UNIVERSITY OF CAMBRIDGE

TAKE YOUR PLACE

Activity 2: How Transplantation Works

You were introduced in the previous activity to the idea of **transfusion**, the taking of blood from one person to another, that we might call a liquid transplant. At the same time, we have more in our bodies than just blood, and the idea of swapping out failing parts of ourselves with working ones has always been very appealing, and so modern medicine has also discovered how to transplant solid organs as well.

Solid organ transplantation has a long and varied history as well. The first breakthrough was **skin transplantation** in the late 19th century. In the middle of the 20th century, the first **kidney transplant** (between identical twins – why is this important?) took place, followed by other organs, such as the lungs, heart and pancreas. We have two kidneys, so it is possible for the donor to be a living person, while organs like the heart and lungs can only be taken from deceased donors.

Organs were initially matched only to the ABO system like you were introduced to in the previous activity, and this was important to prevent **hyperacute rejection** (really really fast rejection), as the blood vessels in these solid organs also have the same ABO antigens on their surface. However, this was not enough, as solid organs are more complex than blood.

Scientists and doctors first learnt about this from skin transplants. As long as the tissue can be kept alive, skin transplants between different sites on the same person have a 100% success rate (an **autograft**). A transplant between two people that are genetically identical (a **syngeneic graft**) are also similarly successful.

However, when skin is transplanted between two unrelated individuals (an **allogeneic graft**), the graft initially survives, but then is rejected about 10-13 days after the grafting. This is known as **acute rejection** (slower than hyperacute rejection but still fairly fast since we hope that it will stay for possibly the rest of the life of the individual!). This is very consistent. When an individual has rejected a graft and is regrafted with skin from the same donor, the second graft is rejected even more quickly than the first (in 6-8 days). This is known as an **accelerated reaction**. Just like our body remembers diseases it has fought against, it also remembers the tissues it has rejected, and acts more quickly the next time it sees this.

Scientists discovered that this recognition of what is not from our own bodies depends on molecules on the surface of our cells called **MHC** or **HLA**. These molecules show off the genetic makeup of each tissue to the immune system, and our body uses it to detect when cells have become infected with virus and are not the same as they once were. Doctors tried to match HLA types like they did with blood types and this is sometimes effective, but the number of possible HLA types is really big, so finding an exact match can be very hard, if not impossible. This variety has evolved to make sure no single virus can very easily infect a large segment of the population and bypass the immune system.

Instead, doctors these days try to suppress the immune response against these transplants, in a process known as **immunosuppression**. This makes people who have had transplants more prone to infections that can be deadly, but also prevents their body from quickly rejecting a life-saving transplant.

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Task

1. Watch this brief video: The Messy Path to the First Successful Organ Transplantation
2. Read this website about the history of transplantation: History of Transplantation
3. Refer to this web page about transplantation: How Organ Donation Works
4. How does our immune system reject organs, what kind of medicines do doctors use to perform immunosuppression and how do they work? Draw a diagram below:

5. What do you think the ethical issues are for acquiring donor organs to be able to transplant them?

Explore More...

If you want to expand your knowledge about how transplantation works and what might come in the future, take a look at this web page: NHS Blood and Transplant