


Science of Microbes

Activity 6
Comparing Sizes of Microorganisms

PowerPoint Slides and Notes
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Science of Microbes

Comparing Sizes of Microorganisms is the sixth lesson in the unit, *The Science of Microbes*. It addresses National Science Education Content Standards related to Inquiry and Life Science. See the downloadable lesson PDF (web address below) for a complete list of the standards addressed.

In this activity, students will compare the relative sizes and shapes of different types of microbes by creating scale models. They will use punctuation—a period printed on a strip of text—as a visible frame of reference.

Viewing this presentation fulfills part of the requirements for completing the short course on *The Science of Microbes*, offered on BioEd Online for professional development contact hours. *The Science of Microbes* Teacher's Guide may be obtained in its entirety from the Center for Educational Outreach at Baylor College of Medicine (1-800-798-8244). You can download a PDF of this lesson and other lessons from the Science of Microbes unit (including a unit pre/post assessment) from www.BioEdOnline.org or www.K8Science.org.

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Health (NIH) to Baylor College of Medicine. The unit was developed in partnership with the Baylor-UT Houston Center for AIDS Research, an NIH-funded program (AI036211). The opinions, findings, and conclusions expressed in this presentation are solely those of the authors and do not necessarily reflect the views of Baylor College of Medicine or the sponsoring agencies.

Materials for Each Group of Students



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Materials for Each Group of Students

To prepare for this experiment, use a word processing program to create a text document consisting of the following phrase, repeated on 24 individual lines: "The period at the end of this sentence is larger than a/an ____." NOTE: Be sure to use *12-point Helvetica font*. Print the page, and cut it so that each row of text is an individual strip of paper. You also will need to prepare a 2.5 m x 2.5 m square of paper, which will serve as a large scale model of the period at the end of the sentence.

Each group of students should receive the following supplies.

- 4 prepared text strips
- 4 hand lenses
- 4 metric rulers with millimeters
- 4 pairs of scissors
- Assorted markers or colored pencils
- Meter stick
- Paper or a science notebook
- Several sheets of colored or plain paper, or roll of chart or craft paper
- Tape or glue
- Copy of *Microbe Scaling Chart* student sheet
- Group concept map (ongoing)

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Image Reference:

Denk, J. (2009). Materials for activity 6. Baylor College of Medicine. Houston, TX.

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Safety Considerations

- Follow all instructions.
- Begin investigation only when instructed.
- Have a clear understanding of the investigation in advance.
- Wash hands thoroughly after the investigation.



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Safety Considerations

It is important that students always think about safety when conducting a science investigation. This slide may be used to review safety with your class before starting the activity. Also, keep the following points in mind.

- Always follow district and school safety guidelines.
- Have a clear understanding of the investigation in advance (practice any investigation with which you are not familiar).
- Continually monitor the area where the investigation is being conducted.

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What Do You Observe?

The period at the end of this sentence is larger than a/an ____.

- Examine the period in the sentence on your paper strips, using your naked eyes only.
- What shape is the period?
- Draw an enlarged picture of what you see.



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What Do You Observe?

Begin the lesson by asking students to examine the period in the sentence on their strips of paper, using only their naked eyes. Have them draw an enlarged picture of what they see.

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A Closer Look

- Pick up your hand lens and observe the period again.
- Does it look different now than when you viewed it with the naked eye?
- Draw an enlarged picture of what you see.
- What can you say about the size of a period?



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A Closer Look

Now, ask your students to examine the period on their text strips using a hand lens or magnifier. Once again, have students draw what they see. They should have noticed that the period appeared round to the naked eye, but square when viewed through the hand lens. Their drawings should reflect this discovery. Ask students what they can say about the size of the period.

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How Big is That?

- The period on your text strip is about 500 micrometers (μm) in length and width.
- How big is a micrometer?
 - 1 millimeter = 1,000 μm
 - 1 centimeter = 10,000 μm
 - 1 meter = 1,000,000 μm
- How many periods could be lined up, end-to-end, on a text strip that is 1 meter long?



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How Big Is That?

If your students have had limited experience with the metric system, now might be a good time to review it with them. The fundamental unit for measuring length in the metric system is the meter (m). Every other metric unit of length is defined as some part or multiple of a meter, using prefixes. For instance, the prefix “centi-” means 1/100. It originates from the Latin word *centum* (“hundred”). Thus, a centimeter is equal to 1/100 of a meter.

Other metric conversions:

- 1 nanometer (nm) = 0.000000001m (1/1,000,000,000m)
- 1 micrometer (μm) = 0.000001m (1/1,000,000m)
- 1 millimeter (mm) = 0.001m (1/1,000m)
- 1 centimeter (cm) = 0.01m (1/100m)
- 1 decameter (dam) = 10m
- 1 kilometer (km) = 1,000m

Explain to your students that a micrometer is a metric unit of measurement too small to see with the naked eye. Have students look at their rulers and find the centimeter and millimeter markings. Ask, *How many centimeters are in a meter?* and *How many millimeters are in a centimeter?* Once they seem to have a good understanding of the different metric units, you may want to ask your students to attempt some conversions, such as *How many micrometers are in a centimeter?* And *How many millimeters are in a kilometer?*

Finally, ask your students to answer the question on the slide, *How many periods from your text strip could be lined up, end-to-end, within a meter?* ($1\text{m}/500\mu\text{m} = 1,000,000\mu\text{m}/500\mu\text{m} = \mathbf{2,000}$)

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What Is a Scale Model?

- A scale model is a representation of a smaller or larger object. It allows us to understand the relative position, size and/or distance of objects.
- What are some examples of scale models?



You can estimate the size of the toy train engine by comparing it with the size of a normal pencil.



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What is a Scale Model?

In this activity, students will make scale models of microbes using the period on their text strips as a relative measure. Be sure students understand that the scale model is intended to show proportional sizes between the different organisms and the period. If they have trouble furnishing examples of scale models, remind them that road maps and solar system models both are scale models.

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Microbial Models

- If the period on your text strip was increased in length and width by 5,000 times, it would be a square with sides 2.5m long.
- To get a sense of the relative sizes of some common microbes, you will make scale models, using the same scale (5,000 x magnification) as used with the period.



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Microbial Models

Before students begin to build their scale models, hang the 2.5 m x 2.5 m prepared paper square on the wall or blackboard. Explain that this square represents the size of the period, increased 5,000 times ($0.05 \text{ mm} \times 5,000 = 2,500 \text{ mm} = 2.5 \text{ m}$).

Pass out copies of the Microbe Scaling Chart Student Sheet, and tell students they will be drawing models of various microbes using the same scale (x 5,000) that was used with the period. Reinforce the need for students to make their assigned microbe(s) the correct size and shape, using the pictures and scale model measurements on the Student Sheet as a guide.

Once students have completed their models, you may want to have them place their organism models inside the square. This will give them a better idea of how large the different microbes are, as compared to the size of the period.

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Extensions

- Research the different organisms on the Microbe Scaling Chart.
 - Are the different species of each organism around the same size?
- Visit www.cellsalive.com/howbig.htm for help visualizing and comparing the sizes of microbes.



Marine Diatoms



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Extensions

Because each organism listed on the Microbes Scaling Chart can represent large groups of different species, students may extend their research to discover how sizes vary within each organism group.

Other resources:

- The CELLS alive! website (www.cellsalive.com) includes an animation to help students visualize the sizes of different microbes.
- BioEd Online (www.bioedonline.org) has a presentation and slide set, entitled "Viruses," that provides additional background information.

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