn Care Chemicals and Childhood Exposure Case Study, the questions to be developed will ask opinions such as whether they feel health consequences from chemical exposure will be the same in children and adults and if different, how so. The same opinion questions will be asked at the beginning and after completion of the case study. Students will not be graded on their responses, they will either receive credit for completing the questions or no credit if they fail to complete the questions. This information will be used to determine the impact of the case study on student opinion.

Students will also be asked questions, at the beginning of the case study, to determine their level of understanding of regulation of chemicals by the EPA and the health implications of chemical exposures in children versus adults. These same questions but in an altered format will be asked after completion of the case study. Students will not be graded on their responses, they will either receive credit for completing the questions or no credit if they fail to complete the questions. This information will be used to determine the effectiveness of using the case study to meet the stated goals.

In addition, there will be factual content questions taken from the MSDS sheets, and questions regarding the regulations and the proposed legislation that will be included on exams for which students will be graded on their responses.

Expected outcomes

At the completion of the case studies, students should be able to:

1. Develop the outline of an ethically and scientifically sound research study.
2. Explain the ethics governing research that involves children.
3. Read peer-reviewed research findings and analyze and interpret the results.
4. Write conclusions based upon research findings they have analyzed.
5. Find laws and regulations governing research in children.
6. Identify chemicals to which they themselves are commonly exposed.
7. Find, read and interpret MSDS sheets on chemicals to which they are exposed.
8. Find laws and regulations governing exposure to chemicals.
9. Evaluate the appropriateness of existing laws to govern exposure of children to chemicals.
10. Identify their politicians and write letters regarding pending legislation that may influence the vote of that politician.

Resources cited

In addition to several websites cited above, the following articles were cited:

Olfson, M, SC Marcus, and D Shaffer. 2006. Antidepressant Drug Therapy and Suicide in Severely Depressed Children and Adults. *Archives of General Psychiatry*, 63:865-872.

Bridge, JA, S Iyengar, CB Salary, RP Barbe, B Birmaher, HA Pincus, L Ren, and DA Brent, MD. 2007. Clinical Response and Risk for Reported Suicidal Ideation and Suicide Attempts in Pediatric Antidepressant Treatment: A Meta-analysis of Randomized Controlled Trials. *JAMA*, 297:1683-1696.

Karr, CJ, GM Solomon, and AC Brock-Utne. 2007. Health Effects of Common Home, Lawn, and Garden Pesticides. *Pediatric Clinics of North America*, 54:63-80.

E. Projected date for submission of a final report:

The final report which will include the case study modules, PDFs of research articles and summaries, Powerpoint presentations, notes for instructors, and an analysis of the effectiveness of the case studies will be submitted January 2010.