CALIFORNIA ACADEMY OF SCIENCES

Light in Air and Water - Scavenger Hunt

Chaperone Guide

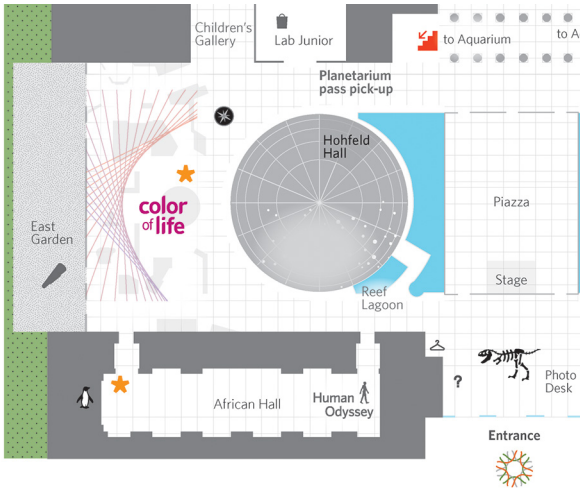
Setting: African Hall, Color of Life, Steinhart Aquarium

Use these maps and Teacher Tips to guide students through the Scavenger Hunt. Use the accompanying Guiding Questions to get students thinking and talking about what they are observing.

» *Teacher Tip: Make sure that each student has at least one other person to work with as they move through the three activities.*

Activity 1: Sketch a Penguin!

Location: *African Hall on Level 1*



» *Teacher Tip: Penguin feeding is at 10:30-11am & 3-3:30pm, it can be very crowded from 10 minutes before to 10 minutes after the program.*

DISCUSS IN COLOR OF LIFE

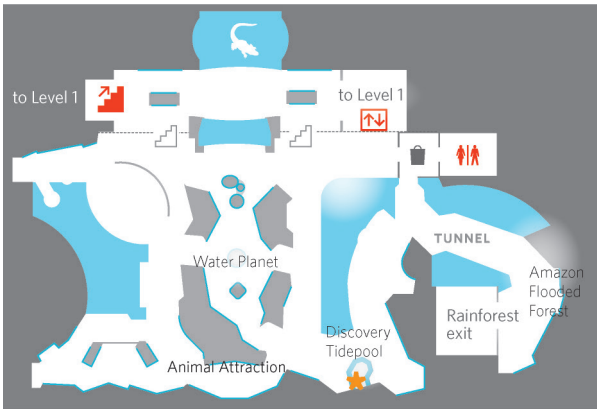
Gather outside the Color Visualizer (look out for the giant, lit up flower petals) in the Color of Life exhibit, at the panel titled "Just Traveling Through."

- How is this similar to what you saw when you were observing the penguins?
- What do you notice?
- How would you explain what it means for light to "refract?"
- Why are we able to see the penguins, or the hand at all?

» *Teacher Tip: If students are having trouble thinking of how we see with light, look to the left at the panel titled "The Path of Light".*

Activity 2: Touch pool challenge

Location: *Discovery Tidepool on the Lower Level*



» *Teacher Tip: Discovery Tide Pool is open from 10am-4pm*

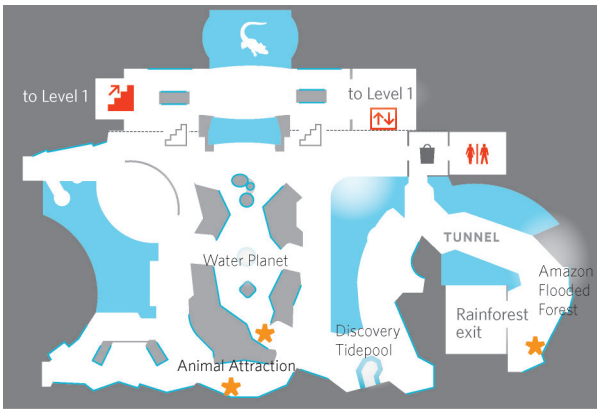
DISCUSS WITH A PARTNER

- Which view made it easier to touch the spot?
- Why do you think that view was easier to touch the spot?
- Where would you need to be to observe NO difference between where your finger hit and your spot?

Remind students: Keep their fingers straight and try touching the spot when looking from above and below the water line.

Activity 3: Do Animals Experience Refraction?

Location: *Various Locations in the Lower Level*



DISCUSS ANIMALS AND REFRACTION

- How do you think the animal you observed might use or adapt to refraction?
- (If time permits) How are the ways that these animals use or adapt to refraction similar or different?

Possible Extensions to this Scavenger Hunt:

1. *In pairs, students continue on to the cylindrical Mangrove Tank, near the Reef Lagoon, to observe and sketch the Chocolate chip sea stars from above and below the water.*
2. *Make your way back to Color of Life and the Color Sources area where the board discusses refraction.*

Animals explored in Activity 3

Four-eyed Fish (Anableps anableps)

Aquarium location: Amazon Flooded Forest, near the Rainforest exit

Distribution: Trinidad and Venezuela to the Amazon delta in Brazil

Diet: Insects, small fish, other invertebrates, and diatoms

These fish spend most of their time at the surface of the water, where their main food source, insects, is plentiful. Since they live in the water and the food source is in the air, their eyes are specially adapted to see in both air and water. The Four-eyed fish's eyes have adapted to compensate for the refraction that happens as light travels between water and air. Seeing through water requires a thicker lens than seeing through the air, so this fish's "four-eyes" that are actually only two eyes have a lens that is thicker on the lower portion (that stays under the water) and thinner on the upper portion (that stays above the water).

Banded Archerfish (Toxotes jaculatrix)

Aquarium location: Water Planet - Feeding

Distribution: Southeast Asia, Australia, Polynesia

Diet: invertebrates, small vertebrates such as lizards

While the Banded Archerfish remain underwater, they hunt by shooting a stream of water from their mouths to hit an insect in the air. Schools of young archerfish practice shooting streams of water.

Not only are they able to accurately aim at an insect from underwater, these fish are also able to move to the place where the struck insect lands in the water within one tenth of a second! Banded Archerfish must account for the bending of light both in knowing where to shoot, and where to retrieve their food.

Burmese Vine Snakes (Ahaetulla fronticta)

Aquarium location: Water Planet - Feeding

Distribution: Burma (Myanmar)

Diet: fishes

Burmese Vine Snakes are characterized by thin, elongated bodies, with extremely long tails and a sharply triangular shaped head. They are primarily green in color which helps them camouflage because they spend their lives up in trees and not moving much. Since they live on land to feed they strike at a fish in water while maintaining half of its body wrapped around a branch or twig. It will use a mild venom to render the fish immobile. Also they're rear-fanged. Their fangs aren't at the front of their mouth like in vipers, but at the back of the upper jaw.

Splashing Tetra (Copella arnoldi)

Aquarium location: Animal Attractions

Distribution: slow-moving streams in the lower Amazon basin

Diet: worms, insects, and crustaceans

These resourceful fish keep their eggs safe by laying them outside of the water! Both males and female Splashing Tetra leap out of the water together and attach themselves to the underside of a leaf. The female lays 6-8 eggs, then the male quickly fertilizes them. They repeat this process, aiming and jumping onto the same leaf, until 200 eggs have been deposited there! The male will hide near the leaf, but in the water, to defend the eggs and splash water on them periodically to keep them wet until they hatch about 48 hours later. Despite the refraction that occurs between air and water, these fish must be able to aim accurately at an object outside of the water in order to lay their eggs, defend them, and keep them moist before they hatch.