

From Coffee to Carbon

Abstract

Using copy-and-cut cards, students place biological structures in order by their relative size from largest to smallest.

Learning Objectives

- ▶ Understand the relative size of microscopic biological structures.

Logistics

Time Required

▶ **Class Time:**
20 minutes

▶ **Prep Time:**
10 minutes

Materials

Object Cards

Prior Knowledge Needed

None

Appropriate For:

Primary Intermediate Secondary College

Special Features You'll Find Inside

- ▶ Copy-and-cut cards with drawings for students to organize.

Tip: This activity can be used as a formative assessment or an anticipatory set.

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Classroom Implementation

Preparation:

- Copy, cut and shuffle sets of object cards (pages 3-5) to distribute to student groups. Each set should contain all 18 object cards.
- Create an overhead transparency of the Object Size Guide, page 2 (unnumbered).

Activity instructions:

- Distribute sets of Object Cards to groups of students and instruct them to arrange the objects pictured in order from largest to smallest. Note: the dimension to be compared is marked by a rectangular bracket for each object.
- Ask students to compare the order of their cards with another group and discuss any discrepancies.
- Project the Object Size Guide, page 2 (unnumbered) on an overhead projector and have students check their work.

Quantities

Per Group of 2-3

- ▶ Full set of Object Cards, cut out and shuffled.
- ▶ Object Size Guide overhead transparency.

Standards

U.S. National Science Education Standards

Grades K-12:

- Unifying Concepts and Processes: Systems, order and organization

Credits

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Molly Malone, Genetic Science Learning Center

Sheila Avery and Harmony Starr, Genetic Science Learning Center (illustrations)

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SEPA SCIENCE EDUCATION
PARTNERSHIP AWARD

Supported by the National Center for Research Resources, a part of the National Institutes of Health

Extensions

Create a scale that compares the microscopic structures in this activity to visible objects and spaces.

For example, if a carbon atom = 7 pixels:

Antibody = 1 inch

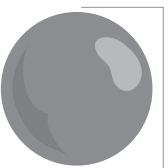
Influenza virus = 8.5 inch x 11 inch piece of paper

Mitochondrion = 8 foot x 30 foot (classroom wall)

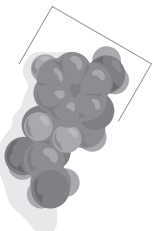
Skin Cell = a 25-floor building

Object Size Guide

sizes are average and approximate.



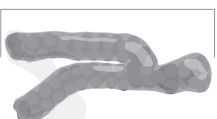
Carbon Atom
340 pm



Adenine
760 pm



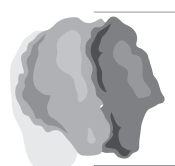
Glucose
900 pm



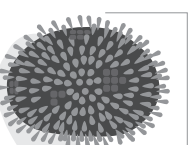
Phospholipid
3.4 nm



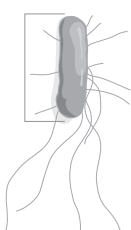
Antibody
12 nm



Ribosome
30 nm



Influenza Virus
130 nm



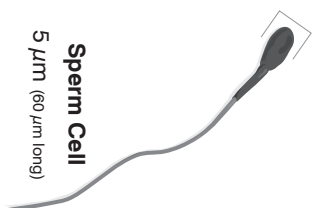
E. coli Bacterium
3 μ m



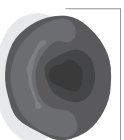
Mitochondria
4 μ m



Baker's Yeast
4 μ m



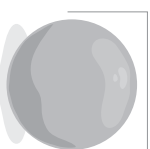
Sperm Cell
5 μ m (60 μ m long)



Red Blood Cell
8 μ m



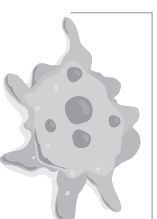
Skin Cell
30 μ m



Human Egg Cell
130 μ m



Paramecium
210 μ m



Amoeba Proteus
500 μ m

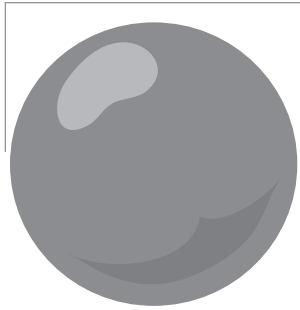


Grain of Salt
0.5 mm

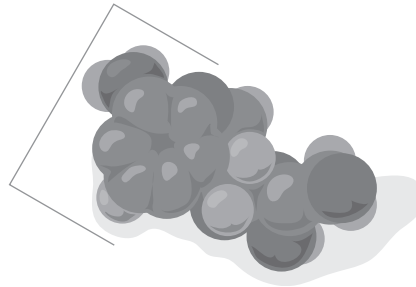


Coffee Bean
8 mm

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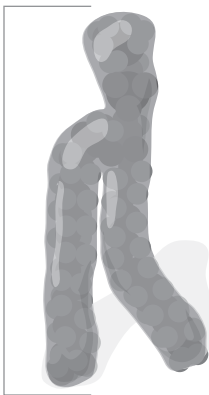
Carbon Atom



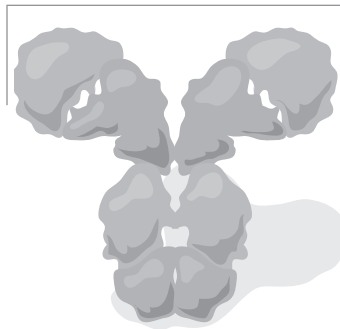
Adenine



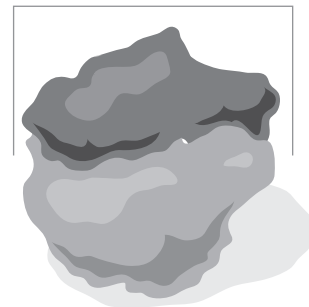
Glucose



Phospholipid

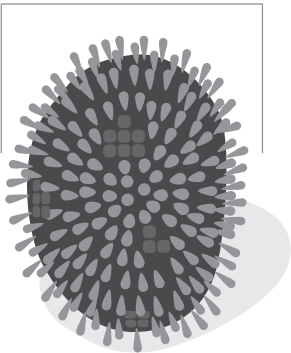


Antibody

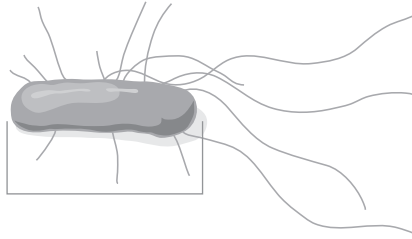


Ribosome

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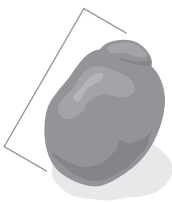
Influenza Virus



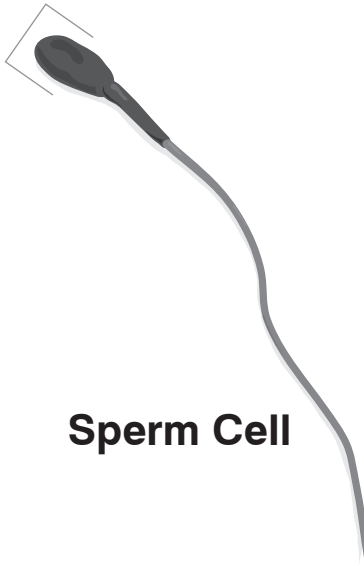
E. coli Bacterium



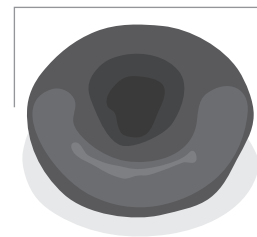
Mitochondria



Baker's Yeast



Sperm Cell

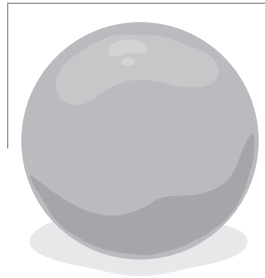


Red Blood Cell

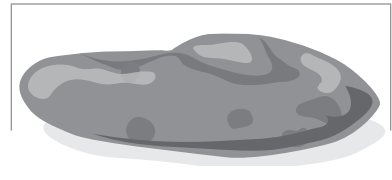
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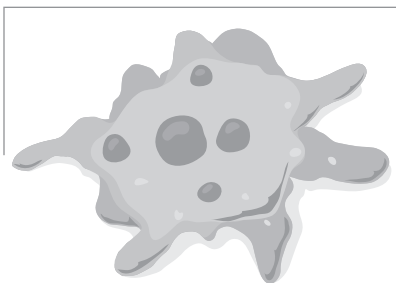
Skin Cell



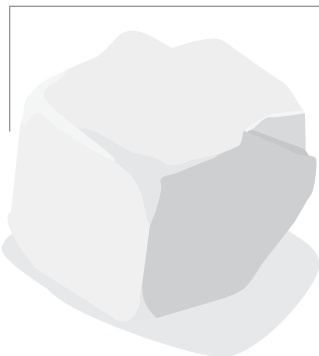
Human Egg Cell



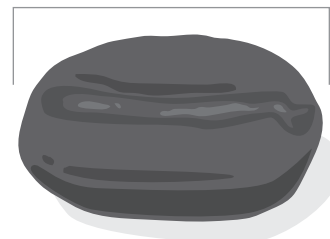
Paramecium



Amoeba Proteus



Grain of Salt



Coffee Bean