Bio-Coding Club Curriculum

BROAD INSTITUTE | STEM ENGAGEMENT AND INCLUSION

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WELCOME & PURPOSE

Welcome to the Bio-Coding Club curriculum. The goal of this curriculum is to give educators all the tools needed to run successful student-driven coding projects related to biology – and to boost student interest in STEM by making science fun.

The Broad Institute created the Bio-Coding Club, in collaboration with Putnam Avenue Upper School in Cambridge, Massachusetts, as an after-school program to teach students in grades 6-8 about both biology and coding. The club met weekly for 75 minutes. A team of professional scientists, all volunteers from the Broad Institute, served as mentors. Club meetings generally started with a snack and a discussion of a biology topic. Students then took part in a hands-on activity before moving on to practice coding with the coding language Scratch (scratch.mit.edu).

This module, curated by the Broad Institute's Office of STEM Engagement and Inclusion, consists of 6+ lessons about infectious disease. The lessons you'll find here are suggestions; they can be modified to fit your program's resources and students.

To download additional Bio-Coding Club modules, visit broad.io/biocodingcurriculum.

The following table shows the suggested order for utilizing the Bio-Coding Club curriculum, but sticking to this order is not strictly necessary.

Semester 1 (12+ meetings)	**Microbiome**
	Infectious Disease
Semester 2 (10+ meetings)	**DNA**
Semester 3 (10+ meetings)	**Neuroscience**
	Evolution

INTRODUCTION TO INFECTIOUS DISEASE

COVID-19, the flu, malaria, and Ebola are all examples of infectious diseases — illnesses that are transmitted by bacteria, viruses, fungi, and other parasites. In a post-COVID world, students are well aware of the profound effects infectious diseases can have on their lives. While their exposure to the world of infectious disease before 2020 may have been limited to the occasional cold and an annual flu shot, students now have first-hand knowledge of the importance of handwashing, contact tracing, vaccine development, and herd immunity.

This unit, developed and piloted before the Coronavirus outbreak, explores the world of infectious disease that has gained such great relevance to students' lives. The unit begins with an activity designed to get students thinking about genetics, the science that underpins the entire field. Activities on epidemiology, herd immunity, handwashing, and vaccine development follow, introducing the fundamentals of infectious disease through 6+ meetings' worth of hands-on activities.

Each week's activity is paired with a self-contained Scratch project designed to be completed in 30 minutes. These modular Scratch projects can be personalized or made more complex if your time or interest allows. As with our other units, each of these Scratch projects comes with a printable "Scratch card" with sample code that allows students to work independently from the club leader and volunteers. By the end of the Infectious Disease unit, students will have a deeper understanding of the science behind infectious diseases, and will have worked on several Scratch projects of increasing complexity.

NEXT GENERATION SCIENCE STANDARDS

- MS-LS3-1: Develop and use a model to describe why structural changes to genes (mutations) located on chromosomes may affect proteins and may result in harmful, beneficial, or neutral effects.

INFECTIOUS DISEASE 1: Origami Frogs

1

Objective

SWBAT model the concept of genotype leading to phenotype by using instructions to build an origami frog.

SWBAT log onto Scratch and work on a project.

Vocabulary

- **Genotype:** a set of genes carried by an organism
- **Phenotype:** the observable characteristics of an organism, which are determined by the genotype

Framing Question

How are instructions similar to DNA?

Materials

- Computers for each student
- *Register Students for a Scratch Account* instructions (p. 6), needed only if you have new students in the club
- *Animate a Name* Scratch cards obtained from: https://resources.scratch.mit.edu/www/cards/en/scratch-cards-all.pdf (again, needed only if you have new students in the club)
- Different colors, sizes, and weights of paper, cut into squares
- Origami frog folding directions, one copy for each student[1]

[1] You can find many sets of directions on the internet. We printed out the ones shown at: www.itsalwaysautumn.com/origami-jumping-frogs-easy-folding-instructions.html

INFECTIOUS DISEASE 1: Origami Frogs

1

Plan/Activities

1. **Welcome returning and new students to the club.**
2. **Introduce the following activity, presented in Cooper et al. (2017).**[2]
   - Show students a pre-made origami frog and ask the following questions:
     - Who has made an origami frog before?
     - What is the purpose of an origami frog? [To jump]
     - Could you make an origami frog with no instructions?
     - What might happen if a step was missing in the instructions?
     - What might happen if an extra step was added to the instructions? Does it matter what kind of extra step is added? What if the added step was to draw a face on the frog at the end? Would this affect the frog's function?
   - Compare these frog-building instructions to the DNA instructions that build living organisms. Explain that the finished products of the DNA instructions are proteins that have specific functions. All living things are built with proteins. If the instructions are bad or missing, we can get a poorly functioning (diseased) result.
3. **Building an Origami Frog**
   - Tell students that today they're going to reinforce the concept of DNA as directions by building origami frogs.
   - Ask students if all living things are the same. Explain that variations in DNA instructions, and the proteins built with those instructions, give us the diversity of life that we see today.
   - Show students the different sizes and types of paper, and inform them that they're going to build different frogs, just like nature builds different proteins. Only the best jumpers will survive. They must decide which paper they want to use, follow the instructions, and build a frog.
   - Once students have selected their materials, hand each a copy of directions for folding an origami frog.
   - When frogs are completed, students can showcase their frogs and note the differences in jumping ability.
4. **Scratch Activity**
   - Have students grab computers and sign into Scratch.
   - Returning students can work on previous projects from the microbiome module.
   - New students should animate their name using the *Animate a Name* Scratch cards.
5. **Share-outs**
   - Ask for 3-4 volunteers to show their animations to the group, or pair-share students to show their work to one another.

[2] Cooper, K., McGraw, A. and B, Khazanchi. 2016. Bioinformatics for middle school aged children: Activities for exposure to an interdisciplinary field, IEEE Integrated STEM Conference, pp 1-9.

How will you determine if students met the objective?

Students will have completed an origami frog and logged onto Scratch.

Facilitator Tips

- It may help to show an online video of folding the frog. You can also walk around to help students as they get stuck.
- If you have new students in the club, make sure they create Scratch accounts and complete the *Animate a Name* activity that was done in Microbiome module 1. Returning students can work on their old projects or help the new members.
- Make sure to provide extra check-ins with new club members.

SCRATCH ACCOUNTS

1

REGISTER STUDENTS FOR A SCRATCH ACCOUNT

At least two days before the lesson:

Sign up for a Scratch teacher account at https://scratch.mit.edu/educators/register. With a teacher account, you can easily reset student passwords and collate student projects. Pick a short username that is easy to type, because your username will be the default password for your students.

Select ***My Classes*** near the top of the screen and then ***+ New Class*** to add a class for your students. You can also create specific *studios* for students to share their work in.

Sign Up a New Student (when students want to pick their own usernames)

1. Sign into your teacher account and select ***My Classes***. (More than one person can sign into the teacher account at the same time, so using multiple facilitators can speed this process.)
2. Under your chosen class, click the blue ***Students (n)***. The number (n) will show the number of students signed up so far.
3. Click ***+ New Student.***
4. Add the student's new username to the class. The username should be unique (it will be rejected if it isn't), and it shouldn't be the student's actual name or have other identifying info.
5. The student should then go to https://scratch.mit.edu/ and sign in with their username. Their default password will be **your teacher account name**. (Note: Your account name, *not* your password.) They will be asked to choose a new password and answer some basic questions as they register. (You can reset their password to your teacher account name anytime they need it.)
6. Once registered, the student should click the ***My Stuff*** file in the blue bar.
7. The student can click ***+ New Project*** to start their first activity.
8. Once done, they should give their project a title in the light blue box at top, click ***Save Now***, and click ***Share***.
9. If you have created a studio, the student can click the blue ***+ Add to Studio*** button at the bottom to add their project.
10. The student can then click the desired studio and ***Okay***.

That's it! The student's work is now shared with the class in the studio.

INFECTIOUS DISEASE 2: Epidemiology

2

Objective

SWBAT explain how diseases spread after participating in the outbreak simulation activity, and describe what an epidemiologist does.

SWBAT code a conversation using the broadcasting function of Scratch.

Vocabulary

- **Infectious disease:** any disease caused by a pathogen such as a virus, bacteria, parasite, or fungus
- **Epidemiology:** the study of how diseases affect the health and illness of populations

Framing Question

How do diseases spread?

Materials

- For outbreak simulation:
  - Clear plastic drink cups
  - Distilled water
  - Phenolphthalein solution,[3] 5 ml
  - Sodium carbonate, 1 teaspoon (available on Amazon, also called soda ash)
  - 15 mL test tubes[4]
  - Index cards
  - Distilled water[5]
- To prepare before the activity:
  - Set out one cup, one test tube, and one index card per participant. Students will commingle fluid in their cups to spread the "disease" and keep track of the individuals they interacted with on their index cards. The test tubes are for reference at the end of the activity.
  - Rather than associating the Club members' names with disease, we labeled each set (cup, test tube, index card) with character names from Harry Potter. We also wrote the numbers 1-3 on each index card.
  - Mix 1 cup of water with 1 teaspoon of the sodium carbonate until dissolved.
  - Choose two cups and add 1/4 cup of carbonate solution to them. Add about an inch of the solution to the test tubes with the same names. These will be the source of infection. Fill the other cups and tubes with distilled water.
- Computers
- Infectious Disease 2 Scratch card (p. 10)

[3] Available from Carolina Biological. Item # 879991.
[4] Available from Carolina Biological. Item #215085. You can use the Styrofoam rack they ship with to hold them upright.
[5] If your tap water has a neutral pH, you can use tap water. If not, bottled water from the grocery store is fine.

INFECTIOUS DISEASE 2: Epidemiology

2

Plan/Activities

1. **Preview**
   - Students simulate the spread of a disease (such as mumps). Each student receives a cup of water, but two students have cups that also contain sodium bicarbonate (the disease). Students go through three rounds of sharing fluids, after which they try to determine who the original carriers were. Students are then able to confirm their suspicions by testing specimens stored from before the outbreak (the test tubes).
   - Ask students why they think we need to learn about how diseases spread. Discuss briefly a relevant infectious disease outbreak (such as COVID-19 or typhoid spread by Typhoid Mary).
2. **Outbreak Simulation Activity**
   - Use this story or set up a similar one: School has ended, and it's time for summer camp! Students from all over the county have arrived at Camp Faraway. The camp is very small, and many students have been sharing drinks and not washing their hands. The class is going to simulate this exchange of germs.
   - Have each student choose one cup and its corresponding index card.
   - Explain that students will be exchanging germs with each other using the following procedure: Students will find one partner. The first person will pour all their liquid into the second person's cup. Then the second person will pour half the liquid back into the first person's cup. In the first space on their index cards, both students should record the name on the cup that they exchanged fluids with. (Use the character names from the cup, not the students' real names.)
   - Students should repeat this procedure two more times so that they exchange fluids a total of three times and fill the three spaces on their index cards.
   - Have students return to their seats. Say that you noticed some of the students are looking very sick. Add a couple of drops of phenolphthalein to each student's cup to see who is sick, indicated by the liquid turning pink.
   - Ask the students if they can figure out which student(s) were the source of the disease, so that you can notify the health department in those students' hometowns to help stop the disease from spreading.
   - Let the students develop their own method for determining who the disease originated from. They may or may not be able to narrow down the results.
   - (Optional) Once the students have come up with a few suspects, you can tell them that luckily, all the students had a medical checkup before camp started. Tell them you have access to blood samples from all the students, then bring out the test tubes and test their suspects.
3. **Debrief**
   - Explain to students that scientists don't generally have access to blood samples from everyone taken right before an outbreak. Traditionally, identifying the source of a disease has involved a lot of interviewing people. But people can forget things or become confused. Scientists at the Broad Institute use the genetic code of the disease to determine where it came from.

     You look more like your parents than a random stranger because you came from your parents. The same idea works in disease transmission. When Amy infects Bob with a virus, the DNA of the virus in Bob will look very similar to the DNA in the virus in Amy. In this way, scientists can track the history of infection by sequencing the DNA of viruses taken from many different sick people.

Scratch Activity: Coding a Conversation

- Transition to Scratch by having students grab computers and sign in.
- Show students the "Knock Knock" coded conversation using this link: https://scratch.mit.edu/projects/480894048
- Tell students that they're going to code their own conversation. They can code their own knock knock joke, or code a conversation about a disease outbreak.
- Pass out the Infectious Disease 2 Scratch card to each student.
- Check in with students as they work.

How will you determine if students met the objective?

Participation in the simulation, and using Scratch to code a conversation.

Facilitator Tips

The facilitator may want to prepare for discussion a slideshow of a relevant example of infectious disease tracing. The cholera epidemic of 1854 in London that was tracked and eliminated by John Snow is a great example.[6]

[6] "John Snow - The Father of Epidemiology." Boston University School of Public Health. October 1, 2015. https://sphweb.bumc.bu.edu/otlt/mph-modules/ph/publichealthhistory/publichealthhistory6.html

Can you code a conversation?

1 Your first talker says something and "broadcasts" a signal

say [message 1] for [2] seconds

broadcast [message 1] and wait

2 Your second talker says something only after it receives the signal

when I receive [message 1]

say [response 1] for [2] seconds

Check out the sample code for a knock knock joke!

when [flag] clicked

say [knock, knock, Giga!] for [2] seconds

broadcast [Giga1] and wait

say [Atch.] for [2] seconds

broadcast [Giga2] and wait

say [Sorry, I didn't know you had a cold!] for [3] seconds

broadcast [Giga3]

when I receive [Giga1]

say [Who's there, Nano?] for [2] seconds

when I receive [Giga2]

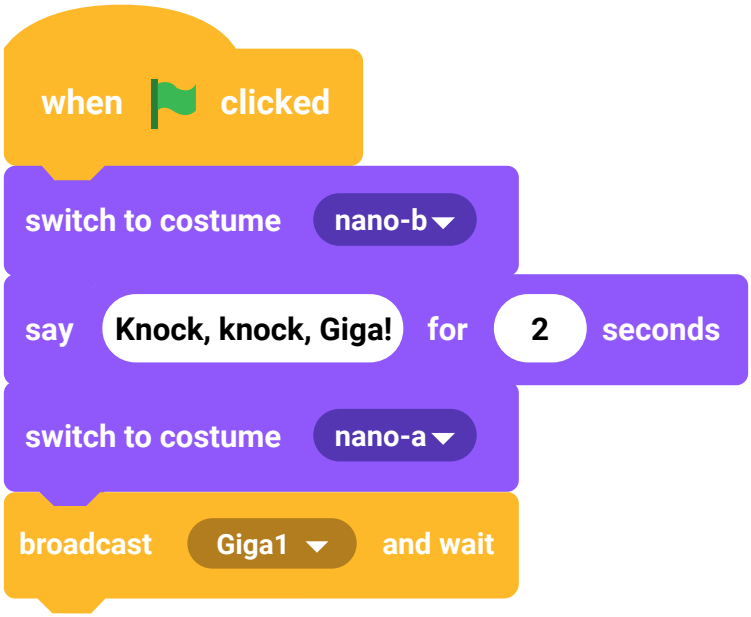
say [Atch who?] for [2] seconds

when I receive [Giga3]

switch to costume [giga-d]

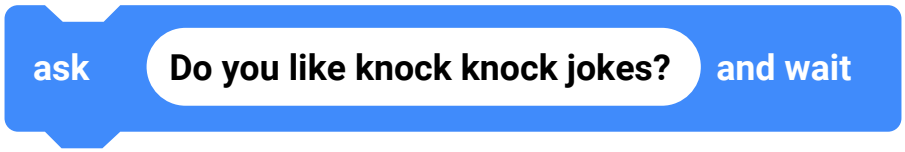
Challenge!!!

Can you make your characters' mouths move when they talk?



Can you code a chat between your character and the computer user?

Youll need these blocks.



INFECTIOUS DISEASE 3: Vaccine Ball

3

Objective

SWBAT demonstrate how vaccines prevent people from getting sick, by participating in the vaccine ball activity.

SWBAT create and write code for clones of sprites in Scratch.

Vocabulary

- **Vaccine:** a substance used to stimulate your immune system so that it your body is prepared to fight off a disease

Framing Question

Why are vaccines effective?

Materials

- Plastic balls, approximately two per student[7]
- Name tag stickers
- Computers
- Infectious Disease 3 Scratch card (p. 15)

[7] We used approximately 2-inch diameter plastic balls sold as pit balls.

Plan/Activities

1. **Vaccines 101: Review the following information with students**
   - A vaccine is a substance that prepares your body to fight off a disease.
   - It is typically made from dead or weakened microbes (or a small part of them).
   - It causes your immune system to quickly recognize and destroy the microbe if it ever encounters it again.
   - Vaccines are very safe. But not every disease has a vaccine, and not every person gets vaccinated.
   - A person might not be vaccinated because they are too young, allergic to part of the vaccine, or have another disease like cancer that affects their immune system.
2. **Activity: Run the Vaccine Ball. This activity is based on the one found in Hopkins et al. (2013):[8]**
   - The first round of the activity demonstrates how vaccines can be beneficial to the vaccinated individual.
     - Divide students into three groups.
     - Give one group of students the plastic balls. They have a communicable disease and can spread it to other people.
     - Give a second group of students name tags with "vaccinated" written on them. They should stick them to their shirts to indicate that they have been vaccinated against the disease.
     - The remaining group of students will get name tags with "unvaccinated" written on them, to show that they are not vaccinated against the disease.
     - Tell all the students with a ball to remain in their seats. Students with both types of stickers should stand at the front of the room.
     - Students with balls are allowed to throw the ball at anyone who is standing during a free-for-all. Their goal is to hit the standing students in the torso (front or back).
     - Vaccinated students are protected and are allowed to use their hands to deflect the ball to keep from getting hit on their torso. Vaccinated students who get hit should remain standing.
     - Unvaccinated students are not protected and must keep their hands by their sides.
     - Any unvaccinated student who gets hit in the torso must sit down. They are now sick and can collect some balls that have already been thrown from the floor to throw at anyone who is still standing.
     - The number of sick people will increase. After each sick student has had four throws, the round stops.
   - The second round of the game illustrates herd immunity. Collect the balls and reassign the students to their original three groups: sick, unvaccinated, and vaccinated.
     - Again, tell the sick students (those with balls) to sit, while the two groups of well students with stickers remain standing.
     - This time, there's a twist: all unvaccinated students stand behind a line of vaccinated students.

[8] Hopkins, J., Pinilla, T., Bhatt, A., and I. Akinsanya-Belso. 2013. *Have you heard about herd immunity?* CDC. www.cdc.gov/careerpaths/scienceambassador/documents/herd-immunity-2013.pdf pp. 5-7.

- The challenge is for the sick kids to hit the torso of the unvaccinated students (behind the barricade) with the ball.
- They should discover that vaccinated kids are "protecting" the unvaccinated students. This simulates the concept of herd immunity.

3. **Debrief**

- Ask what would happen if the group sizes were changed so that more vaccinated students are protecting fewer unvaccinated students. Explain that eventually a point would be reached when it would be virtually impossible for an unvaccinated student to get hit. This point represents the threshold for herd immunity.
- If you have time, do a third round where only one student is unvaccinated. The student should be totally surrounded by the vaccinated students and therefore completely protected by the herd.
- We used the following numbers with 10 students and found the activity worked very well:
  - Round 1: 4 sick, 3 unvaccinated, 3 vaccinated
  - Round 2: 4 sick, 3 unvaccinated, 3 vaccinated
  - Round 3: 4 sick, 1 unvaccinated, 5 vaccinated

Scratch Activity: Cloning

- Have students grab computers and sign into Scratch.
- Tell students that they're going to practice making copies/cloning a sprite in Scratch to create a game. This is a very useful feature in Scratch to avoid creating and coding dozens of individual sprites when they are all similar.
- Show students the sample game, found here: https://scratch.mit.edu/projects/480908382/
- Pass out copies of Infectious Disease 3 Scratch card.

How will you determine if students met the objective?

They should demonstrate an understanding of how vaccines work, and be able to create and code clones of a sprite in Scratch.

Facilitator Tips

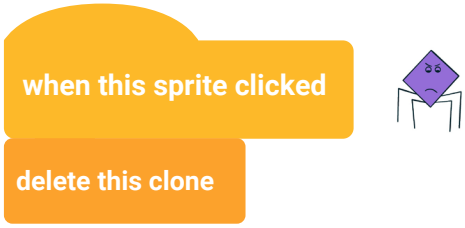
Make sure to model the tossing of balls in the vaccine ball game before starting, so it doesn't get out of hand.

Attack of the Clones!

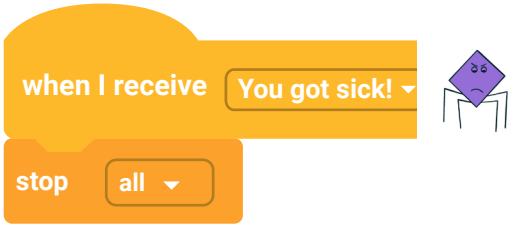
1 Create a Sprite and clone it

2 Code your clones to fall

3 Click the clones to delete them.

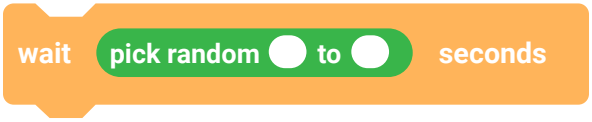


4 Stop the game.

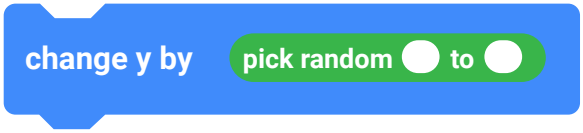


Challenge!!!

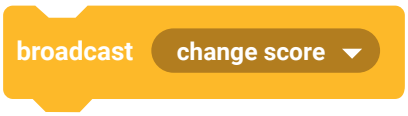
Can you make the clones appear at random times?

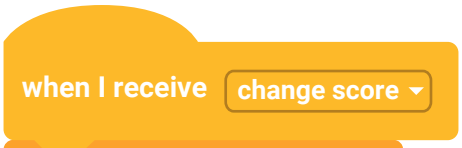


Can you make the clones have random colors and speeds?



Can you add a score box?





INFECTIOUS DISEASE 4: Handwashing

4

Objective

SWBAT demonstrate proper handwashing technique by using Glo Germ to simulate germs and their spread.

SWBAT utilize *variables* in Scratch by coding a variable to give a sprite dynamic movement.

Vocabulary

- **Variable:** a changeable value recorded in Scratch's memory.

Framing Question

Why is handwashing so important?

Materials

- Glo Germ (available from Amazon)
- UV flashlight
- Sinks with soap and paper towels
- Computers
- Infectious Disease 4 Scratch card (p. 20)

INFECTIOUS DISEASE 4: Handwashing

4

Plan/Activities

1. **Handwashing Overview:**
   - Lead students in a discussion about the importance of handwashing
   - Ask the following questions:
     - When should you wash your hands? (After using the bathroom, before preparing food, before eating, if you sneeze or cough into your hands...)
     - Model how to properly wash hands.
2. **Glo Germ Activity**
   - Explain how Glo Germ will simulate germs in our daily environment. (Note: Glo Germ is just a substance that fluoresces under black light. It does not actually cause bacteria to glow.)
   - Divide students into two groups: Have half the students rub Glo Germ into their hands. Those students should then find a member of the group that did not receive Glo Germ to shake hands with.
   - Show the students their hands under the UV light and have them note what they see.
   - Split the class in half again. Have half of the class wash their hands with water and the other half wash with soap and water.
     - Have them look at their hands under the UV light again and note their observations.
     - Have all students wash hands after the activity.
3. **Debrief**
   - Have students share their observations. Talk with them about why handwashing is so important in the prevention of infectious disease.

Scratch Activity: Flying Germs

- Have students grab computers and log into Scratch.
- Tell them that today's Scratch activity will involve making a "flappy bird" type game that involves avoiding flying into germs. They will explore the use of variables to add dynamic speed and direction to a flying sprite.
- Show them the game at https://scratch.mit.edu/projects/480912974/
- Pass out Infectious Disease 4 Scratch card.

How will you determine if students met the objective?

Students should demonstrate an understanding of why washing hands is important, and be able to use variables in Scratch.

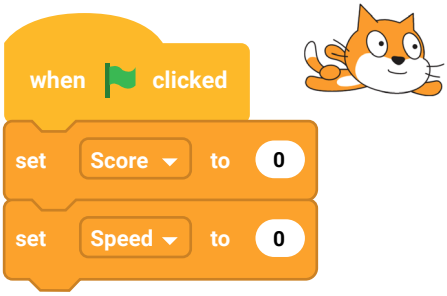
Facilitator Tips

- There are many online videos that do a great job of covering proper handwashing techniques.
- Use a very generous amount of Glo Germ to ensure its visibility under the UV light.
- Make sure that students rub the Glo Germ into their hands before shaking hands with another student.

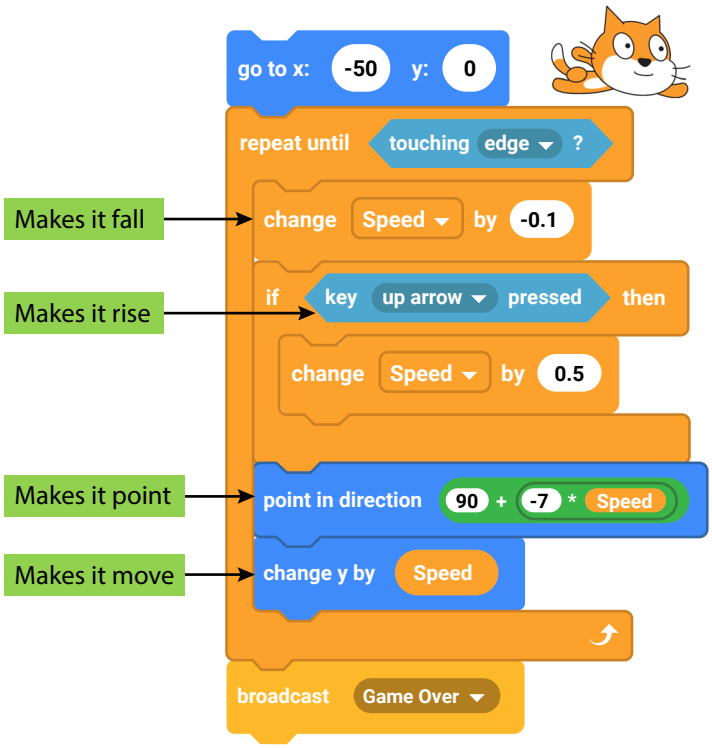
Using Variables: Flying Germs

1 Create two variables and set them to zero

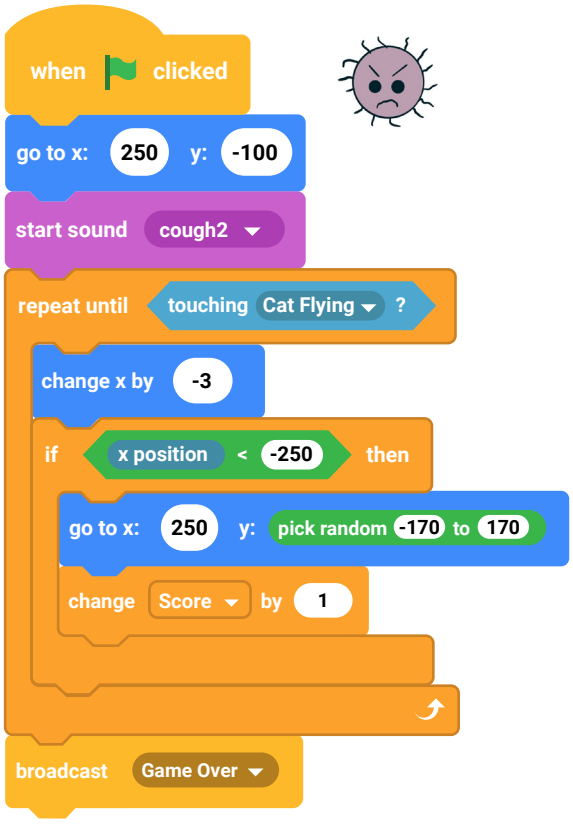
Variables | Make a Variable



2 Add code to move your flying sprite



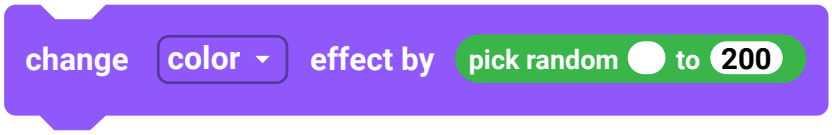
3 Draw a germ and make it move



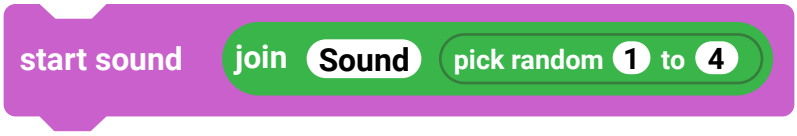
4 Stop the game

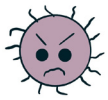
Challenge!!!

Can you change the color of your germ?
What about creating more than one type of germ?



Can you play a random sound for each germ?
Hint: Change the sound names to numbers
and pick the numbers randomly.





Can you change your speed variable to make the game harder or easier?

INFECTIOUS DISEASE 5: Vaccines & Mutations

5

Objective

SWBAT describe how viruses can mutate to escape a vaccine, by using the analogy of making a mistake while folding a Rubik's Snake into a predetermined shape.

SWBAT use the *My Block* function in Scratch to create a shortcut to a set of code.

Vocabulary

- **Mutation:** a change that occurs in the DNA sequence of a living organism
- **My Blocks:** a category of Scratch blocks that allows the user to combine multiple blocks of code into one custom block that's less bulky to use.

Framing Question

Why are annual vaccinations important?

Materials

- Rubik's Snake puzzle[9] (1 per student). Before handing out the snake, use permanent marker to number the joints on one side of the puzzle from 1-12 so that students can follow the folding directions easily.
- *Rubik's Snake* directions (p. 25)
- *Rubik's Snake* key (p. 26)
- Infectious Disease 5 Scratch card (p. 27)
- Computers for each student

[9] We used the Ganowo brand "Big Size" available on Amazon.

INFECTIOUS DISEASE 5: Vaccines & Mutations

5

Plan/Activities

1. Vaccine Preview

- Ask: why do we need to get a flu shot yearly?
- Stimulate discussion around vaccines by reviewing what was discussed during the herd immunity activity two weeks prior: We need to get a new flu vaccine every year because the flu virus can mutate (change), making the previous year's vaccine nearly useless. Remember that a vaccine works because it includes a dead or weakened piece of the virus or bacteria that causes the disease. When the vaccine enters our bodies, the body recognizes it as an unwanted intruder and the immune system is able to remember this for the future. If the body ever comes in contact with the real virus or bacteria, the immune system recognizes it and quickly destroys it before it can lead to disease. Unfortunately, the flu virus changes very rapidly, so the immune system quickly loses its ability to recognize the flu virus as a bad invader. It's important to get a new flu shot every year so that the body has protection against the most recent version of the flu.

2. Building a Rubik's Snake Puzzle

- Tell students that they are going use the Rubik's Snake to model the flu virus.
- The Rubik's Snake puzzle represents the virus, and a set of directions for folding represents the original DNA/RNA of the virus.
- Students must fold the puzzle according to the directions.
- Once they complete the puzzle, they'll get a paper cutout representing their vaccine. (You can make cutouts using the *Rubik's Snake* key.)
  - If students folded their puzzle correctly, it will match the paper shape.
  - If they didn't, then they experienced a "mutation," and their vaccine doesn't work.
- Pass out a Rubik's Snake puzzle to each student, and a copy of *Rubik's Snake* directions for each to work with. There are directions for four different shapes, ranging from beginner to expert. Students can choose which level they feel most comfortable tackling.
  - Circulate through the room to help as needed.
  - Students should notice that it is quite easy to make a mistake and get a completely different shape that doesn't match the "vaccine" cutout at all.

Scratch Activity: Trivia Game

- Have students grab computers and sign into Scratch.
- Tell them that today they're going to create a trivia game and practice using the My Blocks feature in Scratch. My Blocks can condense a lot of code into one block that is much easier to maneuver.
- Show the students the trivia game at https://scratch.mit.edu/projects/480918025/. Note the use of My Blocks for the celebratory dance.
- Hand out each student a copy of Infectious Disease 5 Scratch card.

How will you determine if students met the objective?

Students should have folded at least one Rubik's Snake, and utilized My Blocks in a trivia game.

Facilitator Tips

- There are 4 options of increasing difficulty for the puzzle (beginner = rectangle, intermediate = key, advanced = dog, expert = goldfish).
  - Students can pick their level, but they should not know which final shape they will make before starting.
- Most students will want to try all options, but encourage them to start with the beginner level.
- The shapes are all 2-D to make things simpler.
- Make sure to cut out the final shapes from the *Rubik's Snake* key for the students to compare to their final product.

RUBIK'S SNAKE DIRECTIONS

Beginner

Before 4 – twist twice
After 6 – twist twice
Before 10 – twist twice
After 12 – twist twice

Advanced

After 1 – twist twice
After 2 – twist twice
Before 3 – twist twice
Before 4 – twist twice
After 7 – twist twice
Before 6 – twist twice
After 6 – twist twice
Before 9 – twist twice
Before 10 – twist twice
After 10 – twist twice

Intermediate

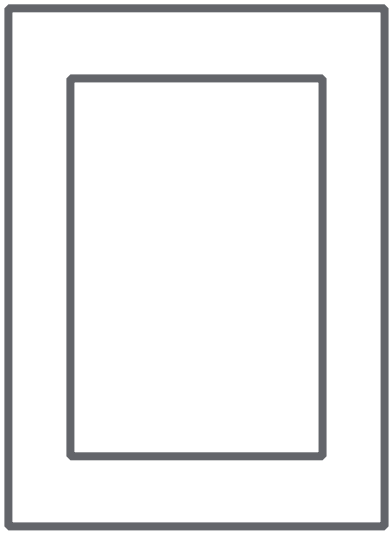
After 2 – twist twice
After 1 – twist twice
Before 4 – twist twice
After 6 – twist twice
Before 9 – twist twice
Before 8 – twist twice
Before 12 – twist twice
After 12 – twist twice

Expert

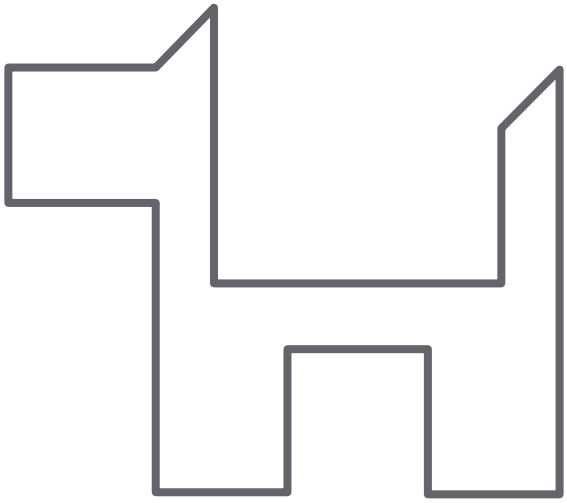
After 3 – twist twice
Before 2 – twist twice
After 2 – twist twice
After 4 – twist twice
Before 5 – twist twice
Before 6 – twist twice
Before 7 – twist twice
After 8 – twist twice
After 7 – twist twice
Before 9 – twist twice
Before 10 – twist twice
After 10 – twist twice
Before 12 – twist twice

RUBIK'S SNAKE KEY

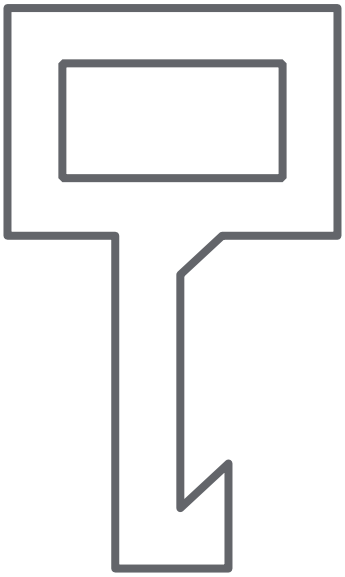
Beginner



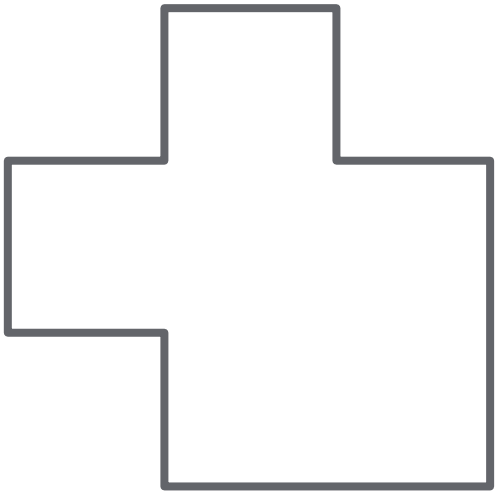
Advanced



Intermediate

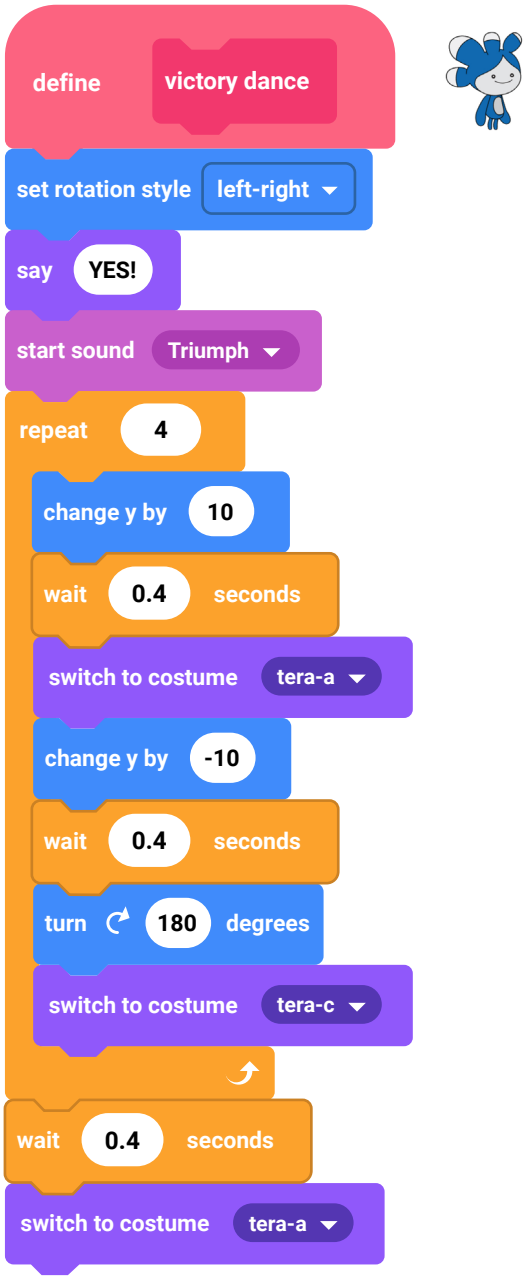


Expert

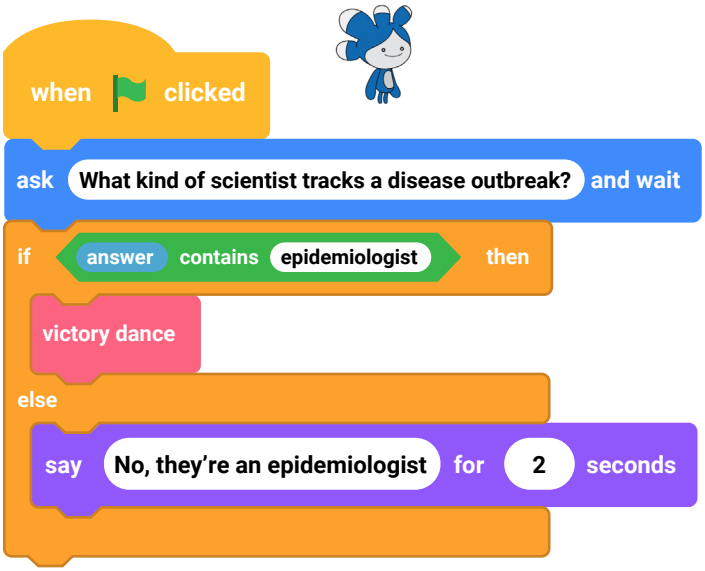


My Blocks: Making a Quiz

1 Use “My Blocks” to create a *new* block that groups a bunch of code together

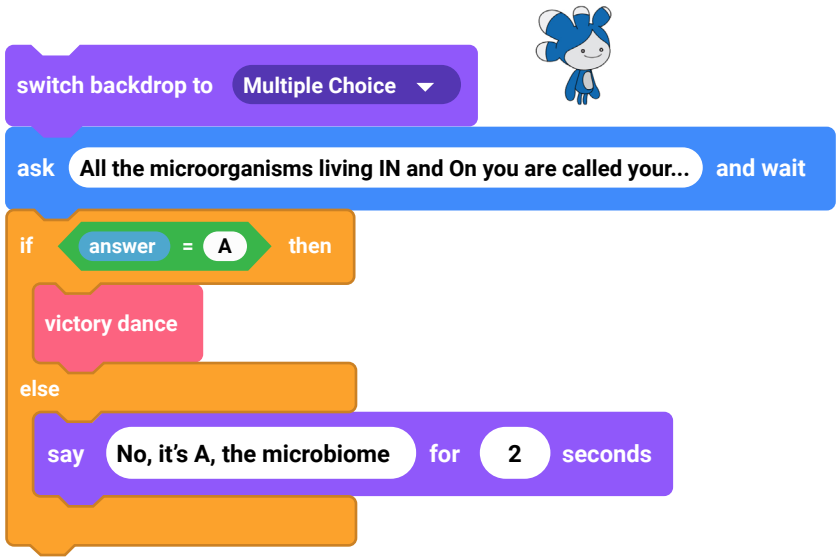


2 Ask a quiz question and use your new block

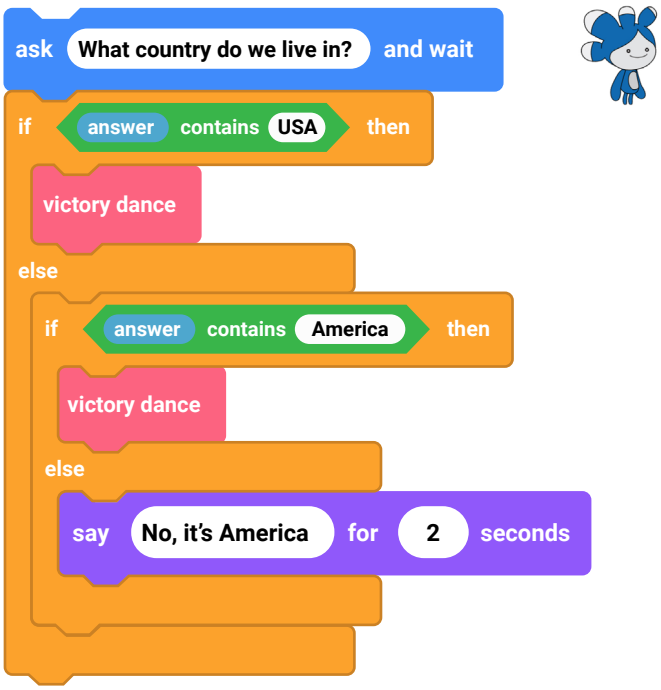


Challenge!!!

Can you add a multiple choice question?
Hint: You can write your options on a new background.



What about situations when more than one answer is correct?



INFECTIOUS DISEASE 6–8: Scratch Projects

6–8

Objective

SWBAT use Scratch to create a project and practice the coding skills they've learned so far.

Framing Question

Can I create a project in Scratch?

Materials

- Computers
- Copies of all previously-used student Scratch cards
- *Scratch Student Planning Template* (p. 30)

Plan/Activities

1. **Criteria for Success**
   - Students will have the remaining weeks left in the club to work on their Scratch projects.
   - Create a project that relates to something that they have learned during their time in the club.
   - Possible topics include:
     - Expansion of a game or activity from the microbiome module (maze)
     - Infectious Disease Game: expand on their flying germ game
     - Student choice: have students pitch you an idea of a code project they would like to produce
2. **Scratch Projects**
   - Once students choose a project, help them start to develop a plan using the *Scratch Student Planning Template*.
   - When students are satisfied with their plan, they should begin to code their design in Scratch.

How will you determine if students met the objective?

Students should have completed a unique Scratch project related to infectious disease or the microbiome.

Facilitator Tips

- While this is an independent project, it's important to provide frequent check-in and feedback to students so they can finish up by the deadline.
- Note that the criteria focuses on students creating projects related to microbiome/infectious disease modules. However, you may add other success criteria as you see fit for your program and students.

Directions

Use this sheet to plan out your project

Student Name(s): _____

Project Name: _____

Project Description:

_____

_____

_____

_____

_____

_____

_____

_____

_____

Sketch of Stage

Flow Chart of Design:

Description of Sprites, Costumes, and Code:

Sprite 1:	Sprite 2:	Sprite 3:	Sprite 4: