Recently, I decided my hardworking chemistry students needed a break from their textbooks and from conventional chemistry. I had always wanted to do a forensic science unit, but the kits and articles available were either too easy, complicated, or expensive. So I decided to develop a forensic science unit with the help of *Crime Scene Investigations* (Walker and Wood, 2000). In this unit, students examine and test evidence from a mock crime scene and, based on their laboratory investigations, choose a “murderer” from three suspects.

This project addresses many areas of the *National Science Education Standards’ Science as Inquiry Content Standard A* (National Research Council, 1996). This standard calls for students to develop the ability to understand and do scientific inquiry. In this inquiry-based lab, students must formulate and revise scientific explanations, and they must be able to communicate and defend a scientific argument by using the scientific method to solve problems. In addition, students use skills and knowledge from several sciences, drawing on biology lessons to test fake blood samples, using chemistry lab skills to test powder found at the scene, and employing some physical science techniques to take measurements. Although taking measurements does not identify the murderer, it may help students develop a motive and understand how the murder was committed.
Students as crime science investigators

When students entered the classroom on day one of the unit, I gave them each a copy of the scenario (Figure 1). The students were told that they would have to present a written and oral report that contained the items listed in Figure 1. I set a due date for four days later and took them to the “murder scene.”

At the scene of the crime

The crime scene was set in a little-used room that represented the victim’s dining room. The following materials were used in creating the crime scene:

- Four handwriting samples;
- Four hair samples (suspects’ hair should be about the same color);
- Four similar unisex athletic shoes;
- Four pieces of different types of red material (I bought 1/4 yard of each at a local department store). This material represented the clothing that the suspects were supposedly wearing the night of the murder;
- Three kinds of white powder: baking soda, plaster of paris, chalk dust. Only baking soda was left at the scene, but all three suspects had reasons to have a white powder on them;
- Water, vinegar, and iodine for testing (the baking soda can be identified because it will fizz when mixed with vinegar—the baker brought it into the scene on his shoes);
- An artificial blood-typing kit (I used type AB and type O as the blood found at the scene);
- A crumpled note with both the victim’s and murderer’s handwriting (My note said, “I will see you Sunday at 7:00.” “No, don’t come, I will not give you what you want!”);
- Various pieces of possible evidence. They don’t all need to have a connection and could include glasses, lipstick, wallet, jewelry, food, fabric, hair, and fake blood—a red slime that is made from a mixture of polyvinyl alcohol, a 4 percent borax solution, and red food coloring;
- A list of characteristics of the suspects and victim (try to have some overlap of characteristics).

The students had to pass through yellow police tape to enter the scene. They saw a chalk outline of the body and a table with two chairs, one of which was on its side. There were two coffee cups, complete with lipstick stains and a black liquid inside. On the floor there were glasses, a wallet, a cigarette butt, crumpled paper, and white powder with footprints in it. Close to the body were some hairs and torn fabric. Some of the books on the bookshelf...
were askew, and one in particular was opened face down on a table with a $10 bill showing at the corner. Blood (red slime) was also noticeable in several places. Without touching or moving anything, students made observations and used metersticks to take measurements of the locations of possible evidence.

Students were serious and diligent when taking measurements and recording observations. They found several items, such as a thread and soda can, which I had not realized were there. They used a scale of 1 cm = 40 cm to draw the scene. Only a few teams noticed the hairs, another spent a lot of time on the meaningless thread, and others were sketching the footprints in the powder. I indicated that the team with the most complete report would receive a “promotion,” therefore, students worked only with their partners and did not share findings with other groups.

On day two, the name, age, sex, and occupation of each suspect were orally presented to the students (Figure 2). It was up to the students to write down the information accurately and organize it. The students then made a list of questions they wanted to ask each suspect and a list of things they wanted to examine from the crime scene. All the students chose to go back to the crime scene to take final measurements and observations. They then began forming hypotheses. Some of the early hypotheses involved thinking the murder was committed because of the money that was present. Some students thought that because the table had two used cups on it, Myra knew the killer. Non-relevant materials were also included in the hypotheses.

**Examine the evidence**

On days three and four, the teacher brought the evidence to the science room and for efficiency set up stations for testing. Once the evidence was in the room, students could touch it. At the stations where the blood and white powders were tested, full-wrap, splash-proof goggles and lab aprons were worn. Students were supplied with hair and cloth samples from the suspects and the victim, along with packets that explained how to run tests on these samples. Students used microscopes to match the samples and created data tables and sketches to present their findings.

All the suspects worked with different white powders; students used vinegar, iodine, and water to test the baking soda, chalk dust, and plaster to match the substances to the powder found at the crime scene. Two samples of red slime “blood” were found at the scene. During the testing phase, students used simulated blood provided in the typing kits to type the blood. Shoes from the suspects and victim were available for comparison. Most teams found part of a popular athletic shoe name in the print left at the scene. The crumpled paper revealed a note that was somewhat threatening and contained two different handwritings. Students were supplied with handwriting samples of the victim and suspects.

During testing, one team at a time could come to me—the director of the investigation—to ask questions about the suspects, coroner, neighbors who found the victim, and history of Myra. I was amazed at the questions asked. Although I could answer questions about suspects’ blood types, hair color, and relationship to Myra, I was unprepared for questions such as “What kind of cars did the people involved drive?”, “Are there any neighbors who might have seen something?”, and “What were the suspects’ alibis?” Some of the students’ questions had no answers. For other questions, I had to “consult” overnight with the suspect to determine an answer. I made many overlaps so the murderer wouldn’t be immediately obvious. For example, when questioning the director of investigation, students should learn that Rollen and D.W. both wore

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**FIGURE 2**

**Characteristics of the three suspects and the victim.**

<table>
<thead>
<tr>
<th>Suspect</th>
<th>Age/Sex</th>
<th>Occupation</th>
<th>Hair</th>
<th>Blood type</th>
<th>Miscellaneous information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rollen Baker</td>
<td>30/male</td>
<td>baker</td>
<td>black, shaggy</td>
<td>O</td>
<td>wears glasses, had been dating Myra</td>
</tr>
<tr>
<td>Josey Drummett</td>
<td>23/female</td>
<td>schoolteacher</td>
<td>curly brunette</td>
<td>O</td>
<td>worked with Myra, also sold Avon, brought dinner to Myra’s house, smokes</td>
</tr>
<tr>
<td>D.W. Lasters</td>
<td>26/male</td>
<td>drywall plasterer</td>
<td>brown</td>
<td>B</td>
<td>has money troubles (owes Myra money), knows Myra, wears glasses</td>
</tr>
<tr>
<td>Victim</td>
<td>25/female</td>
<td>school librarian</td>
<td>blondish</td>
<td>AB</td>
<td>wears contacts and lipstick</td>
</tr>
</tbody>
</table>

Autopsy report showed evidence of a struggle, food in Myra’s stomach, and a severed vena cava. Close to the chalk outline of where the victim was found were a piece of red material and some hair. They were rightly assumed to have been torn from the murderer during a struggle and gave some important evidence.
FIGURE 3

Evaluation suggestion.

**Part I: Drawing of the crime scene  25%**
- Was the drawing to scale and was there a key?
- Were all evidence and furniture there, even if it was not used?
- Were the objects labeled and drawn to proportions?
- Was the North direction indicated?

**Part II: Lab tests  30%**
- A. Footprints
- B. Blood-type testing
- C. Hair comparison
- D. Fabric comparison
- E. White powders
- F. Any other miscellaneous evidence
- Was the data presented in a neat data table? Were there numbers, sketches, or observations to back up the results?

**Part III: Student questions  6%**
- Were they organized and complete? Did students keep track of the answers?

**Part IV: Notes and ideas  4%**
- These did not have to be organized. I just wanted them to keep track of any thoughts that they had during the week.

**Part V: Written paper  25%**
- I looked for the answers to the following questions: Who killed Myra? Why did he or she kill her? When did he or she kill her? What evidence can be provided to prove guilt?

**Part VI: Oral presentation  10%**
- Were both partners involved and organized?

A successful investigation

Although this unit was successful, I already have ideas about improvements for next year. I would like to set the crime scene at a house near the school and have actual people play the parts of the suspects. I want to put out more evidence, such as some broken jewelry, and borrow the school’s CPR dummy to cover with a sheet to present as Myra on the first day.

Regardless of the variations introduced into the crime scene and thus the activity, this exercise was successful for a number of reasons. The students had a job to do but were given few directions on how to do it, allowing them to use critical thinking skills and experience the excitement of doing authentic investigative science. In addition, they used problem-solving and lab techniques that they had learned in all of their science classes. Finally, students really enjoyed this activity and were motivated to do a good job and solve the case. The results of this forensic unit encourage me to find more problem-based lessons that integrate all the sciences.

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References