

MICROCRISIS RANGERS

Learning Guide

Welcome to MicroRangers!

MicroRangers is recruiting... and we want you!
Team up with scientists to explore Museum exhibits and protect biodiversity.

MicroRangers is a new mobile game at the Museum that shrinks you down to microscopic size and sends you into exhibits to combat threats to biodiversity. Nine MicroCrisis await—real-world scenarios involving microorganisms—starting in the 1st floor Hall of Biodiversity. For advanced game players, marshal your resources to take on the 6th Extinction. Armed with the mobile app and a free Communicator Coin, augmented characters - both microbes and scientists - will send you on missions and help you along the way. Have fun while you learn how even the smallest things can make a big difference.

MicroRangers employs a range of technologies to: geolocate you within the Museum, offer augmented animated characters to guide you, and provide mini-games that bring the dioramas to life.

MicroRangers 101

The game is for families and children of all ages (but probably best for ages 8 and up). MicroRangers begins with the Cadet level, which take you on a 20-30 minute randomly-selected quest, or MicroCrisis. Each MicroCrisis centers around a different Museum diorama that is under threat. Your job is to resolve the crisis by making connections between the microscopic and macroscopic world inside the diorama.

At the conclusion of the Cadet level, players graduate to full-fledged MicroRanger. At this point, you can end the game, satisfied with a job well done, or choose between two options to continue: Basic Play unlocks the remaining

MicroCrisis and can be tackled individually, or Advanced Play, which introduces a narrative tying together the MicroCrisis into a global narrative with dire implications. The game is turn-based, not time-based, so you can take as many breaks as you like—whether to enjoy the exhibits, get some food, or catch that 3D Film screening.

How Do We Play?

To play, all you need is a smartphone (we recommend 2-6 players per device) and a Communicator Coin.

1. Download the free MicroRangers app on your iOS or Android device
2. Come to the Museum
3. Get a Collector Coin
4. Head out on a quest



How do I get a Communicator Coin?

A **Communicator Coin** is an actual physical medallion (or a printed version) that is required to play MicroRangers. The Communicator Coin triggers the in-world characters that come alive through augmented reality. There are a number of ways to acquire the free coin:

1. Members can request a Coin at the **Membership desk** in the 2nd Floor Rotunda.
2. General visitors can get the MicroRanger Postcard containing a printed version of the Coin from the **MicroRanger cart**. The cart can be found in and around the Hall of Biodiversity on the 1st floor. Postcards can also be requested from **Teaching Carts** in surrounding halls, such as the Hall of Ocean Life or the Hall of North American Mammals.
3. You can **print out a copy** of the Collector Coin and bring it with you. (All 9 coins are included on the last page of this document.)

Micropedia

Chestnut blight is a fungal infection that was accidentally introduced in the 1900s. It grows under a tree's bark, stealing nutrients, and killing the tree.

Giardia are parasites found worldwide in food, soil, and water that has been contaminated with feces from an infected animal (including humans).

Hemagglutinin and neuraminidase are two proteins located on the surface of some viruses. Scientists use these two proteins to identify flu strains.

Methanogens are a type of microorganism called archaea that produce methane gas when they break down the plant materials in the guts of ruminants, animals like cows and bison.

Mycorrhizal fungi live in or on the roots of plants and help them absorb nutrients while protecting them from harmful substances, like nitrogen pollution.

Photobacteria are bioluminescent bacteria responsible for a bobtail squid's glow. The relationship is mutualistic: the squid provides the bacteria with the food they need, and the photo-bacteria help hide the squid's silhouette from predators viewing them from below at night.

Rabies is a viral disease that is transmitted by saliva when one animal bites another. The virus travels from the bite site to the brain through nerves. Once in the brain, the virus rapidly multiplies and passes into the salivary glands. It is at this point that the animal will begin to show symptoms of rabies.

Spirochete is the shape of the bacterium, *Borrelia burgdorferi*, that causes Lyme disease. They are long and thin bacteria that look like springs because they are tightly coiled.

Zooxanthellae are tiny protists that live inside coral and provide the coral with important nutrients and color.

Getting Help

Watch for the roving MicroRangers cart in and around the Hall of Biodiversity. Cart volunteers can answer questions about the gameplay, the science covered, and the specific dioramas you will visit.

The Science of MicroRangers

Learn more about the game's nine MicroCrises.

HALL OF OCEAN LIFE:

At the **Harbor Seal diorama**, players will make a new flu vaccine that will help protect humans from the H3N8 flu strain. In the process, they will learn that hemagglutinin and neuraminidase are two proteins located on the surface of a virus, and how scientists use these two types of proteins to identify flu strains.



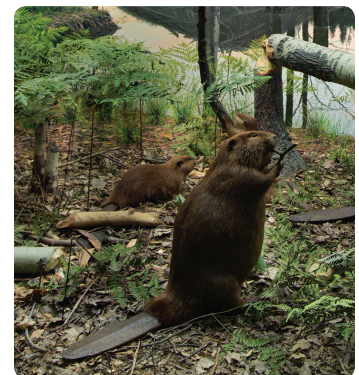
At the **Coral Reef diorama**, players will prevent coral bleaching. In the process they will learn about Zooxanthellae, tiny protists that live inside coral and provide the coral with important nutrients and color.



At the **Deep Sea diorama**, players will clear pollution to make it possible for bioluminescent photobacteria living in bobtail squid to regain their glow. They will learn how the photobacteria and squid have a symbiotic, mutually beneficial, relationship.

HALL OF NORTH AMERICAN MAMMALS:

At the **Beaver diorama**, players will identify and filter Giardia from drinking water. In the process, they will learn that Giardia are parasites found worldwide in food, soil, and water that has been contaminated with feces from an infected animal (including humans).



At the **Raccoon diorama**, players will determine that rabies are to blame for a raccoon's strange behavior and distribute vaccines. They will learn that rabies is a viral disease transmitted by saliva when one animal bites another.



At the **Bison diorama**, players will improve the bloated bison's diet by leading them away from the grass that was building up methanogens in their rumen. In the process, they will learn how methanogens are a type of micro-organism called archaea that ferment plants in grazing animals like the bison and cows.



HALL OF NORTH AMERICAN FORESTS:

At the **Forest Floor diorama**, players will gather information for an environmental assessment report on the health of the forest floor that will be used to inform public policy and protect forests from fertilizer runoff. They will learn how mycorrhizal fungi help the roots of plants to absorb nutrients while protecting them from harmful substances, like nitrogen pollution.

At the **Deciduous Forest diorama**, players will identify the type of fungus growing on the chestnut trees and administer a hypovirus to weaken the cankers. In the process, they will learn how a hypovirus can weaken the fungus and give the tree a chance to recover from the blight.

At the **Northern Spruce diorama**, players will identify the bacterium that causes Lyme disease. They will learn how increasing the biodiversity in an environment lessens the risk of Lyme disease.



Standards

The content in this game can support the teaching of the following concepts:

GRADE 3-5

Next Generation Science Standards

- **LS2.A: Interdependent Relationships in Ecosystems**
A healthy ecosystem is one in which multiple species of different types are each able to meet their needs in a relatively stable web of life. Newly introduced species can damage the balance of an ecosystem.
- **DCI:LS2.C: Ecosystem Dynamics, Functioning, and Resilience**
When the environment changes in ways that affect a place's physical characteristics, temperature, or availability of resources, some organisms survive and reproduce, others move to new locations, yet others move into the transformed environment, and some die.

GRADE 6-8

Next Generation Science Standards

- **DCI: LS2.A: Interdependent Relationships in Ecosystems**
Organisms, and populations of organisms, are dependent on their environmental interactions both with other living things and with nonliving factors. Predatory interactions may reduce the number of organisms or eliminate the whole populations of organisms. Mutually beneficial interactions, in contrast, may become so interdependent that each organism request the other for survival.
- **DCI:LS2.C: Ecosystem Dynamics, Functioning, and Resilience**
Ecosystems are dynamic in nature; their characteristics can vary over time. Disruptions to any physical or biological component of an ecosystem can lead to shifts in all its populations. Biodiversity describes the variety of species found in Earth's terrestrial and oceanic ecosystems. The completeness or integrity of an ecosystem's biodiversity is often used as a measure of its health.

GRADE 9-12

Next Generation Science Standards

- **DCI:LS2.C: Ecosystem Dynamics, Functioning, and Resilience**
Anthropogenic chanced (induced by human activity) in the environment-including habitat destruction, pollution, introduction of invasive species, overexploitation, and climate change-can disrupt an ecosystem and threaten the survival of some species.

- **DCI:LS4.C: Adaptation**

Changes in the physical environment, whether naturally occurring or human induced, have thus contributed to the expansion of some species, the emergence of new distinct species as populations diverge under different conditions, and the decline-and sometimes the extinction-of some species.

- **DCI:LS4.D: Biodiversity and Humans**

Humans depend on the living world for the resources and other benefits provided by biodiversity. But human activity is also having adverse impacts on biodiversity through overpopulation, overexploitation, habitat destruction, pollution, introduction of invasive species, and climate change. Thus, sustaining biodiversity so that ecosystem functioning and productivity are maintained is essential to supporting and enhancing life on Earth. Sustaining biodiversity also aids humanity by preserving landscapes of recreational or inspirational value.

Communicator Coins

After you've downloaded the MicroRangers app, choose one of the coins below to begin a museum quest!

