Background

You are a microbiologist. Your team has been working on the spirochete, Borrelia burgdorferi. Scientists write this as B. burgdorferi. This is the bacterium that causes Lyme disease. You have been studying it to help make a test to diagnose Lyme disease in dogs.

You have found that B. burgdorferi has proteins on the outside. It is a common thing to find special proteins on the outer surface of any type of cell. In bacteria, these outer surface proteins are called Osps. They are part of the outer layer of the bacterial cell.

Osps are also antigens. Antigens cause our immune system to make antibodies. Antibodies are made to recognize and fight specific antigens. You can read more about this in the Discovery File: Immune System. Antibodies work by destroying the outer surface of bacteria. Antibodies can also make antigens to clump together. These actions will kill the bacteria.

*B. burgdorferi* has many outer surface proteins. They are called OspA, OspB, OspC, OspD, and OspF. Different strains of *B. burgdorferi* can have different combinations of Osps. But you recently found something important!

You found that **OspA is the only Osp found on every B. burgdorferi.** You have decided to make a blood test for Lyme that looks for the OspA antigen. You can use an antibody solution called Anti-OspA. When Anti-OspA is added to OspA, it makes the OspA clump together.

You have just been sent your first samples of blood from dogs that may have Lyme disease. You are excited about beginning to work on a test that will help veterinarians.

You decide to read over the steps for “Testing Blood for Outer Surface Proteins” (page 2) before you begin.

Materials for the team:

- Set of containers with blood samples from dogs
- Container with known sample of blood positive for Lyme disease
- Dropper bottle labeled “Anti-OspA”
- Dropper
- Small Petri dishes—one for each blood sample
- Wax pencil
- Plastic medicine cup for measuring
- Paper cup with clean water
**Testing Blood for Outer Surface Proteins — Clumping Reactions**

All outer surface proteins (Osps) are antigens. Every Osp has a different shape from other Osps. Our bodies make a different antibody for each one. These antibodies have shapes that fit into each Osp exactly. They work like a lock and key.

Antibodies for a certain antigen are named by writing “Anti-” before the antigen they can fight against. For example, the antibody that fits OspF is called Anti-OspF. Anti-OspF will only fight OspF and not any other type of Osp. Every Anti-Osp antibody will make its matching Osp clump together.

To test for the presence of Lyme disease in a sample of blood:
- Place 5 ml. of the blood sample in a Petri dish. (5 ml = 1 tsp)
- Add 5 drops of Anti-Osp solution and swirl the dish gently on the table. You can move the dish in the shape of a figure 8. This will mix the contents well. Be careful that you don’t spill the sample.
- Look for signs of clumping.

What does clumping look like?
- Clumping looks like visible particles floating in the blood sample. This is a positive antigen-antibody reaction. It proves the presence of the Osp being tested for.
- If nothing happens to the sample, or if you simply see cloudy material at the bottom, this is a negative antigen-antibody reaction and proves the absence of the Osp being tested for.

**NOTE:** It is always a good idea to test a known blood sample first as a control. Follow the steps above and note what happens. Keep the clumped control sample. Use it to compare to other samples.