

Endosymbiosis Case study & Questions:

Brian slumped over his bench in the lab and put his head down in defeat. “What’s the matter?” asked his lab mate, Sid. Brian explained that his amoebae had all become infected with bacteria. Frustrated and feeling like his experiments were never going to lead to a Ph.D., he left the lab for the weekend.

After the weekend, Brian returned fresh and ready to start his experiments with new amoebae. Although most of his infected amoebae had died, a few were still alive. They looked sick, but at least they were alive. Out of curiosity, Brian decided to see how long it would take for this infection to kill all of his amoebae.

Several months later, Brian found that some of his previously infected amoebae and their descendants were no longer sick. Brian figured that the amoebae had fought off the infection and cleared the bacteria. His lab mate Sid, always pushing Brian to think, said, “What evidence do you have to know they fought it off?”

1. What kind of cell is an amoeba? What kind of cell is a bacterium? What makes them different from each other?

2. What are two hypotheses to explain what happened to Brian’s amoebae?

When Brian looked under the microscope, he found bacteria thriving inside the amoebae. He was surprised and called Sid over to look. “Wow, that’s unexpected. I wonder what would happen if you add antibiotics to some of the amoebae.” Brian thought about the other experiments he was supposed to be doing , but then decided he was interested enough to continue with this side project. He took Sid’s suggestion and added antibiotics to some of the amoebae. When he added antibiotics to the amoebae infected with bacteria, those amoebae died. When Sid heard this news he was excited and began talking about the endosymbiosis hypothesis.

3. What cell type is an antibiotic designed to kill?

4. Would you have predicted the amoebae to have died by adding an antibiotic? Why or why not?

5. What controls would you expect to see and what would these tell you?

6. What scientist is credited for first proposing the endosymbiosis hypothesis? Explain the hypothesis. Do Brian's results provide support for it? Why or why not?

Brian began researching the evidence for endosymbiosis and repeatedly came up with the same three facts:

a) Mitochondria have their own circular DNA.

b) The inner membrane of the mitochondria has a similar composition to a bacterial membrane.

c) Mitochondria pinch in half to give rise to new mitochondria. A cell cannot make mitochondria if it doesn't already have one.

Brian was getting ready to tell his research supervisor about his results with his amoebae but decided he needed one more piece of evidence to show her. Brian wanted to show her that there were other examples of cells living within cells. He sure felt lucky that Sid was his lab mate, when Sid looked at Brian and said, "I have two Latin words for you, dude: *Paramecium bursaria*." Brian rushed over to the computer to do some research at: .
http://evolution.berkeley.edu/evolibrary/article/endosymbiosis_01

As Sid left the lab that day he said to Brian, "Oh yeah, and before you go see the big boss, you might also want to look up two more words: Kwang Jeon. Later, dude."

7. Why do these three facts support endosymbiosis? Explain.

8. What is *Paramecium bursaria*. Was Sid right to mention this?

9. Why should Brian know about Kwang Jeon?