



The Mystery of the Toxic Flea Dip

(Adapted from A. Baines et al. (2004). Mystery of the Toxic Flea Dip: An Interactive Approach to Teaching Aerobic Cellular Respiration. *Cell Biol. Educ.* 3, 62-68).

Directions: This is an “interrupted” case study. You will be given a number of pieces of paper—one at a time—that have some information and “clues” to the case. Each of these “clues” also has some questions that it will ask you to consider and answer. Please answer the questions on this sheet THOROUGHLY and with DETAIL in COMPLETE SENTENCES (where appropriate).

Part 1: The Case & Part 2: The Label

At this point you have very limited information, however, you might be able to make some “hypotheses” about what you think might have happened to the little girl.

1. Review her symptoms. Given this set of symptoms, what do you think the cause of death might have been? Justify your answer.
2. Reviewing the "events of the girl’s morning” (dog bath) and examining the contents of the flea dip, how do you think this might be related to the girl’s death?
3. There are a number of “**natural**” ingredients in the flea dip. Use your electronic device and the websites given to fill in the information below concerning each of the “natural” ingredients.

Ingredient	Chemical Properties (Polar? Non-polar? Water soluble? Fat soluble? Etc...)	Applications (What is it used for?)	Toxicity (Describe its toxic effects)
Oil of Cinnamon http://en.wikipedia.org/wiki/Cinnamaldehyde			
Oil of Cloves http://en.wikipedia.org/wiki/Eugenol			
Oil of Fir (Pine) http://en.wikipedia.org/wiki/Pine_oil			
Oil of Rosemary http://en.wikipedia.org/wiki/Rosemary			
Rotenone http://en.wikipedia.org/wiki/Rotenone			

4. Given what you have discovered about each of the “natural” ingredients and given what you think might have happened to the girl, which ingredient(s) do you think might be the most responsible? Which do you think are less responsible? Justify your answer.
5. If the flea dip is responsible for the girl’s death, how could a product composed of all “natural” ingredients that is “non-toxic” possibly be harmful? (HINT: Think about “normal” use.)

Part 3: The Autopsy Report

6. What metabolic process in the girl’s cells did the Fleacide affect?
7. Why were tissues of many different organs affected?

Part 4: ATP Analysis

8. Based on this “more specific” information and your knowledge of cellular energetics, what seems to be functioning “normally.” Explain your thinking.
9. Given your answer to question #8, what do you think is not functioning correctly? Justify your answer.

Part 5: Subcellular Analysis

10. Given this new information, what specific cellular process do you think was affected by the Fleacide? What information supports your belief?
11. Some health food stores sell supplements containing NAD⁺. If you administered the supplement to the girl, could you have saved her? Why or why not?
12. Would artificial respiration or oxygenation have saved the girl? Why or why not?