

Endosymbiosis Case Study Questions KEY:

1. Amoebae are single celled eukaryotes that are in the Kingdom Protista. A bacterium is also single celled but is a prokaryote. Prokaryotes do not have any membrane bound organelles or a nucleus.
2. Students may have a hard time coming up with two ideas. One hypothesis will come from the story, that the amoeba “fought off the infection.” Talk with students about what this means. Discuss how cells engulf large particles by phagocytosis and perform intracellular digestion with lysosomes. Another hypothesis will be that the amoeba engulfed the bacterium and the bacterium are alive with the amoebae. Students may come up with other ideas, such as the bacterium died on their own.
3. Antibiotics are designed to kill bacteria by exploiting the different characteristics between prokaryotes and eukaryotes. For example, some antibiotics destroy the peptidoglycan in the bacterial cell wall. Others affect protein production, since prokaryotic ribosomes are different enough from eukaryotic ribosomes. Others affect DNA replication of prokaryotes, since the DNA replication proteins are different enough between the two cell types.
4. Since antibiotics are designed to kill prokaryotic cells and not eukaryotic cells, this is unexpected. Even if the antibiotic killed the bacteria within the amoebae, the amoeba should be left unaffected, unless they had become dependent on the bacteria living within. You may choose to discuss parasitism vs. mutualism here.
5. Brian added antibiotic to his amoebae that were infected with bacteria. It was surprising that the amoeba died. As a control, he should add antibiotic to uninfected amoebae to make sure the antibiotic was not acting as an amoeba poison. He would expect this application of antibiotic to have no effect on normal amoebae. He should also have a control in which some infected amoebae do not receive antibiotic, to ensure that some other variable in the environment was not killing off amoebae in his lab.
6. Lynn Margulis first proposed the endosymbiosis hypothesis. Endosymbiosis provides explanation for how mitochondria and chloroplasts may have originated as independent bacteria that were then engulfed by larger eukaryotic cells. Brian’s results do provide evidence of endosymbiosis. Because his cells died when the bacteria within were killed, it indicates that the bacteria were providing some essential role for the amoebae. These results show that it is possible for cells to live within cells and for them to become dependent on each other.
7. These three facts are more evidence, although indirect, for endosymbiosis. These three facts show how similar mitochondria are to bacteria, thus suggesting that mitochondria evolved from bacteria.
8. Sid was right to mention this because *Paramecium bursaria* is another example of one cell living within another. In this case, photosynthetic algae cells live inside a free-swimming *Paramecium*.
9. Brian should know that Kwang Jeon is a scientist that performed experiments like Brian’s with amoebae and bacteria in the 1960s. His experiments provided early evidence to support the endosymbiosis hypothesis.