9-12 Exhibit Educator Guide

Welcome to Frost Science! Use this to guide your learners through an engaging and thought-provoking experience at the museum. Start on Level 4 and have fun exploring our exhibits as you work your way down to Level 1 (stairs are recommended). If you follow this guide and spend 30 minutes in each exhibition, your field trip will be 3 hours.

This guide contains:

- Scripted overviews of each exhibit
- Age-appropriate questions to prompt your students with when exploring
- Scripted interactions for intentional and dedicated student learning

Stay curious, keep exploring, and remember, it's our world, let's explore it!

Look for this icon to see the best route through the museum.

Begin your field trip by taking the stairs or elevators to Level 4.

The Vista

Use this guide to spend **20-30 minutes** in *The Vista*.

Teacher Overview

Welcome to *The Vista*! Located on Level 4, this exhibition places you at the top of our three-level aquarium. Here you will discover key South Florida ecosystems, including the Gulf Stream, the Florida Coast, and the Everglades. Along the way, you will encounter the diverse wildlife that calls these ecosystems home.

Exhibit Introduction (3 minutes)

Share this introduction and the thought-provoking question outside the exhibit before walking in, or in the exhibit before allowing for free exploration.

"Welcome to *The Vista*! Today we will get up close and personal with key South Florida ecosystems, as well as the unique plants and animals that call these places home. To start, we will peer into the Gulf Stream Aquarium and try to catch a glimpse of the animals found here, including sharks, rays, and sea turtles! Next, we will explore the Aviary to learn more about some key species and their interactions within mangrove nurseries and sandy shorelines. Then, we will encounter some of the Florida Everglades' iconic crocodilians to see their predatory adaptations on full display. Finally, if there's time, we will safely touch the stingrays in the Florida Bay Exhibit."

Thought-provoking Question (2 minutes)

"I have a question I would like you to think about while having fun in the exhibit..."

- Choose and aquarium or habitat to observe. Compare and contrast the physical characteristics of the organisms who live there. What does this tell you about the relationships between organisms?
- How do the aquatic environments on *The Vista* differ from one another? Does this affect the types of organisms that can live in those environments?
- How can humans negatively impact ecosystems like mangroves, dunes, and coral reefs?
- What is the Gulf Stream? How does it affect the climate of Florida?

"Explore this exhibit to discover more! You have 10-minutes to explore and investigate!"

10-minute free exploration

Supporting Standards

Grade 9-12

SC.912.E.7.4 Summarize the conditions that contribute to the climate of a geographic area, including the relationships to lakes and oceans.

SC.912.L.15.6 Discuss distinguishing characteristics of the domains and kingdoms of living organisms.

SC.912.L.17.2 Explain the general distribution of life in aquatic systems as a function of chemistry, geography, light, depth, salinity, and temperature.

SC.912.L.17.16 Discuss the large-scale environmental impacts resulting from human activity, including waste spills, oil spills, runoff, greenhouse gases, ozone depletion, and surface and groundwater pollution.

Optional Exhibit Interactive Highlight

Want some dedicated and intentional student learning in this exhibit? Follow the script below to engage with the Florida Bay Exhibit - Sting Ray Touch (5-8 minutes).

"Welcome to the Frost Science Stingray Touch! We will now touch the stingrays in this exhibit, but you must follow the rules to stay safe!"

"Using only one hand, place two fingers in the water with enough space for the rays to swim underneath. Wait for the stingrays to come to you! When a stingray swims by, only touch the top part of the ray by gliding your two fingers gently on the top part of the ray. Make sure not to splash around or lean too far over the touch exhibit. Wait for the stingrays to come closer to the edge of the aquarium instead of instead of leaning over it."

"As you watch and touch the stingrays, think about their body shape and behavior in the water."

Optional guiding questions:

- "How does the body shape of stingrays help them survive in the ocean?"
- What physical characteristics do all the stingrays share? Does this mean they are closely related? Why or why not?
- How might stingrays react to human impacts like oil spills or pollution?
- What kind of habitat do you think stingrays prefer based on their exhibit?

Across from *The Vista* you will find *The Dig.*

The Dig

Use this guide to spend **20-30 minutes** in *The Dig.*

Teacher Overview

Welcome to *The Dig*! *The Dig* is located on Level 4 of Frost Science. In this exhibit, students will learn about fossils, how they are formed, what they can tell us about ecological history, and what it is like to be a paleontologist. If students are lucky, they can even see Frost Science's paleontologists working in the fossil preparation lab!

Exhibit Introduction (3 minutes)

Share this introduction and the thought-provoking question outside the exhibit before walking in, or in the exhibit before allowing for free exploration.

"Welcome to *The Dig*! Do any of you want to be a paleontologist or did any of you want to be a paleontologist when you were younger?" *Accepts responses.* "Why do you or did you want to be a paleontologist?" *Accept responses.* "Did you know that it's hard to study paleontology in Florida? Most paleontology programs in college are in other states because Florida doesn't have any dinosaur fossils. Because of this, Frost Science has the only paleontology research program in all South Florida!"

Thought-provoking Question (2 minutes)

"I have a question I would like you to think about while having fun in the exhibit..."

- What might scientists learn about evolution by looking at the fossil record?
- How does the fossil record support the theory of evolution?
- What are some questions paleontologists might be trying to answer by looking at fossils of ancient life?

"Explore this exhibit to discover more! You have 10-minutes to explore and investigate!"

10-minute free exploration

Supporting Standards

Grade 9-12

SC.912.L.15.1 Explain how the scientific theory of evolution is supported by the fossil record, comparative anatomy, comparative embryology, biogeography, molecular biology, and observed evolutionary change.

SC.912.N.1.6 Describe how scientific inferences are drawn from scientific observations and provides examples from the content being studied.

Optional Exhibit Interactive Highlight

Want some dedicated and intentional student learning in this exhibit? Follow the script below to engage with the High-Tech Tools interactive (5-8 minutes).

"After fossils have been prepared, paleontologists can use different tools to study what they have found. What kind of tools do you think they use to study a fossil?" *Accept responses.* "New technology allows paleontologists to look at fossils in a way that was not possible in the past. Paleontologists can use X-rays, CT scans and spectroscopy to look at the internal structure of fossils to learn more about ancient organisms."

Allow students to use the High-Tech Tools interactive to explore what paleontologists have learned about different dinosaurs using cutting edge technology. Students should be instructed to take turns, so everyone gets a chance to engage with the interactive. Students that are not using the High-Tech Tools interactive should be looking at the Prep a Fossil interactive to learn how fossils are prepped prior to study.

Optional guiding questions:

- "What did paleontologists learn about these dinosaurs from the high-tech tools they used?"
- "What else could paleontologists learn about dinosaurs by studying their fossils?"

Walk down the stairs by the sting ray touch to enter *The Dive.*

Aquarium: The Dive

Use this guide to spend **20-30 minutes** in *The Dive.*

Teacher Overview

Welcome to *The Dive*! Located on Level 3, *The Dive* allows you to explore different habitats within our ocean. Here, you can see sharks in the Gulf Stream Aquarium, invasive lionfish, a goliath grouper, and seahorses. Florida's Coral Reef takes center stage in our ReeFLorida exhibit, which contains interactives focused on conserving this ecosystem.

Exhibit Introduction (3 minutes)

Share this introduction and the thought-provoking question outside the exhibit before walking in, or in the exhibit before allowing for free exploration.

"Welcome to *The Dive*! Here we will explore Florida marine habitats and the animals that live in them. Here you can find sharks, octopus, seahorses, barracudas and more! Don't forget to visit the ReeFLorida interactives to discover how you can help protect Florida's Coral Reef. It's the only barrier reef in the continental US!"

Thought-provoking Question (2 minutes)

"I have a question I would like you to think about while having fun in the exhibit..."

- How do humans impact marine environments including coral reefs?
- Identify producers, consumers, and apex predators in each of the exhibits as you explore.
- What are some distinguishing characteristics of each organism you observe? How do you think animals are grouped based on these characteristics?
- What kind of questions should law makers consider when making policy decisions that affect the marine environment?

"You have 10-minutes to investigate and play!"

10-minute free exploration

Supporting Standards

Grade 9-12

SC.912.L.15.6 Discuss distinguishing characteristics of the domains and kingdoms or living organisms.

SC.912.L.15.6 Discuss the distinguishing characteristics of vertebrate and representative invertebrate phyla, and chordate classes using typical examples.

SC.912.L.17.9 Use a food web to identify and distinguish producers, consumers, and decomposers. Explain the pathway of energy transfer through trophic levels and the reduction of available energy at successive trophic levels.

SC.912.L.17.16 Discuss the large-scale environmental impacts resulting from human activity, including waste spills, oil spills, runoff, greenhouse gases, ozone depletion, and surface and groundwater pollution.

SC.912.L.17.13 Discuss the need or adequate monitoring of environmental parameters when making policy decisions.

Optional Exhibit Interactive Highlight

Want some dedicated and intentional student learning in this exhibit? Follow the script below to engage with the Overfishing interactive (5-8 minutes).

"People all around the world rely on the ocean for food. What do you like to eat that comes from the ocean?" *Accept responses.* "A lot of us love seafood, but is it possible for us to take too many fish from the ocean? Do you know what this is called?" *Accept responses.* "Right! This is known as overfishing. When we take fish from the ocean faster than they can reproduce, it can cause species populations to decline. If species continue to be overfished and no conservation measures are put in place, the species can eventually go extinct."

"In this game, you get to fish. Your goal is to fish as sustainably as possible. In other words, you will need to be careful not to overfish."

Optional guiding questions:

- "You have the choice to fish with nets or lines. Which do you think will be better for the fish population? Why?"
- "Turtles, dolphins and sharks are often unintentionally caught by fishing operations, making them bycatch. Why is it important for fishing operations to take precautions to avoid bycatch?"
- "How might fishing operations avoid catching species like turtles, sharks and dolphins?"
- "What kind of monitoring should be done prior to making policy decisions regarding commercial fishing?"
- "What law would you enact to combat overfishing? How could this help make commercial fishing more sustainable?"
- "What was your strategy for fishing sustainably? Is this a feasible strategy in real life? Why or why not?"
- "Why is sustainable fishing important?"

Use the bridge in *The Dive* to explore *Feathers to the Stars.*

Feathers to the Stars

Use this guide to spend **20-30 minutes** in *Feathers to the Stars.*

Teacher Overview

Welcome to *Feathers to the Stars*, located on Level 3. In this exhibit, students will learn all about flight, from flying dinosaurs to the future of space travel.

Exhibit Introduction (3 minutes)

Share this introduction and the thought-provoking question outside the exhibit before walking in, or in the exhibit before allowing for free exploration.

"Welcome to *Feathers to the Stars*! This exhibit is all about flying – from flying birds to flying spaceships. While lots of things can fly, making things fly is actually really hard, especially getting them to fly in space. This exhibit showcases everything from the beginning of space exploration to the technology being used to explore space today."

Thought-provoking Question (2 minutes)

"I have a question I would like you to think about while having fun in the exhibit..."

- What are some tools used to explore space?
- How do we know about planets outside of our solar system?
- What can we learn by studying celestial objects outside of our solar system?
- What do we need to develop before we are able to send astronauts to other planets like Mars?

"You have 10-minutes to fly around and investigate!"

10-minute free exploration

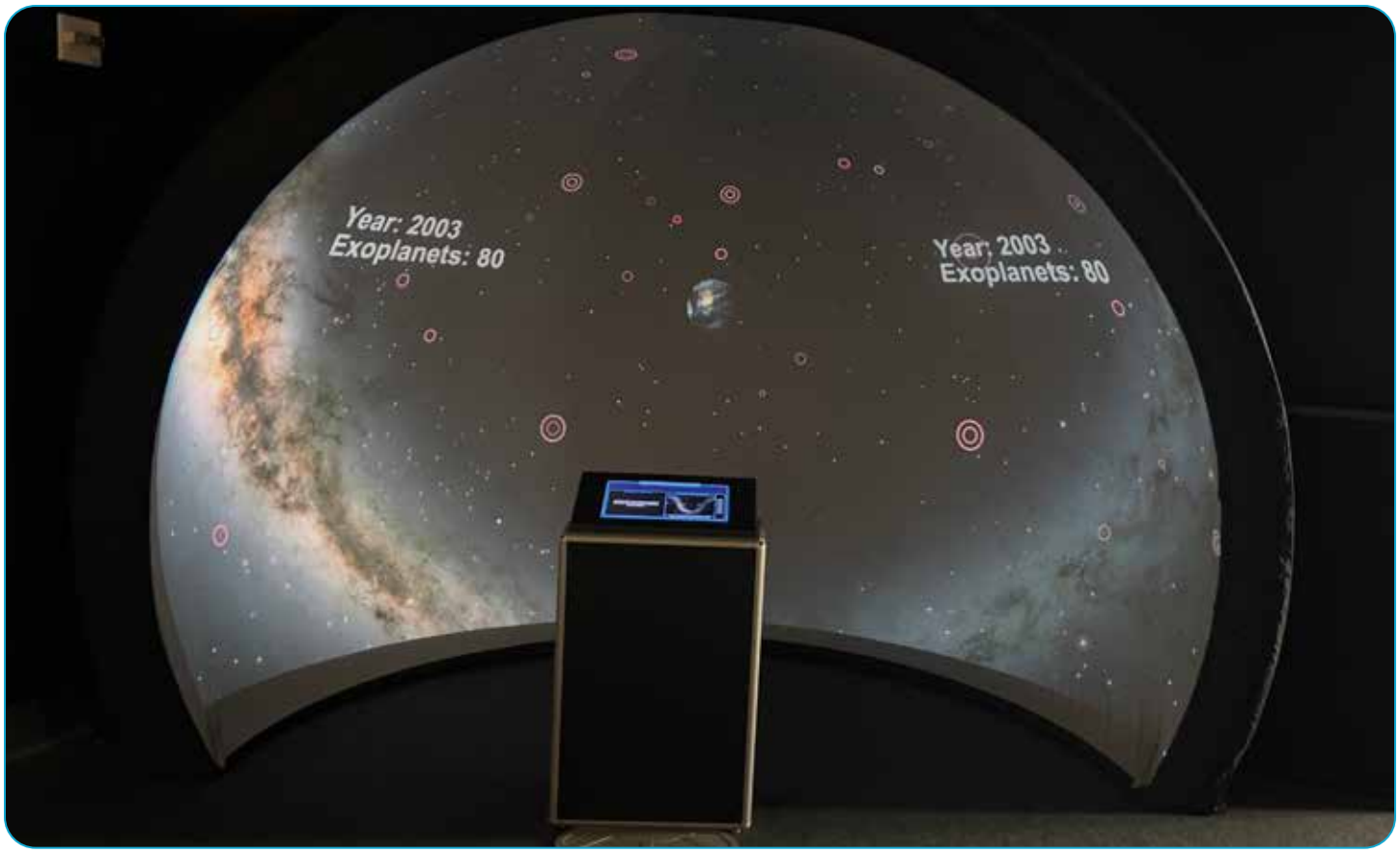
Supporting Standards

Grade 9-12

SC.912.E.5.5 Explain the formation of planetary systems based on our knowledge of our Solar System and apply this knowledge to newly discovered planetary systems.

SC.912.E.5.7 Relate the history of and explain the justification for future space exploration and continuing technology development.

SC.912.E.5.8 Connect the concepts of radiation and the electromagnetic spectrum to the use of historical and newly-developed observational tools.



Optional Exhibit Interactive Highlight

Want some dedicated and intentional student learning in this exhibit? Follow the script below to engage with the Space Exploration Virtual Command Center (5-8 minutes).

"Exoplanets are planets that have been discovered in different solar systems, and this virtual command center allows us to pay them a visit. Why do you think scientists are interested in learning about exoplanets?" *Accept responses.* "Right! Scientists are interested in learning whether there is life on these distant planets. What might indicate extraterrestrial life or indicate that a planet is hospitable to life?" *Accept responses.* "Liquid water can indicate that a planet is hospitable to life and the presence of oxygen and carbon dioxide might be a sign of life. Finding any of these things would make scientists want to take a deeper look into that exoplanet."

"Use the controls on the screen to select different exoplanets to investigate."

Optional guiding questions:

- "What exoplanet did you visit?"
- "Did scientists find any signs of possible life on that exoplanet?"
- "Why else might scientists be interested in learning about this specific exoplanet? What about exoplanets in general?"
- "How can studying other solar systems inform us about our own solar system?"
- "How do tools like telescopes and space probes help us learn about objects in space?"

Leave *Feathers to the Stars* using the glass automatic doors. Walk past the elevators to the other side of the building to explore *meLab*.

meLab

Use this guide to spend **20-30 minutes** in *meLab.*

Teacher Overview

Welcome to *meLab*! *meLab* is located on Level 2 and Level 3 of Frost Science. On Level 2, students explore *meLab: The Journey*, where they can learn what being healthy means to them and experiment with lifestyle choices to live healthier, happier lives. On Level 3, students can explore *meLab: The Discovery,* where they can learn how scientists and doctors know what it means to be healthy.

Exhibit Introduction (3 minutes)

Share this introduction and the thought-provoking question outside the exhibit before walking in, or in the exhibit before allowing for free exploration.

"Right now, we're going to spend some time exploring *meLab: The Discovery!* On this level of *meLab,* you can learn more about the human brain and human anatomy. You can also explore how smells can help doctors diagnose illness and how viruses like the flu are spread through human contact.

"This level of *meLab* also has the *Discovery Lab*, where educators sometimes lead tech activities."

Thought-provoking Question (2 minutes)

"I have a question I would like you to think about while having fun in the exhibit..."

- How are scientists studying the human brain? What have they learned?
- How do different parts of the brain work together?
- How are X-rays used to help doctors identify medical problems?
- What are some novel ways doctors have been able to identify and diagnose illnesses?

"Explore this exhibit to discover more! You have 10-minutes to explore and investigate!"

10-minute free exploration

Supporting Standards

Grade 9-12

SC.912.L.14.14 Identify the major bones of the axial and appendicular skeleton.

SC.912.L.14.20 Identify the major muscles of the human on a model or diagram.

SC.912.L.14.21 Describe the anatomy, histology, and physiology of the central and peripheral nervous systems and name the major divisions of the nervous system.

SC.912.L.14.26 Identify the major parts of the brain on diagrams or models.

SC.912.L.14.27 Identify the functions of the major parts of the brain, including the meninges, medulla, pons, midbrain, hypothalamus, thalamus, cerebellum and cerebrum.

SC.912.L.14.50 Describe the structure of vertebrate sensory organs. Relate structure to function in vertebrate sensory systems.

Optional Exhibit Interactive Highlight

Want some dedicated and intentional student learning in this exhibit? Follow the script below to engage with the Autopsy Table (5-8 minutes).

"These are both autopsy tables. Do you know what an autopsy is?" *Accept responses.* "When a person has died, doctors will sometimes perform an autopsy to identify the cause of death. At the autopsy table, you can look at different cases to learn more about what doctors may have noticed when performing the autopsy. In addition to looking at scans of bodies post-death, the autopsy tables also have options to view scans performed on living patients and organisms."

Optional guiding questions:

- "What was the cause of death for the person in a traffic accident? How do you know? What else does the autopsy show?"
- "What surgery did the doctor perform on the patient who had a stroke? Was the procedure successful?"
- "What are some of the things that happen to a body as it ages?"
- "How does a heart pump help patients with heart problems?"
- "What can scientists learn from scans of the shortfin mako shark?"

Walk outside of *meLab* and walk down the stairs to *meLab* on Level 2 (if you have time).

Walk down the stairs to Level 1 to explore *Power of Science*, located behind the yellow elevators, in the Ocean Gallery.

Power of Science

Use this guide to spend **20-30 minutes** in *Power of Science*.

Teacher Overview

Welcome to *Power of Science*! *Power of Science* is located on Level 1 of Frost Science. In this exhibit you will discover innovative technologies and groundbreaking discoveries across four scientific frontiers.

Exhibit Introduction (3 minutes)

Share this introduction and the thought-provoking question outside the exhibit before walking in, or in the exhibit before allowing for free exploration.

"Welcome to *Power of Science*! This exhibit will teach us about how scientific discoveries and new technologies in different fields of science have improved our understanding of life on Earth and beyond! We will visit each of the four scientific frontiers: 'our oceans', 'our bodies', 'our environment', and 'our universe' to learn what kinds of groundbreaking research scientists are doing right now."

Thought-provoking Question (2 minutes)

"I have a question I would like you to think about while having fun in the exhibit..."

- How does the production of fossil fuels affect coral reefs?
- How has ocean warming led to an increase in the frequency of severe storms?
- What are the pros and cons of having the ability to genetically modify organisms?
- How has emergent technology been used to improve the environment?

10-minute free exploration

Supporting Standards

Grade 9-12

SC.912.L.16.10 Evaluate the impact of biotechnology on the individual, society and the environment, including medical and ethical issues.

SC.912.L.17.15 Discuss the effects of technology on environmental quality.

SC.912.E.6.6 Analyze past, present, and potential future consequences to the environment resulting from various energy production technologies.

SC.912.E.7.6 Relate the formation of severe weather to the various physical factors.

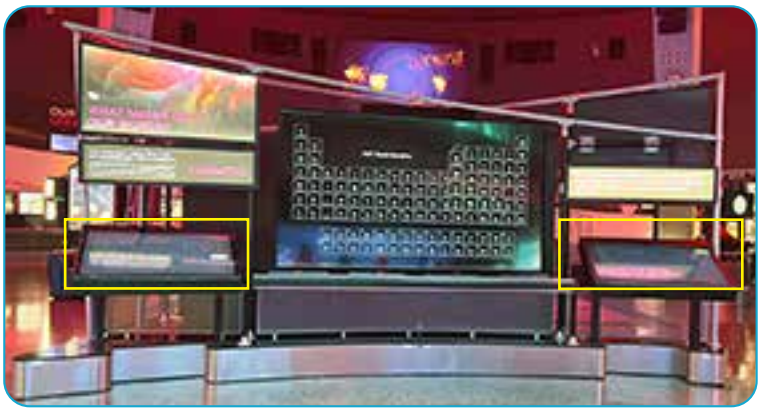
Optional Exhibit Interactive Highlight

Want some dedicated and intentional student learning in this exhibit? Follow the script below to engage with the Create a Shoreline interactive (5-8 minutes).

"Today we are going to create a shoreline to protect our beaches from storm surge. Storm surge is what happens when hurricanes and other storms push water up onto land. To protect our beaches, we can add two different types of barriers: natural barriers or manmade barriers. Natural barriers include things like coral reefs and mangroves while manmade barriers include things like seawalls, like those found downtown or around the edge of the park next to the museum. Let's give it a try!"

Optional guiding questions:

- "How do mangroves and coral reefs protect shorelines from storm surge?"
- "What are some other ways that we could potentially protect our coastlines from storm surge?"
- "Aside from reducing storm surge, why else would you want to include natural barriers along your coastline?"



Try this!

Ag (silver) + Cl (Chlorine)

Li (Lithium) + O (Oxygen)

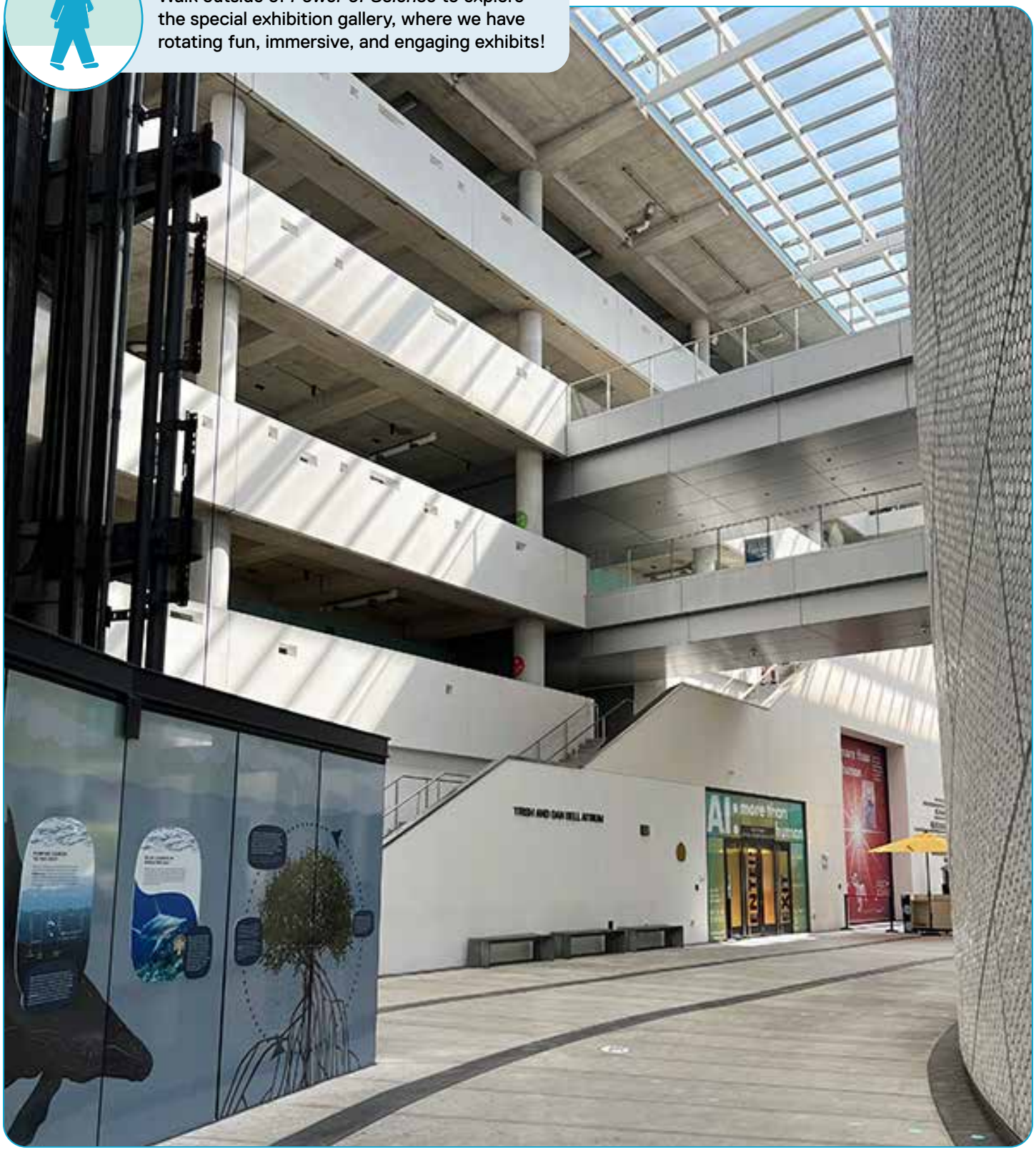
Na (Sodium) + Cl (Chlorine)

Walk up the ramp or the stairs to view the Oculus and stand underneath the Gulf Stream Aquarium. Then, take a look at our jellies in *The Deep*.

The Oculus and The Deep

The Deep, the aquarium on Level 2, features jellies and a unique view of the Gulf Stream Aquarium via the Oculus.

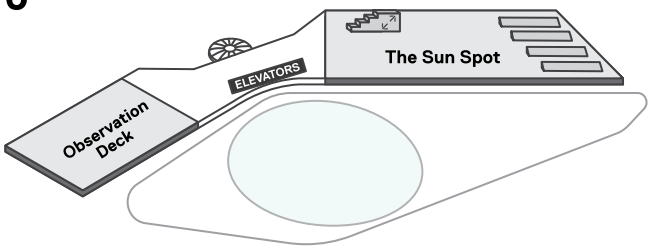
Walk outside of *Power of Science* to explore the special exhibition gallery, where we have rotating fun, immersive, and engaging exhibits!



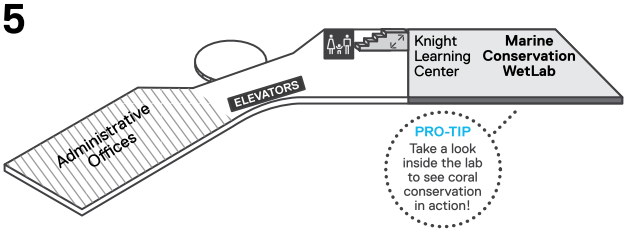
Congrats! You explored, investigated and discovered all the exhibits at Frost Science. We hope you and your students had a great time with us!

Museum Floorplan

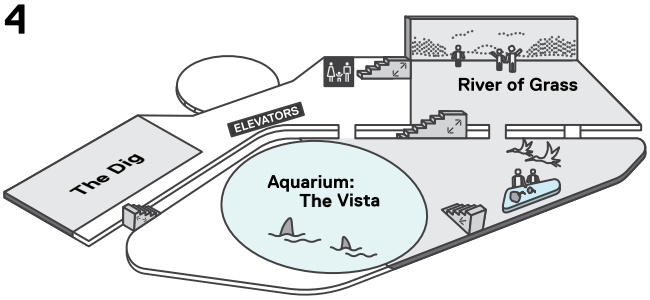
LEVEL 6
(ROOF)



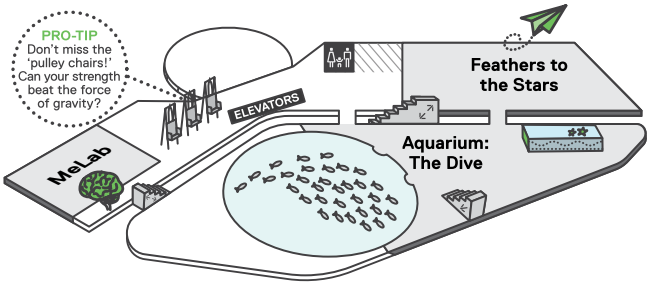
LEVEL 5



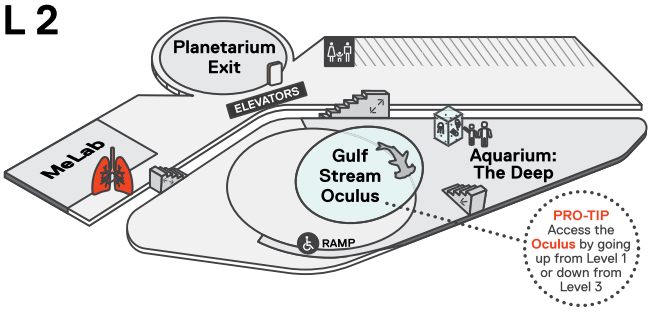
LEVEL 4



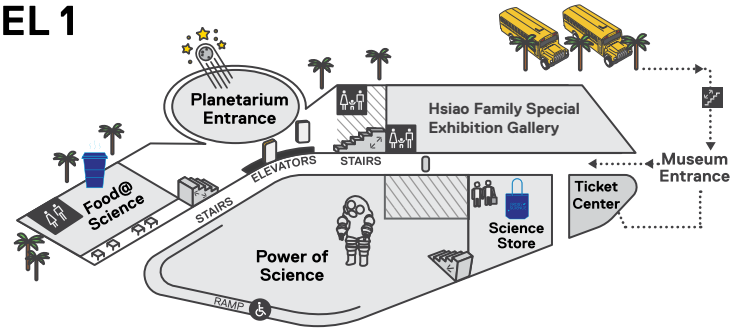
LEVEL 3



LEVEL 2



LEVEL 1



For the safety of our animals and divers, please, no flash photography.

Food, drinks, gum and smoking are not allowed in museum galleries and exhibitions.

All galleries and exhibitions are wheelchair accessible.

Frost Science is a smoke-free facility. No smoking or vaping on property.