CASE A: His Sister Wants to Donate a Kidney

Kidney disease has devastated the Sanchez family. Mr. Sanchez had failing kidneys; his 15-year-old son, Julio, was already on dialysis, but his older daughter, Maria, was healthy. When her biology class studied heredity, Maria did a family pedigree using kidney disease as the trait to be studied. She discovered that her great-grandmother had died of kidney disease in Mexico, as had her grandfather.

Maria desperately wanted to help Julio, who was on a list for a kidney transplant, but his tissue type was rare. She knew from reading her biology book that siblings are often the best match for transplants. She went to see Dr. Tulley, her family doctor, and asked him to test her to see if her tissue type matched Julio's. He was hesitant, but she said, "I am your patient, and I want you to do this—and don't tell my parents." He agreed.

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Transplantation of a human organ.

The test results showed that she was a close match. So Maria asked her father for permission to donate a kidney to Julio, but he became angry. "No," he said, "I want you to stay healthy . . . we'll wait."

Maria still wanted to donate her kidney to Julio, but she was only 17 (not yet legal age) and didn't know what to do.

Some questions come to mind when reading about Maria's family. Before we can address those questions, let's look at the biology of immunity and transplantation.

Circulation in a Human Hand

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14.1 What Does the Immune System Do?

The human immune system protects the body from infection caused by bacteria, viruses, and other foreign invaders. Our body's first line of defense against infection is the skin, which acts as a barrier and blocks these invaders when they try to enter the body. The second line of defense is the inflammatory response, which activates the immune system in response to bacteria, fungi, and viruses. The third line of defense is called the adaptive immune system. It has two components: white blood cells (*lymphocytes*) called **T cells** (Figure 14.1a, page 282) and other white blood cells, the **B cells** (Figure 14.1b). Each of these cell types mount specific targeted responses that work to attack and destroy infectious agents and the molecules they secrete. In this chapter we will focus on the role of the immune system in infection, blood types, and transplants. We will also discuss disorders of the immune system.

Most agents that infect the body carry protein molecules called **antigens**. These molecules are detected by the immune system and trigger a response that usually involves several stages. Follow these stages in Figure 14.2 (page 282).

1. Detection of the antigen activates a type of T cell called a **T4 helper cell**, which in turn activates B cells.
2. The activated B cells divide and produce and secrete proteins called **antibodies** that bind to and inactivate the antigen on the surface of the invader.

T cells one of two types of immune system cells (B cells are the other)

B cells antibody-secreting cells of the immune system

antigens molecules that enter the body and trigger an immune response

T4 helper cells specialized T cells that serve as the on switch for the immune system

antibodies proteins synthesized by B cells that inactivate antigens