LAB REPORTS

All write-ups must be typed and must not exceed two pages. Include the following:

Title - brief, clear, descriptive

Hypothesis - state it clearly and concisely

Prediction - the prediction should be able to disprove your hypothesis

Treatments and Controls - list your treatments and controls; explain why you chose to include each control

Results - state briefly what you observed; provide a table or graph with data if you made measurements

Conclusions - explain why your results support or refute your hypothesis

Key question - answer one of the key questions included in the lab guide

HOW TO WRITE A BETTER LAB REPORT

TITLE

1. Make it brief, short enough to be centered on one line. If you really feel the need to make it longer, try a few words of the most important information followed by a colon and a subtitle with details or explanation.

   Examples: Mold and the Disease Triangle
   Bread Mold: The Effects of Environment

2. Be sure it relates clearly to the main point or process of the lab.

3. Use humor sparingly. Try a funny, cute, or catchy tide only once you know the instructor will appreciate it.

4. Use a title given in the manual or a slight variation of it, if all else fails.

HYPOTHESIS

1. Try to get all the important information into your hypothesis in as few words as possible.

2. Remember that a hypothesis should be stated as a "truism" or statement of how things generally work rather than a "prediction" of how things will come out in your experiment or of what you think is going to happen. It is very tempting to write a hypothesis in the future tense ("Bread will get moldy if ... ") but it is more meaningful and true to the scientific method if it is written in the present tense ("A warm environment favors the growth of mold ...") .

3. Be patient with yourself. Formulating hypotheses can be complex and difficult, but you will get better at it with practice.

TREATMENTS AND CONTROLS

1. Include all your treatments and controls. Make sure you show clearly which are the treatments and which are the controls.

2. Consider using a list or table to organize this information (see examples below).

Example 1:

Experimental condition

treatment	bread type	incubation condition
1 slice spore-sprayed	sourdough	37°C

Spore-sprayed bread has been sprayed 6 times with a spore suspension of *Penicillium notatum*.

Controls

treatment	bread type	growth condition	isolates effects of...
1 slice spore-sprayed	sourdough	4°C	temperature
1 slice spore-sprayed	sourdough	24°C	temperature
1 slice water-sprayed	sourdough	37°C	spore inoculum
1 slice water-sprayed	sourdough	4°C	spore inoculum
1 slice water-sprayed	sourdough	24°C	spore inoculum

Water-sprayed bread was sprayed 6 times with pure water. All 6 slices were stored in closed plastic bags.

Example 2:

	growth condition			
Bread type	warm	cool	room temp	treatment/control
spore-sprayed sourdough	X			experimental condition
spore-sprayed sourdough		X	X	control- effect of temperature
water-sprayed sourdough	X	X	X	control- effect of spore inoculum

Spore-sprayed sourdough was ...
Water-sprayed sourdough was ...
All 6 slices were stored ...

RESULTS

1. State just what the results were, what you observed. **Describe** them: "a blue-green fuzzy growth" not just "a mold." A simple and clear way to include all results is to plug them into the table or list you generated for your treatments and controls. Make sure to separate your observations from your interpretation of the observations. This will enable others who read your report to form their own conclusions based on your data. Save the interpretation of what the results mean for the next section, "Conclusion."

   Example:
   Results: I see a blue fuzz vs. Conclusion: I believe it to be Penicillium.

   It may seem to you that this is too obvious, too easy, but simple description is all that is required here and is really the most difficult and important part of science. Making good

observations and recording them accurately is the crux of good experimental biology.

2. Quantify your results, if possible. Use a standard scale or count, or devise a simple numerical scale of your own.

   Example:
   fraction of bread covered with mold: 0 = no mold, 1 = 1/4 covered, 2 = 1/2 covered, etc.

CONCLUSIONS

1. Explain why your results support or reject your hypothesis. Use expressions like, "The results support/refute the hypothesis" or "This evidence is/is not consistent with the hypothesis. " DO NOT say, "This proves our hypothesis," because it is possible to disprove a hypothesis but not to prove it.

2. Relate your conclusion directly to your hypothesis. If your hypothesis has more than one part, make sure your conclusion deals with each part.

3. Propose an explanation or multiple explanations of why your data do not support the hypothesis, if, in fact, they do not. You are not a failure and you do not need to cover it up or hide it when your data and hypothesis do not match up. Some of the greatest discoveries in science have been made when the initial hypothesis was shown to be wrong! Honesty is an essential part of good science.

4. Suggest a follow-up experiment or question to answer based on what your treatments and controls have revealed. Remember that science is a process of inquiry, so it is good if your experiment leads to another experiment.

In science, experiments are not always successful on the first try. Scientists improve their skills by analyzing what they did wrong and learning from their mistakes. Experimental protocols are often not successful when they are first developed and must be altered and retested before they are fully established.

If your experiment did not work for technical reasons or the results were inconclusive:

- the title, hypothesis, controls and treatment, and results should be presented as they are for any lab report.
- the conclusions section should discuss why the experiment was unsuccessful and why the results could not be interpreted. Provide suggestions for how the experiment can be improved so that it would be successful if you were to redo it.
- suggest an alternative approach or related question to answer based on your experiment.

KEY QUESTION

1. Identify which question you are answering. Give both the number and a brief restatement of the question.

2. Be concise. Science writing places high value on brevity and clarity. This is one way scientists let the data speak for themselves.

Adapted from Handelsman J., Houser B., Kreiger H. *1997*. Biology Brought to Life. Times Mirror Higher Education Group, Dubuque, Iowa.