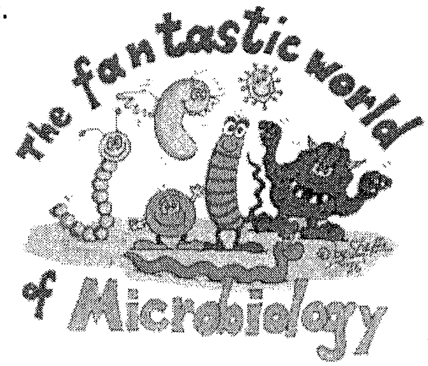
Unit 1: Introduction to Microbiology

Name: Completed Notes Period:

Learning Goals:

1. **I can name and follow all lab safety rules as outlined in my lab safety contract.**
   Biology Laboratory Safety Agreement
2. **I can identify the parts of the microscope and describe their functions.**
   Microscope Notes
3. **I can describe and perform the proper method for carrying a microscope.**
   Microscope Notes
4. **I can focus and use the microscope.**
   Microscope Notes,Introduction to Microscopy Lab
5. **I can properly make a wet mount.**
   Introduction to Microscopy Lab



6. **I can explain what happens to the magnification, resolution and field of view when the objective lens is changed.***Introduction to Microscopy Lab*
7. **I can identify the constants, control, and independent and dependent variables in an experiment.**
   Experimental Analysis Term Notes,Microorganism Adventure Lab, Biogenesis v. Spontaneous Generation Debate
8. **I can create an appropriate hypothesis for an experiment.**
   Experimental Analysis Term Notes,Microorganism Adventure Lab, Biogenesis v. Spontaneous Generation Debate
9. **I can make conclusions in response to a hypothesis when presented with the results of an experiment.**
   Experimental Analysis Term Notes, Microorganism Adventure Lab
10. **I can name and describe the experiments for the scientists involved in the debate over biogenesis versus spontaneous generation.**
    Biogenesis v. Spontaneous Generation Debate
11. **I can list and explain the 8 characteristics of living things.**
    Characteristics of Living Things Notes, p.
12. **I can explain compare and contract viruses and living things.**
    A Charlie Brown Sickness,Is A Virus A Living Thing Activity,How a Clever Virus Kills a Very Hungry Caterpillar Article

VOCABULARY(I can define/describe the following terms in my own words – *Flashcards, p.22*)

- Agar
- Arm
- Asexual Reproduction
- Bacteria
- Biogenesis
- Body Tube
- Cell
- Coarse Adjustment Knob
- Colony
- Conclusion
- Constant
- Control
- Coverslip
- Dependent Variable
- Evolve
- Field Of View
- Fine Adjustment Knob
- Homeostasis
- Hypothesis
- Incubator
- Independent Variable
- Iris Diaphragm
- Magnification
- Metabolism
- Multicellular
- Nosepiece
- Objective Lens
- Ocular Lens
- Orientation
- Qualitative
- Quantitative
- Resolution
- Sexual Reproduction
- Slide
- Spontaneous Generation
- Stage
- Stage Clips
- Unicellular
- Virus
- Wet Mount

About My Biology Class

1. What is the late work policy?

2. What can be retaken?
   How long do I have to retake them?
   What time of day can I retake them?
   Which score counts?

3. What materials should I have to be successful in this class?

4. How much is daily homework worth?
   Can I turn in daily homework late?

5. How much of my grade are tests and quizzes worth?

6. What is the most effective way to raise my grade?

7. So how can I do well on tests?

8. When is it never appropriate to use the hall pass?

9. Where should my phone be during class?

10. What will happen if I touch my phone during class?

11. Where should my ear buds be during class?
    When is the only time during class that something can be plugged into my head?

12. What is the first thing that I do when I am absent?

13. Where are the copies located?

14. If I miss a quiz or test on the first day of my absence, when do I need to make it up?

15. If I miss a lab, what should I do?

16. If I miss notes, what should I do?

17. If I don't understand something, what is my job?!?!

Biology Laboratory Safety Agreement

LG #1-I can name and follow all lab safety rules as outlined in my lab safety contract.

_______I will wear my goggles when I am instructed to do so. At nopoint in time during the lab will my goggles leave my eyes.

_______I will wash my hands after any lab in which I touch chemicals orbiological materials.

_______I will behave properly in the laboratory. I will not touch other students or engage in horseplay of any kind. I will stay focused on the task at hand for the duration of the laboratory activity.

_______I will be respectful of all lab equipment. I will use equipment only as I am instructed to. I will clean all lab equipment and leave my lab station in better condition than I found it.

_______I will bring ONLY my lab sheet and a writing utensil into the laboratory area. I will leave all other personal materials in the classroom area.

_______I will not eat or drink in the laboratory area. I especially will not eat or drink any of my lab materials.

_______In the event that a chemical should enter my eye (which it won't because I will be wearing my safety goggles at all times when working with potentially harmful chemicals) I will use the eyewash located at the end of the instructor lab table in the front of the classroom.

_______In the event that chemicals have spilled or glassware is broken I will immediately call for my instructor. I will not try to clean up the mess myself. My instructor will assess the situation and determine if it is safe for a student to clean up or not.

_______I WILL FOLLOW ALL LABORATORY PROCEDURES EXACTLY AS THEY ARE STATED ON MY LAB SHEET AND/OR BY MY INSTRUCTOR

_______I am fully aware that breaking any of these lab safety rules will result in immediate dismissal from the laboratory, a zero grade for the lab activity, and possibly a trip to the principle's office.

I ____________________________________agree to follow all biology laboratory safety rules stated above. I am aware of the consequences should I break this contract.

Signed ____ Dated ___________________

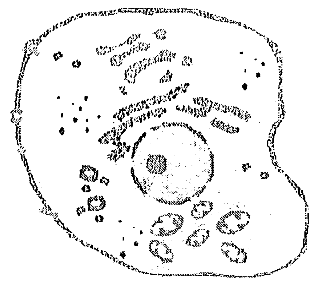
Notes: Characteristics of Life

LG#11-I can list and explain the 8 characteristics of living things.

BRAINSTORM

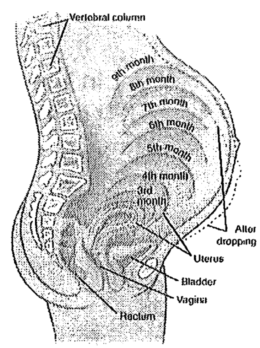
There are 8 characteristics that all living things have in common. Think of a tree, bacteria, a puppy, a spider, and an amoeba. What do they all have in common?

1. LIVING THINGS are made up of cells



- Unicellular Organism are made up of a single cell and are often referred to as microorganisms.
- Multi-cellular Organism contain many cells. Often there are many different types of cells in one organism. What are some of the different types of cells in your body?

2. LIVING THINGS Reproduce



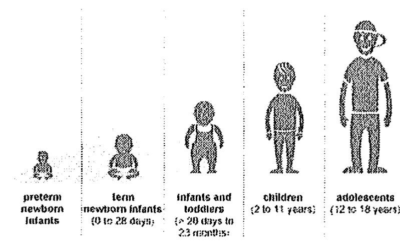
- Sexual Reproduction - two cells from different parents unite to form the first cell of the new organism. Plants and most multicellular organisms use sexual reproduction.
- Asexual Reproduction - new organism has a Single parent. In some unicellular organisms the cell divides in half to form 2 separate organisms.

3. LIVING THINGS are base on a universal genetic code (DNA)

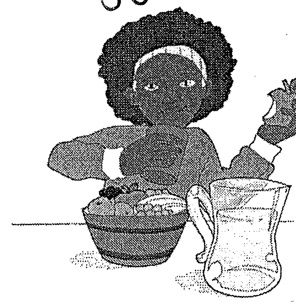
- Offspring always resemble their parents. Sexual reproduction creates offspring that differ from each parent in some ways. DNA carries the directions for inheritance.

4. LIVING THINGS Grow and Develop

- Each type of organism has a pattern of growth and development. From Redi's experiment: eggs → larvae (maggots) → adult fly. Cells not only grow larger and multiply, but they can Specialize to perform different tasks.

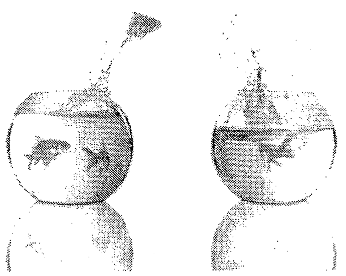


5. LIVING THINGS Obtain and use materials and energy



- Metabolism - the combination of Chemical reactions through which an organism builds up or breaks down materials as it carries out its life processes.
- All organisms take in materials for energy, such as light (Producers), consuming plants and/or animals (Carnivores, Herbivores, or Omnivores), or consuming dead things (Decomposers).

6. LIVING THINGS Respond to their environment

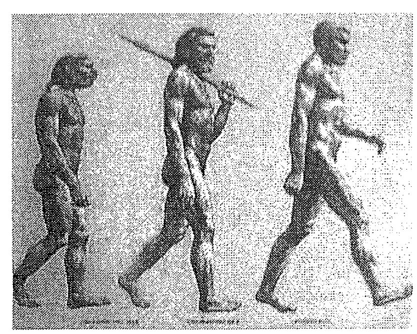


- Organisms live in environments that Change constantly via amount of water and light, temperature, affects of other living and nonliving things. Response: a seed will only germinate with sufficient wormth and water. Roots grow down in response to gravity.

7. LIVING THINGS Maintain a stable internal environment

- Homeostasis - process by which organisms keep their internal environment stable. (Example: Body Temperature stays the same) 98.6°F
- Homeostasis is constantly being influenced by stimuli in the environment.

8. As a group **LIVING THINGS** change over time

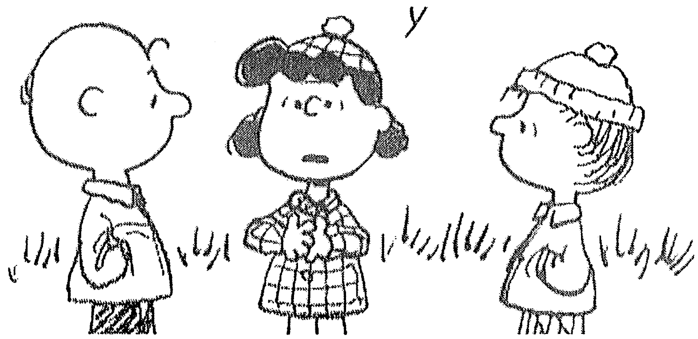


- Organisms go through many changes in a lifespan, but this is the same life cycle their parents went through.
- Evolution - for a group to change over time is to evolve. In this way, organisms respond to their environment. Example: trees that can survive long periods without water.

A Charlie Brown Sickness

LG#12-I can explain compare and contract viruses and living things.

Charlie Brown: "Wow, I feel gross. My nose is running, my eyes are watery and my throat is on fire. I didn't feel this way last night."



Lucy: "You must have caught a bug, Charlie Brown."

Charlie Brown: "*A BUG!* Well, I wish it would just die, then."

Lucy: "It can't die ……. it was never alive."

Charlie Brown: "What do you mean it was never alive?"

Lucy: "Well, it's not a real bug, it's a virus."

Linus: "It seems to be causing a lot of problems for Charlie Brown to be *not alive*."

Lucy: "Not everything that causes sickness is living."

Charlie Brown: "Well, maybe my doctor can give me some of those antibiotics – like when I had strep throat."

Lucy: "No, no, no! You can't get cured this time with antibiotics, you block head. Viruses don't cause strep throat, bacteria do. They can be cured with antibiotics."

Charlie Brown: "Big deal – what's the difference? Either way, I'm still sick and I can't go out on the playground today.

Lucy: "I already told you – viruses aren't living organisms, bacteria are. Do I have to explain everything? Tell you what, if you can tell me why viruses are not living and bacteria are, then I promise to hold the football for you when you are feeling better."

Charlie Brown: "Good grief."

Activity: Is A Virus A Living Thing?

LG#12-I can explain compare and contract viruses and living things.

List the 8 characteristics of living things, then determine whether or not a virus has each of them.

8 Characteristics of Living Things	Yes, viruses have this characteristic.	No, viruses do not have this characteristic

SO........IS A VIRUS A LIVING THING? ________ WHY OR WHY NOT?

Draw a picture of a virus and give a brief description of how it works.

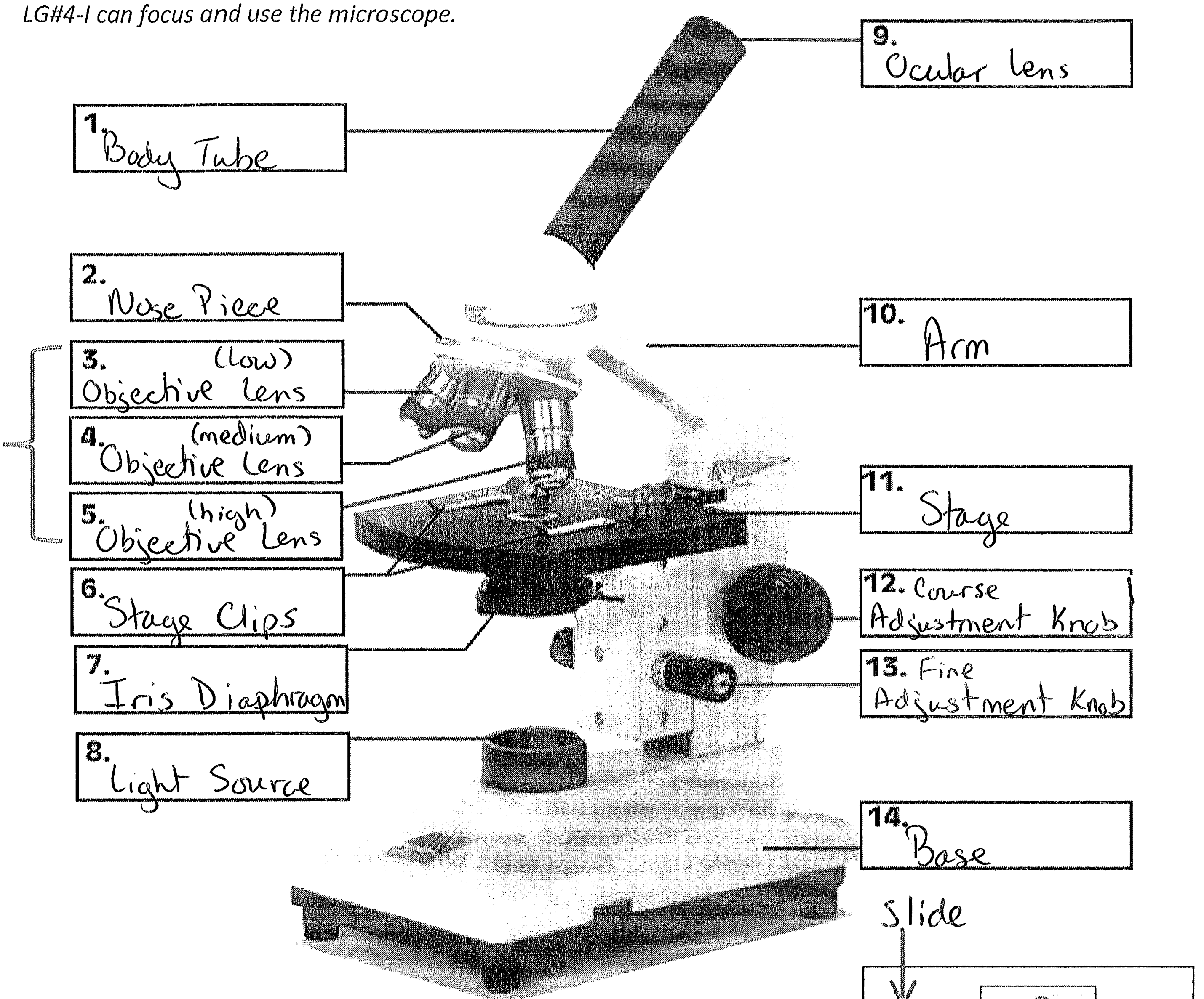
(1) Virus lands on cell and injects viral DNA into cell.

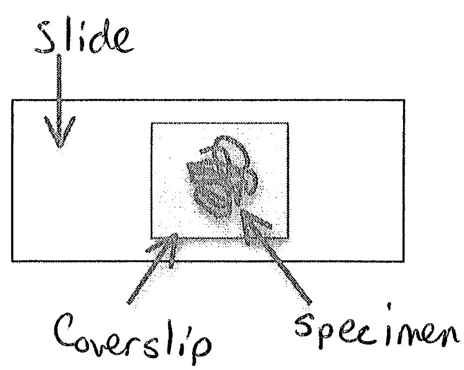
(2) Viral DNA tricks cell into stopping normal cell function and starting virus production.

(3) Cell bursts spewing viruses into body to infect other cells.

Notes: The Microscope

LG#2-I can identify the parts of the microscope and describe their functions.
LG#3-I can describe and perform the proper method for carrying a microscope.
LG#4-I can focus and use the microscope.





How do you carry the microscope?

One hand on the arm, one on the base

Which knob do you adjust first? Course

Which lens should you start with? Low Power

When the highest power lens is in place, which part of the microscope should you NOT use?

Course adjustment knob

If you look through the 10X ocular lens and the 40X objective lens, the specimen will appear 400 times larger than it actually is.

Notes: Experimental Analysis Terms

LG#7-I can identify the constants, control, and independent and dependent variables in an experiment.
LG#8-I can create an appropriate hypothesis for an experiment.
LG#9-I can make conclusions in response to a hypothesis when presented with the results of an experiment.

Squidward's Symphony

Squidward loves playing his clarinet and believes it attracts more jellyfish than any other instrument he has played. In order to test his hypothesis, Squidward played a song on his clarinet for a total of 5 minutes and counted the number of jellyfish he saw in his front yard. He played the song a total of 3 times on his clarinet and then repeated the experiment using a flute and a guitar. He also recorded the number of jellyfish he observed when he was not playing an instrument. The results are shown in the chart:

Trial	No music	Clarinet	Flute	Guitar
1	5	15	5	12
2	3	10	8	18
3	2	12	9	7
total	10	37	22	37

Term	Definition	As it pertains to Squidward's Symphony
Hypothesis	• An educated guess for a possible solution to a scientific question • A statement that can be proved or disproved • No "I think", "I feel," or "I believe" • No reasons • No Pronouns (it, they)	
Independent (manipulated) Variable	• The thing the scientist changes • What is being tested • A good experiment has <u>one</u>	
Dependent (responding) Variable	• The thing that changes in response to the independent variable. • What data is collected	
Constant	• The things that stay the same in the experiment	
Control	• A group in an experiment that is used to compare to all other data. (group not tested)	

Qualitative Data		
Quantitative Data		
Conclusion		

Remind 101

Sign up for Remind101 to get daily text messages reminding you of homework, upcoming tests and retake deadlines.

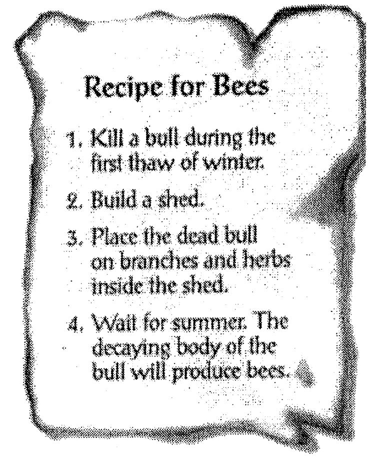
Biogenesis vs. Spontaneous Generation Debate

LG10 - I can name and describe the experiments for the scientists involved in the debate over biogenesis versus spontaneous generation.

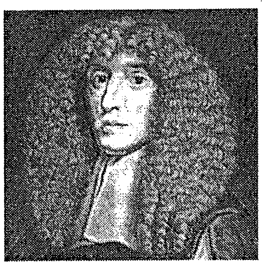
The Debate

People's ideas about where living things come from have changed over the centuries. People used to think that there were special "vital forces" that brought some living things into being from nonliving things. These ideas, exemplified by the directions in figure 1-7, persisted for many centuries. Observations seemed to indicate that some living things could just suddenly appear. Maggots showed up on meat, mice were found on grain, and beetles turned up on cow dung. For centuries people accepted the prevailing explanation for the sudden appearance of some organisms, that life "arose" from nonliving matter: maggots "arose" from meat, mice "arose" from grain, and so on. The term that was assigned to this idea that life could arise from nonliving matter is **spontaneous generation.** About 400 years ago, some people began to challenge these established ideas. They also began to use experiments to answer their questions about life. A new idea gained popularity – that living things can only come from living things. This is called **biogenesis**. The following scientists performed experiments to settle the debate between biogenesis and spontaneous generation.

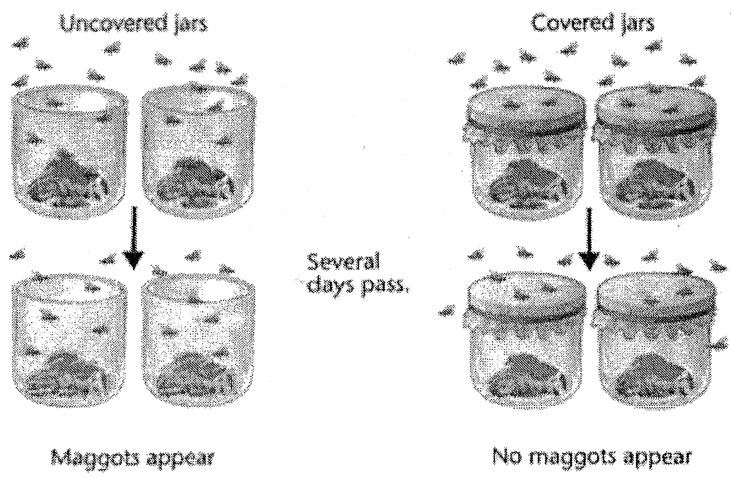
▼ **Figure 1–7** About 2000 years ago, a Roman poet wrote these directions for producing bees. **Inferring** *Why do you think reasonable individuals once accepted the ideas behind this recipe?*



Francesco Redi



In 1668, Francesco Redi, an Italian physician, proposed a different hypothesis for the appearance of maggots. Redi observed that the maggots appeared on meat a few days after flies were present. He considered it likely that the flies laid eggs too small for people to see. Thus, Redi was proposing a new hypothesis – flies produce maggots. Redi designed an experiment to test his hypothesis. The experiment is pictured to the right.



Redi's hypothesis:	
Independent Variable:	Dependent Variable:
Control:	Constants:
Results:	Which idea do the results support?

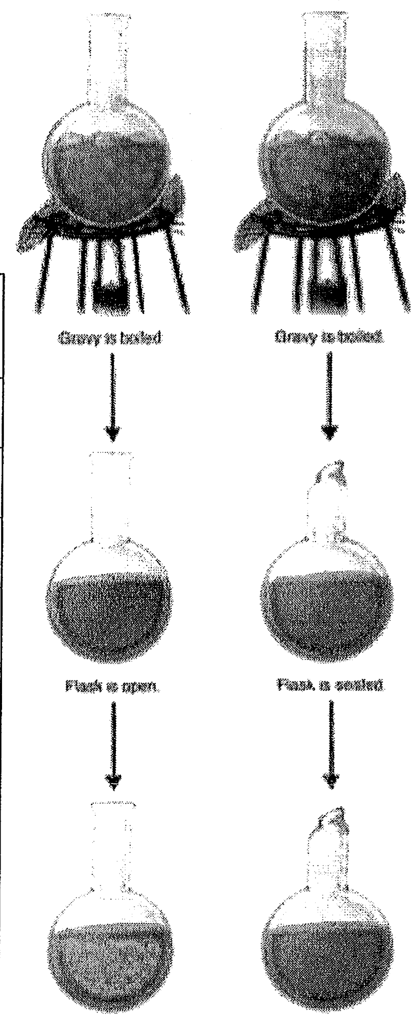
John Needham

An English scientist in the mid-1700's tried to attack Redi's work. Needham thought that under the right conditions, spontaneous generation could occur. Needham tried to prove this with microorganisms in gravy. Needham placed equal amounts of gravy in two flasks. He sealed one flask and left the other open. He heated both flasks in an effort to kill anything in the gravy. After several days he found both flasks swarming with microorganisms.

Needham's hypothesis:	
Independent Variable:	Dependent Variable:
Control:	Constants:
Results:	
	Which idea do the results support?

Lazaro Spallanzani

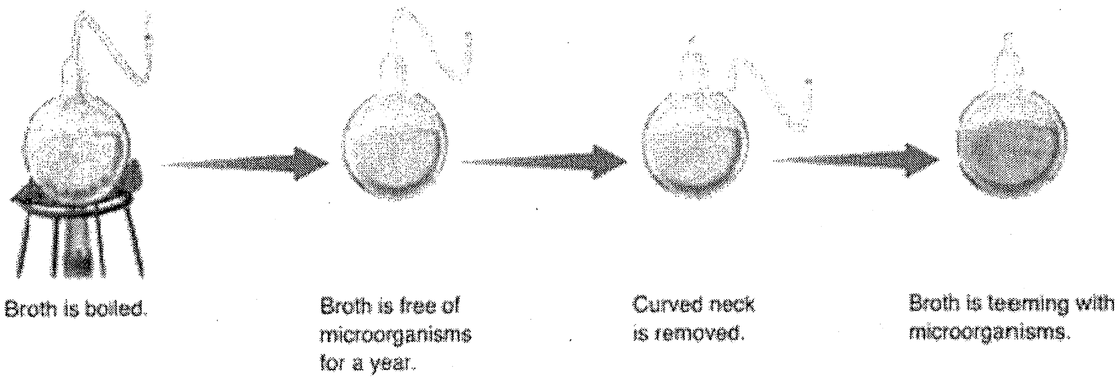
Spallanzani, an Italian scholar, read Redi's and Needham's work. He felt that Needham had not heated his samples enough so he decided to repeat Needham's experiment, but this time he would *boil* the gravy instead of just heating it. Spallanzani's results are shown.



Spallanzani's Hypothesis:
Independent Variable:
Dependent Variable:
Control:
Constants:
Results:
Which idea do the results support?

Louise Pasteur

In the late 1800's scientists were still supporting the idea of spontaneous generation. They said that air contained the "life force" needed to produce new life, and Spallanzani's experiment deprived the gravy of air because the jar was sealed. Louis Pasteur designed a flask that would allow air in, but trap microorganisms. Pasteur put broth into his special flask, boiled the broth, and then let the flask sit for a year. The broth remained free of microorganisms for the entire year. After one year Pasteur broke the neck of the flask, and within a few days the broth was teeming with microorganisms. Pasteur proved that the idea of spontaneous generation was incorrect. This change in thinking represented a major shift in the way scientists viewed living things.



Pasteur's hypothesis:	
Independent Variable:	Dependent Variable:
Control:	Constants:
Results:	Which idea do the results support?

How to Study for High School Biology

1. Complete, correct and cut out the flashcards. You should practice with your flashcards creating a correct and an incorrect pile. Once you can get all of the flashcards into the correct pile 3 times in a row, try looking at the word and come up with a definition.
2. Complete and CORRECT your study guide. Have someone quiz you on the questions.
3. Read over all: warm-ups, notes, activities, labs, and homework. We can't pack every detail into the study guide so you need to look over ALL of your materials.
4. Study in small chunks. You remember the first thing and the last thing you study the best, so the more firsts and lasts you have, the more you'll remember.
5. Get to class early on test days and spend a few minutes going over your flashcards to get your brain in the science groove.

Microorganism Adventure Lab

LG#7-I can identify the constants, control, and independent and dependent variables in an experiment.
LG#8-I can create an appropriate hypothesis for an experiment.
LG#9-I can make conclusions in response to a hypothesis when presented with the results of an experiment.

Background Information

Have you ever looked at your desk and wondered just how clean it really is? In this adventure we will find out. We are going to investigate the wonderful world of microorganisms. A microorganism is a living thing that is too small to be seen with the naked eye. There are many different types, a few examples are: bacteria, archaea, and fungi. In this lab we will be focusing on bacteria and where they can be found in our everyday lives. Bacteria are prokaryotic organisms, which means they are single-celled organisms with very simple cell structures. Bacteria are often cited as the cause of a multitude of illnesses and infections; however, there are many types of bacteria that are beneficial to human life. The vast majority of the millions upon millions of bacteria that we encounter on a daily basis are harmless to humans due to our body's natural defense system.

You will be taking samples from objects of your choice by swabbing a surface with a damp cotton swab. You will spread this sample onto a nutrient-rich gel in a Petri dish. The gel is called agar and it is specifically designed to facilitate the growth of microorganisms like bacteria. Once you have streaked the sample onto your Petri dish we will place the Petri dish into an incubator. The incubator will keep the bacteria at a higher temperature, allowing them to multiply much faster than if they sat out on the lab tables. We will observe the colonies on the plate, which are large amounts of bacteria clumped together, over the next few days.

Choose A Method of Testing

Option 1: Choose a single **type of object/surface** and take a sample from three locations on those objects/surfaces (examples: sample three areas on the gym floor, three door handles in three different rooms, or sample the bottom of three shoes belonging to different people)
Option 2: Choose a single **location** and sample objects/surfaces in that location (examples: take samples from a desk, a chair, and a pencil in the same classroom or take samples from the forehead, ear, and under the fingernail of the same person's body)

Materials

Petri dish with agar gel | Cotton swabs | Tap water | Masking tape

Procedure Day 1

1. Obtain a Petri dish containing nutrient-rich agar (1 dish for your group of 3). Each student will get his/her own cotton swab. BE CAREFUL NOT TO TOUCH THE SWAB PART! Keep the lid on the plate at all times unless you are taking a sample.
2. Divide plate into four equal sections by drawing two intersecting perpendicular lines through the center of the plate. Draw these lines on the UNDERSIDE of the plate (the half which contains the agar). In small print along the outside edge of the plate, write the area being tested in three of the four quadrants. In the fourth quadrant, write the word "control" along the outside edge.
3. Each student will dampen the cotton swab with the tap water found on your lab table, and then run the swab over the surface she/he has chosen. Be careful not to contaminate the swab by touching it with your hands or other objects, or by breathing on it.
4. Each student will transfer his/her sample to the plate by *gently* streaking the swab across the surface of the gel in a zig-zag pattern in the specified section. While the lid is off of the Petri dish, be careful not to contaminate the agar by breathing, coughing or sneezing on it.
5. In the quadrant labeled control, dip a cotton swab in water and immediately streak the plate.
6. Replace the lid, secure it with masking tape, and write your group members' names on it. Place your Petri dish into the incubator **up-side-down**.
7. Wash your hands and return to your seat.

Name ______________________________ Period ______

Procedure Day 2

1. Create an appropriate hypothesis for this investigation:

   ____

   ____

2. Identify the following parts of the experiment:

   a. Independent Variable: ______________________________

   b. Dependent Variable: ______________________________

   c. Control Group: ______________________________

3. Examine your spread plate. Carefully remove masking tape and lid. Be careful not to contaminate your plate.
4. When finished, return lid and re-tape closed. Then **wash your hands** and return to your seat.

Procedure Day 3

1. Examine your spread plate. Carefully remove masking tape and lid.
2. Complete the data and observations section as described below.
3. Tape your plate back up and discard it in the trash can.
4. Wash your hands and return to your seat.

Data and Observations:

In the circle in the right half of the table below **draw** what you see in each quadrant of your petri dish. In the boxes in the felt side of the table below, identify the source of bacteria and briefly **describe** what you see in each quadrant of your petri dish.

Section 1 source: Section 1 description:	Section 2 source: Section 2 description:	1 2
Section 3 source: Section 3 description:	Section 4 source: water only Section 4 description:	3 4

Conclusion

Construct an appropriate conclusion for this investigation based on your results. (Restate your hypothesis, state whether or not your hypothesis was correct, then back up your statement with specific data or observations from your investigation.)

Follow Up Questions

1. What is a colony?
2. Why did we incubate the bacteria rather than leave the plates at room temperature?
3. What was the purpose of the agar in the petri dishes?
4. Which lab safety procedure did you follow at the end of each day during this investigation?
5. Why did you need to be careful not to touch, breathe on, or leave the agar open to the air when plating your bacterial swab sample?
6. Why did you streak the control quadrant with water?
7. What could you do to improve the validity of your results? (i.e. What variables were not held constant that may have negatively influenced the accuracy of your results?)
8. What would have happened if we had put the Petri dish in the refrigerator and how does that relate to why we put food in the refrigerator?
9. Why is it that we do not get sick all the time with so many bacteria living all around us?
10. Now that you've had some time to think about this activity, where else might you want swab to test for bacterial growth and why? ("Nowhere" is not an appropriate answer.)

Name ____ Period ____________

Introduction to Microscopy Lab

LG#4-I can focus and use the microscope.
LG#5-I can properly make a wet mount.
LG#6-I can explain what happens to the magnification, resolution and field of view when the objective lens is changed.

Vocabulary:

- Orientation –
- Magnification –
- Field of View –
- Focus –
- Resolution –

Procedure:

1. With a pair of scissors, cut the smallest letter "e" from a piece of newspaper.
2. Prepare a **wet mount** of the "e" by doing the following:
    a. Position the "e" on the center of a clean glass microscope slide.
    b. Use a dropper to place one drop of water on the piece of newspaper.
    c. Hold a clean coverslip with your fingers at an angle so that one edge is touching the slide.
    d. Use a dissecting needle to slowly lower the coverslip onto the slide. This will prevent trapping air bubbles. If you have air bubbles trapped, take the coverslip off and try again.
3. Center the wet mount on the stage of the microscope with the "e" in a right-side-up when you are **not** looking through the microscope. You probably will not want to use stage clips because you will be moving the slide around.
4. Turn the lowest-power objective lens into position and bring the letter "e" into focus using the coarse adjustment knob.
    - **Question:** What is the orientation of the letter "e" when looking through the microscope? (Ex: right-side-up, up-side-down, on its side, backwards)
    - **Drawing:** Draw the "e" under low power in the circle provided to the right. Be sure the orientation is correct and your drawing is detailed.
5. While looking through the microscope, move the slide to the right across the stage.
    - **Question:** Which direction does the image move? (Ex: right, left, up, down)

Low Power Drawing

6. While looking through the microscope, move the slide to the left across the stage.
    - **Question:** Which direction does the image move?

7. While looking through the microscope, move the slide up.
    - **Question:** Which direction does the image move?

8. While looking through the microscope, move the slide down across the stage.
    - **Question:** Which direction does the image move?

High Power Drawing

13. Turn to the high power objective lens and focus the image using the fine adjustment knob.
    - **Drawing:** Draw the "e" under high power in the circle provided to the right.

14. To increase magnification, you must switch from low power to a higher power objective lens. Switch between the low and high power objective lenses to answer the following questions. Remember to adjust the focus each time you switch lenses.
    - **Question:** What happens to the **field of view** as you increase the magnification?
    - **Question:** What happens to the **resolution** as you increase the magnification?

15. Dismantle your wet mount by taking your coverslip off your slide, throwing away your "e" and rinsing both your coverslip and slide under running water. Leave your slide and coverslip on the brown p.

Additional Images (These can be done in any order depending on which supplies are available when you start)

16. Find the pyramid's eye on a $1 bill using low power (place the bill right on the stage of the microscope). The pupil of the eye has three darker circular lines traveling around it.
    - **Question:** How many of these lines go <u>completely around</u> the visible area of the pupil as solid lines?

17. Two members of your group need to pull a strand of hair out of their heads. Make an X with the two hairs on your clean slide. Put a piece of clear tape on top of the hairs to hold them in place. Observe them under the low, medium and high power.
    - **Question:** What do the strands have in common?
    - **Question:** How do the strands differ?

18. Obtain a slide of red onion root plant cells from your instructor. Observe the cells under low, medium and high power.
    - **Question:** What is the shape of the majority of plant cells?
    - **Question:** What color are the cells?
    - **Question:** Why aren't they green like other plant cells?

19. Clean up:
    a. Turn off your microscope
    b. Place your clean and dry slide and coverslip on the stage of your microscope for the next class to use
    c. Place the beaker of water, pipette, newspaper and scissors neatly in the center of the lab table
    d. Push your lab stools completely under the lab table