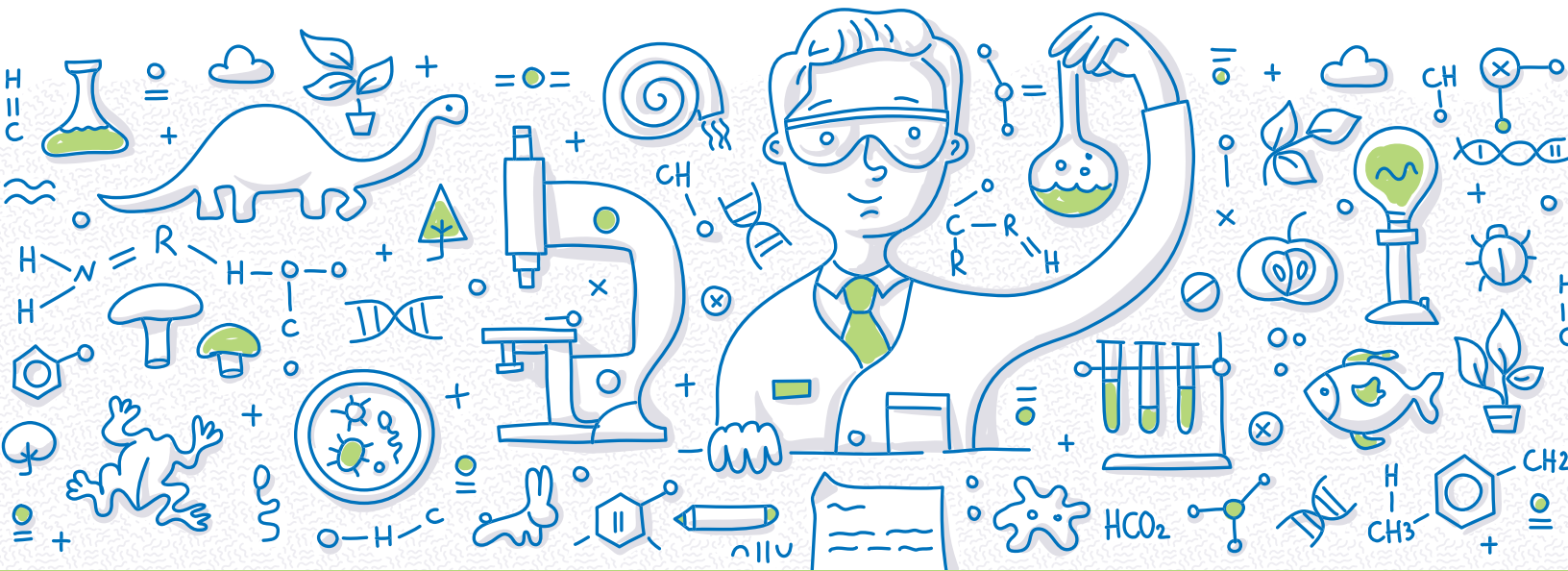
LAFAYETTE SCIENCE MUSEUM

TEACHER GUIDE



LETTER FROM THE DIRECTOR

DEAR TEACHERS,

The Lafayette Science Museum is eager to welcome you and your students to our playful portal into a vast universe of discovery. We offer a fun, hands-on experience for curious minds of all ages. Located in the heart of downtown Lafayette, the museum offers exhibits and installations to enlighten and educate. We invite patrons young and old to learn something new and have fun in the process.

In 1969, the museum and planetarium began as a community project designed to provide science enrichment for area schools. Les Deux Douzaines, a women's organization, began with a volunteer program that visited schools to provide events focused on science education.

Since that time, the museum has evolved and expanded always focusing on the future and continued growth. By applying the latest technology to interactive experiences and immersive education, we strive to promote interest and inspire careers through science, technology, engineering, and math.

The Lafayette Science Museum is dedicated to providing tools and resources to make your field trip an engaging and dynamic learning experience.

Kevin Krantz
MUSEUM ADMINISTRATOR
LAFAYETTE SCIENCE MUSEUM

LAFAYETTE SCIENCE MUSEUM

HOURS OF OPERATION

Tuesday – Friday 9am – 5pm | Saturday 10am – 6pm | Sunday 1pm – 6pm | Closed Monday

FIELD TRIP PLANNER

Phone 337.291.5544 | Email egilbert@lafayettela.gov

SPECIAL FIELD TRIP ADMISSION RATES

Lafayette Public School Students and Teachers: FREE
Private/Out-of-Parish: $1.00 + tax per student/teacher, $2.00 + tax per chaperone

OTHER GROUP RATES

For information on group rates not related to a school function or youth organization, call 337.291.5544 for Group Sales or email egilbert@lafayettela.gov for assistance.

433 Jefferson Street • 337-291-5544 • lafayettesciencemuseum.org

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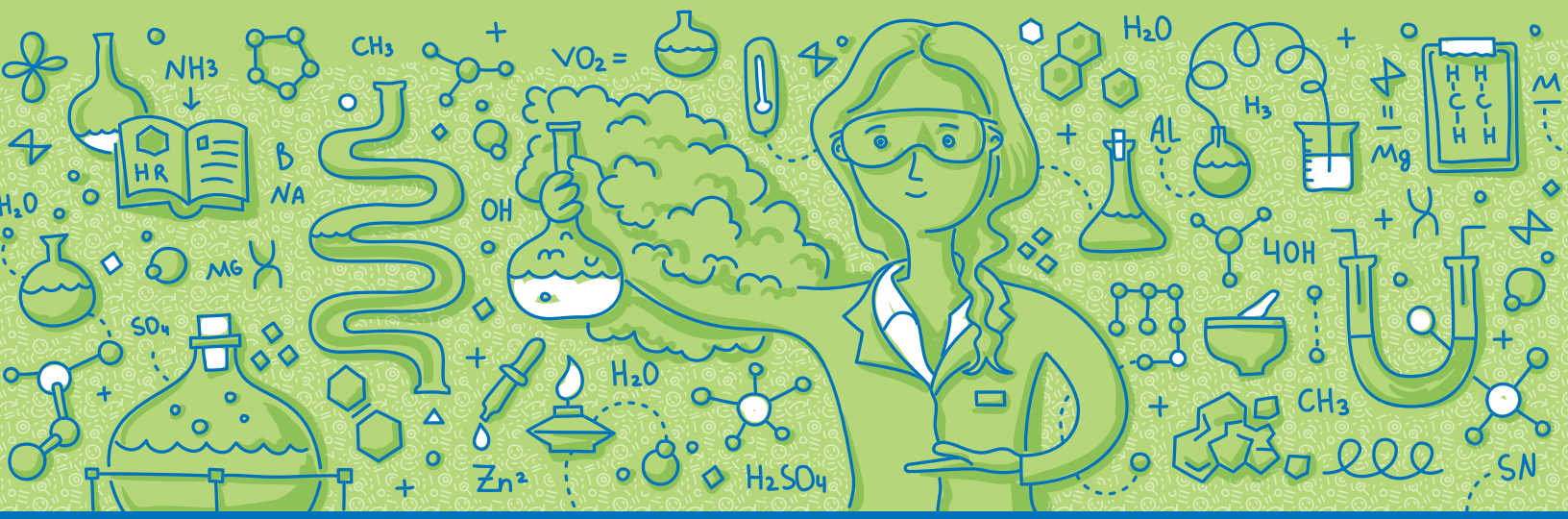


CURRICULUM CONNECTIONS

Look for these icons throughout the Museum Guide to connect our exhibits to your educational goals.

- PHYSICAL SCIENCE
- LIFE SCIENCE
- EARTH & SPACE
- ENVIRONMENTAL SCIENCE
- ENGINEERING, TECHNOLOGY & APPLICATIONS
- HANDS-ON ACTIVITIES

TECHNOLOGY

VIRTUAL REALITY LABORATORY

Recommended only for 5th grade and above.

This first-of-its-kind exhibit will transport players into immersive new worlds through eight science-themed stations. Blast off through the solar system, trek through the natural landscapes, explore the deepest oceans, model a 3D masterpiece, and more.

THE STUDENT WILL LEARN:

- Virtual reality is an interdisciplinary field that involves science, technology, engineering, mathematics, and the arts.
- Virtual reality technology is still evolving and improving with new research, innovation, and advances making richer and more realistic experiences possible.
- Virtual reality has is applicable in a range of fields such as education, medicine, training, psychology, biology, and more.

Virtual Reality, or VR, refers to computer technologies used to generate realistic, immersive experiences using images, sound and other sensations that replicate a real environment or create an imaginary setting. These three-dimensional 360-degree simulations are created using interactive software and hardware and are controlled by movement of the body.

Specialized, head-mounted goggles are used to present a stereoscopic display in front of the eyes. Stereoscopic displays project two slightly offset images separately to the left and right eyes. These offset 2D images are combined in the brain to give the perception of 3D depth. Combined with shading and parallax (objects further from you seem to move slower) to create depth, VR environments create an almost life-like experience.

Hand-held controllers transmit vibrations and other sensations to the user, engaging the user's sense of touch, also known as haptic feedback. Headphones or speakers enhance the user's experience with sound. VR simulates the user's physical presence in this immersive experience allowing them to move about and interact with features or items depicted in the headset.

VIRTUAL REALITY SAFETY GUIDELINES:

- Players must be in 5th grade or older to participate in the VR Lab.
- Physical contact with players while they are wearing the headset should be avoided since they cannot see and could become disoriented.
- Players should stop using the VR headset if they experience any discomfort or motion sickness.

PLASMA GLOBE & COLUMNS

Plasma is one of the four fundamental states of matter. Unlike solids, liquids, and gases, it is a gaseous mixture of negatively charged electrons and highly charged positive ions created by heating a gas or subjecting gas to a strong electromagnetic field. Plasma globes can be tools for studying high voltages and electric fields.

THE STUDENT WILL LEARN:

- Plasma is one of four fundamental states of matter, created by heating a gas or subjecting gas to a strong electromagnetic field.
- Plasma globes can be used to study high voltages and electric fields.
- The human body can act as a conductor, serving as a path through which electricity can flow.

The glass is filled with a mixture of various noble gases, commonly neon, argon, xenon, or krypton. A very high voltage is created by a Tesla coil-like circuit setting up a high electric field between a central electrode and the inner glass. The electrode at the center of the plasma ball emits a high-frequency, high-voltage alternating electrical current. This current flows through the plasma filaments to create colorful tendrils of light. The color depends on the gases used.

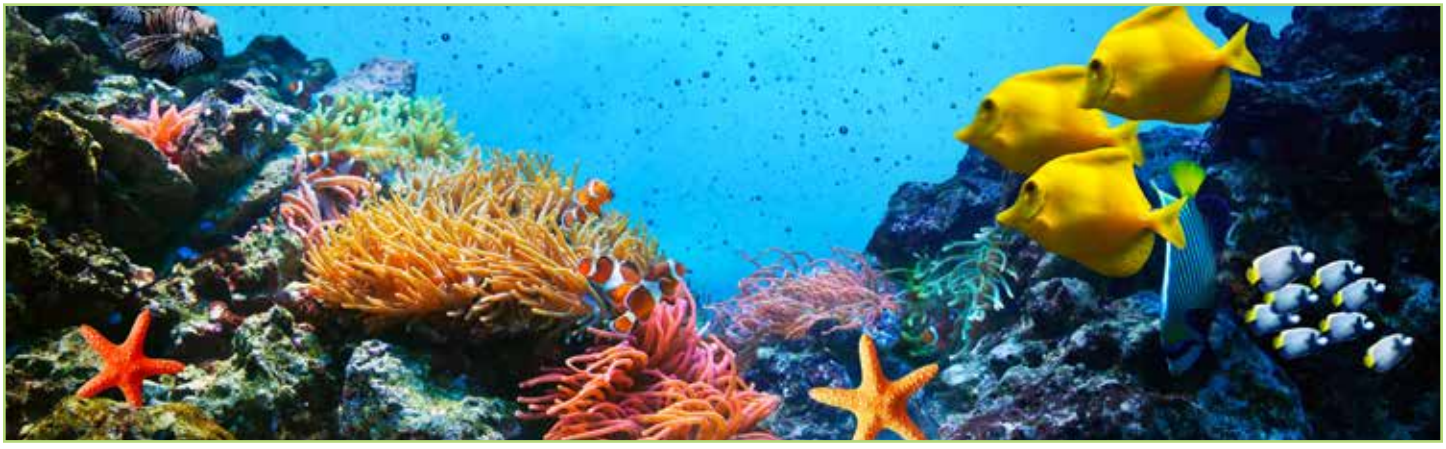
When you touch the glass, you create a discharge path with less resistance than the surrounding glass and gases. This occurs because of the conductive properties of the human body. The plasma globe can be used to demonstrate that an electric field can be diverted to a grounded short circuit if a second person touches the glass, reinforcing the idea that the body can be a path through which electricity can flow.

VIRTUAL AQUARIUM

Most museums or aquariums would frown upon visitors disturbing the fish, but we encourage our visitors to tap on the glass. The fish in our virtual aquarium will respond due to vibration sensors connected to the glass and computer software and programming that powers the game. The responses range from curiosity to fight or flight. There is even a Moray Eel lurking at the bottom waiting to surprise unsuspecting visitors.

THE STUDENT WILL LEARN:

- The Virtual Aquarium was created with the same technology used in popular multi-player video games.
- Computer animators first created 3D models of the individual fish using special software, then overlaid the models with realistic colors, patterns, and textures.
- Software engineers used a mathematical equation to animate the fish, mimicking natural movements and swimming patterns.



NANOSCIENCE

Nano is an interactive exhibition that engages audiences in nanoscale science, engineering, and technology. Hands-on exhibits present the basics of nanoscience and engineering, introduce some real world applications, and explore the societal and ethical implications of this new technology.

THE STUDENT WILL LEARN:

- Materials can act differently when they are nano-sized.
- Nanotechnology lets us build things they way nature does, atom by atom.
- Nano is all around us, in nature and technology.
- Nanotechnology will affect our economy, environment, and lives.

Nanoscience is the study of structures and materials on the scale of nanometers. The prefix "nano" means one billionth. A nanometer is very, very small – there are one billion nanometers in a meter.

Very, very small things sometimes behave in surprising ways. When structures are made small enough—in the nanometer size range—they can take on interesting and useful properties and behaviors.

ACADIANA 360: VIRTUAL REALITY EXPERIENCE

Acadiana 360 is a captivating way to experience our uniquely Cajun culture through virtual reality. Two-step at a Fais Do-Do, ride in a Mardi Gras parade, and even take a swamp tour. Supported in part by the Lafayette Convention and Visitors Commission, this unique experience was captured using state-of-the-art virtual reality technology.

STEM TV: SCIENCE ON SCREEN

Students can experience informative science content on any of the six monitors on the first and second floors. Short, engaging videos cover a range of science topics from astronomy and biology to volocanoes and zoology.

AUGMENTED REALITY

A unique edutainment experience for all ages, Augmented Reality uses realistic 3D animation, LED video panels, a camera system, and stereo sound to create an immersive encounter for museum visitors.

The Back to the Jurassic encounter features some of the most realistic 3D animated dinosaurs found outside of a movie theater including Caulkicephalus, Neovenator, Polacanthus, Iguanodon, Valdosaurus, Pelorosaurus, Tyrannosaurus Rex, Raptors, and Diplodocus.

In the Air, Land and Sea encounter, visitors meet a diverse range of animals from Africa to the Arctic and beyond. Watch as an elephant, leopard, rhinoceros, giraffe, polar bear, seal, whale, dolphins and penguins graze, drink, and interact with the environment around them.

THE STUDENT WILL LEARN:

- Augmented reality is a technology that superimposes computer-generated images on a user's view of the real world.
- The composite view created with Augmented Reality is combination of a live view of a real-world environment and computer-generated sensory elements, which can include images, sounds, and tactile information.
- Real world applications for augmented reality include education and training, medicine, architecture and design, archeology, navigation, and more.

LUSFIBER SPEED OF LIGHT: THE SCIENCE OF FIBER OPTIC COMMUNICATION

Fiber optics have revolutionized the telecommunications industry in the Information Age. By using pulses of light transmitted through hair-thin strands of glass, fiber optic communication provides faster speeds and larger bandwidths than traditional electric cable.

THE STUDENT WILL LEARN:

- Optical fibers are long, thin strands of very pure glass about the diameter of a human hair.
- Optical cables – bundles of hundreds or thousands of fibers – are used to transmit light over long distances.
- Photons are bundles of electromagnetic radiation, or light.
- Photons travel at 186,000 miles per second, which is the speed of light.
- Copper wire used in traditional telecommunication transmits electrons, which are subatomic particles with a charge of negative electricity.

WATCH LIVE: THE POWER OF FIBER OPTICS:

A powerful fiber optic connection makes it possible to offer a live video stream of the Alligator Bayou at the Tennessee Aquarium in Chattanooga, TN. Both Lafayette and Chattanooga were grantees of the Mozilla Gigabit Community Fund, and this connection is a result of each community's investment in fiber optic infrastructure, which provides opportunities for technology and innovation. There are 13 American alligators and one massive alligator snapping turtle living in the Alligator Bayou's wetland habitat. How many do you see?

HANDS ON: VR EXPERIENCE – INTERNET THROUGH THE AGES

In this virtual reality experience, students can explore the evolution of the Internet from dial-up to broadband to the fiber-connected home of today!

ENVIRONMENTAL SCIENCE

PROJECT FRONT YARD

Project Front Yard is a hands-on community effort to create more appealing outdoor spaces. The project aims to build awareness and improve the community through revitalizing our cities gateways, improving streetscapes, litter clean-up and prevention, public art, river clean-up, and education. Our exhibit focuses specifically on waterways and civic and environmental responsibility.

STUDENTS WILL LEARN:

- A watershed is an area of land where water drains into a large body of water; it's like a funnel and is made up of ditches, storm drains, coulees, streets, parks, businesses, and homes.
- All of south Louisiana is part of the Lower Mississippi Watershed, which flows into the Gulf of Mexico.
- Each of us has a responsibility to keep our watershed clean and free of debris and pollution, which can be harmful to wildlife and drinking water sources.

THE EXHIBIT INCLUDES:

Amelie's River Report – Amelie, a civic-minded student, set out to learn more about the litter she saw on her way to school. She wrote a letter to the Mayor asking how she could help solve the problem. As a result, she was able to tour Bayou Vermilion and interview its caretakers to learn what it takes to keep our river clean.

Storm Drain Model – Meet Yardley the Gnome, Project Front Yard's mascot, and learn about storm drains, their function as part of our watershed, and how to keep trash and pollution out of the storm drains to protect our community's water resources.

The Litter Quitter Pledge – "I will demonstrate pride in my community by picking up the litter around me ... to create a clean room, a clean home, a clean front yard, a clean neighborhood, a clean city, a clean state, a clean country, and a clean world."

LITTER LIFESPAN QUIZ

- Guess how long it takes common litter items like newspapers, plastic bottles and styrofoam cups, to biodegrade – or break down into natural components. Lift the flaps to find answers that may surprise you.

In conjunction with Keep Louisiana Beautiful and Keep Lafayette Beautiful, Project Front Yard offers teachers an environmental education curriculum containing 10 environmental lesson plans, hands-on activities for a variety of grade levels, fun activity sheets, GLE matches, and other resources. Topics include defining litter, timeline of trash, litter decomposition, watershed, clean water, effects on wildlife, plastics, reducing, reusing, recycling, and civic responsibility.

Visit www.projectfrontyard.com for more information and additional resources.

PALEONTOLOGY

The museum features paleontology exhibits on the first and second floors. The exhibits are grouped by geological era.

OCEAN GIANTS: PREHISTORIC & PRESENT

The first floor atrium features giant fossil skeletons of two prehistoric whales hanging high overhead. These are replicas of *Basilosaurus* and *Zygorhiza*, which were first discovered in Louisiana in the 1800's. Now extinct, these whales swam in the ocean that once covered present-day Louisiana in the Late Eocene epoch, 40 to 35 million years ago. In the exhibit, the 55-foot *Basilosaurus* is displayed preying on the smaller 18-foot *Zygorhiza*.

STUDENTS WILL LEARN:

- *Basilosaurus cetoides*, approximately 50 feet long, is a prehistoric whale that lived during the Late Eocene epoch, 40 to 35 million years ago, when much of Louisiana was covered by a shallow sea.
- *Zygorhiza kochii* is an extinct early whale, approximately 18 feet long, which lived during the Late Eocene epoch.
- The first fossils of both *Basilosaurus* and *Zygorhiza* were found in Louisiana.
- In 1834, *Basilosaurus*, which means "king lizard," was first thought to be a reptilian sea serpent but further examination of the bone structures revealed similarities to mammals and whales in particular.
- When *Zygorhiza* was first discovered in 1847, it was thought to be a smaller *Basilosaurus* species. Many years later, scientists studying the size of the bones and the tooth structure realized they were so different that the smaller whale was actually part of a new genus. *Zygorhiza* means "yoke tooth" in reference to the shape of the premolar and molar tooth roots.

MODERN WHALES

For comparison, the exhibit includes examples of modern whales. From docile and solitary to powerful pods of predators, Earth's oceans are home to a variety of whales, which are aquatic mammals. Large format images encourage students to learn about various whale species, including Right whales, Orcas, Humpback whales, Sperm whales, and the largest animal inhabiting Earth – the Blue whale.

In addition, students can view the skull of a Sei whale, which is a baleen whale that can grow to more than 50 feet in length and typically lives 50-70 years. The skull on display is of a juvenile, female Sei whale approximately 18 months old. She was found by the Louisiana Department of Wildlife and Fisheries beached on Marsh Island on Louisiana's coast.

STUDENTS WILL LEARN:

- Whales are marine mammals classified in two groups: toothed whales and baleen whales.
- Baleen is flexible fingernail like substance that hangs in fringed plates from the upper jaw used to strain plankton from seawater.
- Whales are some of the largest animals on the planet – the Blue whale being the largest.

NOAA OCEAN TODAY TOUCH SCREEN

- Developed by the National Oceanic and Astmospheric Administration, Ocean Today is an exciting, multimedia kiosk that features videos on all aspects of the ocean realm – exploration and discoveries, marine life and science, and research. Learn about weather patterns, hurricanes, storm surge, ocean temperatures, sea ice, fisheries, marine debris, the deep ocean, arctic exploration, whales, and more.

AGE OF DINOSAURS

In the lobby and on the second floor, students can examine dinosaur fossil casts from the late Jurassic Period including Allosaurus, Camptosaurus, and Stegosaurus. The Jurassic Period is also known as the Age of Dinosaurs. During the Jurassic Period, from about 199 to 145 million years ago, the supercontinent of Pangaea split apart opening up basins that would form the Atlantic Ocean.

STUDENTS WILL LEARN:

- Allosaurus, one of the most common predators of the late Jurassic Period, was similar but only distantly related to the later-evolving Tyrannosaurus rex. It was bipedal, meaning it walked on two hind legs.
- Camptosaurus was a plant-eating, beaked, ornithiscian dinosaur. Ornithiscian means its pelvic structure was similar to a bird's.
- Stegosaurus was a large plant-eating dinosaur with two rows large bony plates running along its back. It walked on all four legs and had large spikes at the end of its tail.
- Compsognathus was a small, bipedal, carnivorous theropod dinosaur that lived about 150 million years ago.

VISIT THE DINO LOUNGE

Explore the Dino Lounge on the second floor for more fossil casts from the late Jurassic Period including Stegosaurus and Compsagnathus. Compare the size of these two very different dinosaurs. Take a break on one of the sofas and enjoy a selection of colorful dinosaur reference books for all ages. Don't forget to strike a pose and snap a picture with the giant Selfie-saurus hanging on the wall!

MEGATYLOPUS

Beyond the atrium, a fossil of an extinct giant camel, called Megatylopus, is on display as part of the UL Lafayette Geology collection. The fossil is the most complete skeleton known of the creature, which stood 12-14 feet tall and functioned much like a giraffe. The excavation and transport of the 7 million year old fossil found in Oregon was completed by Dr. James E. Martin, curator of paleontology and research professor with UL's School of Geosciences.

STUDENTS WILL LEARN:

- Megatylopus, a giant giraffe-like camel, was an herbivore that evolved in North America lived 5-8 million years ago.
- No complete skeletons of Megatylopus have been recovered, but the fossils on display at LSM represent the most complete skeleton known of the animal.

UL LAFAYETTE GEOLOGY PREPARATION LABORATORY

While viewing Megatylopus, students also can see geologists at work in the UL Geology Preparation Laboratory. Faculty, staff, students, and volunteers work in the lab to remove fossils and minerals from rocks collected in the field. Using microscopes, miniature jack hammers and sandblasters, and other tools, preparators locate fossils ranging from minuscule mice to immense mammoths. The fossils and mineral specimens are prepared for scientific research, displays, and preservation.

For a more indepth look at the Prep Lab's geologists, students, and volunteers, share with students a feature by News 15, which covers the discovery, preparation, and preservation of Megatylopus: www.lafayettesciencemuseum.org/paleontology.

GEOLOGY

ENERGY UNEARTHED – THE SCIENCE OF PETROLEUM EXPLORATION

Energy Unearthed showcases the science of oil exploration and production. The exhibit is designed to illustrate how oil is formed and found, explored and extracted, and how petroleum products are created and consumed. Throughout the exhibit, geologic samples, digital interactives, equipment, and scale models tell the story of the oil industry and its role in Louisiana's economy and around the globe.

STUDENTS WILL LEARN:

- Oil and natural gas, or hydrocarbons, are non-renewable energy resources.
- Non-renewable resources take millions of years to form only where conditions in the Earth are just right.
- Non-renewable resources cannot be regenerated.
- Oil and gas are forms of petroleum, which formed from animals and plants that lived millions of years ago, when heat and pressure turned decayed matter into crude oil.

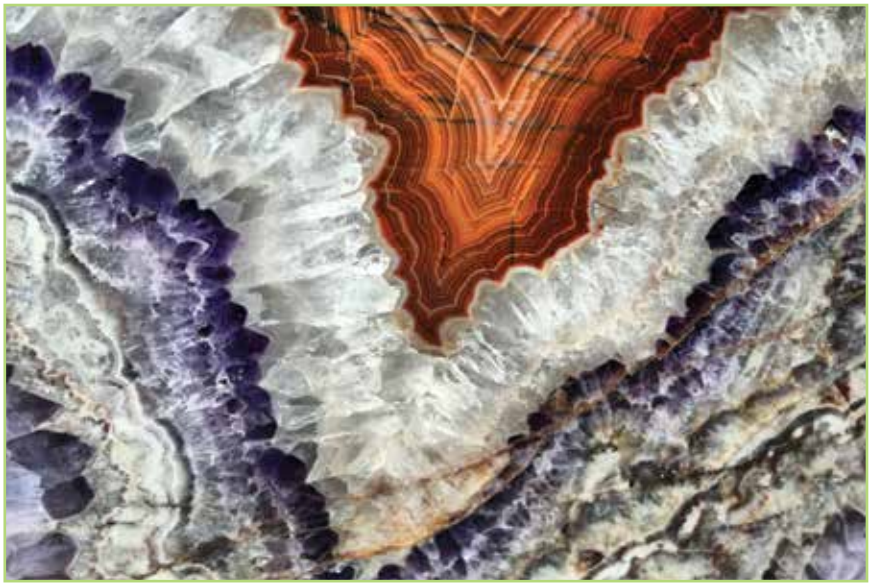
ENERGY UNEARTHED
The Science of Petroleum Exploration

ROCKS AND MINERALS

The story of petroleum begins with geology, which is the study of the solid Earth, the rocks of which it is composed, and the processes by which they change over time. Rock and mineral samples from the UL Geology Museum collection are displayed according to type to demonstrate real-world applications of geology. Encourage students to compare and consider differences in the rocks and minerals and how and where were they formed. Refer to the Periodic Table of the Elements and consider what elements combined to give rocks their color, texture, shape, and structure.

STUDENTS WILL LEARN:

- Geology is the study of the solid Earth, the rocks of which it is composed, and the processes by which they change over time.
- Minerals are the building blocks of the rocks that form the Earth.
- The rock cycle is a model of the geological process that make and recycle rocks.
- Most of the rocks on Earth today are composed of the same materials that were present from the time our planet formed. These rocks have simply been recycled, changing from one type of rock to another, over billions of years.



HANDS ON: CYCLE TOUCH TABLE

The Rock Cycle Touch Table encourages students to learn about the rock cycle, the geological processes that make and recycle rocks. See and feel the differences between the main types of rock – igneous, metamorphic, and sedimentary. Learn how rocks are formed in different ways and changed into other types of rocks over and over again through the natural processes of weathering and erosion, compaction and cementation, heat and pressure, melting and cooling, and plate tectonics.

HANDS ON: MAGNIFICATION STATION

Invite students to explore ammonites under the videoscope. Ammonites are fairly common index fossils that scientists use in biostratigraphy, a branch of geology that orders and correlates layers of rock, or strata, by using fossils. Turn the wheels to see the spiral, suture patterns of the ammonite samples. Magnified images are displayed on the video screen overhead allowing groups of students to share the view.

PETRIFIED WOOD

Use the magnifying glass on the top of the case to get an up-close look at petrified wood, a type of fossil created when plant material like a tree limb or log is turned to stone. The process that creates petrified wood is called permineralization, and it occurs when plant material is buried and deprived of oxygen, which delays the decaying process. If the buried plant material also comes in contact over a period of time with a mineral-rich water source, minerals from the water are deposited in the slowly decaying cells of the plant as the water flows through it. Silicate minerals, such as quartz, are common in petrified wood. These and other minerals replace the organic material and result in a stone with wide variations in color and brilliance.

STUDENTS WILL LEARN:

- Petrified wood is a type of fossil formed under rare conditions.
- Permineralization is the process by which organic plant material is replaced by minerals to create a stone.
- Unlike other fossil impressions or compressions, petrified wood is a three-dimensional representation of the original organic matter, down to the microscopic level.

ASTRONOMY & SPACE

PLANETARIUM PROGRAMS FOR SCHOOL GROUPS

Located on the second floor of the Museum, our state-of-the-art, all-digital planetarium presents live and playback programs designed both in-house and by other production companies. From learning about the night's constellations to experiencing the wonders of space flight, your exploration of the universe begins here!

Programs begin at 9:10 a.m., 10:10 a.m., 11:10 a.m., and 12:10 a.m., and last 50 minutes. The planetarium seats 80.

THE SKY TONIGHT | GRADES K THROUGH 12

See the sky as it will be on the night of your visit! Students will learn the stars, constellations, and planets which will be visible that evening.

Addresses the following parts of the Common Core Curriculum Map depending on sky conditions on the night of your visit:

- K) Social Studies Focus: Learning to be Good Citizens in our Community; Science Focus: Sorting and Constructing Patterns; Science Focus: Earth & Sky
- Gr. 2) Science Focus: Earth & Beyond; Social Studies Focus: Our Community and Its Physical Environment
- Gr. 3) Social Studies Focus: Louisiana's Geography; Science Focus: The Solar System
- Gr. 4) Science Benchmark 2: Earth & Space Science
- Gr. 5) American History, Block 1: America's First People; Benchmark 4: Earth & Space Science.

SPACE: A PLACE | GRADES 1 THROUGH 2

An introduction to space flight for younger students. Large 1/50th scale 2-D rockets will help students understand the size of space vehicles, while models will help them understand how the rockets work.

Addresses the following parts of the Common Core Curriculum Map:

- Gr. 1) Social Studies Focus 4: How Maps Help Us; Strand—Science as Inquiry
- Gr. 2) Science Focus: Earth & Beyond; Social Studies Focus: Our Community and Its Physical Environment; Social Studies Focus: Our Community & Its Economy.

SUN, MOON, & STARS | GRADES 3 & 4

Learn the reasons for the seasons as well as how the movements of Earth affect where we see the sun and what we see in the night sky from month to month. Discover the moon's phases, and find out how they happen through a kinetic activity. Students will also learn how to observe these phenomena safely in the real sky.

Addresses the following parts of the Common Core Curriculum Map:

- Gr. 3: Social Studies Focus: Louisiana's Geography; Science Focus: Measuring and Describing Matter; Science Focus: The Solar System
- Gr. 4) Space: ESS-64, ESS-67, ESS-68

EXPLORING THE PLANETS | GRADES 4 THROUGH 8

Offers a close up look at each planet of our solar system and many of the larger moons. NASA images provide the most up-to-date viewing possible.

Addresses the following parts of the Common Core Curriculum Map:

- Gr. 4) Space: ESS-66, ESS-69 Gr.5) Technology & the Work of Scientists: I-SI-40; Science as Inquiry ES-42, ES-44, ES-43, ES-45, ES- 47
- Gr. 8) Inside Earth & Geologic Time: ES-48

FINDING YOUR STAR | GRADES 4 THROUGH 8

Students learn how to use star maps in this highly interactive presentation. Your class will be divided into groups. Groups will be assigned a constellation to find using their star maps and then will be given an opportunity to point out their findings to the other groups in the class. Available only for groups of 30 students or fewer.

Addresses the following parts of the Common Core Curriculum Map depending on sky conditions on the night of your visit:

- Gr. 4) Map Skills: Examining the United States' Place in the World, Geographic and Cultural Characteristics of Regions and Historical Perspective
- Gr. 5) Block One America's First People, Focus on Geography Skills; Benchmark 4: Earth & Space Science, ES-40, ES-41

ROCKETS AND SPACECRAFT | GRADES 3 THROUGH 8

This popular program looks at the history of space flight, how rockets work, and common misconceptions about space. Models of the Saturn V and Space Shuttle help students understand the Apollo moon flights and how the Shuttle worked.

Addresses the following parts of the Common Core Curriculum Map:

- Gr. 3) Social Studies Focus: Louisiana's Riches; Science Focus: Forces & Motion
- Gr. 4) United States, Block 2: The Movement of Ideas: Scientific Contributions/Culture History/Goods & Resources–Economics; Space: ESS-69
- Gr. 5) Science as Inquiry: ES-47
- Gr. 8) Inside Earth & Geologic Time: ES-48; May the Force be With You: ES-39

FINGERPRINTING THE STARS | GRADES 8 THROUGH 12

Based on modern spectroscopy, the heart of modern astronomy, during the program students use diffraction gratings to observe the spectra of various gas discharge tubes and then learn how astronomers use similar observations to understand the Universe.

Addresses the following parts of the Common Core Curriculum Map:

- Gr. 8) Inside Earth & Geologic Time: ES-48; May the Force be With You: ES-37

LOBBY MODELS

Look Up! Hanging from the ceiling high above the museum's lobby are detailed flight models of the 1903 Wright Flyer, the Gemini Spacecraft, and the Space Shuttle. There is also an actual, inert Loki-Dart Sounding Rocket. Find information panels about each one and get a closer look from the second floor balcony.

1903 WRIGHT FLYER This aircraft was used to conduct the first controlled, powered, heavier-than-air human flight on December 17, 1903. Orville Wright piloted the flyer for 12 seconds, covering 120 feet.

GEMINI SPACECRAFT Much of the information NASA needed for a successful moon landing was learned on Gemini missions. Ten piloted Gemini spacecraft flew in 1965 and 1966.

SPACE SHUTTLE Design and testing began in 1969, with the aim of developing a reusable orbital spacecraft designed to launch vertically like a rocket and land like an aircraft upon reentry. Five Shuttle systems were built and used on a total of 135 missions between 1981 to 2011, before the Shuttle Program ended.

LOKI-DART SOUNDING ROCKET A research rocket designed to launch on short flights that do not go into orbit. In nautical terms, to sound means throwing a weighted line overboard to measure the depth of water. Sounding rockets get their name because they are used to take scientific measurements.

TURBULENT ORB

Spin the sudsy, liquid-filled sculpture that mimics the Coriolis effect, which causes swirling clouds above Earth's surface and the bands of color on gaseous planets like Jupiter and Saturn.

STUDENTS WILL LEARN:

- By rotating the sphere slowly, the fluid flows in smooth, orderly currents called laminar flow.
- With more rapid spinning, the currents become more complex causing disorderly swirls and eddies, a pattern called turbulent flow.

LEAVING EARTH: THE STORY OF SPACE TRAVEL

Explore space flight from the earliest attempts at rocketry to the future plan for space tourism. From the first dreamers who looked up at the moon to those who stepped on its surface, see the story of how mankind used the scientific method to break the bounds of gravity to leave Earth and travel into space.

STUDENTS WILL LEARN:

- Rockets are used to deliver spacecraft beyond the astmosphere and into orbit.
- All rockets from basic fireworks to complex machines are based on the simple physics principle of action and reaction – the rocket's forward motion is a reaction to the opposing motion of the rocket's expelled propulsive mass.
- Escape velocity is the speed and power necessary for an object to escape Earth's gravity – first calculated in the early 1900's by Russian scientist, Konstantin Tsiolkovsky.
- The Space Race refers to competing efforts by the U.S. and the Soviet Union to launch satellites, unmanned space probes, and achieve human spaceflight and a successful moon landing.

SPACE TRAVEL FIRSTS:

- The Soviet Union achieved the first success of the Space Race when the Sputnik I artificial satellite was launched into low Earth orbit on October 4, 1957.
- The first human in space was Yuri Gagarin, a Soviet cosmonaut, in April 1961.
- Alan Shepard was the first American in space on May 5, 1961. Though he did not achieve orbit, he was the first person to manually control his spacecraft.
- John Glenn was the first American to orbit the Earth on February 20, 1962; he orbited the Earth three times, in 4 hours and 56 minutes, before splashing down in the Atlantic ocean.
- On June 16, 1963, Valentina Tereshkova, a Soviet cosmonaut was the first woman in space.
- American astronauts Neil Armstrong and Buzz Aldrin landed on the moon on July 20, 1969; the trip took just over three days. The astronauts walked on the moon's surface and spent 2.5 hours collecting samples, taking photographs, and planting an American flag.

Ask your students to consider how they would tackle an impossible challenge – like sending a human into space. Think about the Space Program as a prime example of the scientific method at work. Innovators started with what they had, such as rockets and airplanes, and worked to make modifications. They tested each hypothesis and with small incremental improvements and successes, moved closer and closer to their goal.

Ultimately, the space program accomplished its goals, but this journey was not without setbacks and failures. Each step was an opportunity to learn more. What were some of these challenges? How were they overcome?

In the story of humans' first attempts and first successes at space travel, ask students to consider the importance cooperation and competition between the world's leading scientists? What were some of the barriers to cooperation? How might the story of space travel have been different if scientists had been able to share their work earlier in the process? How would it be different if scientists from different countries had not collaborated at all?

The exhibit features small scale models of various spacecraft, a display of NASA mission patches designed by astronauts, and real samples of space shuttle thermal protection tiles. Also included in the exhibit are Hubble telescope images, ultraviolet telescope images of solar phenomena, a display of space station supply missions, and more.

LEAVING EARTH INTERACTIVE STATIONS

- Leaving Earth features interactive stations that challenge visitors to test their motor skills with robotic arms and explore space travel with the Solar System Touch Panel, which puts the entire solar system at their finger tips.

METEORITES

Meteorites contain a record of our solar system's evolution and how meteorite impacts could affect our future. View and learn about pieces of rock and metal, actual debris from outer space, that have survived the trip through our astmosphere and impact with the Earth's surface. When these objects enter the atmosphere, friction, pressure, and chemical interactions with atmospheric gases cause meteorites to heat up and radiate energy. Many meteorites are vaporized on entry through the atmosphere. The museum's collection includes different types of meteorites found around the world, including two found in Louisiana and one that's likely from Mars!

STUDENTS WILL LEARN:

- Meteorites are pieces of metal and rock from outer space that fall to the ground through the atmosphere.
- Meteorites originate as meteoroids, small pieces of debris in the solar system, or pieces of larger asteroids.
- Meteors refer to streaks of light in the sky caused when the solid matter enters Earth's atmosphere.

NICKEL-IRON METEORITES

In the nickel-iron meteorites case, students can observe meteorites that are denser than normal rocks and surprisingly heavy for their size. The largest one in our display is about the size of bowling ball and weighs 78 pounds! Ask students to observe the criss-cross, or Widmanstätten, pattern on some of the meteorites. The pattern is related to the amount of nickel in the meteorite and becomes visible after specially treating the meteorite with a chemical solution. Astronomers can use these patterns to determine if a piece iron comes from a meteorite. Nickel-iron meteorites also tend to rust because they are exposed to humidity and oxygen here on Earth, which is an alien environment for these bits of space debris. Chemical and vapor treatments help protect these meteorites from the elements and prevent or slow the rusting process.

STONY METEORITES

In the stony meteorite case, students can observe various types of meteorites. Chondrites are the most common type of meteorite and are characterized by the presence chondrules, which as appear as round spots within the chondrite. Chondrules are the building blocks of chondrites and form as molten or partially molten droplets in space that come together to form larger bodies. Carbonaceous chondrites have water molecules as part of their mineral structure and are richer in carbon than other meteorites. They also include amino acids, the so-called building blocks of life, that are not found on Earth. The Murchison meteorite on display is a carbonaceous chondrite. Achondrites are stony meteorites with no chondrules. They are formed by lava flows at or near the surface of very large asteroids.

SPECIAL METEORITES

NEW! - LUNAR METEORITE Our lunar meteorite, Northwest Africa 11273, was found in 2017. It's a lunar breccia, made of smaller broken rocks cemented together by the heat and shock of the asteroid impact that originally ejected our meteorite from the moon. Although our NWA 11273 sample is not much bigger than a US quarter, many of the angular smaller rocks (called clasts) are clearly visible. Only about one meteorite in a thousand appears to be lunar, distinguished from Earth rocks by a lack of water-based minerals and other subtle chemical differences.

LOUISIANA METEORITES In the special meteorite case, students can observe slices of two meteorites found here in Louisiana – only three meteorites have ever been found in Louisiana. The Atlanta meteorite was named after the town of the same name in Winnfield Parish, and the Greenwell Springs meteorite was found near Baton Rouge. Other museums and collections in Washington, D.C., New York City, New Mexico and Vienna, Austria have pieces of the Greenwell Springs meteorite, but our museum is the only known place where it is on exhibit. A third small meteorite was found in New Orleans shortly before Hurricane Katrina, but most of it was lost in the aftermath of the storm.

MARTIAN METEORITES Our Zagami stony meteorite is an actual piece of the planet Mars! Out of tens of thousands of collected meteorites, only about 120 are thought to be Martian meteorites because they match well with Martian rocks collected by landers. Martian rocks and meteorites are volcanic and significantly younger than most meteorites with atoms matching the Martian atmosphere between their mineral crystals. Mars is one of the few places in the solar system with volcano activity in geologically recent times.

VESTA METEORITES Several meteorites in the museum's collection appear to be from the asteroid Vesta, which has a giant crater at its south pole. These meteorites match well with the minerals in the surface of Vesta as confirmed by the recent Dawn spacecraft, which orbited Vesta for more than a year capturing images and other measurements.

METEORITE SAMPLES

- While most meteorite specimens in the museum's collection are kept in cases to control their environment and prevent rusting and corrosion, a couple meteorites have been set aside for visitors hold. If time permits after your students' planetarium show, these two meteorites, one stony and one nickel-iron, will be passed around for students to examine.

CRATER MAP, TEKTITES, AND SHATTER CONES

IMPACT CRATERS Impact craters are caused by the collision of large meteorites with Earth's surface. More than 150 impact craters are known on Earth, but they can be difficult or even impossible to see because they are buried by sediment or have eroded. Geologists can find them through different forms of aerial imaging and drilling core samples of suspected craters. Impact craters are much larger than the objects that create them. The largest known impact crater has a diameter of 180 miles.

TEKTITES AND STREWN FIELDS Tektites are an unusual form of natural glass that form when material from Earth's surface is blasted into the upper atmosphere by the impact of asteroids or comets on Earth. The material melts, solidifies, and falls back to Earth. This process creates distinctive odd shapes, flow lines, and bubbles. Some entered the atmosphere while still nearly molten, stretching into "dog bone" shapes as they rotated. Teardrop shapes are dog bones that rotated fast enough to split in half. Small pits and gouges in tektites were caused by entry into the atmosphere at very high speeds. Regions where tektites and meteorites are found are called strewn fields. Ask students to compare the different shapes of tektites on display and the regions where they were found.

SHATTER CONES Shatter cones are Earth rocks found below impact craters. The cone-shaped grooves and cracks in them happen when shock waves from an impact go through the rock. Shatter cones are a key feature in determining whether a crater is volcanic in origin or due to the impact of an asteroid or meteorite because shatter cones are only found under impact craters. Ask students to look for the shatter cone shape in the rocks on display, which are especially visible in the small shatter cone from Sierra Madera, Texas.

THE GREAT METEOR OF 1957 In 1957, people across the southeastern United States witnessed an extremely bright meteor accompanied by a rumbling sonic boom that shook houses and rattled windows. Witnesses still ask about it when they visit the museum, and many think it must have hit nearby them because of how bright it appeared. However, observations from the Galveston, Texas area indicate it must have come down over the Gulf of Mexico if it survived the trip through our atmosphere. No specimen was ever recovered, but the Army Corps of Engineers estimates the object's mass at about 600 tons! Modern calculations suggest it broke into small pieces in the atmosphere several miles high. Our meteor map shows where observations were reported, and a small "X" indicates incorrect claims of impact.

BIOLOGY

BIOLOGY

Biology is the study of life and living organisms and their physical structure, function, development, and evolution. Our mounted and osteological specimens will encourage students to explore and compare physical structures, shapes, and scale of various vertebrates. Many of the specimens on display are native to Louisiana. They include skull samples of raccoon, beaver, bobcat, fox, deer, alligator, dolphin, turtle, pelican, and more. Additionally, students will see mounted specimens including a grizzly bear, bobcat, and beaver. Ask students to compare the skeletal features and consider how each animal has evolved for locomotion and developed other abilities based on its habitat.

STUDENTS WILL LEARN:

- Biology is the study of life and living organisms.
- Vertebrates are animals with a backbone surrounding a spinal cord.
- 60,000 vertebrate species have been described throughout world so far.
- In Louisiana, 60 native species of mammals and more than 450 species of birds can be found.

DIGITAL DIVIDE: THE EVOLUTION OF FINGERS & TOES

What can we discover about humans and our origins by studying other animals? It turns out there is an enormous amount to learn just by studying fingers and toes, or digits. Using the scientific method we examine similarities and differences in digital structures of tetrapods, or four-limbed vertebrates, in this comparative study of humans and animals.

STUDENTS WILL LEARN:

- Science is knowledge about, or the systematic study of, the natural world based on facts learned through experiments and observation.
- The scientific method is based on:
    - The direct observation of facts.
    - The formulation of a hypothesis, a tentative explanation of a relationship between facts.
    - The formulation of a theory, which consists of many validated hypotheses explaining the relationship between facts.
- Evolution is the history of life on Planet Earth and how life has adapted to different environments.

Ask your students: If you could wish for an adaptation for yourself based on your environment, what would you wish for? If you were going to live in the water all the time, you'd probably wish for fins to move through the water with ease, escape predators, and catch food. If you were going to live in the sky, you'd probably wish for wings and a lightweight skeleton with hollow bones.

Encourage students to examine the bone structures of the specimens on display and compare them to their own fingers and toes. Consider how the adaptations relate to each animal's environment.

GAME BIRDS AND WATERFOWL

Ornithology is a branch of zoology that concerns the study of birds. The scientific study of avain species have resulted in the development of key concepts in evolution, ecology and conservation.

The game birds and waterfowl on display represents the natural history of game birds and waterfowl collected over 50 years from the United States and many countries around the world. Many of the specimens collected years ago are now considered protected species due habitat loss and other environmental factors. The exhibit offers a rare chance to study these now-protected birds.

STUDENTS WILL LEARN:

- Ornithology is the study of birds.
- The study of birds have resulted in the development of key concepts in evolution, ecology and conservation.
- Due to loss of habitat and environmental factors, many bird species are now considered protected or endangered.

THE CRAWL SPACE

Enter the World of Entomology, the branch of zoology focused on the scientific study of insects. The Crawl Space features terrariums with beetles, bugs, roaches, arachnids and more on display. See a variety of live and mounted specimens, including some your students will be glad are behind glass, such as tarantulas and black widow spiders. New larger-than-life sculptures made of metal and wood by local artist Kelly Guidry offer an artist's interpretation of common insects including a cicada, dragonfly, wasp, ladybug, cricket, junebug, and bee.

STUDENTS WILL LEARN:

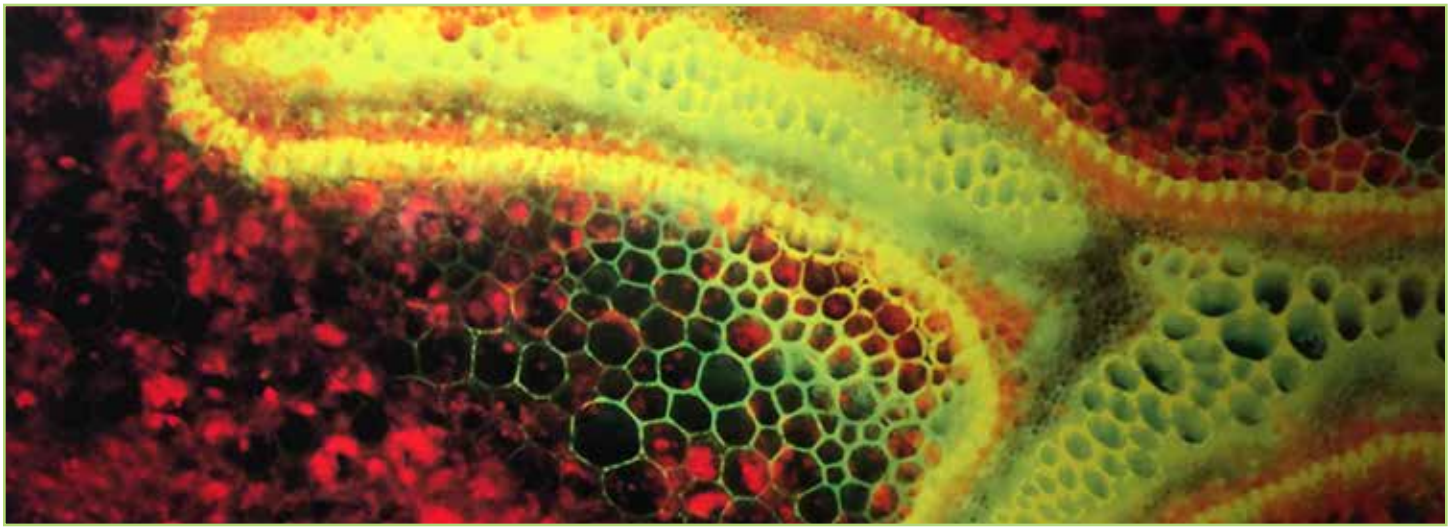
- Insects are the most diverse group of animals on the planet, accounting for 60 percent of all multicellular organisms.
- Insects are one of the first animal groups to shift from aquatic (water-based) life and adapt to terrestrial (land-based) life.
- Insects play an important role in maintaining a healthy environment by improving soil, pollinating plants, controlling pests, and as a food source for other animals.
- Insects have specific characteristics that distinguish them from other arthropods, such as arachnids (spiders) and myriapods (centipedes and millipedes).
- The characteristics of an insect: six legs, three distinct body parts (head, thorax, and abdomen), compound eyes.
- The characteristics of an arachnid: eight legs, two distinct body parts (fused head and thorax, or cephalothorax, and abdomen), simple eyes.
- The characteristics of a myriapod: many body segments, each segment bearing one or two pairs of legs, simple eyes.

MICROSCOPY

High resolution, magnified images of insects and plants made with a scanning electron microscope allow students to learn about distinct features of insects and to see plant structures up close. See internal structures of a plant's vascular system to learn how nutrients are transported to tissues. Compare and find differences between the structures of various plant species. Explore more images of insects and arachnids to learn about features that simply cannot be seen with the naked eye. Take for instance, the compound eye of a fly, the coiled proboscis of a moth or mosquito, and the hairs that trap pollen on a bee's leg.

STUDENTS WILL LEARN:

- Microscopy is the technical field of using microscopes to view objects and areas of objects that cannot be seen with the naked eye.
- There are different types of microscopes each with varying levels of power, which allow us to see smaller and smaller objects: optical microscopes, electron microscopes, and scanning probe microscopes.
- Optical and electron microscopes use diffraction, reflection, or refraction of electromagnetic radiation or electron beams interacting with the specimen in order to create and image.
- Scanning probe microscopes are tools used to make images of nanoscale surfaces and structures, including atoms.



NILE CROCODILE

The Nile crocodile, *Crocodylus niloticus*, is the largest freshwater predator in Africa. Wide-spread throughout sub-Saharan Africa, it lives in aquatic environments like lakes, rivers, and marshlands. On average, this apex predator can grow to a length of 11 to 16 feet and weigh between 500 and 1,650 lbs. The specimen on display is a 14 foot male crocodile taken in Mozambique in 2016 by Kackie Lerille of Lafayette. She traveled to Africa on a hunting expedition for this animal, which was threatening villagers who lived near Lago de Cahora Bassa, a large freshwater lake from which they drew water for their daily needs.

THE STUDENT WILL LEARN:

- Crocodiles and alligators belong to different taxonomic families.
- The Nile crocodile is a freshwater dweller belonging to the family crocodylidae, which also includes the saltwater crocodile, *Crocodylus porosus*.
- The American alligator, *Alligator mississippiensis*, which is native to our area, belongs to the family alligatoridae, which also includes caimans.
- The shape of the nose and arrangement of the teeth illustrate the differences between species:
    - Crocodiles have a V-shaped snout with lower and upper jaws of the same width resulting in an interlocking tooth pattern.
    - Alligators have a U-shaped snout with a wider upper jaw that completely overlaps the lower jaw and teeth.

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