

## Accidental Drowning or Foul Play? A Case Study in Organic Chemistry

by  
**Monika Konaklieva**  
Department of Chemistry  
American University, Washington DC

Even when she used to scuba dive for pleasure, Dr. Anderson never liked to dive in lakes. Not because of the cold water—and heaven knew the lakes in New York State were *very* cold indeed, and for most of the year—but because of the murkiness of the water. The poor visibility made her feel closed-in, claustrophobic.

Dr. Anderson's new assignment brought back memories of her own lake-diving experiences. It was a case that would have been solved already if someone had properly labeled the bodies.

"There's been a recent rash of murders in a 25-square-mile area of upstate New York," said the District Attorney over the phone. "Thirteen bodies have been found in various lakes throughout the region. Yesterday, two more bodies were found in two different lakes."

The voice droned on, flat and unemotional.

"One body was found in Kidney Lake by a family on a fishing boat, another washed up on the shore of Lake Zona. Both of the bodies were taken to the Baker County Morgue. Upon arrival, they were put aside for later examination. When the coroner arrived this morning, the bodies were unmoved but also unlabeled. We don't know which body came from which lake. It's important for us to solve that puzzle. Sorry for the short notice...", said the voice, finally losing some of its matter-of-fact tone.

Not wanting to hear more, Anderson ended the conversation with her usual answer, "We'll try to help," and hung up the phone. For a brief moment her thoughts went back to the murky waters of the lakes and to the two young men who had visited them before their deaths.

Anderson turned to her computer, did some searches on it, and then typed the following notes:

Kidney Lake is located next to a chicken farm. There are various agricultural wastes that come from this type of industry. Some prominent wastes include castor oil esters, conjugated fatty acids, benzophenone, medium-chain triglycerides, and various forms of antibiotics.

Lake Zona is adjacent to a cosmetic plant and perfumery. Known wastes from these industries include heptaldehyde, heptanoic acid, undecylenic acid, ethyl heptoate, and medium-chain triglycerides.

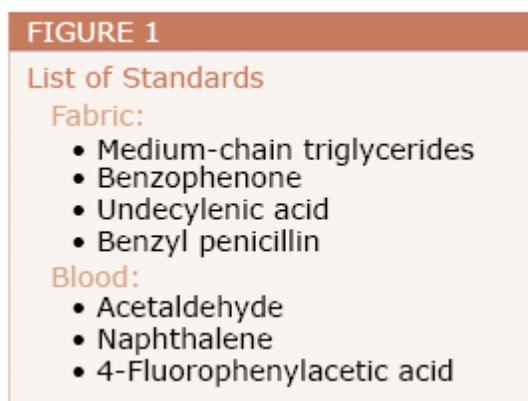
She paused for a moment, and then continued:

To clarify the cause of death, blood samples were taken from each body. Samples from the fabric of the victims' clothes have been also obtained.

She saved the file and leaned back in her chair. It was now the responsibility of her team to determine which body came from which lake. They would also need to determine whether or not each body was a victim of murder or perhaps of an accidental drowning that happened to coincide with the outbreak of the killing spree. Before going back to her laboratory, Anderson opened the folder on her desk labeled "Standards" and took more notes. She then grabbed her sweater and went to meet her waiting team.

You are part of Dr. Anderson's team. It is your job to analyze two fabric samples—one from the clothing of Body A, and another from the clothing of Body B. You will compare your findings to the standards that may correspond with compounds that could possibly be found in these fabric samples. As with any criminal case, you must offer a justified methodology to determine what compounds, if any, are present within the fabric.

You also will be responsible for analyzing the two blood samples. You must evaluate these samples to determine what compounds, if any, are present within the blood. You will be given standards (see Figure 1) that may be present within the samples. Based on your findings, the detectives assigned to the case will know whether the victims were murdered or whether their deaths were the result of a misadventure.



You should then plan a lab report that will do the following:

- Determine the location of each body.
- Determine the cause of death for each body.
- Justify and explain your conclusions.
- Describe your created methodology.
- Find and draw chemical structures for all compounds discovered in the samples.

**Image Credit:** Photo of Lake Umbagog courtesy of U.S. Fish and Wildlife Service.

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