

Learning objectives

- Synthetic biologists solve problems by applying engineering principles to the life sciences.
- Researchers in the field of synthetic biology are engineering viruses to help treat diseases.
- Synthetic biology benefits from many voices.

Conversation questions

- How do people choose which problems to solve (such as which diseases to try to cure)?
- Is it surprising to think about using a virus to treat a disease? If we use this approach, how can we make sure it is as safe as possible?
- Can you imagine other uses for “reprogramming” viruses, beyond fighting disease?

Materials

- Activity and facilitator guides
- Activity sign and holder
- Index cards
- Purple and orange yarn
- Scissors
- Tape
- Small cardboard takeout boxes
- Sticky notes
- Markers
- Reference sheets: Synthetic Biology, Genes and DNA, and Structure of a Virus

All written activity materials and graphics can be downloaded from buildingwithbiology.org.

Notes to the presenter

Preparation: Before beginning this activity, assemble some takeout boxes, and cut some 3-inch lengths of yarn.

Safety: Scissors can be sharp.

Audiences: You can adjust this activity to work for different audiences. Tailor the amount of information you initially share depending on the age and interest of the visitors. Remember that you can always share more information if visitors ask questions! Some visitors may want to know more about DNA and RNA, while other visitors may just want to focus on designing their engineered virus to treat a disease.

In this game, people can think of many different places in the body to send their “VirEx Delivery,” such as the heart, lungs, or brain. They can also think up a variety of instructions for their re-programmed virus, such as Rush Delivery, Immune System Ignore, Cancer Cells Only, or Important Instructions Enclosed. Younger visitors might find it easier to draw messages on the outside of the takeout boxes, or describe what the virus should do rather than write it out.

Conversation: This activity is designed to promote back-and-forth conversation about ways that technology is interconnected with society. You can help encourage visitors to develop and share their own ideas by referring to the **Tips for Conversations** guide.

You can use the “**Talk about it...**” questions in the activity guide to get visitors started. (These are also summarized in the list of “Conversation questions” above.) Be sure to listen to visitors’ thoughts and opinions, and feel free to share your own opinions as well. As your group talks, help everyone to remember that there is no right or wrong answer to the questions this activity raises. Science provides information that can help us form opinions and make choices—but we also consider other perspectives such as cultural traditions and personal values.

If visitors seem uneasy or have questions regarding the safety and security of synthetic biology systems, you might respond that these are serious factors that scientists—and we as a society—need to consider. As with many new technologies, there are important ethical and social questions surrounding research in synthetic biology. Government regulations, biosafety committees, scientific transparency, and informed citizens help to make sure that these technologies maximize benefits and minimize risks. Together, we all have a role in shaping how technologies are developed and used.

Additional Background:

- **Viral capsid:** The *capsid* is the exterior shell of the virus. Capsids come in a variety of shapes and sizes. A capsid has proteins all over its surface. These proteins tell the virus what cells to attach to and can even help disguise it so it isn’t recognized by the immune system.
- **Viral genome:** The *viral genome* is the genetic material that provides instructions for a host cell to replicate the virus. It’s found inside the capsid. Viral genomes can be composed of either *deoxyribonucleic acid* (DNA) or *ribonucleic acid* (RNA). DNA and RNA are kind of like codes that tell a cell what to do. Different viruses have different numbers of genetic instructions, or *genes*, in their genome. Here, we are pretending that the viral genome is composed of DNA, because visitors will be learning about DNA in other Building with Biology activities.
- **Viral replication:** The proteins on the viral capsid attach themselves to host cells. Once attached, the virus inserts its genome into the host cell. The viral genome then takes over normal cellular function. It causes the host to produce new copies of the viral capsid and viral genome, which then assemble themselves together to create new copies of the virus.

Passports: In your activity box, you’ll find a marker stamp. This stamp is for the Building with Biology event passports. Each facilitator will need to be prepared to stamp visitors’ passports if guests ask them a question and/ or share what they think about synthetic biology. Facilitators who are scientists should wear “I’m a scientist” stickers at the event and should be ready to stamp passports if guests talk to them. Your event may choose not to use the passports, and that’s fine, too.

Related educational resources

The NISE Network website (www.nisenet.org) contains additional training resources to help scientists and educators have conversations with museum visitors about technology and society:

http://www.nisenet.org/catalog/tools_guides/nano_society_training_materials

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This activity is a modified version of the “VirEx” activity developed by the Children’s Museum of Houston for the Building with Biology pilot project.

Image of viral capsids Wacomka, Shutterstock.com. Stock images are not covered under the terms of Creative Commons.

Image of Counter Culture community bio space, Cody Pickens. Used by permission.



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