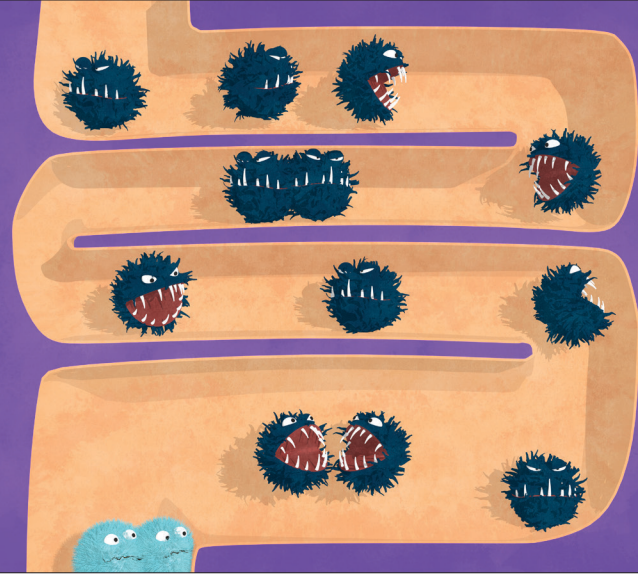


# Sarah's Stomach: When Good Bacteria Go Bad

by

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## Part I – A Sick Semester

Sarah was having a blast in her first semester of college. Ever since she was little, she had dreamed of being a Division I swimmer, and finally her dream had come true; she was swimming at her university, and she couldn't be happier. At the beginning of her first semester, everything was going her way. Although she was having some trouble adjusting to the difficulties of college-level classes and training at the collegiate level, she loved her team, loved her classes, and loved her sport.

One day, after an intense lifting session with her team, Sarah was leaving the weight room when she started to get a stomach ache. She had experienced stomach aches in the past, but this was unlike anything she had experienced before. She was nauseated and felt a sharp pain in her lower abdomen. She ran to the bathroom and began to vomit. The vomiting continued all night and seemed to subside in the morning. Feeling better, Sarah left her dorm and headed out for the day.

Sarah met her friends at the dining hall for breakfast before her first class. She ordered her typical breakfast: coffee with milk, oatmeal with cinnamon and fruit, and an apple. After eating and chatting with her friends, Sarah headed to her first class. In the middle of class, she started to feel sick again. Her nausea returned, even worse than the night before. Sarah left class and went back to her dorm where she looked in the mirror and noticed that her stomach was more bloated than normal. She curled into bed and waited for her symptoms to subside.

### Questions

1. What could be causing Sarah's symptoms? Brainstorm possible causes of these symptoms that you are familiar with. Once you have a list, hypothesize at least three different possible diagnoses for the cause of Sarah's illness.
2. Which of your potential diagnoses seems the most likely? What additional information would be helpful to reach a conclusion? Are there any tests that could be run?

## Part II – A Trip to the Doctor

Sarah started to feel better around dinner time; moreover, she was starting to get hungry. Knowing how she felt after eating a normal breakfast that morning, she went for something blander to eat for dinner. She made herself a piece of toast that she accompanied with a handful of pretzels. After eating her dinner, the pain in Sarah's stomach returned. She was extremely nauseous and started to vomit again. She also experienced a sharp increase in gas and stomach pain. Sarah began to cry, frustrated with the way she had been feeling. Her pain had stopped her from attending classes, and prevented her from swimming, something that she loved to do. She knew that she could not go on like this and decided to make an appointment with the campus doctor.

Sarah was examined at the student health center. The doctor took note of her symptoms as well as her medical history and recent travel as follows:

- *Medical History:* Sarah was diagnosed with inflammatory bowel disease (IBD) when she was in middle school, and since then has had it under control.
- *Recent Travel:* Over the summer, Sarah traveled to the Czech Republic to visit family for a few weeks. After her return to the United States, it was reported that the Czech Republic had had an outbreak of *Salmonella enterica* during her visit. No one else in her family has experienced any stomach issues since the trip.

There were many things that could have caused Sarah's symptoms. The campus doctor was unable to pinpoint an exact cause, so he recommended that Sarah see a specialist.

### Questions

1. In your groups, look over the hypotheses that you came up with in Part I. Using the new information that was provided in Part II, which hypotheses can you exclude? What additional causes might you consider based on the new information you have about Sarah? Create a list of your top possible cause(s) for Sarah's symptoms.

## Part III – Going to the Gastroenterologist

Before seeing the gastroenterologist, the doctor recommended that Sarah keep a log of her symptoms, activities, and food consumption. After logging for a week, Sarah began to notice a pattern: her intense symptoms returned every time she ate. Even though Sarah was sticking to bland foods, which had helped her combat her stomach aches in the past, nothing seemed to help Sarah now.

The gastroenterologist examined Sarah, reviewed her medical history and recent travel, and considered her symptoms log. The doctor was able to determine that Sarah's symptoms were not due to a viral infection, because the symptoms lasted for more than the typical time frame for a stomach virus. She considered two possibilities for Sarah's symptoms: an infection, or small intestinal bacterial overgrowth (SIBO). Because of Sarah's recent travel to the Czech Republic, it was possible that she had contracted *S. enterica*, which could potentially be the cause of her symptoms. The other option, SIBO, was something that was unfamiliar to Sarah.

The specialist explained to Sarah that SIBO is a condition caused by the overgrowth of bacteria in the small intestine. The doctor explained how the gut is full of bacteria, which play important roles in human digestion. When these bacteria begin to overgrow, they can start to interfere with digestion and cause symptoms similar to what Sarah experienced. SIBO is also common in patients who suffer from IBD, which put Sarah at risk of having SIBO as well. To determine the best course of treatment, the specialist decided to test Sarah for both the infection and SIBO.

To test for a *Salmonella* infection (salmonellosis), the doctor tested Sarah's stool (Giannella, 1996). To test for SIBO, the doctor used a glucose breath test. For this test, Sarah consumed carbohydrates, and then her breath was analyzed for the presence of hydrogen gas (Simren & Stotzer, 2006).

### Expert Groups

You will be assigned to one of three groups in order to become an “expert” on a given topic. Only research and answer questions *a–e* for the condition that is assigned to your group. Write a 3–5 sentence response for each question (*a–e*) and be ready to present this information to your classmates during the next meeting.

#### Expert Group 1: The Gut Microbiome

1. Watch the video “The Invisible Universe of the Microbiome” (5:28 min) from NPR on YouTube at <<https://youtu.be/5DTrENdWvvM>>.
2. Read the following article from the Harvard T.H. Chan School of Public Health for information on a healthy human microbiome at <<https://www.hsph.harvard.edu/nutritionsource/microbiome/>>.
3. Outline the important information you have learned about the gut microbiome and dysbiosis. Make sure to answer the following:
  - a. Where in or on the body do we typically find helpful bacteria?
  - b. How do intestinal bacteria contribute to digestion?
  - c. How do intestinal bacteria help prevent us from getting sick?
  - d. What is meant by “dysbiosis”?
  - e. What is the connection between diet and which bacterial species are growing in our intestines?

#### Expert Group 2: SIBO

1. Read through the FAQ on SIBO from the Cleveland Clinic at <<https://my.clevelandclinic.org/health/diseases/21820-small-intestinal-bacterial-overgrowth-sibo>>.
2. Pay particular attention to the section “How is SIBO Diagnosed?” Click on the link for “Breath Test” and focus on the subsections “Test Details” and “Results and Follow-Up.”

3. After reading the assigned sections, outline the important information about the SIBO breath test. Make sure to answer the following:
  - a. What is SIBO?
  - b. How do doctors test for SIBO?
  - c. How does the breath test work?
  - d. Why is the breath test a good test to perform for patients?
  - e. Predict the test results for patients who have SIBO and those that do not.

*Expert Group 3: Salmonellosis*

1. Find the list of foodborne illnesses at the Centers for Disease Control and Prevention (CDC) to learn more about infection at <<https://www.cdc.gov/foodsafety/diseases/index.html>>. Click on the link for *Salmonella*, and read through the information on that page.
2. Click on the “Diagnosis and Treatment” section (one of the grey boxes in the middle of the webpage).
3. Read:
  - a. The first paragraph on the page.
  - b. The “Steps in laboratory testing and reporting *Salmonella* infection” section.
4. Go to the article “Stool Culture Test” at <<https://www.dovemed.com/common-procedures/procedures-laboratory/stool-culture-test/>> and read through to learn more about testing for salmonellosis.
5. After reading the assigned sections, outline the important information about salmonellosis. Make sure to answer the following:
  - a. What is salmonellosis?
  - b. How do doctors test for salmonellosis?
  - c. How does the test work?
  - d. Predict the test results for patients who have salmonellosis and those who do not.
  - e. What is one additional foodborne illness that may cause food poisoning, and how do the symptoms compare with salmonellosis?

