

# Baxter STEM Academy

## TEAM CHALLENGE

**Goal: Design and build a device or protocol to reconstitute a vaccine that needs to be freeze dried, packaged, transported, and administered to save lives**

### Your Tasks

Investigate the various ways that vaccines are produced, freeze-dried, packaged, transported, and administered, and design and build a device or protocol that can improve these processes for Baxter Biopharma Solutions to help save lives.

### Background

Vaccines are widely available in the U.S., saving people's lives every day. Yet, in developing countries, vaccination rates are comparatively lower and children in these countries are particularly vulnerable to complications of diseases because of poor nutrition and lack of healthcare access.

Although there are numerous challenges to providing vaccinations to developing countries, getting viable vaccines to countries-in-need is often the most difficult. Vaccines often need to travel long distances from manufacturers to where they are distributed. Without proper manufacturing and delivery, vaccines themselves can be ineffective or even deadly.

To ensure vaccines stay effective, they can first be **freeze-dried (lyophilized)** during manufacturing and placed in sterile vials. Solution then needs to be added - from a separate vial - to **reconstitute** the vaccine before it is administered.

To produce, transport, and administer vaccines, companies like Baxter Biopharma Solutions must: (1) be able to freeze-dry a vaccine; (2) be able to maintain sterile environments; (3) engineer a process to filter water of contaminants; (4) test the water to ensure it is free of contaminants; and (5) continuously monitor the vaccines along every step of the process – from manufacturing to administration.

### Tasks

- Understand the Scientific Process and the Engineering Design Process (EDP)
- Learn about freeze-drying (lyophilizing) and reconstitution
- Investigate how to maintain a sterile environment
- Investigate water quality testing
- Engineer water filtration solutions
- Create a poster with your team's solutions to the mission
- Have fun!

### Real Life Connection



Not all vaccines need to be packaged cold. An anti-meningitis immunization campaign in West Africa has shown that vaccines can be delivered to remote areas without using ice boxes and still remain viable. For more information, check out this article from Scientific American: [goo.gl/jaqPzo](http://goo.gl/jaqPzo)

### STEM CAREER CONNECTIONS

#### Chemical Engineer

Design processes to produce, transform, or transport materials. Avg. National Salary: \$102,160

#### Systems Engineer

Design and optimize successful projects by looking at system inputs and outputs and minimizing risks. Avg. National Salary: \$84,000

#### Chemist

Study substances at the atomic and molecular level and analyze interactions. Avg. National Salary: \$81,870