

CASE TEACHING NOTES

for

"Kermit to Kermette?"

Does the Herbicide Atrazine Feminize Male Frogs?"

by

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INTRODUCTION / BACKGROUND

The unintended side effects of chemicals introduced into our environment are a largely unrecognized problem for us all. It has recently become clear that some organic compounds can act as environmental estrogens, chemical castration agents that can interfere with the sexual development of embryonic males. While this is a matter of concern to elements of the scientific community, the general public is largely unaware of the problem and it is given little, if any, attention in the education of science students. The intent of this case is to bring this important issue, its scientific, economic, and political aspects, to the attention of the students in the honors seminar and non-science major's chemistry course in which this case is used.

Atrazine is an herbicide that is used in enormous quantities in the United States, although its use has been banned by the European Union countries and Switzerland due to safety concerns. Since it is a frequent ground water contaminant in the U.S., the renewal of the license issued to the Swiss-based Syngenta Corporation, atrazine's manufacturer, to continue to sell atrazine in the U.S. became a hotly contested issue. By presenting the science that underlies the atrazine controversy, together with the political and economic issues that impact this science, this case study seeks to give students insight into how these factors interact in the atrazine license renewal process.

Objectives

Upon completion of this case study, students should be aware of the following:

- A way in which environmental estrogens can act to feminize embryonic males.
- The presentation and interpretation of scientific data in graphical form.
- The diverse ways in which the same set of scientific data may be interpreted by groups having differing political and economic viewpoints.
- The power that lobbying has to influence the political outcome of scientific studies.

CLASSROOM MANAGEMENT

This case is taught using a progressive disclosure case study format (see Herreid, 2004) in which students are given data and asked a set of questions about the data, then given more data to consider, in a piecemeal fashion. This case has three parts consisting of three data sets. These three data sets are given to four-person student teams. The teams are asked to interpret each data set and to compare their interpretations to those that others have given about these same data.

The first part of the case the students are given presents data on the feminization of frog larvae that were grown to sexual maturity in water samples collected from Midwestern U.S. streams and ponds having varying degrees of atrazine contamination. These data also distinguish between concentration and dose, a distinction some students may be unaware of. The second part of the case given to the student teams discloses the results of a Syngenta supported study (Carr, 2003). This study is similar to that conducted by Hayes (presented in Part I of the case), except that the frog larvae were grown in de-chlorinated laboratory water. The student teams are asked to interpret this data set and compare the conclusions that they arrive at to those they reached about the first data set. They are further asked to compare their interpretation to that given in a Syngenta Corporation press release.

In Part III of the case, student groups are provided with data collected by Hayes and a second data set gathered by a Syngenta supported team. Both of these studies consider the blood testosterone levels present in control and atrazine treated males. The data reported in the two studies are quite different. The student teams are asked to speculate on the reasons for these differences, and are then given the EPA's interpretation of why these studies have such different outcomes.

Finally, the teams are informed that Syngenta's license to continue to use atrazine in the U.S. was approved. They are asked whether they agree with this outcome, to search the Internet for explanations of the reasoning/events that led to this decision, and to write a brief report summarizing their findings.

After the students have submitted their reports on the case, a final discussion and review is conducted in class to attempt to bring consensus to the conclusions the student teams have reached and, generally, to tie up loose ends that still exist.

Anyone wishing to better understand the political and legislative basis that exists for questioning scientific input into environmental regulation should be directed to investigate the Data Quality Act passed by Congress in 2003 (Weiss, 2004). The Act renders environmental regulation very difficult.

ANSWER KEY

Answers to the questions posed in the case study are provided in a separate answer key to the case. Those answers are password-protected. To access the answers for this case, go to the [key](#). You will be prompted for a username and password. If you have not yet registered with us, you can see whether you are eligible for an account by reviewing our [password policy](#) and then [apply online](#) or write to answerkey@sciencecases.org.

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