

Description

Joseph Leidy was said to be the last man to know everything. Even when he was just a boy, he was always trying to understand his world. Known as the Father of American Vertebrate paleontology, Joe was always on the go. In the spirit of Joseph Leidy, the Academy of Natural Sciences of Drexel University wants you to engage with the world of science in your classroom and take one of natural history's most important figures with you! Include Lil' Leidy in your experiments, take a picture, and share your explorations with the Academy!

This packet includes activities your class can do that relate to the amazing work that Joseph Leidy did throughout his career. Keep reading to better understand the man behind some of the most interesting finds in natural science. Whether he was solving a mystery by taking a close look at cell structure or piecing together fossil remains of an ancient beast based on a modern-day descendant, Joseph Leidy was always on the go! Let's join in celebrating 200 years of discovery at the Academy of Natural Sciences of Drexel University and take Joe on the Go!

This curriculum guide is broken down into two parts that reflect many of the themes of Joseph Leidy's personal and professional life. **Be a Scientist!** asks students to apply general scientific skills to their world. **Paleontology Rocks!** digs deeper into the field of fossils.

Outcomes Students will understand the contributions of Joseph Leidy not only to the Academy, but also to the field of natural sciences. They will practice the general skills necessary for doing science such as making observations, recording data, and classifying objects. They will encounter the challenges of paleontology through puzzles, role-playing, and examining current animals.

Vocabulary

paleontology	scientist	observation
senses	fossil	

Joe on the Go: Be a Scientist!

Classroom Activities:

- Play "I Spy" with a focus on detailed observations
 - Start the game by giving very vague, broad clues. For example, say: "I spy something red." Ask the class to find the object you are referencing. Play another round, but this time, give very detailed clues like: "I spy something red and shiny. It is round with a brown stem coming up out of the top of it." Ask the class again to find the object. Was it easier or harder this time to find the object? Explain that a

scientist needs to make detailed observations for others to be able to use his or her research. Have the class practice in pairs playing "Spy".

- Start a nature journal
 - As a class, decide on a habitat to observe. Choose a habitat that would be easy to visit on several different occasions (the school yard, a local park, a backyard pond, etc.) Keep a nature journal on the life in that habitat. Don't forget smaller animals like insects as well as plant life when you observe your habitat! Try to observe the habitat during different seasons. For a great resource on helping students to create nature journals, check out Claire Walker Leslie and Charles E. Roth's Keeping a Nature Journal: Discovering a Whole New Way of Seeing the World Around You.
- Adopt-a-Plant
 - Choose an easily observable plant (in the classroom or nearby). Have each student choose a single plant to observe. It could be a huge tree or a small weed. The important thing is that each student really gets to know their adopted plant. Have them practice scientific skills like measuring the growth of the plant, using their senses to learn as much as they can, interviewing others about their experiences with this plant or others like it, and recording all that they learn using words, numbers, and drawings. Have the students make a graph of changes in growth throughout the observation period. If doing the project for a long period of time (throughout the year), predict what the plant will look like at different times of the year. Check your predictions and make new observations. Make new predictions about the next season, and start the process all over again. At the end of the observation period (anywhere from two weeks to the entire school year) have the students share what they learned about their plant. The scientific community wouldn't function if scientists didn't share what they learned!

Homework Assignments:

- Taking Science Home
 - See attached "Home is Where the Science is!" for family-friendly ways to practice the skills of observation and experimentation at home.
- Travels with Lil' Leidy
 - When Joseph Leidy was a young boy in the early 19th century, he was fascinated with the world around him. He collected plants, rocks, and shells. He spent time studying and drawing the world around him. How would young Joseph's life have been different than the students' lives? Give each student a "Lil' Leidy" to take with them on their own scientific endeavors.

Interdisciplinary Activities

- Art Senses
 - Ask the class to describe how they would paint a picture from beginning to end. What materials would they use? How would they start? Keep track of how many steps they provide that are related to each of their senses. Remind them that a good observation can often involve all of their senses. Allow them to practice creating pictures using their senses in a slightly different way. For example, blindfold the students and allow them to use only their senses to feel all the brushes and other art tools (including the paint!) and create pictures only using their sense of touch. Use scented markers and blindfold the children and allow them to choose colors to draw

with based only on the way they smell. Use marbles coated in paint in an aluminum tray and allow blindfolded students to listen to the marbles as they roll them over paper in the tray and see if their pictures turned out the way they envisioned. Finally, if classroom allergies and school policies allow, use food to create a picture! Put small plates and bowls out with various foodstuffs that are easily sprinkled and smeared: puddings, cookie crumbs, bright berries, gelatin, yogurt, cereals, etc. Blindfold your students and allow them to taste each of their materials and create a picture from their delicious art supplies.

Class Projects

- Class Collections
 - Give each student the task of gathering objects for your collection. You can simply have them collect things that are interesting to them or be more specific in the themes (things from nature, objects that show the colors of the rainbow, etc.) After the collection period, the class must work together to curate their collection. Talk about how to classify objects. Have the students closely observe the objects and group them by size, shape, and color. Are there other ways that they would group their objects together? Put together a display, invite other classes, and have your student curators give tours explaining why they arranged their displays the way they did.

Joe on the Go: Paleontology Rocks

Classroom Activities:

- Puzzling Fossils
 - Talk about the process of “putting together” a dinosaur. What do the students think would be difficult about finding fossils and putting them together? Select a few puzzles with only a few pieces (no more than 20 for younger students) and remove important pieces like edges, corners, or distinct parts. Give small groups of students the prepared piles of pieces but not the missing pieces or the box lid from the puzzle, and ask them to put the puzzle together. Discuss any challenges they are having with them while they are working. What problems are they facing? Discuss that some of their challenges are the same problems a paleontologist might face in trying to put together a skeleton. What sorts of things might help their process? In paleontology, scientists often compare the pieces they find with other animals (comparative biology). Give them the lids from the puzzles. Stop them again. What problems are they facing now? There are missing pieces! Talk about how this was certainly the case when *Hadrosaurus foulkii* was discovered and is still a challenge with new discoveries today!
- Fossils in the field
 - See attached “Going on a Dig” activity
- Measuring up
 - Joseph Leidy was very interested in how dinosaurs may have walked around. Prior to his investigations, many dinosaurs were depicted walking on all fours like a crocodile. Walk in Leidy’s shoes and investigate animal movement. Start with the

facts. Have the students look at the legs of all the animals they have at their disposal (family members, pets, or even looking up the facts online about animals they can't observe in person). What trends do they see? What observations can they make about these animals? Are all the legs the same size? Are the animals fast or slow? Practice walking on all fours (hands and feet). Is it harder than walking upright? Do you think it is this difficult for animals that typically walk on all fours? Why not?

Homework Assignments:

- Digging with Leidy
 - Talk with your students about Joseph Leidy. Ask them to think about an imaginary fossil dig with "the last man who knew everything." What would they talk to him about? What questions would they ask him? Where would they go? What would they find? Ask them to draw a picture of their adventures!

Interdisciplinary Activities

- Bony Macaroni
 - Explain that in just about all cases we don't find all the bones of the dinosaurs. Show them *Hadrosaurus foulkii* on the Academy's digital exhibit. <http://www.ansp.org/museum/leidy/paleo/hadrosaurus.php> Count how many bones we have found of "Haddy." Did we find its head? Talk about how Leidy described an entire animal even though he only had the few bones to look at. How do we draw pictures and make models of "Haddy" and other prehistoric animals even though so few bones have been found? Paleontologists look at other dinosaurs and living animals and make educated guesses about what the rest of the body would look like. Give small groups of students a mixture of different shaped pasta on their tables. Tell the students that this is their "dig." How would they start putting these "bones" together to make a dinosaur? Give them access to models and skeletons of all different kinds of animals from books and the internet and have them glue their creations to the paper plates. If they don't see a piece of pasta that they would need for a certain body part, allow them to draw it in. If school policies prevent the use of pasta, gather beads, pipe cleaners cut to different lengths, cut sponges, buttons, etc. to complete the activity.

Class Projects

- Tell Your Dinosaur Story
 - Create your own dinosaur exhibit. Decide as a class what you want people who visit your museum to learn. Do you want to stress the non-avian dinosaur/bird connection and the evolution of dinosaurs? Do you want to focus on American dinosaurs? Will you include any prehistoric "non-dinosaurs" like the *Plesiosaurus* or a pterodactyl? Visit the Academy's website to see which animals we included in our Dinosaur Hall at www.ansp.org. Then, create the exhibit in your classroom. Tell the stories you want to tell about the truly fascinating animals that used to (and in some cases still do!) inhabit our planet.

Resources for Students

- Practice your observation skills in this online spot-the-difference game: <http://www.spotthedifference.com/practice.asp>

- Eyewitness: Great Scientists by Jacqueline Fortey
- The Everything Kids' Easy Science Experiment Book: Explore the World of Science through Quick and Fun Experiments by J. Elizabeth Mills
- Discover just one of the stories of the Academy's very own *Hadrosaurus foulkii* in The Dinosaurs of Waterhouse Hawkins by Barbara Kerley
- Eyewitness: Dinosaurs by Dr. David Norman and Dr. Angela Milner
- Study one of a paleontologist's greatest treasures, the coprolite, in this online game. http://www.bbc.co.uk/sn/prehistoric_life/games/who_dung_it/
- Check out Dragonfly TV for a look at how two kids just like you investigate which animals lived with the dinosaurs: <http://pbskids.org/dragonflytv> Click on "Earth and Space" and then "Dinosaurs"
- The Time-Life Guides: Dinosaurs edited by Michael K. Brett- Surman
- Build a dinosaur at The Children's Museum of Indianapolis, but make sure it has all it needs to survive! http://www.childrensmuseum.org/games/grades_3-5.htm

Additional Resources for Educators

- Science is Simple: Over 250 Activities for Pre-Schoolers by Peggy Ashbrook
- Science Play: Beginning Discoveries for 2-to-6 Year Olds by Jill Frankel-Hauser
- The Everything Kids' Science Experiments Book: Boil Ice, Float Water, Measure Gravity- Challenge the World Around You! by Tom Robinson
- The website of The Academy of Natural Sciences includes wonderful information on the dinosaurs that can be found in our very own Dinosaur Hall: <http://www.ansp.org/museum/dinohall>
- For a quick reference guide to all things prehistoric, pick up a copy of Smithsonian Handbooks: Dinosaurs and Prehistoric Life by Hazel Richardson
- Additional dinosaur activities can be found in Janice Van Cleave's Dinosaurs for Every Kid.
- For some of the more probing questions about fossils, what happened to the dinosaurs, and the connections between dinosaurs and other animals, check out the University of California Museum of Paleontology at <http://www.ucmp.berkeley.edu/>.
- Shark tooth or belemnite fossils can be purchased from Two Guys Fossils at <http://www.twoguysfossils.com/>
- Last Child in the Woods by Richard Louv. This is a wonderful book for any educator who wants to bring nature back into the classroom.
- Janice Van Cleave's Animals: Mind-Boggling Experiments You Can Turn into Science Fair Projects- by Janice VanCleave
- How Nature Works (How It Works) by David Burnie

Standards:

AAS's Project 2061 Benchmarks

1. The Nature of Science: The Scientific Worldview
1. The Nature of Science: Scientific Inquiry
5. The Living Environment: Evolution of Life

Pennsylvania Academic Standards in Science and Technology

3.1.4

3.2.4

Pennsylvania Academic Standards in Environment and Ecology

4.7

New Jersey State Science Standards

5.1

5.4

Home is Where the Science is!

Parents:

Children are natural scientists, investigating their world and asking questions. As parents, it can be an enjoyable process to make discoveries with your child. **Science happens every day** in the kitchen, in the bathroom, and on the walk to school.

The class has been talking about what it takes to be a scientist. They made observations using their senses and recorded what they observed to share with fellow scientists. You can help your child practice these important skills.

Encourage them to use their **five senses** as you do any activity together. What do you feel, hear, see, taste, or smell? Cooking with your child can be a great and safe way to encourage your child to use multiple senses. And cooking (including measuring and temperature reading) is a scientific activity!

Observation is just the first step! When a child has observed a phenomenon, ask your child to make predictions based on those observations. Check to see if their predictions were correct. Extend the experience by making new observations and new predictions and checking your guesses.

Encourage **safe experiments**. An experiment goes beyond the observation and aims to answer a question. Experiments require one to predict what will happen next. Experiments do not need fancy lab equipment or dangerous chemicals. Some of the most interesting and naturally stimulating experiments involve the common objects children see every day just examined from a different angle.

One of the best ways to develop your children's curiosity about the world around them is to encourage them to investigate or discover answers on their own. Questions pave the way for great investigations, and investigations lead to discoveries. For instance, blowing bubbles with your child can end with surprising discoveries:

Child: Look at this bubble! it is so big!

Parent: Can you make a bubble of a different size? How could we make different types of bubbles? How many bubbles can you make with one dip in the bubble solution? Can you make a bubble that is not round? Why or why not? How could we find out what shapes we can make with bubbles?

Child: I see reds and blues in the bubble!

Parent: What other colors can you see? Do the colors remind you of anything you have seen before? (Perhaps a rainbow?) What if we add food coloring to the bubble mix! what color will the bubbles be if we add red? Blue?

There are many ways to encourage curiosity in your child.
Attached to this sheet are a few simple examples.
Don't be afraid to try new things and have fun together!

Musical Glasses

Materials:

8 Drinking Glasses of the same size and shape

Pitcher of Water

Metal Spoon

What to do:

On a flat surface, like a table, place same sized and shaped glasses near each other but not touching. Then fill each glass with a different amount of water. With your spoon, tap on each glass. Ask your child if they hear different sounds? Then, tap on different parts of each glass. Again, what do you hear? Play around with the amounts of water in each glass until you feel like you have all the notes in "Mary Had a Little Lamb." Even if you don't get the notes, it's fun to sing together with your child.

Tips:

Now it's time for you to experiment. Think of a question you want answered. Like, what would happen to the sound if you used glasses of different shapes? What if you used a liquid like milk? Make a prediction. Then, change one thing-that's the variable-and test it out.

Goop!

Materials:

Cornstarch, water, and a bowl

What to do:

This basic cornstarch and water material can provide hours of messy experimentation for you and your child. The basic recipe is **two parts cornstarch and one part water**. Always add the water slowly! You can always add more water if necessary, but if you add too much at the beginning, you end up with soup! Stir slowly. It takes a while to get the right consistency.

Mix the solution together in a large flat tub. When you are done with the goop, you can keep it in the refrigerator for a few days, but if kept too long it will mold. **DON'T** pour the solution down your drain as it will clog your pipes. Instead, allow the water to evaporate for a few days and pour the dry mixture into a trashcan.

Some things to try:

- slowly poke finger in goop
- quickly poke finger in goop
- slap your hand onto the goop as hard as you can. What happens?
- lay your hand gently on the surface of the goop. What happens?
- pour goop into a bag (Does it pour? Does it take the bag's shape?)
- roll the goop into a ball
- hit the goop with a hammer
- bounce the goop
- can you stretch the goop?

On a nice day, take the goop outside and experiment with it in a less messy situation.

Outside you can throw the goop up in the air. What happens when it is tossed? What happens when it lands on the ground?

Hug a Tree

Materials:

Crayons, tape, and paper

What to do:

Trees are an important part of our everyday lives. They are responsible for much of the oxygen we breathe on Earth. Teach your child how important it is that we conserve and protect these plants. Say thank you to a tree by giving it a hug. Yes, a hug. While you hug a tree, feel the bark. Is it rough, smooth, or bumpy? How does it smell? Ask your child questions like these to promote inquiry in your young child. You can also create beautiful bark rubbings by using blank paper, crayons, and tape. Tape a piece of paper to the area you've found. Rub the paper with a crayon to reveal the pattern of the bark under the paper.

Dinosaur Orchestra

Materials:

Paper tubes from wrapping paper
Empty containers made from plastic and cardboard
CDs of animal sounds— birds, frogs, elephants, lions, etc.

What to do:

What are some sounds that the children know that animals make? What sound does a lion make? A duck? A chicken? What about an elephant? Children are familiar with many of the sounds that animals make. Dinosaurs certainly made sounds too— especially as the living dinosaurs, the birds, are very vocal.

If you can, play some sounds of animals making different types of calls. Which ones do the children imagine sound most like the dinosaurs? Maybe *T. rex* roared like a lion. *Parasaurolophus* had such a long crest on its head that scientists think it used to make trumpet-like calls like an elephant. The large Sauropods might have been so heavy that they thundered across the land.

Have the student put together a musical dinosaur orchestra! Have them experiment with various materials to make a range of sounds that mimic the noises these extinct animals might have made.

Take a Hike

Materials:

None!

What to do:

Go on a nature walk with your child. While on your walk, use your senses to discover what's going on in our habitat. Discuss the sounds, smells, and sights of your neighborhood. Try a new fruit from a fruit vendor, or feel the bark of a tree. Talk about the different jobs that animals have in their habitats, and look for the smaller habitats of other living creatures in our area.

Going on a Dig

Your students will discover some of the more unusual items that can be helpful on a paleontological dig and figure out how to safely bring home the fruits of their labor: fossils.

Materials:

Paintbrush

Toothbrush

Sandwich bags

Aluminum foil

Toilet paper

Chisel

Hat

Gloves

Notebook

pencil

camera

ruler

measuring tape

water bottle

bag

paper

markers

crayons

Plaster-infused gauze

Small fossils to wrap in jackets

These can be purchased from online retailers such as those mentioned in the attached resources. You can also practice wrapping stones or fossils made from clay.

bowls

water

- Go on a pretend fossil dig
 - Tell the students that you're going to go on an imaginary fossil dig. What sorts of things should you bring? Place all the supplies (not including the gauze, paper, crayons, markers, bowls, water, and small fossils) on the table and have them one by one come up and place things they think they would need on a dig in the bag. (Everything on the table can be used on the dig. The brushes and chisel for removing sediment; sandwich bags for small pieces of fossil broken from larger specimens; aluminum foil and toilet paper to wrap delicate small fossils that don't make it into the jacket; the hat, water bottle, and gloves to protect the paleontologists from the elements; ruler and measuring tape to help more accurately record what they find; camera, notebook and pencils to record the details of the dig site)
 - Have the students make up a location to go fossil hunting. Will it be hot? Will the area they will be searching be under water in a stream bed? Will there be a lot of rain? Will it be close to where people live? Are there dangerous animals where they will be digging? Will the fossils they are hunting come from dinosaurs, plants, or other animals? Will they be big or small? Try to flesh out a real fossil dig.
 - How do these new details affect what they have to bring with them? Should they add anything else to their bags?

- Have the students draw a picture of themselves dressed for this dig and all the things they would need to bring with them.
- Create a fossil jacket
 - Talk to the students about what it would take to bring a fossil back safely. How might bringing the fossil to the lab safely change if the fossil is very big or very small? Reference the Academy's website for information about field jackets and transporting fossils. http://www.ansp.org/museum/dinohall/paleo_lab.php
 - Take them back to the classroom and give each camper a fossil, small piece of aluminum foil, and small lengths of plaster-infused gauze. Tell them that they need to stabilize and protect their fossil in order to get back into the lab. Allow them to dip the gauze in the water, shake of the excess, and wrap their fossil carefully in the aluminum foil and then in the moistened gauze. Make sure they are careful not to over-wet the gauze.
 - When the plaster dries, the students can take their field jackets home. With a parent's help, they can carefully remove the jackets and retrieve their fossils.

Joe on the Go: LiløLeidy

THE ACADEMY
OF NATURAL SCIENCES
of DREXEL UNIVERSITY



Instructions for Joe on the Go and Flickr:

1. Upload your Joe on the Go photos to your own Flickr account
2. Go to <http://www.flickr.com/groups/academyjoeonthego/>
3. Click the link to join the group
4. Click the link "Add Photos"
5. Select all of your Joe on the Go Photos (up to 6 at a time)
6. Click the "Add to Group" link