Table 3.1 EnGaugements

Activities that simultaneously engage students and gauge their learning

EnGaugement	Goal *Students learn to . . .*	Biology Examples
Brainstorming Answer a question with as many answers as possible.	share prior knowledge about a subject.	What does a plant need to survive? *Comment: This activity works well for any organism, and drives home the point that students already know more than they think they do. The list can go on and on, if students start to list individual minerals and other components. But no matter what they come up with for the brainstorm list, it can generally be separated into two categories. For example: abiotic vs. biotic factors or environmental vs. genetic requirements. These categories can then be used as the framework for a subsequent lecture or laboratory exercise, or for an entire unit.*
Case Solve a problem or resolve a real-world situation.	determine what they need to learn in order to solve the case.	A patient had itchy, goopy eyes, so he went to the doctor. The doctor diagnosed the irritation as conjunctivitis and prescribed antibiotics. The symptoms cleared up within a few days but returned two weeks later. The patient called the doctor, and she advised taking antibiotics again. In addition, the patient laundered his bedsheets and face washcloths in hot water and bleach, washed his hands incessantly, cleaned his computer keyboard with soap and water, and took care not to touch his eyes. The symptoms did not go away. The patient called the doctor, who advised taking antibiotics again. (1) Propose three hypotheses to explain why the infection reoccurred. (2) What should the patient do? Should he take the doctor's advice? Describe any assumptions you make and justify your recommendation with biological reasons and principles.
"Clicker" questions Answer questions electronically in class	gauge what they understand about a topic or concept.	Which organisms are most distantly related? (a) bacteria and archaea (b) plants and animals (c) plants and fungi (d) humans and fungi
Decision-making Read a scenario and decide which among two or more options to recommend.	evaluate the pros and cons of each solution, make a decision, justify their choice, and create a logical argument.	You are the director of the antibiotic discovery unit in a major pharmaceutical company and you are asked for a five-year plan to develop new antibiotics. You are told that the plan will be funded only if you can convince your managers that you will be able to develop five new drugs with entirely new modes of action. What is your plan? How will you defend it?
Group exams Work together to discuss exams, then write answers individually.	collaborate to solve difficult problems for a grade.	Explain the role of aflatoxin in liver cancer.

EnGaugement	Goal *Students learn to…*	Biology Examples
Mini-map* Draw a representation that explains how terms relate to each other.	represent their ideas graphically and explain the relationships among concepts.	Explain how these terms relate to each other by arranging them in a logical order: protein, tRNA, promoter, translation, DNA, transcription, amino acid, replication, gene expression, nucleotide, mRNA.
One-minute paper Write a one-minute paper about a topic or question.	gauge what they understand about a topic or concept.	What about the structure of DNA suggests a mechanism for replication?
Pre/post questions Answer questions about a concept or topic before and after the material is taught.	gauge what they learned from the unit.	Describe two ways a bacterium could harm a plant. *Comment: Ask the question at the start and end of a lecture about bacterial pathogens.*
Predict-observe-explain Make a prediction about a scenario, then observe the results. Explain any differences between the prediction and observation.	recognize and explain differences between predictions and actual results.	You will be given several Petri plates containing bacterial growth medium. Based on the hypothesis that "Microbes are everywhere," touch the Petri plate with your fingers, incubate the plates for a few days, and predict what you'll see. In a few days, observe what happens, and record and explain your results. *Comment: The students can analyze data from a table or graph in lieu of doing a real experiment.*
Strip sequence Put a series of events in correct order.	recognize cause and effect between events.	Use your textbook as a guide and work with a partner. You write the important steps in meiosis; your partner writes the steps for mitosis. Cut the steps apart and scramble the order. Swap with your partner. Each of you should try to put the other person's steps into the correct order. Discuss.
Think-pair-share Write individual answers to a scenario or question, then share with a partner.	create and evaluate multiple solutions to a difficult problem.	Experimental design consists of three treatments of radish seed sets: (1) light, no water (2) light, water (3) no light, water Which set of plants will have the lowest dry weight after 3 days? First, students answer the question individually for 1-2 minutes. Next, they work in groups to share and discuss their answers and come to a consensus. After 3-5 minutes of discussion, the students answer the question again. Finally, show the actual experimental results: Treatment #3 has lowest biomass. It's important that students discuss the experimental results with their group so they can figure out themselves that the result only makes sense if they understand that respiration, in addition to photosynthesis, occurs in plants. *This example is used with permission from Ebert-May et al. (2003).*
What's wrong with this statement?	apply knowledge of a situation to a new scenario and evaluate why it is incorrect.	"I don't want to be eating any viruses or bacteria in my food, so I refuse to eat genetically modified plants."