



The Nucleus

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President's Message:

In 1159, the Bishop of Chartres, John of Salisbury, wrote:

“Bernard of Chartres used to say that we are like dwarfs on the shoulders of giants, so that we can see more than they, and things at a greater distance, not by virtue of any sharpness of sight on our part, or any physical distinction, but because we are carried high and raised up by their giant size”

This dwarf would like to take the opportunity to thank the teachers who have “raised” me up. When I began my teaching career as a young, uncertified, and admittedly clueless newbie, the stars aligned and I was placed in a classroom next door to Texas biology giant Carolyn Schofield. Carolyn provided such a shining example of what a biology teacher should be that I would have been unable to sleep at night if I did not attempt to follow her lead. Through Carolyn I was introduced to other giants like Carol Leibl, Debbie Richards, and Robert Dennison whom I have had the pleasure of learning from. To these teachers, and many others, I would like to wish a heartfelt thank you for providing guidance to a wayward dwarf.

As we careen towards the end of another school year, I would like to encourage our young biology teachers to actively seek out a giant of their own. Look for the veteran science teacher who inspires students, and learn from them as much as you can. Every time you talk to a great teacher, try to incorporate something that you have learned in to your own classroom. On the other hand if you are a giant then you should seek out the new biology teacher in your building, and do everything that you can to make their lives easier. Your knowledge can make the difference between a young teacher having a productive

career in science education, or becoming another casualty of the system. Having a great mentor can really make the difference to a new biology teacher.

We are facing an exciting year for biology teachers in Texas. The revision process, for the science TEKS, is under way, and we patiently wait to see the outcome which will guide our biology teaching world for years to come. I would like to encourage all of you to find some way to get involved with the greater community of Texas biology teachers. Presenting at C.A.S.T., traveling on a TABT sponsored trip, volunteering for a TABT committee, and mentoring that new biology teacher, in your building, are just a few ways to get involved. Thank you all for everything that you do, and keep up the good work!

Benjy Wood, TABT President



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Teaching Tips: Safety & Scientific Method

Suzy Thacker and Nadine Dickson

(Edited from an article of the same title published in the Fall, 1993 issue of *The Nucleus*)

At the beginning of a new teaching year, before getting to the meat of their subject, high school science teachers are frequently given the task of refreshing and reinforcing previously presented information – anything from metric measurement to how to use a compound microscope. The following two activities have been used to help students refresh their memories concerning laboratory safety and scientific inquiry. Since these have been used for many years, we don't remember where they came from; we may have even written them ourselves. In any event, they can be used by any of the various disciplines in science.

Role Playing Safety Situations

This is a good icebreaker for the beginning of the school year. Copy and laminate these situations so they can be reused for several years. Each of seven lab tables has groups that randomly pick one card and then spends ten minutes discussing the problem(s) and the solution(s) with others in their group. Follow this with a group presentation. Each group reads the card to the class and then demonstrates – with the necessary equipment – how the problem(s) should have been solved. This is a good way to get input from the rest of the class as possible solutions are brainstormed.

Situation #1

Rapunzel and Prince Charming were doing a lab experiment that required a hotplate to boil a beaker of water. While leaning over the lab table to whisper sweet nothings in her ear, Charming accidentally pushed his lab notebook up against the hotplate. As you might have guessed, the paper caught fire. In the excitement, Rapunzel leaned over and her hair ignited, too.

- Determine what you will do to stop this catastrophe, and then go get the necessary materials.
- Determine how this fiasco could have been prevented.

Situation #2

During the lab one day, Bill and Ted were asked to look at and draw a dog tapeworm from a prepared microscope slide. While carrying the microscope in one hand and the tapeworm slide in the other hand, Bill tripped over Ted's backpack. As would be expected, Bill and Ted's \$500.00 microscope lay in pieces all over the floor.

After carefully hiding the broken microscope in a nearby cabinet, Ted volunteered to get another microscope and find the tapeworm on the slide. He places the slide on the stage and turned the large, coarse adjustment knob to bring the worm into focus. All of a sudden the slide cracks into pieces by the 100X objective that someone had left in position.

- Identify the errors in technique that caused each of the above mishaps.
- Demonstrate how each of these situations could have been avoided.

Situation #3

While studying common human microorganisms during their microbiology unit, the Tree sisters (Willow and Magnolia) were asked to "kiss" a Petri dish containing agar, a Jell-O-like substance on which bacteria grow. Three days later, proud of their results from the culture, the girls opened the Petri dish to display the growth on the agar. In addition, they were anxious to show Mom and Dad how hard they'd been working, so they tucked the Petri dish in a purse and took it home to show the family. The next week, a surprisingly unusual epidemic of strep throat infection swept the community.

- Explain the sudden appearance of the widespread outbreak of illness.
- How could this have been prevented?
- Gather the necessary materials from the above lab activity and demonstrate the safe lab procedures necessary for this type of equipment.

Situation #4

The Derryberry twins, Mary and Larry, along with their half brother, Harry, were asked to heat a test tube, full of glucose solution, in a hot water bath. After placing the chemicals in the test tube, Larry placed a cork on the top to mix the contents of the tube. Using her fingers, Mary then placed the corked tube in boiling water to await the reaction.

- What reaction did Mary, Larry, and Harry get?
- Gather the necessary materials for this exercise and demonstrate the proper safe lab technique required for this situation.

Situation #5

Carmine Cool, the most handsome guy in school, is Cherry Cheerleader's fish dissection lab partner. It would be too embarrassing to wear her geeky glasses to class, so Cherry wears her "Baby Doll" blue contact lenses instead. Halfway through the lab her contacts become so hazy from the formaldehyde fumes that she accidentally cut Carmine's finger. He is too cool to complain, so he casually sucks the blood from his injured finger and continues with the dissection.

- Where did both students lose their way?
- Gather the necessary materials and demonstrate the proper lab techniques required for this situation.

Situation #6

Gertrude and Gerabaldi are feverishly dissecting their pet pig, Ham Hocks, when Gertrude squirts preservative into Gerabaldi's eye.

- What should Gertrude do?
- Demonstrate the necessary first aid procedures for this situation.
- Describe the proper laboratory technique for this situation.

Situation #7

You and Darlene Dweeb have been assigned as new lab partners. Both of you are to consult the MSDS for information on the lab chemicals to be used that day. The chemicals are phenolphthalein indicator and hydrogen peroxide. Darlene refuses to read the MSDS and then proceeds to accidentally switch the dropping pipettes in each bottle after their use. To her horror, Darlene gets an unexpected reaction.

- Describe Darlene's unexpected reaction.
- Explain the error Darlene's ways.
- Demonstrate safe lab techniques for this particular situation.

Scientific Inquiry

This activity uses cooperative grouping, creative problem solving, and formal writing skills. After a quick refresher on the scientific method, assign each lab group one of the following problems. Don't give students any information other than the problem and a list of materials with which they will be provided. Try to assign the problems the day before they actually do the activity so they have the opportunity to do some background research on their topic. It is up to the individual lab groups to solve their problem using any or all of the materials provided. Following the activity, groups present their results to their classmates. This is a good time to employ "peer scrutiny" – an opportunity for the class to question the group's methods and results. The class can help groups to identify errors in experimental design or invalid conclusions they've drawn. Following this, ask each student or use a formal format to write his or her experimental design.

Problem #1

Answering the call from desperate dentists suffering from a slump in dental cases, scientists at the Already Been Chewed Gum Company, Inc. have been trying to discover the answer to the classic dental school final exam question. ABC Company, Inc. wants to know: “Why doesn’t gum stick to teeth?”

Materials: various types of chewing gum, sandpaper, an old shoe, toothbrush, tin can, spoon, sponge, plastic cup, paper plate, metric ruler, and triple beam balance.

Problem #2

Scientists at Redenbacher, Inc. have recently been experimenting with genetically engineered strains of popcorn. Their experiments have netted three different types of popcorn – one white, one yellow, and one multicolored. Their next test is to determine whether each of these strains contain different amounts of water.

Materials: three types of popcorn, paper bags, measuring cups, metric ruler, triple beam balance, and a popcorn popper.

Problem #3

Scientists at Armageddon Scientific, Inc. have been asked by the U. S. Defense Department to develop a type of candy that can withstand the heat encountered in desert combat situations. Development of such a candy, according to the Defense Department, would greatly improve the morale of the combat troops. Scientists are, therefore, trying to decide how color affects the melting rate of candy-coated chocolate.

Materials: bags of M&Ms, various colors of construction paper, heat lamp, metric ruler, tongue depressor, and triple beam balance.

Problem #4

The management at Post Cereals has received numerous complaints from irate consumers claiming that they are being cheated out of marshmallows in several bowls from the same box of Alphabets Cereal. Management would like to know if the complaints are valid or just a ruse in order to receive free samples of the product.

Materials: unopened boxes of Alphabet Cereal, paper bags, measuring cups, metric ruler, spoon, bowl, and triple beam balance.

Problem #5

A manufacturer of coin-operated machines has recently received complaints that their machines do not properly dispense candy when pennies from the years 2004, 2005, 2006, or 2007 are used, but work perfectly with pennies minted in 1999, 2000, 2001, 2002, or 2003. The manufacturer wants to know if there is a significant difference in the size, shape, or weight of coins minted since 2003 when their machines first came on the market.

Materials: ten pennies from each year 1999 to 2007, paper plate, 100-ml cylinder, water, metric ruler, and a triple beam balance.

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Safety Role Play in the Biology Classroom

Nadine Dickson (Jersey Village High School) and Suzy Thacker (Klein Collins High School)

The following is a list of “catastrophic” laboratory safety violations in role play form that we typically use with freshman biology students as a way to get them up and moving around. They can be used at any level and can be modified to fit your particular science subject matter. While these scenarios are by no means comprehensive, they do cover safety issues relevant to a freshman biology class.

To begin the activity, we copy these scenarios onto cardstock and have them laminated so they can be used from year to year. The activity can be done in any format, but typically we divided the class into groups of 4 and have the groups spend about 5-10 minutes reading through their scenario and discussing it with their group members. After studying the scenarios in groups, we randomly draw numbers and have each group stand up and read its particular scenario. Then we lead a class discussion about what went wrong with that particular activity (*i.e.* what safety rules were violated). After this, the groups of 4 go get the necessary materials and demonstrate the **correct** way to proceed. (Never allow students to demonstrate the accident!) You can follow up with a written list of safety rules and written assessment of some kind. Students and parents should also be required to sign a safety contract following student safety instruction. We include an answer key as well as a supply list at the end of this article. This activity usually takes one traditional class period (55 minutes). Have fun with these and feel free to modify as needed.

Catastrophe #1

Rapunzel and Prince Charming were participating in a lab experiment that required the use of a hot plate to boil a beaker of water. While leaning over the lab table to whisper sweet nothings in her ear, Charming accidentally pushed his lab notebook against the hot plate. As you might have guessed, the paper caught fire. In all the excitement, Rapunzel leaned over and (yes...that’s right...) her hair ignited too.

- 1) Determine what you will do to stop this catastrophe.
 - 2) Next, determine how this fiasco could have been prevented and get the necessary materials to demonstrate the correct way to perform this lab procedure.
-

Catastrophe #2

During lab one day, Bill and Ted were asked to observe a dog tapeworm from a prepared microscope slide. While carrying the microscope in one hand, and the tapeworm slide in the other hand, Bill tripped over Ted’s backpack. As would be expected, Bill and Ted’s \$500.00 microscope lay in pieces all over the floor. After carefully hiding the broken microscope in a nearby cabinet, Ted volunteered to get another microscope and find the tapeworm on the slide. Ted couldn’t find one of the nice, new, shiny microscopes the other students had, so he got an old microscope with a frayed cord out of another cabinet. All of the good slides were already taken too. So Ted got the last slide from the box, but it was okay because it was only missing a small piece of glass from the corner. He placed the slide on the stage and turned the large, coarse adjustment knob to bring the worm into focus. All of a sudden – **crack!** – the slide was smashed to pieces by the high power objective someone had left in position.

- 1) Identify the errors that caused each of the above mishaps.
 - 2) Next, using the appropriate equipment, demonstrate how each of these situations could have been avoided.
-

Catastrophe #3

The Derryberry twins, Mary and Larry, (along with their half-brother Harry) were asked to use a hot water bath to heat a test tube full of a glucose solution. After placing the chemicals in the test tube, Larry placed a rubber stopper on top so he could shake the tube and mix the contents. Mary then placed the stoppered test tube into the boiling water to wait for a reaction.

- 1) What reaction did Mary, Larry and Harry get?
 - 2) Gather the necessary materials and demonstrate the correct way to do this lab procedure.
-

Catastrophe #4

During their microbiology unit, while studying common human microorganisms, The Time twins, (Ahn and Justin) were asked to “kiss” a Petri dish containing nutrient agar (a Jell-O-like substance bacteria readily grow on) and place the dish in the incubator to allow the bacteria to grow. 3 days later, proud of their results, the twins opened the dish to display the bacterial growth that had developed on the agar. In addition, they were anxious to show Mom and Dad how hard they had been working, so Justin tucked the Petri dish into his backpack and took it home to show the family. Within days, a surprisingly unusual outbreak of strep throat infections swept the community.

- 1) Explain the sudden appearance of the widespread illness. How could this have been prevented?
 - 2) Gather the necessary materials used above and demonstrate the correct way to do this lab procedure.
-

Catastrophe #5

Carmine Cool, the most handsome guy in school, is your starfish dissection partner. It would be too embarrassing to wear your glasses to class, so you wear your “Baby Doll Blue” contact lenses instead. Halfway through the lab, your contacts become so hazy from the fumes that you accidentally cut Carmine’s finger with the scalpel. Carmine is too cool to complain, so he casually sucks the blood from his injured finger and continues with the lab.

- 1) Where did you both lose your way?
 - 2) Gather the necessary materials and demonstrate the proper lab technique required for this lab procedure.
-

Catastrophe #6

The Dover twins (Ben and Eileen) were feverishly dissecting their pet pig, Ham Hocks, when Eileen dug a bit too deep and squirted preservative into Ben’s eye.

- 1) What should the Dover twins do now?
 - 2) Gather the necessary equipment and demonstrate the correct way to do this lab procedure.
-

Catastrophe #7

To your horror, you find that Darlena Dweeb has been assigned as your new lab partner. You and the Dweeb are to consult the MSDS for information concerning the chemicals to be used in lab that day. The chemicals to be used in the lab are hydrogen peroxide and phenolphthalein. You and the Dweeb forget to examine the MSDS sheets and then proceed to accidentally switch the eyedroppers in each bottles after their use. To your horror, you and the Dweeb get an unexpected reaction.

- 1) Describe the unexpected reaction.
 - 2) Using the appropriate materials, demonstrate the correct procedure for using this lab equipment.
-

Answers to the Safety Role Play

(Certainly not a complete list but most of the major issues)

Catastrophe #1

- 1) Using the fire blanket, extinguish Rapunzel's hair.
- 2) Using the fire extinguisher, extinguish the paper fire.
- 3) All long hair, and long sleeves, should be tied back when using heat, chemicals, or open flame.
- 4) All unnecessary materials (especially paper) should be off the lab table.
- 5) No horseplay in lab.

Catastrophe #2

- 1) Bill was carrying the microscope with one hand and something else with the other hand.
- 2) Ted's backpack was a trip hazard because it was left out in the aisle.
- 3) Bill hid the microscope from the teacher.
- 4) Someone left the high power objective in position.
- 5) Ted didn't look before he put the slide on the stage.
- 6) The prepared slide has a thick coverslip which often doesn't allow enough room between the top of the coverslip and the surface of the high power objective. One should never begin to focus a slide with the high power objective in place.
- 7) Microscopes should be carried with 2 hands; one on the base the other on the arm.
- 8) All backpacks should be placed along the side or back of the lab room, out of the way of traffic areas.
- 9) Slides should be focused first using the low power objective. Only then should the high power objective be put into position. Microscopes must be stored with the scanning or low power objective in place.
- 10) Electrical equipment must not be used if cords are frayed, loose or have exposed wires. Nor should they be used in or around wet surfaces.
- 11) Glassware, including microscope slides, should not be used if cracked or broken.

Catastrophe #3

- 1) The rubber stopper popped off the top of the heated test tube.
- 2) Test tubes should never be heated with anything over the mouth.
- 3) Test tubes should be heated with the mouth pointing away from anyone else.

Catastrophe #4

- 1) By opening the cultured Petri dish, the Time twins potentially exposed everyone to whatever was growing on the surface of the agar. Since they were culturing mouth microorganisms, if either twin was carrying a pathogen at the time they "kissed" the plate, the agar may have grown a colony of pathogens.
- 2) Petri dishes are clear for a reason. Anything growing in a dish can be viewed without taking the lid off.
- 3) Microorganisms should be disposed of by the teacher, not the student.
- 4) Demonstrate that Petri dishes come in two parts. One part fits over the other and all contents can be viewed through the plastic (glass).

Catastrophe #5

- 1) Contacts should probably not be worn in lab on days where chemicals are in use.
- 2) Carmine should not have "sucked" the blood from his finger. He should have notified the teacher, washed the cut thoroughly and obtained a sterile bandage from the nurse. All accidents must be alerted to the teacher.
- 3) All equipment exposed to bodily fluids must be sterilized to prevent pathogen transmission.
- 4) Demonstrate how to hold a scalpel (like a pencil) and how to cut (away from you and anyone else).

Catastrophe #6

- 1) Eyes should be rinsed out at the emergency eye wash station for a minimum of 10 minutes followed by consultation with a health care professional.
- 2) Demonstrate that goggles should be worn at all times in lab when heat, fire, chemicals, or any other potentially hazardous materials are being used.
- 3) Locate the eye wash station and show how to operate it.

Catastrophe #7

- 1) The MSDS will describe that hydrogen peroxide and phenolphthalein combined, produce potentially "violent" reactions (explosions).
- 2) Demonstrate that eye dropper bottles should be used, one at a time. The tops should be securely replaced after each use, no matter how many people are waiting in line to use the same bottle.

*Note – it is probably a good idea to go over general lab procedures for clean up (solids and liquids disposed of in separate locations) burns, cuts, fire, and common lab equipment they will use this year. Follow up with a written list of laboratory safety rules.



Supply List for Safety Role Play

Materials	Amount	Catastrophe #
Goggles	Class set	1 - 7
Hydrogen peroxide MSDS	1 copy	7
Phenolphthalein MSDS	1 copy	7
Dropper bottle	2	7
Dissection try	2	5, 6
Dissection tools	2 sets	5, 6
Petri dish	1	4
Hot plate	2	1, 3
Beaker	2	1, 3
Test tube	1	3
Rubber stopper	1	3
Test tube tongs	1	3
Microscope	1	2
Tapeworm slide	1	2
Fire blanket	1	1
Fire Extinguisher	1	1
Eye Wash	1	6



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