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A Look inside the Lab: Incubators Too Cold or Too Hot: Why it Matters

Think back to a time when you were really hot. What about a time when you were really cold? How did you feel? What were you doing at the time? How well were you doing it? If you are like most people, when you are uncomfortably hot or cold, you are not very effective at what you are doing because all you can think about is how hot or cold you feel. Although we don't think about it too often, the temperature of our environment is important.

Temperature is important in science as well, particularly in biological systems. For example, did you know that:

- Our immune systems work better at higher temperatures
- Pathogens do not function as well at higher temperatures

It is for these two reasons that we sometimes get fevers when we are sick. Even though most people think that fevers are caused by the illness, they are really a tool of our immune systems. Pretty cool, huh? That is also why taking fever-reducing medications may prolong our illness. The medicine brings down the temperature, so our immune system then needs to start again as it tries to make our body less welcoming for the disease-causing agent. Of course, if someone is very uncomfortable because of a high fever, they may need to take medicine to reduce it, but they should be aware that they are often trading short-term comfort for longer-term healing.



Most pathogens work best at body temperature — 98.6 degrees Fahrenheit (37 degrees Celsius). As such, if scientists are studying a human pathogen, they often need to set up their model to mimic the environment of the body, including temperature. This is why virtually every lab that studies biological systems or disease-causing agents has incubators.

Incubators are enclosed environments in which conditions can be adapted to mimic a biological system. While temperature control is often a critical part of mimicking an environment, incubators can also vary in terms of their ability to control humidity, sample movement, and composition of environmental gases.

Using temperature to human advantage

Did you know that the temperature inside your nose is different than the temperature inside the rest of your body? Before reading on, think about why that might be the case.

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Hopefully, you thought about the fact that our nose is where air from the environment enters our body. Because of this exposure to the outside environment, the temperature of our nose is typically cooler than that found inside our body. In fact, part of the job of the nasal cavity is to warm the air as it heads toward our lungs, so that it is similar to the environmental temperature in the lungs when it arrives.

When creating the “intranasal” flu vaccine, scientists took advantage of this temperature difference. Here’s how:

- The intranasal influenza vaccine differs from other influenza vaccines in two ways. First, it is given in the nose instead of as a shot. Second, it contains live, weakened influenza viruses instead of dead viruses or parts of the virus.
- Influenza viruses typically reproduce in the cells that line our respiratory tract – from our noses to the deepest parts of our lungs. The deeper the virus gets into our lungs, the sicker we get.
- So, when scientists wanted to weaken the influenza virus for the intranasal flu vaccine, they focused on creating a version that grows in the cooler temperatures of the nose, but not the warmer temperatures of the lungs. If you look at the description of this vaccine, it is said to include influenza viruses that are “cold-adapted” and “temperature-sensitive.” Cold-adapted means they grow at cooler temperatures than most influenza viruses. In this case, 25 degrees Celsius. Temperature-sensitive means they do not grow well at certain temperatures. In this case, 37 degrees Celsius. In sum, this means that the intranasal influenza vaccine viruses can grow in the comparatively cooler environment of the nose, but not in the warmer environment of the lungs.

So, the next time you go for your flu vaccine, if you get the drops in your nose, you are benefiting from temperature-based technology!