

SCHOOL LAUNCH · EXPLORE TRACKS

EXPLORE TRACKS · TRAIL E

The fifth trail of three interest tracks for curious Scouts: Animals (insects and small creatures), Dinosaurs (sea and sky reptiles, and the Ice Age) and Great Battles of the World Wars. Short, self-paced stops with true stories, great pictures, hands-on projects and games.

First edition

O LORD, how manifold are thy works! in wisdom hast thou made them all: the earth is full of thy riches.

Psalms 104:24 (KJV)

COURSE GUIDE

Explore Tracks are for children who want more of what they love. Each track is a trail of short stops. At every stop the child hears a true story, studies a great picture, does something with his or her hands, plays a game and adds a page to a Field Notebook.

Trail E is the fifth trail of each track at the  Scout level (ages 7–9). The Animals track gets down on hands and knees with the small creatures, from the ant of Proverbs 6:6 and the locusts of Exodus 10 to Jean-Henri Fabre, the patient insect watcher, and ends with a bug hotel to build. The Dinosaurs track goes to sea and sky with the ichthyosaurs, plesiosaurs, mosasaurs and pterosaurs (reptiles that lived alongside the dinosaurs but were not dinosaurs), then meets the woolly mammoths, saber-toothed cats and giant ground sloths of the Ice Age and the La Brea Tar Pits. The Great Battles track visits eight battles of the two World Wars, from the Marne (1914) to the Battle of the Bulge (1944–1945). Earlier trails are not required first.

WHO IT IS FOR

Written for children about ages 7–9 who are read to by a parent, or who read short passages on their own. Older siblings can join in. Nothing earlier is required.

HOW TO USE THIS COURSE

1. **One stop at a time.** A stop takes 15–25 minutes: read the story aloud, look at the picture, do the hands-on part and play the game. Two or three stops a week works well.
2. **Any order.** The tracks are independent. Do one track at a time, or rotate between them.
3. **Goes deeper in.** Each stop names the School Launch course that teaches the same topic in full (for example Life Science, Earth Science, Gardening & Animals, Geography or History), so a stop can lead straight into a lesson.
4. **Field Notebook.** Every stop ends with a page for the notebook. At the end of the trail the pages become a booklet, and the parent signs the Trail E certificate.
5. **Badge quizzes.** Each track has two short, optional oral quizzes. They are for fun, not grades.

SCOPE AND SEQUENCE

Track 1: Animals  **Trail E: Insects and Small Creatures** (Self-paced)

Track 2: Dinosaurs  **Trail E: Sea and Sky Reptiles, and the Ice Age** (Self-paced)

Track 3: Great Battles  **Trail E: The World Wars** (Self-paced)

MATERIALS

- **Field Notebook (a sketchbook or composition book)** One for the whole trail.

- **Colored pencils, a ruler, scissors and glue**For drawings and maps.
- **A magnifying glass and a clear jar with a lid**For looking closely at small creatures. Watch, then let them go where you found them.
- **Household things**Each hands-on project lists what it needs: blocks, clay, string, toy figures, cups, sticks, pinecones and cardboard tubes.
- **A Bible (KJV)**For the verse at each stop.

GRADING

Explore Tracks are not graded. A stop is done when the child has heard the story, done the hands-on part and made a notebook page.

Badges and the Trail E certificate are earned by finishing the stops.

A NOTE TO PARENTS

You do not need to be an expert. Read the story aloud, look at the picture together and ask, “What do you notice?” Each stop has a short *For families* note with background and any facts that scholars still discuss.

Small creatures: the Animals stops invite children to look closely at real insects and spiders. Each one has a safety line: look with eyes and a magnifying glass, do not handle bees, wasps or spiders, wash hands afterward, and let every creature go where it was found.

Dinosaur dates: museums give ages in millions of years for the sea and sky reptiles and in tens of thousands of years for the Ice Age. Stops where dates come up are marked ⌚ and include a short box: *What the sign says*, *What we observe* and *How Christians read it*. The trail teaches the period names as museum words and explains that the dates are interpretations; many Christian families understand the fossils within a young earth and the Flood, with the Ice Age coming after the Flood.

Battles are told for young children: who, where, the plan, what happened and why it mattered, with honor for courage, faith and wisdom and no gory detail. Casualties are given as numbers, and wounds and deaths are stated plainly but not described. Both sides are described fairly, in the terms of their own time. The World War II stops name the crimes of the Nazi regime plainly, in words suited to young children and without images; you may wish to preview those paragraphs.

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- 1.5 Beetles: So Many Kinds
- 1.6 Fireflies: Little Lights
- 1.7 Dragonflies: Champions of the Air
- 1.8 Locusts: The Eighth Plague (Exodus 10)
- 1.9 Fabre the Insect Watcher
- 1.10 Make a Bug Hotel

Track 2: Dinosaurs 🦖 Trail E: Sea and Sky Reptiles, and the Ice Age

- 2.1 Ichthyosaurs: The Fish Lizards
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Track 3: Great Battles ✂ Trail E: The World Wars

- 3.1 The Marne (1914): The Taxis of Paris
- 3.2 Sergeant York in the Argonne (1918)
- 3.3 Dunkirk (1940): The Little Ships
- 3.4 The Battle of Britain (1940)
- 3.5 Midway (1942): Code-Breaking and Four Carriers
- 3.6 El Alamein (1942)
- 3.7 D-Day (June 6, 1944)
- 3.8 The Battle of the Bulge (1944–1945): Bastogne and “Nuts!”

Each stop takes 15–25 minutes. Tracks may be done in any order, and a child may do just one track.

ANIMALS TRAIL E: INSECTS AND SMALL CREATURES

The fifth trail of the Animals track gets down on hands and knees to meet the small creatures: the ant of Proverbs 6, honeybees and their waggle dance, monarch butterflies and their journey to Mexico, spiders and their webs, beetles of every kind, fireflies, dragonflies, the locusts of Exodus 10, Jean-Henri Fabre the insect watcher, and a bug hotel to build at home. Each stop is a short read-aloud story, a picture to study, something to draw or build, quick questions, a game and a verse of Scripture.

This is the  **Scout** level, written for ages 7 to 9. A parent reads the story aloud, or a strong reader reads it alone. Every stop stands by itself, and most of the activities happen outdoors with a magnifying glass and a Field Notebook. Small creatures are watched gently and put back where they were found. The  **Ranger** and  **Expert** levels of these same stops will add diagrams, numbers and primary sources later.

Five stops earn the **Bug Scout badge, part 1**, and ten stops earn part 2 and the **Trail E certificate**. The badge quizzes are at the end of the trail and are optional.

BEFORE YOU BEGIN

- Listen to a story of about five minutes and tell it back.
- Sit still and quiet for five minutes while watching something small outdoors (a grown-up may help).

MASTERY CHECKLIST

- ☐ I can tell the difference between an insect (six legs, three body parts) and a spider (eight legs, two body parts).
- ☐ I can tell the four stages of a butterfly's life: egg, caterpillar, chrysalis and butterfly.
- ☐ I can tell one true and surprising fact about each creature on this trail.
- ☐ I can tell the story of the locusts in Exodus 10 and say what Proverbs 6:6 teaches.
- ☐ I can watch one small creature for ten minutes and draw and date it in my Field Notebook, as Fabre did.

OPTIONAL BOOKS AND RESOURCES

- **BugGuide (Iowa State University)** (<https://bugguide.net>): Free photo guide to the insects and spiders of North America; good for naming a creature you found.
- **Monarch Watch (University of Kansas)** (<https://monarchwatch.org>): Free pages on the monarch life cycle, migration and tagging, and on planting milkweed, for Stop E3.
- **Project Gutenberg** (<https://www.gutenberg.org>): Free old English translations of Jean-Henri Fabre's insect books, such as *The Life of the Spider* and *The Life of the Caterpillar*, to read aloud with Stop E9.

1.1 ANTS: “GO TO THE ANT”

OBJECTIVES

- Name the three body parts and six legs of an ant.
- Tell how ants in a colony work together without anyone giving orders.
- Say Proverbs 6:6 and tell what the ant teaches us.

Warm-up. Try to pick up a grown-up. Too heavy? Many ants can carry ten or more times their own weight. That would be like you carrying ten children on your back at once!

Video slot. Video coming. Ants at work: harvester ants storing seeds, leafcutter ants carrying leaves, an ant trail. Search approved channels (Smithsonian Channel, PBS Nature, BBC Earth, National Geographic Kids); preview first.

KEY TERMS

insect

A small animal with six legs and three body parts: head, thorax and abdomen.

colony

A big family of ants (or bees) that live and work together.

queen

The ant that lays all the eggs for the colony.

antenna

A feeler on an insect’s head used to smell, touch and taste. Two are called antennae.

CORE IDEAS

The story. One hot summer afternoon, a girl sat on the back steps eating a cookie. A crumb fell on the sidewalk. A few minutes later, one tiny black ant found it. The ant hurried away. Soon there was a whole line of ants marching to the crumb and back, each one carrying a bit of cookie home. How did they all know where to go?

Made for the job. An ant is an **insect**. It has six legs and three body parts: a head, a middle part called the thorax, and a back part called the abdomen. On its head are two bent **antennae**. Ants smell with their antennae. The first ant left a smell trail on the ground on its way home, and the other ants followed the smell to the crumb.

A big family. Ants live together in a **colony**, sometimes thousands in one nest. The **queen** lays the eggs. The worker ants dig tunnels, feed the babies, guard the door and gather food. The queen does not give orders! Each ant does its work, and the whole colony is fed.

Ants that store food. In the land of Israel live harvester ants. All summer they gather seeds and carry them into rooms under the ground. When winter comes, they have food saved up.

In the jungles of South America, leafcutter ants carry pieces of leaves home and use them to grow a garden of tiny mushrooms to eat.

“Go to the ant.” King Solomon watched ants too. He wrote to the lazy person, called a “slothead”: “Go to the ant, thou slothead; consider her ways, and be wise” (Proverbs 6:6). The ant has “no guide, overseer, or ruler,” yet it works hard and saves food for later. God made the little ant to be a lesson for us.

PICTURE STUDY



The Grasshopper and the Ants, from Aesop's Fables, Arthur Rackham, 1912 · Pen and ink drawing (printed in a book) · From Aesop's Fables, translated by V. S. Vernon Jones (London: Heinemann, 1912)
Wikimedia Commons · Public domain

Aesop told an old fable about a grasshopper who sang all summer while the ants worked. When winter came, the ants had food and the grasshopper had none. Arthur Rackham drew pictures for a book of Aesop's fables in 1912. His pictures are full of tiny, careful lines.

Look closely

- Find the grasshopper. Find the ants.
- What are the ants doing? What is the grasshopper doing?
- Look for clues that tell you what season it is.

Talk about it

1. How is this fable like what Solomon says in Proverbs 6:6–8?
2. What do you think the grasshopper should have done in the summer?

HANDS-ON: ANT WATCH PICNIC

Set out a tiny picnic for ants and watch how they find it, like the girl in the story.

You will need

- An index card or paper plate
- Three tiny crumbs of food: a bit of cookie, a bit of apple and a bit of bread
- A magnifying glass (if you have one)
- Your Field Notebook and a pencil

Steps

1. Put the three crumbs on the card, a little apart from each other.
2. Set the card outside near a crack in the sidewalk or the edge of a garden, where you have seen ants.
3. Check every five minutes for fifteen minutes. Which food did the ants find first? Do they come in a line?
4. Draw the card, the crumbs and the ant trail. Leave the ants in peace when you are done.

Check your work

- I watched for at least fifteen minutes.
- I can tell which food the ants liked best.
- I counted an ant's six legs (with the magnifying glass or in a picture).

FIELD NOTEBOOK

1. Draw a big ant. Label the head, thorax, abdomen, six legs and two antennae.
2. Copy Proverbs 6:6 in your best handwriting.

Did you know? All the worker ants in a colony are sisters, daughters of the same queen. Some queen ants live for many years. Ants are found almost everywhere on land except the coldest places, like Antarctica.

Goes deeper in. Life Science, Grade 3, Unit "Insects and Spiders" (coming soon); and Literature, for Aesop's fables.

For families. Harvester ants of the genus *Messor* live in Israel and store seeds in underground chambers, which fits Proverbs 6:8 ("gathereth her food in the harvest"). How much an ant can lift depends on the kind; "ten or more times its weight" is a safe figure. The Rackham drawing is from the 1912 Heinemann edition with an introduction by G. K. Chesterton; if you cannot find it, Milo Winter's picture of the same fable in *The Aesop for Children* (1919) works as well. Fire ants sting; choose a spot without fire-ant mounds for the project.

PRACTICE

1. **EASY** How many legs does an ant have?
2. **MEDIUM** How did the other ants find the cookie crumb?
3. **EASY** What does Solomon tell the sluggard to do?

Make it a game • Ant Trail. One player is the scout ant. The scout walks a winding path through the house or yard, dropping small paper squares as a “smell trail,” and hides a snack (the food) at the end. The other ants follow the trail, picking up every square, find the food and carry it back “home” together.

Scripture. “Go to the ant, thou sluggard; consider her ways, and be wise:” (Proverbs 6:6, KJV)

No one has to tell the ant to work. God made it a little teacher of hard work and of saving for later.

Practice: answers

1. Six.
2. They followed the smell trail the first ant left on the ground.
3. “Go to the ant” and watch how it works and saves food, and be wise.

1.2 HONEYBEES: SWEETER THAN HONEY

OBJECTIVES

- Name the three kinds of honeybees in a hive: queen, workers and drones.
- Tell how bees make honey and why their comb is built of six-sided cells.
- Describe the waggle dance a bee uses to show where flowers are.

Warm-up. Taste a drop of honey on a spoon. One worker bee makes only about one-twelfth of a teaspoon of honey in her whole life. It takes about twelve bees working all their lives to fill one teaspoon!

Video slot. Video coming. Honeybees in the hive: the waggle dance, building comb, gathering nectar and pollen. Search approved channels (PBS Nature, BBC Earth, Smithsonian Channel, a state university extension bee program); preview first.

KEY TERMS

hive

The home of a family of honeybees.

nectar

A sweet juice inside flowers. Bees turn it into honey.

pollen

A fine yellow powder made by flowers. Bees carry it from flower to flower, and it helps plants make fruit and seeds.

honeycomb

Rows of six-sided wax rooms, called cells, that bees build to hold honey, pollen and baby bees.

CORE IDEAS

The story. Early one morning, a worker bee flew home to her hive with her body full of sweet nectar and her back legs packed with yellow pollen. Inside, in the dark, she began to dance. She ran in a straight line, wiggling her body, then circled back and did it again. The other bees crowded close to feel her dance. Soon many of them flew off, straight to a field of clover she had found.

A hive family. A hive may hold tens of thousands of bees. There is one **queen**, who lays the eggs. The **workers** are her daughters: they clean, feed the babies, build comb, guard the door and gather food. The **drones** are the boy bees. Their one job is to mate with a new queen.

Making honey. A worker sips **nectar** with her long tongue and carries it home. Bees pass it from mouth to mouth and fan it with their wings until most of the water dries out. Then it is

honey! They store it in **honeycomb** made of wax from their own bodies. Each cell has six sides. Six-sided cells fit together with no space wasted.

The waggle dance. A scientist named Karl von Frisch watched bees for many years. He learned that the waggle dance is a map. The direction of the wiggly run tells which way to fly, compared with the sun. The longer the wiggle, the farther away the flowers are. He won a Nobel Prize for this work in 1973.

Sweeter than honey. As bees visit flowers, pollen sticks to their fuzzy bodies and rubs off on the next flower. This helps apples, cherries, pumpkins and many other foods grow. In the Bible, God promised Israel “a land flowing with milk and honey.” King David said God’s words are “sweeter also than honey and the honeycomb” (Psalm 19:10).

PICTURE STUDY



The Beekeepers, Pieter Bruegel the Elder, c. 1568 · Pen and brown ink on paper · Kupferstichkabinett (Museum of Prints and Drawings), Berlin
Wikimedia Commons · Public domain

Pieter Bruegel lived in what is now Belgium more than four hundred years ago. He liked to draw farmers at work. Here beekeepers are moving their beehives, which in those days were baskets woven of straw, called skeps.

Look closely

- Find the beekeepers’ faces. What are they wearing to keep from being stung?
- Find the straw beehives. How many can you count?
- Find the boy in the tree. What do you think he is doing?

Talk about it

1. Why would the artist hide the beekeepers' faces?
2. How is a straw skep different from a beehive today?

Safety first. Look at bees from a few steps away and move slowly; a bee that is not bothered rarely stings. Never poke a hive or nest. If anyone in the family is allergic to bee stings, keep their medicine close and stay well back.

HANDS-ON: WHY HEXAGONS?

Find out why bees build their cells with six sides.

You will need

- Paper and scissors (with a grown-up)
- A coin or bottle cap to trace circles
- The hexagon and square shapes a grown-up draws for you (all about the same size)
- Yellow and orange crayons

Steps

1. Trace and cut out six circles, six squares and six hexagons (six-sided shapes).
2. Push the circles together on the table. Are there gaps between them?
3. Now fit the hexagons together like a honeycomb. Are there gaps?
4. Color your hexagon comb yellow and glue it in your Field Notebook. Draw a bee on it.

Check your work

- I tested circles and hexagons.
- I can tell why bees use six-sided cells: they fit together with no gaps.
- I can name the queen, the workers and the drones.

FIELD NOTEBOOK

1. Draw a honeybee with pollen on its back legs. Label the head, wings, stinger and pollen.
2. Draw a picture of the waggle dance with arrows.

Did you know? A bee's wings beat about two hundred times every second; that makes the buzz. Worker bees in summer live only about six weeks. Honey keeps for a very long time without spoiling if it is sealed.

Goes deeper in. Gardening & Animals, for bees, pollination and keeping a hive; and Life Science, Grade 3, Unit "Insects and Spiders" (coming soon).

For families. The figure of about 1/12 teaspoon of honey per worker is widely used by bee scientists and extension programs. Karl von Frisch shared the 1973 Nobel Prize in

Physiology or Medicine with Konrad Lorenz and Nikolaas Tinbergen. “A land flowing with milk and honey” first appears in Exodus 3:8. Bruegel’s drawing (Berlin, KdZ 713) carries an old Dutch saying about the person who knows where the nest is and the one who robs it.

PRACTICE

1. **EASY** Which bee lays all the eggs in the hive?
2. **MEDIUM** What does the waggle dance tell the other bees?
3. **EASY** How many sides does a honeycomb cell have?

Make it a game • Waggle Dance. One player hides a paper flower in the room or yard while the others close their eyes. The “bee” comes back and may not talk or point. She can only waggle-walk in the direction of the flower, with a long wiggle for far away and a short wiggle for close. The others try to find the flower from the dance.

Scripture. “More to be desired are they than gold, yea, than much fine gold: sweeter also than honey and the honeycomb.” (Psalm 19:10, KJV)

David is talking about God’s words. Honey is the sweetest thing he knew, and God’s Word is sweeter still.

Practice: answers

1. The queen.
2. Which way to fly and how far to go to find the flowers.
3. Six.

1.3 MONARCH BUTTERFLIES: THE GREAT JOURNEY

OBJECTIVES

- Name the four stages of a butterfly's life: egg, caterpillar, chrysalis and butterfly.
- Tell why monarch caterpillars eat only milkweed.
- Describe the monarchs' long trip to the mountains of Mexico.

Warm-up. Lie on the floor and wiggle like a caterpillar. Now curl up tight and hold still: you are a chrysalis. Count to ten, then slowly stand and flap your arms like wings. You just did a butterfly's whole life!

Video slot. Video coming. Monarch butterfly life cycle (caterpillar to chrysalis to butterfly) and the monarchs wintering in Mexico. Search approved channels (U.S. Fish and Wildlife Service, National Park Service, Monarch Watch, PBS Nature); preview first.

KEY TERMS

metamorphosis

A big change in body shape as an animal grows up, like a caterpillar turning into a butterfly.

caterpillar

The young, worm-like stage of a butterfly or moth that hatches from the egg and eats leaves.

chrysalis

The hard case a caterpillar makes around itself while it changes into a butterfly (say "KRIS-uh-lis").

migration

A long trip that animals make at the same time each year to find food or a better place to live.

CORE IDEAS

The story. In August, a boy found a fat caterpillar with yellow, black and white stripes munching a milkweed leaf in the ditch by his house. He watched it every day. One morning it hung upside down in the shape of a J. By evening it had turned into a smooth green **chrysalis** with tiny gold dots. Two weeks later the case turned clear, and out climbed an orange and black monarch butterfly.

Four stages. A monarch's life has four parts: a tiny egg, a hungry **caterpillar**, a still chrysalis, and a butterfly with wings. This great change is called **metamorphosis**. Inside the chrysalis, the caterpillar's body is made over into a whole new shape. No one can watch it happen from the outside.

Milkweed only. Monarch caterpillars eat just one kind of plant: milkweed. Milkweed has a bitter juice that makes the caterpillars, and the butterflies they become, taste bad to birds. Their bright orange color is like a warning sign that says, “Don’t eat me!” A bird that tries one usually spits it out and leaves monarchs alone after that.

The great journey. In the fall, monarchs from the eastern United States and Canada fly south, some of them as far as 3,000 miles, to the same few mountains in Mexico. There they hang by the millions on fir trees all winter. In spring they fly north and lay eggs on milkweed. It takes their children, grandchildren and great-grandchildren to get all the way back north. For many years no one knew where they went. In 1975, two searchers, Ken Brugger and Catalina Aguado, found the trees covered with orange wings.

Made new. No one teaches a monarch the way to Mexico; God built that into it. And the change from caterpillar to butterfly is a picture the Bible uses for us. “If any man be in Christ, he is a new creature: old things are passed away; behold, all things are become new” (2 Corinthians 5:17).

PICTURE STUDY



Cassava with White Peacock Butterfly, Plate 4 of Metamorphosis insectorum Surinamensium, Maria Sibylla Merian, 1705 · Hand-colored engraving (from Merian’s watercolor) · From *Metamorphosis insectorum Surinamensium* (The Metamorphosis of the Insects of Suriname)
Wikimedia Commons · Public domain

Maria Sibylla Merian was a German artist who loved caterpillars. In 1699 she sailed all the way to Suriname in South America to paint insects. She was one of the first to show the egg, caterpillar, chrysalis and butterfly together on the very plant the caterpillar eats. This butterfly is not a monarch, but it changes in the same way.

Look closely

- Find the caterpillar. Find the chrysalis. Find the butterflies.
- What plant is the caterpillar eating?
- Find the little lizard. What do you think it is looking for?

Talk about it

1. Why do you think Merian painted the whole life cycle in one picture?
2. What would a picture of a monarch's life cycle need to show?

HANDS-ON: LIFE CYCLE WHEEL

Make a turning wheel that shows the four stages of a monarch's life.

You will need

- Two paper plates
- Crayons or markers
- A brass paper fastener
- Scissors (with a grown-up)

Steps

1. Draw two lines across the first plate to make four pie pieces. In each piece draw one stage: an egg on a milkweed leaf, a striped caterpillar, a green chrysalis with gold dots, and an orange monarch.
2. On the second plate, cut out one pie-piece window.
3. Put the window plate on top and push the fastener through the middle of both plates.
4. Turn the wheel and tell the story of the monarch in order.

Check your work

- My wheel shows all four stages in the right order.
- I can tell what monarch caterpillars eat (milkweed).
- I can tell where eastern monarchs go in winter (the mountains of Mexico).

FIELD NOTEBOOK

1. Draw a monarch butterfly with its wings open. Color the orange and black carefully and add the white dots on the edges.
2. Draw a map arrow from your home toward Mexico. Write: "Monarchs fly south in the fall."

Did you know? The monarchs that fly to Mexico live about eight months, much longer than their summer parents, who live only a few weeks. People put tiny round stickers on monarch wings to learn where they travel. Monarchs from west of the Rocky Mountains spend the winter on the coast of California instead.

Goes deeper in. Life Science, Grade 3, Unit “Insects and Spiders” (coming soon); Gardening & Animals, for planting milkweed and a butterfly garden; and Geography, for the route to Mexico.

For families. Canadian scientists Fred and Norah Urquhart spent decades tagging monarchs; Ken Brugger and Catalina Aguado located the overwintering colony in Michoacán, Mexico, on January 2, 1975, and the find was announced in *National Geographic* in August 1976. Milkweed contains cardenolides that make monarchs distasteful. Planting a native milkweed is good stewardship (Genesis 2:15); check a local native plant society for the right kind for your area. Merian’s plate shows the white peacock butterfly (*Anartia jatrophae*); monarchs do not appear in her 1705 book.

PRACTICE

1. **EASY** Put these in order: butterfly, egg, chrysalis, caterpillar.
2. **MEDIUM** Why do birds leave monarchs alone?
3. **EASY** Where do eastern monarchs spend the winter?

Make it a game • Find the Milkweed. A grown-up hides ten green paper leaves around the room or yard: five marked with an M for milkweed and five plain. The monarchs flutter around and may land and lay an “egg” (a dot) only on milkweed leaves. Whoever finds the most milkweed leaves without landing on a plain one wins.

Scripture. “Therefore if any man be in Christ, he is a new creature: old things are passed away; behold, all things are become new.” (2 Corinthians 5:17, KJV)

A caterpillar becomes a whole new creature with wings. God makes the people who trust in Christ new on the inside.

Practice: answers

1. Egg, caterpillar, chrysalis, butterfly.
2. Milkweed makes monarchs taste bad, and their orange color warns birds.
3. On fir trees in the mountains of Mexico.

1.4 SPIDERS: “IN KINGS’ PALACES”

OBJECTIVES

- Tell two ways a spider is different from an insect.
- Describe how an orb-weaver spider spins its web.
- Say Proverbs 30:28 and tell what it says about the spider.

Warm-up. Count your arms and legs together. Four! Now hold up eight fingers. A spider walks on eight legs. Try to crawl on the floor using both hands and both feet. Imagine needing to move eight legs in order!

Video slot. Video coming. An orb-weaver (garden) spider spinning its web, step by step. Search approved channels (BBC Earth, PBS Nature, Smithsonian Channel, National Geographic Kids); preview first.

KEY TERMS

arachnid

An animal with eight legs and two body parts, such as a spider (say “uh-RAK-nid”). Arachnids are not insects.

silk

The thin, strong thread a spider makes inside its body.

spinneret

A tiny spout at the back end of a spider where the silk comes out.

orb web

A round web with spokes like a wheel and a sticky spiral, spun by orb-weaver spiders.

CORE IDEAS

The story. On a cool, foggy morning, a boy walked out to feed the chickens. Between two fence posts hung a round web, shining with tiny drops of dew like a necklace of glass beads. In the very middle sat a big black and yellow garden spider, waiting. A fly buzzed too close and stuck fast. Quick as a wink, the spider ran down the threads to get her breakfast.

Not an insect. Spiders look like bugs, but they are not insects. A spider is an **arachnid**. It has eight legs, not six. It has two body parts, not three. It has no wings and no antennae. Most spiders have eight eyes, though many still cannot see very well. They feel the world through their legs.

Spinning the web. A spider makes **silk** inside its body and pulls it out through tiny spouts called **spinnerets**. To build an **orb web**, the spider first makes a bridge line, then spokes like a wagon wheel, then a sticky spiral going round and round. The spider knows which

threads are sticky and does not get caught. Many orb weavers eat their old web and spin a fresh one almost every day.

Garden helpers. Spiders eat flies, mosquitoes and bugs that harm plants, so they are a farmer's friends. Baby spiders, called spiderlings, can let out a long silk thread and float away on the breeze to find a new home. Spider silk is very strong for how thin it is, and scientists still study it.

Small but wise. Proverbs 30 names four little creatures that are "exceeding wise": the ant, the coney, the locust and the spider. "The spider taketh hold with her hands, and is in kings' palaces" (Proverbs 30:28). A tiny spider can climb into the grandest palace in the world. Being small does not stop God's creatures from doing great things.

PICTURE STUDY



Guava Branch with Spiders, Ants and a Hummingbird, Plate 18 of Metamorphosis insectorum Surinamensium, Maria Sibylla Merian, 1705 · Hand-colored engraving (from Merian's watercolor) · From *Metamorphosis insectorum Surinamensium* (The Metamorphosis of the Insects of Suriname); this copy is in the British Library, London
Wikimedia Commons · CC0

Maria Sibylla Merian painted this branch in Suriname, South America. It shows big hairy spiders, smaller spiders with webs, and ants marching along the branch. When Europeans saw it, many did not believe a spider could be so big. Today we know big hairy spiders like these really do live there.

Look closely

- Count the spiders. Which is the biggest?
- Find a web. Find the lines of ants.
- Count the legs on one spider. Are there eight?

Talk about it

1. Why do you think people in Europe were surprised by this picture?
2. How can you tell the spiders from the ants?

Safety first. Look at spiders, but do not touch them with bare hands. Most spiders are harmless, but black widow and brown recluse bites can make a person very sick. Let a grown-up check any spider before you get close.

HANDS-ON: WEB HUNT AND YARN WEB

Go looking for real webs, then spin one of your own.

You will need

- A spray bottle of water
- A paper plate with eight small notches cut around the edge (a grown-up helps)
- A long piece of yarn, with tape on one end
- Your Field Notebook

Steps

1. Early in the morning, look for webs in bushes, porches and fences. Gently mist a web with water to make it shine. Do not break it.
2. Draw the web you found. Is it round, messy or shaped like a funnel?
3. Now make an orb web: wrap the yarn across the plate through opposite notches to make spokes.
4. Then weave the yarn round and round from the middle out, over and under the spokes, like a sticky spiral.

Check your work

- I found and drew at least one real web.
- My yarn web has spokes and a spiral.
- I can tell two ways a spider is different from an insect.

FIELD NOTEBOOK

1. Draw a spider next to an ant. Label the spider's two body parts and eight legs and the ant's three body parts and six legs.
2. Copy Proverbs 30:28.

Did you know? Not all spiders spin webs. Jumping spiders hunt by leaping on their food, and they have very good eyes. Wolf spider mothers carry their babies on their backs. A spider is never stuck in its own web because it walks on the dry threads and has special feet.

Goes deeper in. Life Science, Grade 3, Unit “Insects and Spiders” (coming soon); and Art, for Maria Sibylla Merian.

For families. Merian’s plate also shows a tree spider over a hummingbird’s nest; the picture gave rise to the name “bird-eating spider,” though such spiders very seldom if ever catch birds. The plate is shown here for its spiders and ants; the alt text and questions keep to those. Proverbs 30:28 in some newer translations reads “lizard” instead of “spider,” because the Hebrew word is uncertain; the KJV reads “spider.” In North America, black widows and brown recluses are the spiders whose bites need a doctor.

PRACTICE

1. **EASY** How many legs does a spider have?
2. **MEDIUM** Name two ways a spider is different from an insect.
3. **EASY** Where does a spider’s silk come out?

Make it a game • Spider and Fly. Draw a big web on the driveway with chalk (or lay one out with string). One player is the spider in the middle. The flies must hop across the web from one side to the other, landing only on the lines. The spider may move only along the lines too. A fly who is tagged becomes the next spider.

Scripture. “The spider taketh hold with her hands, and is in kings’ palaces.” (Proverbs 30:28, KJV)

The spider is small, but it holds on and gets into a king’s house. God gives little creatures, and little children, their own kind of wisdom.

Practice: answers

1. Eight.
2. Any two: eight legs, not six; two body parts, not three; no wings; no antennae.
3. From its spinnerets, at the back end of its body.

1.5 BEETLES: SO MANY KINDS

OBJECTIVES

- Tell what makes a beetle a beetle: hard wing covers over its flying wings.
- Name three different beetles and one amazing thing about each.
- Say Genesis 1:25 and tell what God said about the creeping things.

Warm-up. Hold one hand flat. Cup your other hand over it like a shell. Now open the shell and wiggle the fingers underneath. That is how a beetle flies: it lifts its hard wing covers and unfolds thin wings from underneath!

Video slot. Video coming. Beetles for young viewers: a ladybug opening its wings, dung beetles rolling balls, stag beetles. Search approved channels (BBC Earth, Smithsonian Channel, PBS Nature, the Natural History Museum, London); preview first.

KEY TERMS

beetle

An insect with a pair of hard wing covers that close over its flying wings.

wing cover

A beetle's hard front wing that protects the soft flying wing underneath. Its science name is elytron (say "EL-ih-tron").

grub

A young beetle. It hatches from an egg and looks like a fat worm.

kind

A group of living things God made to bring forth young like themselves (Genesis 1).

CORE IDEAS

The story. A girl and her grandfather rolled back an old log at the edge of the woods. Underneath, the ground was cool and damp. A shiny black beetle scurried away. A brown one hid under a leaf. A tiny one with red spots climbed onto Grandpa's finger, lifted its red shell, unfolded two thin wings and flew away. Then they rolled the log gently back, so the beetles would have their home again.

Wearing armor. All of those were **beetles**. A beetle is an insect with six legs, but its two front wings are hard **wing covers** that meet in a straight line down its back. They protect the beetle like a suit of armor. Folded underneath are two thin wings for flying.

So many kinds. Scientists have named about 400,000 different beetles, more than any other group of animals on earth! About one out of every four animals people have named is a beetle. They come in green, gold, black, red and even rainbow colors. Some are smaller than the dot on this i, and some are as big as your hand.

Amazing beetles. The ladybug eats tiny plant-eating bugs called aphids, so gardeners love it. The dung beetle rolls a ball of animal droppings in a straight line, and scientists found it steers by the light of the Milky Way at night. The stag beetle has huge jaws like a deer's antlers. The bombardier beetle sprays a hot, popping mist at anything that tries to eat it.

Every creeping thing. On the sixth day, God made "every thing that creepeth upon the earth after his kind: and God saw that it was good" (Genesis 1:25). With so many beetles, God shows that He loves variety. He made each kind with care, even the ones only a beetle hunter will ever see.

PICTURE STUDY



Stag Beetle, Albrecht Dürer, 1505 · Watercolor and gouache on paper · J. Paul Getty Museum, Los Angeles
Wikimedia Commons · Public domain

Albrecht Dürer was a great German artist who loved to paint small things from nature, like a hare, a clump of grass and this beetle. He painted it so carefully that it looks as if it could walk off the page.

Look closely

- Find the big jaws. What do they look like?
- Count the legs. Find the antennae.
- Find the shadow under the beetle. How does it make the beetle look real?

Talk about it

1. Why do you think the stag beetle got its name? (A stag is a boy deer.)
2. Why would a great artist spend so much time painting one beetle?

HANDS-ON: BEETLE BOARD

Make a cool, dark hiding place and see which beetles come to stay.

You will need

- A flat board or a piece of old carpet about the size of a book
- A shady spot of bare ground or grass
- A magnifying glass
- Your Field Notebook

Steps

1. Lay the board flat on the ground in a shady spot. Water the ground a little first if it is dry.
2. Wait one or two days.
3. With a grown-up, lift the board slowly. Look quickly. How many beetles can you see? Look for other small creatures too.
4. Draw one beetle. Then put the board gently back.

Check your work

- I checked my beetle board at least once.
- I drew a beetle and counted its six legs.
- I put the board back gently so the animals could stay.

FIELD NOTEBOOK

1. Draw a beetle with its wing covers open and its thin flying wings spread. Label the wing covers, the flying wings, the six legs and the antennae.
2. Draw three different beetles: a ladybug, a dung beetle with its ball and a stag beetle.

Did you know? Fireflies are beetles too (Stop E6). The heaviest beetles, such as the Goliath beetle of Africa, can weigh about as much as a small apple. Some beetle grubs live inside wood for years before they grow up.

Goes deeper in. Life Science, Grade 3, Unit “Insects and Spiders” (coming soon); Gardening & Animals, for ladybugs and garden pests; and Art, for Albrecht Dürer.

For families. Roughly 400,000 beetle species have been described (estimates vary). The Milky Way navigation of dung beetles was reported by Marie Dacke and colleagues in *Current Biology* (2013). Dürer’s *Stag Beetle* (1505) is in the J. Paul Getty Museum. The bombardier beetle’s spray is near boiling hot; the stop does not suggest handling one.

PRACTICE

1. **EASY** What do a beetle’s hard wing covers protect?

2. **MEDIUM** Why do gardeners like ladybugs?
3. **EASY** What does the dung beetle use to steer at night?

Make it a game · Draw-a-Beetle Dice Game. Each player needs paper, a pencil and a turn with one die. Roll to draw a beetle: 6 = body (you need this first), 5 = head, 4 = a wing cover (2), 3 = a leg (6), 2 = an antenna (2), 1 = an eye (2). You need the head before eyes or antennae. If you roll a part you already have all of, pass the die. The first to finish a whole beetle calls out “Beetle!”

Scripture. “And God made the beast of the earth after his kind, and cattle after their kind, and every thing that creepeth upon the earth after his kind: and God saw that it was good.” (Genesis 1:25, KJV)

Every little beetle is one of the creeping things God made and called good.

Practice: answers

1. The thin flying wings folded underneath.
2. Ladybugs eat aphids, little bugs that harm plants.
3. The light of the Milky Way.

1.6 FIREFLIES: LITTLE LIGHTS

OBJECTIVES

- Tell why a firefly is really a beetle and not a fly.
- Explain that a firefly's light is "cold light" that stays cool.
- Describe how fireflies talk to each other with flashes.

Warm-up. Turn off the lights and hold a flashlight. Flash it two quick times, then wait. Flash it two quick times again. Fireflies talk in blinks like that, and each kind has its own pattern.

Video slot. Video coming. Fireflies flashing at night; the synchronous fireflies of the Great Smoky Mountains. Search approved channels (National Park Service, PBS Nature, Smithsonian Channel, National Geographic Kids); preview first.

KEY TERMS

firefly

A kind of beetle that makes light in the back part of its body. Some people call it a lightning bug.

bioluminescence

Light made by a living thing (say "BY-oh-loo-mih-NES-ens").

signal

A sign that sends a message, like a wave, a whistle or a flash of light.

larva

The young, worm-like stage of an insect. Firefly larvae glow too and are called glowworms.

CORE IDEAS

The story. On a warm June night in the Great Smoky Mountains of Tennessee, a family sat quietly in the dark woods. At first they saw a few little green-yellow lights blinking here and there. Then thousands of fireflies began to flash all together, on and off, on and off, so that the whole forest seemed to blink at once. Then all went dark, and a few seconds later it began again. No one said a word. It was too beautiful.

Not a fly at all. A **firefly** is not a fly. It is a beetle! It has hard wing covers like other beetles (Stop E5). Under its belly, near the end, is a light. Many people call fireflies lightning bugs. They come out on summer evenings in fields, yards and woods.

Cold light. A light bulb gets hot when it glows, and a candle burns. A firefly's light stays cool. Special stuff inside its body mixes with air and shines. Light made by a living thing is called **bioluminescence**. Almost all of the firefly's energy turns into light, not heat. People have never made a lamp that does it quite so well.

Talking in flashes. Fireflies use their lights as a **signal**. A firefly flying in the air flashes its own pattern: one long flash, or two quick ones, or a J-shaped swoop. Another firefly waiting in the grass answers back with the right flash, and they find each other. Each kind of firefly has its own code. Even the **larvae** glow; they are called glowworms.

Let your light shine. Jesus said, “Let your light so shine before men, that they may see your good works, and glorify your Father which is in heaven” (Matthew 5:16). A firefly does not keep its light hidden. When we do good and kind things, people can see them, and they can thank God.

PICTURE STUDY



Catching Fireflies, Kitagawa Utamaro, c. 1796–1797 · Color woodblock print · Cleveland Museum of Art
(other copies are in other museums)
Wikimedia Commons · CC0

In Japan long ago, families went out on summer evenings to watch and catch fireflies by the water. Kitagawa Utamaro made this print by carving pictures into wooden blocks, putting ink on them and pressing paper on top, one color at a time.

Look closely

- Find the stream. Find someone wading in the water.
- Find the little cage. What is inside it?
- Look for the fireflies. How did the artist show tiny lights?

Talk about it

1. How can you tell it is a summer evening?
2. How is this firefly evening like or unlike one in your own yard?

HANDS-ON: FIREFLY FLASH CODES

Use a flashlight to talk like a firefly, then watch real fireflies on a summer evening.

You will need

- Two flashlights
- Two index cards and a pencil
- A clear jar with air holes in the lid (for a real firefly, if it is summer)
- Your Field Notebook

Steps

1. Make up a firefly code on a card, such as two quick flashes, then wait. Give your partner a different card with the “answer” code.
2. In a dark room, the “flier” flashes the code while walking around. The “grass” firefly answers only when it sees the right code.
3. On a summer evening, sit outside at dusk and count real flashes. Are they long or short? Do they swoop?
4. If you catch a firefly, keep it only a short while, then let it go the same night.

Check your work

- I flashed a firefly code and got the right answer.
- I can tell why a firefly’s light is called cold light.
- I can tell that a firefly is a beetle.

FIELD NOTEBOOK

1. Draw a firefly. Color its glowing tail yellow-green. Label the wing covers, the six legs and the light.
2. Draw dots and dashes to show the flash pattern of a firefly you saw or imagined.

Did you know? There are about 2,000 kinds of fireflies in the world. Some fireflies can trick other kinds by copying their flash code. Fireflies need dark nights; bright yard lights can make it hard for them to see each other’s signals.

Goes deeper in. Life Science, Grade 3, Unit “Insects and Spiders” (coming soon); and Art, for Japanese woodblock prints.

For families. The synchronous fireflies of the Great Smoky Mountains are *Photinus carolinus*; they display for about two weeks in late May or June, chiefly near Elkmont, and the National Park Service manages viewing. Firefly light comes from a reaction of luciferin with the enzyme luciferase and oxygen. Utamaro’s print is dated c. 1796–97 by the Cleveland Museum of Art; the picture-study questions are written to fit any copy of the print. Turning off porch lights on summer nights is a simple kindness to fireflies.

PRACTICE

1. **EASY** Is a firefly a fly or a beetle?
2. **MEDIUM** Why is a firefly's light called cold light?
3. **EASY** Why do fireflies flash?

Make it a game • Firefly Find. Play in a dim room or at dusk. Each player picks a secret flash code with a flashlight, such as one long, two short or three quick. All the fireflies scatter and flash their codes. One player calls out a code, and must find and tag the firefly who flashes it. Then that firefly calls the next code.

Scripture. "Let your light so shine before men, that they may see your good works, and glorify your Father which is in heaven." (Matthew 5:16, KJV)

A firefly shines where everyone can see. Jesus wants our good works to shine so that people thank God.

Practice: answers

1. A beetle.
2. It stays cool; almost all the energy becomes light, not heat.
3. To send signals so they can find fireflies of their own kind.

1.7 DRAGONFLIES: CHAMPIONS OF THE AIR

OBJECTIVES

- Tell how a dragonfly's four wings let it hover and fly backward.
- Describe a dragonfly's big eyes and how it catches food in the air.
- Tell how a dragonfly begins its life under the water.

Warm-up. Stand up and try to run backward, then sideways, then stop still. Can you do it without wobbling? A dragonfly can fly forward, backward, sideways and up and down, and it can stop in the air in a moment!

Video slot. Video coming. Dragonflies in slow motion: hovering, catching insects; a nymph climbing out and the adult unfolding its wings. Search approved channels (BBC Earth, PBS Nature, Smithsonian Channel, National Wildlife Federation); preview first.

KEY TERMS

dragonfly

An insect with a long thin body, big eyes and four strong clear wings that hunts other insects in the air.

hover

To stay in one place in the air.

compound eye

An eye made of thousands of tiny eyes packed together.

nymph

The young dragonfly that lives under the water before it grows wings (say "nimf").

CORE IDEAS

The story. A boy sat on the end of a dock with his fishing pole. A bright blue dragonfly zipped past, stopped in the air right in front of his nose, hung there like a tiny helicopter, then shot off backward. Zip! It snatched a mosquito out of the air and landed on the tip of his fishing pole to eat it. "Thank you," said the boy. That was one less mosquito to bite him.

Four wings. A **dragonfly** has four long, clear wings, and it can move each one by itself. That lets it **hover**, turn quickly and even fly backward. Dragonflies are among the fastest insects. Some can fly faster than you can ride a bicycle.

Big eyes. Most of a dragonfly's head is eyes! Each one is a **compound eye** made of thousands of tiny eyes packed together, so it can see almost all the way around itself. It spots a fly, aims for where the fly is going, and catches it with its spiny legs held like a basket. One study found that dragonflies catch their food more than nine times out of ten.

Born under water. A dragonfly starts its life as an egg in a pond or stream. The young **nymph** has no wings. It lives under the water for months or even years, eating tadpoles and bugs. At last it climbs up a plant stem into the air. Its skin splits down the back, and out comes a dragonfly. It pumps up its crumpled wings, lets them dry in the sun, and flies away.

Manifold works. People who build helicopters and tiny flying machines have studied how dragonflies fly. The psalm says, “O LORD, how manifold are thy works! in wisdom hast thou made them all” (Psalm 104:24). “Manifold” means many and of many kinds. A dragonfly is one of God’s wise and wonderful works.

PICTURE STUDY



Dragonfly and Bellflower, Katsushika Hokusai, Late 1820s · Color woodblock print · The Metropolitan Museum of Art, New York
Wikimedia Commons · CC0

Katsushika Hokusai was a Japanese artist who drew all his long life. He is famous for a great wave, but he also made prints of flowers. In this one, a dragonfly flies over a patch of bellflowers.

Look closely

- Find the dragonfly. Count its wings.
- Look at the bellflowers. What shape are their petals?
- Is the dragonfly flying or resting? How can you tell?

Talk about it

1. Why do you think Hokusai put a dragonfly with the flowers?
2. What would you add if you made this picture?

HANDS-ON: CLOTHESPIN DRAGONFLY

Make a dragonfly with four wings that you can hold out to “hover.”

You will need

- A wooden clothespin
- Two pipe cleaners
- Waxed paper or clear plastic from a package
- Markers, scissors and glue (with a grown-up)

Steps

1. Color the clothespin bright blue or green. That is the long body.
2. Cut four long, thin wings from waxed paper. Draw veins on them with a marker.
3. Glue two wings on each side of the clothespin near the top, one pair a little in front of the other.
4. Wrap a pipe cleaner around the top for big eyes. Clip your dragonfly to a curtain or a plant to rest.

Check your work

- My dragonfly has four wings and big eyes.
- I can tell how a dragonfly can hover and fly backward.
- I can tell where a dragonfly nymph lives (under water).

FIELD NOTEBOOK

1. Draw the life of a dragonfly in three boxes: an egg in the water, a nymph on the pond bottom, and a dragonfly flying.
2. Draw a dragonfly from above. Label the four wings, the big eyes, the six legs and the long tail part (abdomen).

Did you know? A dragonfly nymph catches its food by shooting out a long lower lip with hooks on the end. Dragonflies do not sting or bite people. Damselflies are their thinner cousins; most damselflies fold their wings together over their backs when they rest, but dragonflies hold theirs out flat.

Goes deeper in. Life Science, Grade 3, Unit “Insects and Spiders” (coming soon); Earth Science, for ponds and streams; and Art, for Hokusai.

For families. The “more than nine times out of ten” figure comes from studies of dragonfly hunting success (commonly cited as about 90–95 percent). A dragonfly compound eye may hold up to about 30,000 facets (ommatidia). Speeds are hard to measure; the stop says only that some are faster than a bicycle. The Hokusai print is dated c. 1833–34 and is often called *Bellflower and Dragonfly*; museum titles vary slightly.

PRACTICE

1. **EASY** How many wings does a dragonfly have?
2. **MEDIUM** Why can a dragonfly see almost all the way around itself?
3. **EASY** Where does a young dragonfly (nymph) live?

Make it a game • Hover!. Everyone is a dragonfly zipping around the yard with arms out as wings. When the leader calls “Hover!”, freeze in place and buzz. When the leader calls “Backward!”, fly backward carefully. When the leader calls “Mosquito!”, try to tag the leader before reaching the safe tree. The first dragonfly to tag the leader becomes the next leader.

Scripture. “O LORD, how manifold are thy works! in wisdom hast thou made them all: the earth is full of thy riches.” (Psalm 104:24, KJV)

God made many, many kinds of creatures, and each one shows His wisdom, even a tiny dragonfly over a pond.

Practice: answers

1. Four.
2. Its huge compound eyes are made of thousands of tiny eyes and cover most of its head.
3. Under the water in a pond or stream.

1.8 LOCUSTS: THE EIGHTH PLAGUE (EXODUS 10)

OBJECTIVES

- Tell the story of the plague of locusts in Exodus 10.
- Explain what a locust is: a kind of grasshopper that gathers in huge swarms.
- Tell how the wind brought the locusts and took them away at God's command.

Warm-up. Stand at a line and jump forward as far as you can. Ask a grown-up to measure. A grasshopper can jump about twenty times the length of its own body. For you, that would be a jump longer than a school bus!

Video slot. Video coming. Grasshoppers and desert locusts: how a grasshopper jumps, and a locust swarm (for young viewers). Search approved channels (BBC Earth, Smithsonian Channel, National Geographic Kids, the UN Food and Agriculture Organization locust pages); preview first.

KEY TERMS

locust

A kind of grasshopper that, when there are very many, gathers in a huge flying crowd.

swarm

A huge crowd of insects moving together.

plague

A terrible trouble that spreads over a land. God sent ten plagues on Egypt.

Pharaoh

The title of the king of ancient Egypt.

CORE IDEAS

The story. Long ago, God's people, the Israelites, were slaves in Egypt. God sent Moses to tell Pharaoh, "Let my people go." Pharaoh said no, again and again. So God sent plagues on Egypt. Before the eighth plague, Moses warned Pharaoh: locusts are coming. Pharaoh still would not listen. Moses stretched out his rod over the land, and the LORD sent an east wind all that day and all that night. In the morning, the wind brought the locusts.

Not one green thing. The Bible says the locusts "covered the face of the whole earth, so that the land was darkened." They ate every plant and all the fruit the hail had left. Not one green leaf was left in the fields or on the trees in all Egypt. Then Pharaoh hurried to call Moses and said, "I have sinned." Moses prayed, and God turned "a mighty strong west wind," which carried every locust into the Red Sea (Exodus 10:19).

What is a locust? A **locust** is a kind of grasshopper. Most of the time locusts live alone, like other grasshoppers. But when there are many of them close together, they change color, get

hungry and restless, and fly off together in a giant **swarm**. A swarm can have millions and millions of locusts and eat as much food in a day as a whole city of people.

Locusts today. Desert locusts still swarm in parts of Africa and Asia, and farmers there watch for them. In the 1870s, great clouds of Rocky Mountain locusts landed on the farms of the American prairie. Pioneer families, like Laura Ingalls Wilder's, saw their wheat eaten in a day. That kind of locust is gone now; no one has seen a living one since 1902.

The wind obeys God. In Exodus 10, the locusts came when God sent the east wind and left when He sent the west wind. Insects, wind and kings are all under God's rule. Locusts are not only for plagues: John the Baptist ate "locusts and wild honey" in the wilderness (Matthew 3:4).

PICTURE STUDY



The Plague of Locusts, James Tissot, c. 1896–1902 · Gouache (thick watercolor) on board · The Jewish Museum, New York
Wikimedia Commons · Public domain

James Tissot was a French painter who spent the last years of his life painting the stories of the Bible. He traveled to the Holy Land to see the real places and people so his paintings would look true. This painting shows Exodus 10.

Look closely

- Look at the sky. What makes it look dark?
- Look at the land and the plants. What is happening to them?
- Look for people. How do you think they feel?

Talk about it

1. Which verse of Exodus 10 do you think Tissot was painting?
2. Why do you think Pharaoh changed his mind after the locusts came?

HANDS-ON: GRASSHOPPER LOOK AND LEAP

Look closely at a real grasshopper, then see how your jump compares.

You will need

- A clear jar or bug box with air holes and a few fresh leaves
- A magnifying glass
- A tape measure or a long piece of string
- Your Field Notebook

Steps

1. In late summer, look in tall grass for a grasshopper. Cup your hands gently to catch it and put it in the jar.
2. Look with the magnifying glass. Count its legs. Find the two big back legs for jumping. Find its antennae and wings.
3. Let it go where you found it. Draw it in your Field Notebook.
4. Measure your best jump with the string. Then lay out how far you would jump if you were a grasshopper: twenty of you lying head to toe!

Check your work

- I found the grasshopper's two big jumping legs.
- I let the grasshopper go where I found it.
- I can tell how a locust is different from a grasshopper living alone.

FIELD NOTEBOOK

1. Draw the eighth plague in two pictures: the east wind bringing the locusts, and the west wind carrying them into the Red Sea.
2. Draw a grasshopper. Label the big jumping legs, wings and antennae.

Did you know? God's law in Leviticus 11:22 said Israel could eat locusts and grasshoppers. People in some lands still eat them today, roasted or fried. A grasshopper "hears" with ears on the sides of its body, not on its head.

Goes deeper in. History, for Moses and ancient Egypt; Life Science, Grade 3, Unit "Insects and Spiders" (coming soon); and Literature, for the pioneer stories of Laura Ingalls Wilder.

For families. The story follows Exodus 10:1-20 (KJV); the quoted phrases are from verses 15-17 and 19. The locusts of Egypt were most likely the desert locust (*Schistocerca gregaria*), which changes from a solitary to a swarming form when

crowded. The Rocky Mountain locust swarms of 1874-1877 are well recorded; the last living specimen was collected in 1902. Wilder's *On the Banks of Plum Creek* (1937) tells of the grasshopper years in Minnesota; it is summarized here, not quoted. The plague is told plainly as God's judgment on Pharaoh's hard heart.

PRACTICE

1. **EASY** Which wind brought the locusts to Egypt?
2. **MEDIUM** Where did the west wind carry the locusts?
3. **EASY** What is a locust?

Make it a game • East Wind, West Wind. Mark one side of the yard "east" and the other "west." The players are locusts, crouched in the middle like grasshoppers. When the leader calls "East wind!", the locusts hop to the east side. When the leader calls "West wind!", they hop to the west side and sit down quietly in the "Red Sea." If the leader calls "Pharaoh says!", nobody moves. Anyone who moves sits out one turn.

Scripture. "And the LORD turned a mighty strong west wind, which took away the locusts, and cast them into the Red sea; there remained not one locust in all the coasts of Egypt." (Exodus 10:19, KJV)

God sent the locusts, and God took every one of them away. The wind and the smallest creatures obey Him.

Practice: answers

1. An east wind.
2. Into the Red Sea. Not one locust was left in Egypt.
3. A kind of grasshopper that gathers in huge swarms when there are very many.

1.9 FABRE THE INSECT WATCHER

OBJECTIVES

- Tell the story of Jean-Henri Fabre, who spent his life watching insects.
- Describe Fabre's experiment with the marching caterpillars.
- Practice watching one small creature patiently, as Fabre did.

Warm-up. Set a timer for two minutes. Sit very still and watch something outside the window: a bird, a leaf, a bug. Do not talk! When the timer rings, tell one thing you saw that you would have missed if you had only glanced.

Video slot. Video coming. Jean-Henri Fabre and his garden (the Harmas) at Sérignan, France; processionary caterpillars marching in a line. Search approved channels (Smithsonian Channel, BBC Earth, the Muséum national d'Histoire naturelle); preview first.

KEY TERMS

entomologist

A scientist who studies insects (say “en-tuh-MOL-uh-jist”).

observe

To watch something carefully and notice what is really there.

experiment

A careful test to find out what will happen.

instinct

Something an animal knows how to do without being taught, because God made it that way.

CORE IDEAS

The story. Two hundred years ago, in the hills of southern France, a little boy named Jean-Henri Fabre was sent to live with his grandparents on their farm. His family was poor, and he had no toys. But he had eyes! He watched beetles, bees and grasshoppers for hours. One evening he heard a little song in the bushes and crept up, again and again, until he found the singer: a grasshopper.

A teacher who kept learning. Fabre was born in 1823. He grew up to be a schoolteacher. He had little money, but he taught himself from books and saved up to buy more. Wherever he lived, he watched insects. He wanted to know not just what they looked like, but what they did and why.

The Harmas. When Fabre was 55 years old, he bought a house with a stony, weedy field in the village of Sérignan. He called the field the Harmas, an old word for wasteland. He let the

thistles and wildflowers grow, and the insects came. He watched them there for more than thirty years, until he died in 1915, at 91.

The marching caterpillars. Pine processionary caterpillars travel nose to tail in a line, each one following the silk thread of the one ahead. One day a line of them crawled up onto the rim of a big flowerpot and made a circle, with no leader at all. Fabre watched. Around and around they went, for seven days, before they finally broke free! He learned that their **instinct** was to follow, even when it led nowhere.

Books full of stories. Fabre wrote ten books about what he saw. He wrote them like stories, so that children and grown-ups loved to read them. People called him “the Homer of insects,” after the great storyteller of Greece. The Bible says, “It is the glory of God to conceal a thing: but the honour of kings is to search out a matter” (Proverbs 25:2). Fabre spent his life searching out God’s hidden wonders.

PICTURE STUDY



Portrait of Jean-Henri Fabre, Unknown photographer, Early 1900s · Black-and-white photograph · Wikimedia Commons (from a printed source)
Wikimedia Commons · Public domain

This photograph shows Jean-Henri Fabre when he was old and famous. By then people came from far away to visit the insect watcher of Sérignan, but he still spent his days in his weedy garden.

Look closely

- Look at his face. Is he young or old? How can you tell?
- What is he wearing?
- Look at his eyes. What kind of man do you think he was?

Talk about it

1. What would you ask Fabre if you could meet him?
2. Why might a person who watches insects need to be patient?

HANDS-ON: FABRE'S TEN MINUTES

Be an insect watcher like Fabre: pick one small creature and watch it for ten whole minutes.

You will need

- A timer
- A magnifying glass (if you have one)
- Your Field Notebook and a pencil
- A spot outside where you can sit: a garden, a flower bed or a patch of weeds

Steps

1. Sit quietly and look until you find one small creature: an ant, a bee on a flower, a beetle, a caterpillar or a spider.
2. Set the timer for ten minutes. Watch only that one creature. Do not touch it.
3. Write or tell a grown-up three things it did. Where did it go? What did it eat or carry?
4. Draw it, and write the date, the time and the place at the top of the page, as a real scientist does.

Check your work

- I watched one creature for ten minutes.
- I wrote down three things it did.
- My page has a drawing, a date and a place.

FIELD NOTEBOOK

1. Draw a circle of marching caterpillars around the rim of a flowerpot.
2. Copy Proverbs 25:2.

Did you know? Fabre also wrote science schoolbooks, and he loved plants and mushrooms as well as insects. His house and garden at Sérignan, the Harmas, are still kept and can be visited today. Fabre found that the caterpillars in the flowerpot went around the rim hundreds of times.

Goes deeper in. Life Science, Grade 3, Unit “Insects and Spiders” (coming soon); History, for France in the 1800s; and Literature, for Fabre’s own insect stories.

For families. Jean-Henri Fabre (1823–1915) was born in Saint-Léons, Aveyron, bought the Harmas at Sérignan-du-Comtat in 1879 and published the ten volumes of *Souvenirs entomologiques* between 1879 and 1907. The processionary-caterpillar circle happened in

January 1896; Fabre counted about seven days and some 335 trips around the rim. The nickname “Homer of insects” is often credited to Victor Hugo, but historians doubt that, so the stop says only “people called him.” Fabre did not accept Darwin’s theory and wrote with wonder about instinct; a line often quoted, “I do not believe in God; I see Him,” is widely attributed to him but its source is uncertain, so it is not used here. Older English translations of Fabre (e.g., by Alexander Teixeira de Mattos) are free on Project Gutenberg.

PRACTICE

1. **EASY** What did Fabre spend his life watching?
2. **MEDIUM** What happened when the caterpillars made a circle on the flowerpot?
3. **EASY** What did Fabre call his weedy field?

Make it a game · Fabre’s Eye. A grown-up sets ten small things on a tray: a leaf, a pebble, a button, a feather and so on. Players look for one minute. Then the tray is covered and one thing is taken away. Who can tell what is missing? Take turns hiding things. Good watchers, like Fabre, notice small changes.

Scripture. “It is the glory of God to conceal a thing: but the honour of kings is to search out a matter.” (Proverbs 25:2, KJV)

God hides wonders in His creation, and it is a good and honorable thing to search them out, as Fabre did.

Practice: answers

1. Insects.
2. They kept following each other around and around for seven days.
3. The Harmas.

1.10 MAKE A BUG HOTEL

OBJECTIVES

- Build a simple bug hotel from sticks, stems, pinecones and bark.
- Name three small creatures that might move in and how each helps the garden.
- Tell how caring for little creatures is part of keeping God’s garden (Genesis 2:15).

Warm-up. Pretend you are a tiny ladybug and winter is coming. Look around the room. Where would you hide to stay safe and dry? Under a cushion? In a crack? Bugs need hiding places too, and today you will build them one.

Video slot. Video coming. How to build a bug hotel (insect hotel) for children; mason bees nesting in hollow stems. Search approved channels (Royal Horticultural Society, the Xerces Society, National Wildlife Federation, a state university extension program); preview first.

KEY TERMS

habitat

The place where an animal lives and finds food, water and shelter.

shelter

A safe place to hide from cold, rain and hungry animals.

pollinator

An animal, such as a bee or butterfly, that carries pollen from flower to flower so plants can make fruit and seeds.

mason bee

A gentle bee that lives alone, not in a hive, and builds its nest in small holes, sealing it with mud.

CORE IDEAS

The story. One fall afternoon, a family built a little wooden box and filled it with bundles of hollow stems, pinecones, bark and sticks. They hung it on the garden fence and called it the Bug Hotel. All winter, nothing seemed to happen. But in the spring, the children saw something wonderful. A small blue-black bee was flying in and out of a hollow stem. A few days later, the end of the stem was plugged with mud. A mother mason bee had moved in!

Who checks in? A bug hotel gives little creatures **shelter**. **Mason bees** lay their eggs in hollow stems about as thick as a pencil. Ladybugs hide between pinecones in winter. Beetles crawl under the bark, and spiders spin webs in the corners. Pill bugs, also called roly-polies, curl up in damp leaves at the bottom.

Good guests. The guests in a bug hotel pay their rent by helping the garden. Mason bees are **pollinators**; they help apple and cherry trees make fruit. Ladybugs eat aphids that hurt plants. Beetles and spiders eat other pests. Pill bugs help turn dead leaves back into rich soil.

Keeping the garden. When God made the first man, He “put him into the garden of Eden to dress it and to keep it” (Genesis 2:15). To dress a garden is to work it; to keep it is to care for it. Building a **habitat** for small creatures is one way we can keep the part of God’s world He has given us, even if it is only a backyard.

Hotel keepers. A good hotel keeper checks on the guests. Look at your bug hotel each week, quietly and without poking. Write down who you see in your Field Notebook. By the end of a year, you may have a whole list of tiny neighbors you never knew you had.

PICTURE STUDY



Study of Butterfly and Insects, Jan van Kessel the Elder, c. 1655 · Oil on copper · National Gallery of Art, Washington, D.C.

Wikimedia Commons · Public domain

Jan van Kessel lived in Antwerp, a city in what is now Belgium, about 370 years ago. He painted tiny pictures of insects on thin sheets of copper, so small and careful that each one looks almost real. This little painting is only about as big as a postcard.

Look closely

- Count the insects. How many different kinds can you find?
- Find the butterfly. Find the moths.
- Look at the shadows under the insects. Which way is the light coming from?

Talk about it

1. Which of these insects might move into your bug hotel?
2. Why do you think people liked to hang little paintings of insects in their homes?

Safety first. A grown-up does any cutting with saws, pruners or a drill. Wear gloves when gathering sticks and bark, and wash your hands afterward. Hang the hotel away from doors and play areas, and do not poke inside it.

HANDS-ON: BUILD A BUG HOTEL

Build a small hotel for the creatures of your garden and check on it all year.

You will need

- A clean, empty can (with no sharp edges), a milk carton with the top cut off, or a small wooden box
- Hollow stems or bamboo cut to fit (a grown-up cuts them), about as thick as a pencil
- Pinecones, small sticks, pieces of bark and dry leaves
- String or wire for hanging

Steps

1. Pack the hollow stems tightly into the can or box so they point out the open end. Leave one end of each stem closed if you can.
2. Fill the gaps with pinecones, sticks and bark. Pack everything tight so nothing falls out.
3. Hang or set the hotel in a sunny, sheltered spot about as high as your waist, with the open side facing away from the rain (south or east is best).
4. Check it every week. Draw any guests you see in your Field Notebook.

Check your work

- My bug hotel has hollow stems, pinecones and bark.
- It is hung in a sheltered spot, out of the rain.
- I can name three guests and how each helps the garden.

FIELD NOTEBOOK

1. Draw your bug hotel. Label each part: stems, pinecones, bark and leaves.
2. Start a guest list: write the date and draw each creature you see at the hotel.

Did you know? Most bees do not live in hives. Many kinds, like mason bees, live alone, and they very seldom sting. Pill bugs are not insects; they have fourteen legs and are cousins of crabs and shrimp. A pile of dead leaves left under a bush is a free bug hotel too.

Goes deeper in. Gardening & Animals, for pollinators and a wildlife-friendly garden; and Life Science, Grade 3, Unit “Insects and Spiders” (coming soon).

For families. Mason bees (genus *Osmia*) prefer holes about 5/16 inch (8 mm) across and 5 to 6 inches deep. Replace or clean nesting stems every year or two to keep mites and mold down. Wasps may also nest in a bug hotel; they are part of the garden too, but keep the hotel away from doors. The stop teaches stewardship (Genesis 2:15), not alarm. The Van Kessel painting is in the National Gallery of Art (gift of John Dimick); its public-domain image can be downloaded from the gallery's website.

PRACTICE

1. **EASY** Which bee might lay its eggs in a hollow stem in your bug hotel?
2. **MEDIUM** Name one bug hotel guest and how it helps the garden.
3. **EASY** What two jobs did God give Adam in the garden?

Make it a game · Who Lives Here?. A grown-up makes two sets of cards: one with guests (mason bee, ladybug, beetle, spider, pill bug) and one with rooms (hollow stem, pinecone, under the bark, web corner, damp leaves). Lay all the cards face down. Take turns turning over two cards. If the guest matches its room, keep the pair and tell how that guest helps the garden.

Scripture. “And the LORD God took the man, and put him into the garden of Eden to dress it and to keep it.” (Genesis 2:15, KJV)

From the very beginning, God gave people the job of caring for His world. A bug hotel is a small way to keep the garden.

Practice: answers

1. A mason bee.
2. Any one: mason bee, pollinates fruit trees; ladybug, eats aphids; beetle or spider, eats pests; pill bug, turns dead leaves into soil.
3. To dress it (work it) and to keep it (care for it).

TRACK 1 BADGE QUIZZES

The badge quizzes are optional. Read each question aloud; the child may answer by talking, pointing or drawing. Four right out of five earns the badge. Badges and the certificate are earned by doing the stops, not by scores.

Badge quiz 1 (Stops 1–5)

1. What does Proverbs 6:6 tell the sluggard to do?
2. What does a honeybee's waggle dance tell the other bees?
3. What is the only plant monarch caterpillars eat?
4. How many legs does a spider have, and is it an insect?
5. What do a beetle's hard wing covers protect?

Badge quiz 2 (Stops 6–10)

6. Why do fireflies flash their lights?
7. Where does a young dragonfly live before it has wings?
8. In Exodus 10, how did God take the locusts away?
9. What did Fabre's marching caterpillars do on the rim of the flowerpot?
10. Name one guest that might live in a bug hotel and how it helps the garden.

TRAIL CERTIFICATE: MY BUG FIELD NOTEBOOK AND TRAIL E CERTIFICATE

Gather the Field Notebook pages from this trail into one booklet with a cover: "My Bug Field Notebook," your name and the dates you started and finished. Put your bug hotel guest list from Stop E10 at the back, and keep adding to it.

Add one "Fabre's Ten Minutes" page from Stop E9 with a drawing, a date and a place.

When the booklet is done, a parent signs the Trail E certificate.

- **Ten stops:** At least one page for each stop, each with a title and a date.
- **Insect or spider?:** One labeled drawing shows an insect's six legs and three body parts beside a spider's eight legs and two body parts.
- **Observation:** At least one drawing made from a real creature the child watched outdoors, with the date and place.
- **Care:** Drawings are labeled and done carefully, and creatures were watched gently and returned.

Answer key

1. "Go to the ant" and watch its ways and be wise: work hard and save for later.
2. Which way to fly and how far to go to find flowers.
3. Milkweed.
4. Eight legs. No, it is an arachnid, not an insect.
5. The thin flying wings folded underneath.

6. To send signals so they can find fireflies of their own kind.
7. Under the water in a pond or stream.
8. He sent a mighty strong west wind that carried them into the Red Sea.
9. They followed each other around and around in a circle for seven days.
10. Any one: mason bee, pollinates fruit trees; ladybug, eats aphids; beetle or spider, eats pests; pill bug, turns dead leaves into soil.

DINOSAURS TRAIL E: SEA AND SKY REPTILES, AND THE ICE AGE

The fifth trail of the Dinosaurs track visits the creatures that lived alongside the dinosaurs and the giants that came after them. It starts in the sea with ichthyosaurs, plesiosaurs and mosasaurs, rises into the sky with the pterosaurs and the giant Quetzalcoatlus, and then goes to the Ice Age with woolly mammoths, saber-toothed cats, giant ground sloths and the La Brea Tar Pits. It ends with the child building a museum display of their own. None of these animals is a dinosaur, but every museum dinosaur hall has them. Each stop is a short read-aloud story, a picture to study, something to draw or build, quick questions, a game and Scripture.

This is the  **Scout** level, for ages 7 to 9. A parent reads the story aloud, or a strong reader reads it alone, and every stop stands by itself. The track is creation-friendly: God filled the seas and the sky on the fifth day and made the land animals on the sixth (Genesis 1:20–25). Many Christians read the Ice Age as coming in the centuries after Noah’s Flood. Words such as **Jurassic**, **Cretaceous** and **Ice Age** are taught as museum words, and dates on museum signs are called what they are: interpretations. Stops E3, E6, E9 and E10 have the  box: *What the sign says / What we observe / How Christians read it.*

Stops 1 to 5 earn the **Sea and Sky badge**, and Stops 6 to 10 earn the **Ice Age badge** and the **Trail E certificate**. The badge quizzes are at the end of the trail and are optional.

BEFORE YOU BEGIN

- Listen to a story of about five minutes and tell it back.
- Know what a fossil is and the days of creation in Genesis 1 (Trails A and D help but are not required).

MASTERY CHECKLIST

- ☐ I can tell an ichthyosaur, a plesiosaur and a mosasaur apart by their shapes.
- ☐ I can tell how a pterosaur’s wing was made and how it was different from a bird’s or a bat’s.
- ☐ I can name three Ice Age animals and one true fact about each.
- ☐ I can tell how the La Brea Tar Pits trapped animals and kept their bones.
- ☐ I can read a museum sign and tell what we observe from what people think.

OPTIONAL BOOKS AND RESOURCES

- **La Brea Tar Pits and Museum** (<https://tarpits.org>): Free photos, videos and fossil pages about the tar pits, Smilodon, dire wolves and mammoths; for Stops E7 and E9.
- **Oceans of Kansas Paleontology** (<https://oceansofkansas.com>): A free site with photos and history of mosasaurs, plesiosaurs and Pteranodon from the Kansas chalk; for Stops

E2 to E4. A grown-up should pick the pages.

- **Big Bend National Park (National Park Service)** (<https://www.nps.gov/bibe>): Pages on the fossils of Big Bend, including Quetzalcoatlus; for Stop E5.
- **Biodiversity Heritage Library** (<https://www.biodiversitylibrary.org>): Old books and plates by Conybeare, Faujas de Saint-Fond, Cuvier and Figuier to look at and copy in the Field Notebook.

2.1 ICHTHYOSAURS: THE FISH LIZARDS

OBJECTIVES

- Tell how an ichthyosaur was shaped like a dolphin but was really a reptile that breathed air.
- Name two surprising things about ichthyosaurs: their huge eyes and their live-born babies.
- Say Genesis 1:21 and tell what God made on the fifth day.

Warm-up. Make a circle with your two hands, as big as a dinner plate. Some ichthyosaurs had eyes about that big, among the biggest eyes of any animal ever found!

Video slot. Video coming. Ichthyosaurs for children: the “fish lizard,” its big eyes and live birth; Mary Anning’s ichthyosaur at the Natural History Museum, London. Search approved channels (Natural History Museum London, Smithsonian, PBS Eons with preview); preview first.

KEY TERMS

ichthyosaur

A sea reptile shaped like a dolphin (say “IK-thee-oh-sor”). The name means “fish lizard.”

reptile

An animal with a backbone that breathes air and is usually covered with scales, such as a lizard, turtle or crocodile.

flipper

A wide, flat limb used for swimming, like a sea turtle’s or a dolphin’s.

marine reptile

A reptile that lives in the sea. “Marine” means “of the sea.”

CORE IDEAS

The story. Far out in a deep, dim sea, a sleek shape glides through the water. It looks like a dolphin, with a pointed snout, a fin on its back and a tall tail. It swishes its tail and shoots upward. At the top it lifts its nose out of the water and takes a breath of air. Then it dives again, its enormous eyes searching the dark water for a squid.

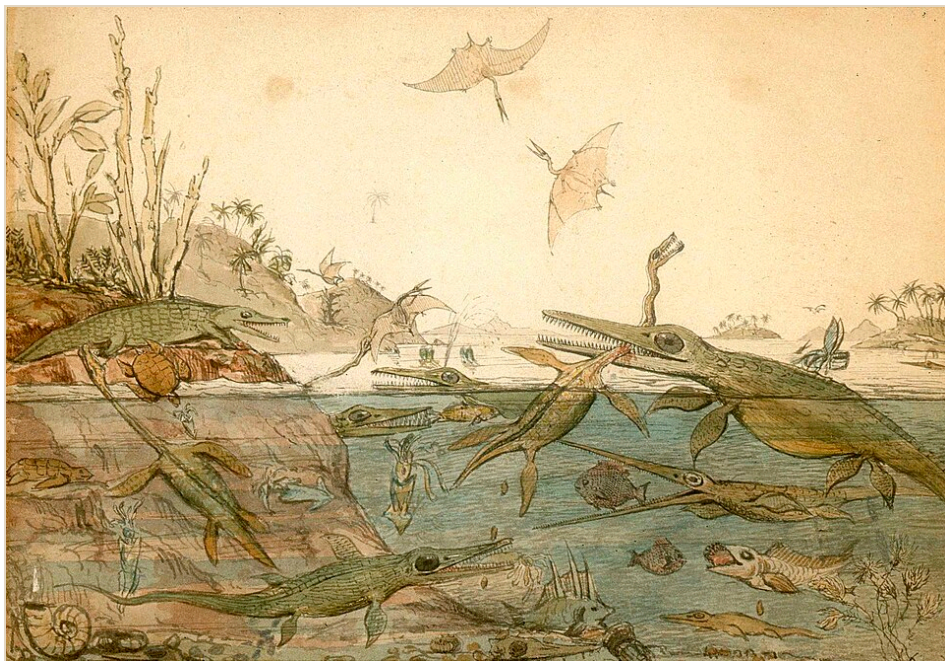
Fish lizard. This animal is an **ichthyosaur** (say “IK-thee-oh-sor”). The name means “fish lizard,” because it was shaped like a fish but had the bones of a **reptile**. It steered with four **flippers** and pushed itself along with its tail, which stood up and down like a shark’s tail. Its long jaws were full of sharp, cone-shaped teeth, just right for grabbing slippery fish and squid.

Eyes like dinner plates. Ichthyosaurs had some of the biggest eyes of any animal ever found. One kind had eyes about 10 inches across, as wide as a dinner plate! A ring of thin bones inside each eye helped it keep its shape. Big eyes gather a lot of light, so ichthyosaurs could probably see well deep down where the water is dark.

Babies born in the sea. An ichthyosaur could not crawl up a beach to lay eggs. Its flippers were made for swimming, not walking. So how did it have babies? Fossils from Germany answer the question: some show a mother with little ones still inside her, and one even seems to show a baby being born. Ichthyosaurs gave birth to live babies right in the water, the way dolphins and whales do.

Made on the fifth day. Genesis tells us that on the fifth day God filled the waters with living creatures, great and small (Genesis 1:21). Ichthyosaur fossils have been found all over the world, from England and Germany to Nevada and China. Museum signs often call the rocks they come from **Jurassic**, a museum word for one set of rock layers. Wherever they are found, they show a Maker who designed a reptile to live its whole life in the sea.

PICTURE STUDY



Duria Antiquior (A More Ancient Dorset), Henry De la Beche, 1830 · Watercolor (later printed as a lithograph) · Amgueddfa Cymru – Museum Wales, Cardiff
Wikimedia Commons · Public domain

Henry De la Beche was a geologist and a friend of Mary Anning. In 1830 he painted this picture of the sea near Lyme Regis as he imagined it long ago. It was one of the first pictures ever made to show fossil animals alive. Prints of it were sold to raise money to help Mary Anning and her family.

Look closely

- Find an ichthyosaur. Look for its long jaws and its big round eye.
- Find a reptile with a very long neck. That is a plesiosaur (Stop E2).
- Look up at the sky. What is flying there?

Talk about it

1. The artist knew these animals only from their bones. What parts of the picture might be guesses?
2. Why do you think he showed the sea from above and below the water at the same time?

HANDS-ON: CLAY ICHTHYOSAUR

Build an ichthyosaur and give it the parts God designed for life in the sea.

You will need

- Modeling clay or play dough (gray, blue or brown)
- Two small buttons or beads for the big eyes
- A toothpick
- A sheet of paper and a crayon

Steps

1. Roll a fat clay sausage for the body. Pinch one end into a long, pointed snout.
2. Shape a tall tail fin that stands up and down, like a shark's. Add a fin on the back.
3. Add four flippers, two big ones in front and two smaller ones behind.
4. Press in two big button eyes. Use the toothpick to poke tiny teeth along the jaws and two nostrils near the eyes.
5. Make a paper label: "Ichthyosaur, the fish lizard. It breathed air."

Check your work

- My ichthyosaur has a long snout, four flippers, a back fin and a tall tail fin.
- It has big eyes and nostrils for breathing air.
- I can tell how an ichthyosaur's babies were born.

FIELD NOTEBOOK

1. Draw an ichthyosaur swimming. Label the snout, eye, flippers, back fin and tail.
2. Draw a dinner plate next to it and write: "Some ichthyosaurs had eyes this big!"

Did you know? Some ichthyosaur fossils still have their last meal inside. Scientists have found tiny hooks from the arms of squid-like animals in the place where the stomach was. Shonisaurus, a giant ichthyosaur found in Nevada, is the state fossil of Nevada.

Goes deeper in. Life Science, the units on animals with backbones and reptiles; and Earth Science, the fossils unit (coming soon). Trail B, Stop B1 tells how Mary Anning and

her brother found the first famous ichthyosaur.

For families. Ichthyosaurs are marine reptiles, not dinosaurs. The very large eyes belong to *Temnodontosaurus*, about 26 cm across (Motani and others, *Nature*, 1999). The birth fossils are from Holzmaden, Germany. *Duria Antiquior* (1830) was lithographed by George Scharf and sold for Mary Anning's benefit; the original watercolor is in the collection of Amgueddfa Cymru – Museum Wales. The picture shows animals eating each other, as a sea does; preview it if your child is sensitive. The stop names "Jurassic" as a museum word and gives no dates.

PRACTICE

1. **EASY** What does "ichthyosaur" mean?
2. **MEDIUM** An ichthyosaur looked like a fish. How do we know it was a reptile that breathed air?
3. **EASY** How were ichthyosaur babies born?

Make it a game • Up for Air. Everyone "swims" around the room as ichthyosaurs. When the leader calls "Dive!" everyone crouches low and holds their breath. When the leader calls "Breathe!" everyone pops up and takes a big breath. Anyone who pops up too early becomes the next leader.

Scripture. "And God created great whales, and every living creature that moveth, which the waters brought forth abundantly, after their kind, and every winged fowl after his kind: and God saw that it was good." (Genesis 1:21, KJV)

God filled the seas on the fifth day. The ichthyosaur, with its big eyes and strong tail, was made for the sea, and God saw that it was good.

Practice: answers

1. "Fish lizard."
2. It had a reptile's bones and nostrils for breathing; it came up to the top of the water for air, as dolphins do.
3. Alive, right in the water.

2.2 PLESIOSAURS: LONG NECKS UNDER THE SEA

OBJECTIVES

- Describe a plesiosaur: a small head, a long neck, a wide body and four flippers.
- Tell how plesiosaurs “flew” through the water with their flippers.
- Tell how a scientist’s mistake about Elasmosaurus was found and fixed.

Warm-up. Stretch your neck up as tall as it will go. Now feel the bones at the back of your neck. You have seven. Some plesiosaurs had about seventy!

Video slot. Video coming. Plesiosaurs for children: long necks, four flippers and how they swam; Mary Anning’s plesiosaur at the Natural History Museum, London. Search approved channels (Natural History Museum London, Smithsonian, PBS Eons with preview); preview first.

KEY TERMS

plesiosaur

A sea reptile with a small head, a long neck and four big flippers (say “PLEE-see-oh-sor”). The name means “near to a lizard.”

vertebra

One of the small bones that make up the backbone and neck. More than one are called vertebrae.

stomach stones

Smooth stones some animals swallow. They may help grind food or help the animal stay steady in the water.

pliosaur

A cousin of the plesiosaurs with a short neck and a very big head (say “PLY-oh-sor”).

CORE IDEAS

The story. One winter day in 1823, Mary Anning was searching the crumbling cliffs at Lyme Regis in England. Slowly she uncovered a skeleton like nothing anyone had seen whole before. It had a tiny head, a neck longer than its body, a wide, flat body like a turtle’s without a shell, and four big flippers. Someone said it looked like a snake pulled through a turtle!

Is it real? In Paris, the great scientist Georges Cuvier saw a drawing of it and was not sure. The neck was so long! Perhaps someone had stuck two fossils together to fool people. So scientists studied the skeleton bone by bone. It was real, and Cuvier said so. The animal was named **Plesiosaurus**, “near to a lizard.”

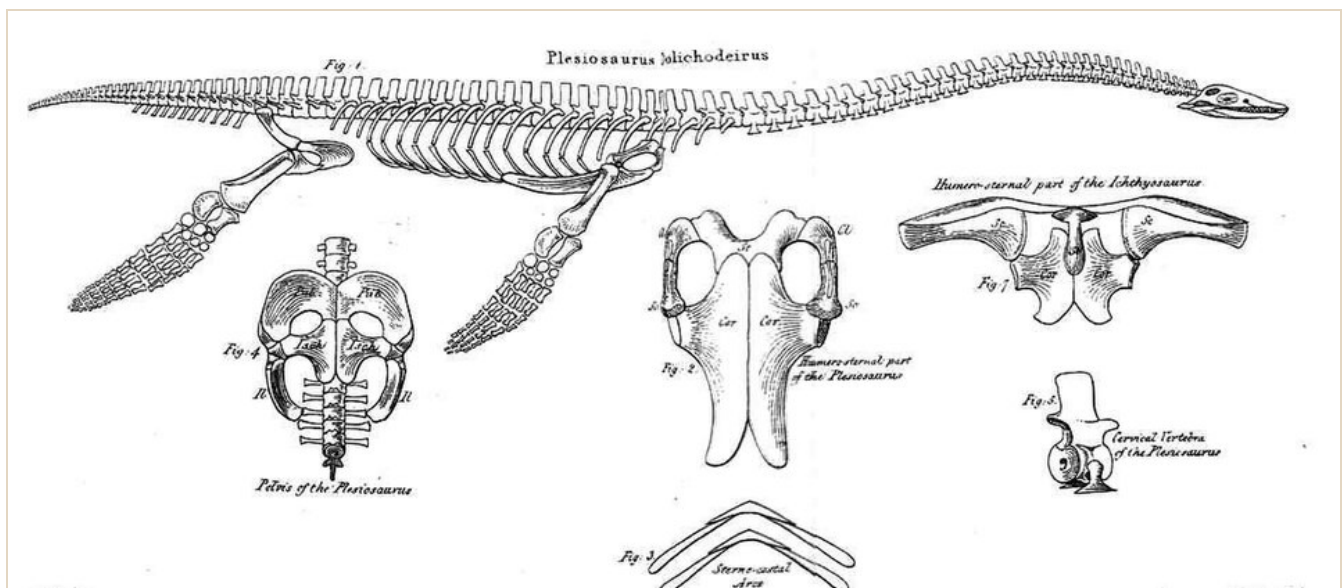
Flying under water. A plesiosaur did not swish a tail to swim. It moved its four flippers up and down, like a sea turtle or a penguin “flying” through the water. Its long neck may have

let it sneak its small head close to a school of fish before the fish noticed the big body behind. Some plesiosaurs swallowed smooth **stomach stones**, which are found with their skeletons.

Head on the wrong end. In America, about 150 years ago, a scientist named Edward Drinker Cope put together the bones of a plesiosaur with an extra-long neck, *Elasmosaurus*. He set the head on the end of the tail! Another scientist, Joseph Leidy, showed that the head belonged on the neck. Cope fixed his drawing. *Elasmosaurus*'s neck had about 70 **vertebrae**. Yours has seven.

Great and small. Not every plesiosaur family had a long neck. Their cousins the **pliosaurs** had short necks and huge heads with strong jaws. The psalm says the sea is full of "both small and great beasts" (Psalm 104:25). Long necks and short necks, small heads and big heads: God's sea creatures are wonderfully different.

PICTURE STUDY



Plesiosaurus dolichodeirus, the skeleton found by Mary Anning, William D. Conybeare, 1824 · Engraving ·
From the Transactions of the Geological Society of London
Wikimedia Commons · Public domain

William Conybeare was an English clergyman and geologist. In 1824 he described the plesiosaur skeleton Mary Anning had found, and this careful drawing of it was printed with his paper. A drawing like this let scientists in other countries study the fossil without traveling to England.

Look closely

- Find the head. How big is it next to the body?
- Look at the neck. Can you count some of the little neck bones?
- Find the flippers. Are the front and back flippers the same size?

Talk about it

1. Why would Cuvier want to see the real skeleton, not only a drawing?
2. What would you say to someone who thought this fossil was a fake?

HANDS-ON: SEVENTY-BONE NECK

Build a plesiosaur with a neck of about seventy “bones” and feel how bendy a long neck can be.

You will need

- A paper plate (the body)
- About 70 pieces of tube pasta or O-shaped cereal
- A long piece of yarn or string
- Paper for a head and four flippers
- Tape and crayons

Steps

1. Color the paper plate as the body. Cut and tape on four flippers.
2. Tie a knot in one end of the yarn. Thread on the pasta, counting out loud by tens, until you have about 70 pieces.
3. Tape a small paper head to the end of the neck. Tape the other end to the body.
4. Wiggle the neck. Now thread only 7 pieces on a short string for your own neck. Which bends more?

Check your work

- My plesiosaur has a small head, a long neck, a wide body and four flippers.
- I counted about 70 neck bones.
- I can tell where Cope put the head by mistake.

FIELD NOTEBOOK

1. Draw a plesiosaur “flying” through the water with its four flippers. Add a school of fish.
2. Draw a pliosaur beside it. Write one way they are different.

Did you know? In 2011, scientists in Los Angeles described a plesiosaur fossil from Kansas with one big baby inside. Like ichthyosaurs, plesiosaurs gave birth to live babies in the sea. Mary Anning’s plesiosaur can still be seen today at the Natural History Museum in London.

Goes deeper in. Life Science, the units on reptiles and on how animals move (coming soon). Trail B, Stop B6 tells more about Cope and the Bone Wars.

For families. Mary Anning found the first nearly complete *Plesiosaurus* in December 1823; Conybeare described it in 1824 (the genus was named by Conybeare and De la Beche in 1821 from partial bones). Cuvier at first doubted the neck and then accepted it. The “snake threaded through a turtle” comparison is often quoted but its first speaker is uncertain, so the stop does not name one. Cope’s reversed *Elasmosaurus* (1868–1869) was pointed out by Joseph Leidy; neck counts of about 70 to 72 vertebrae are commonly given. The pregnant plesiosaur is *Polycotylus* (O’Keefe and Chiappe, *Science*, 2011). The stop gives no dates in millions of years.

PRACTICE

1. **EASY** Name three parts of a plesiosaur.
2. **MEDIUM** How did a plesiosaur swim?
3. **MEDIUM** What mistake did Cope make with *Elasmosaurus*, and who helped fix it?

Make it a game • Long-Neck Tag. The plesiosaur holds both arms straight out in front, hands together, for a long neck. It may tag only with its fingertips, and it must keep its arms straight. The other players are fish. Anyone tagged becomes a second plesiosaur. Play walking, not running.

Scripture. “So is this great and wide sea, wherein are things creeping innumerable, both small and great beasts.” (Psalm 104:25, KJV)

The sea is full of more creatures than we can count, small and great. The long-necked plesiosaur was one of them.

Practice: answers

1. Any three: a small head, a long neck, a wide body, four flippers, a short tail.
2. It moved its four flippers up and down, “flying” through the water like a sea turtle or penguin.
3. He put the head on the tail; Joseph Leidy showed it belonged on the neck.

2.3 MOSASAURS: GIANT SEA LIZARDS

OBJECTIVES

- Tell the story of the great skull found near Maastricht and how it got its name.
- Name two ways a mosasaur was built for catching food in the sea.
- Read a museum sign about mosasaurs and tell the observation from the interpretation.

Warm-up. Open and close your mouth slowly. Your lower jaw bends only at the back, near your ears. A mosasaur had an extra bending joint partway along each side of its lower jaw, so its mouth could spread wide for big bites.

Video slot. Video coming. Mosasaurs for children: the Maastricht skull, the double-hinged jaw and the mosasaurs of the Kansas chalk. Search approved channels (Smithsonian, Natural History Museum London, Sternberg Museum, PBS Eons with preview); preview first.

KEY TERMS

mosasaur

A huge sea lizard with flippers and a long tail (say “MOH-zuh-sor”). The name means “Meuse lizard,” after a river in Europe.

quarry

A place where people dig stone out of the ground.

monitor lizard

A family of big lizards living today, such as the Komodo dragon. Mosasaurs were their cousins.

Cretaceous

A museum word for one set of rock layers (say “krih-TAY-shus”). Mosasaur fossils come from rocks with this label.

CORE IDEAS

The story. Under a hill called Saint Peter’s Mount, near the city of Maastricht in the Netherlands, workers dug long tunnels to cut out soft, chalky stone. Around the year 1780, deep in the **quarry**, their tools struck something hard. Slowly they uncovered a giant head with long jaws and rows of sharp, curved teeth. Word spread fast. What kind of monster was this?

A skull goes to Paris. In 1794 a French army surrounded Maastricht and took the city. The French wanted the famous skull. An old story says soldiers were promised a reward if they found where it was hidden. It was carried to Paris, and it is still in a museum there today.

What was it? Some people thought it was a crocodile, and others a kind of whale. Scientists compared it bone by bone with living animals. They decided it was a giant sea-going lizard, a cousin of the **monitor lizards** like the Komodo dragon. In 1822 it was named **Mosasaurus**, “lizard of the Meuse,” after the river that flows past Maastricht.

Built for the sea. A mosasaur had a long body, four flippers and a strong tail with a fin, which pushed it through the water. Its lower jaw could bend in the middle, and it had extra rows of teeth on the roof of its mouth to keep slippery fish and squid from getting away. The biggest mosasaurs were about as long as a school bus.

Sea monsters in Kansas. Many mosasaur skeletons have been dug out of chalk in western Kansas, more than a thousand miles from the ocean. Chalk is made of tiny shells from the sea, so the sea once covered that land. Psalm 148 calls on the great sea creatures to praise God: “ye dragons, and all deeps.” Even the fiercest sea lizard was made by Him and points to Him.

PICTURE STUDY



The finding of the great Maastricht animal in the quarry, Engraved by G. R. Levillaire for Barthélemy Faujas de Saint-Fond's book on Saint Peter's Mount, 1799 · Engraving · From *Histoire naturelle de la montagne de Saint-Pierre de Maestricht* (Paris)
Wikimedia Commons · Public domain

Faujas de Saint-Fond was a French geologist who wrote a big book about the fossils of Saint Peter's Mount. This picture shows how he imagined the moment the skull was found. Historians think he made the scene more exciting than it really was, but it shows the deep, dark tunnels where the workers dug.

Look closely

- Find the giant jaw in the stone. Can you see the teeth?

- Find the torch and the people. What is each person doing?
- Look at the tunnel walls. What kind of place is this?

Talk about it

1. How would you feel if your shovel hit a giant jaw full of teeth?
2. Why might an artist make a picture more exciting than the real event?

HANDS-ON: BENDY MOSASAUR JAW

Make a paper jaw that bends in the middle, like a mosasaur's, and see how it opens wider.

You will need

- Cardstock or a cereal box
- Four brass paper fasteners (brads)
- Crayons and scissors (with a grown-up)
- A pencil for poking holes (a grown-up helps)

Steps

1. Draw and cut out a long upper jaw with teeth along the bottom edge.
2. Draw the lower jaw in two pieces, a back half and a front half, each with teeth.
3. With a grown-up, poke holes and join the two lower-jaw pieces with a brad so they bend. Join the back of the lower jaw to the upper jaw with another brad.
4. Open and close your jaw. Then bend the middle joint outward. How much wider can the mouth spread?

Check your work

- My jaw opens at the back and bends in the middle.
- I added sharp, curved teeth.
- I can tell why a bendy jaw helped a mosasaur swallow big bites.

FIELD NOTEBOOK

1. Draw a mosasaur swimming. Label the jaws, flippers and tail fin.
2. Find Maastricht and Kansas on a map or globe. Draw a star on each.

Did you know? Some mosasaur fossils are so well kept that scientists can see the outline of the tail. It bent down at the end and had a fin shaped like a half-moon, much like a shark's tail. Mosasaurs have even been found with fish bones inside them.

 **What the sign says / What we observe / How Christians read it.**  **What the sign says:** "Mosasaurs lived in the Cretaceous seas and died out about 66 million years ago." **What we observe:** mosasaur bones lie in thick layers of chalk made of tiny sea shells, together with sharks' teeth, fish and clams, in places like Kansas that are dry land

today. **How Christians read it:** many young-earth Christians read these sea layers on dry land as laid down when the waters of Noah's Flood covered the earth, thousands of years ago. Many other scientists think a shallow sea covered the middle of North America slowly over a very long time. Both agree on what we can see: sea creatures were buried where there is dry land now.

Goes deeper in. Earth Science, the units on rock layers, fossils and the Flood (coming soon); and Geography, for the Netherlands and Kansas.

For families. This stop carries the ⏳ box. The famous second Maastricht skull was found around 1780 and seized by the French in 1794-1795; it is in the Muséum national d'Histoire naturelle, Paris. Faujas de Saint-Fond's account (1798-1799) tells of a reward of wine to the grenadiers who found it; historians think the story was exaggerated, so the stop says only "a reward." *Mosasaurus* was named by William Conybeare in 1822. Lengths for the largest mosasaurs (*Mosasaurus hoffmannii*, *Tylosaurus*) are estimates of roughly 12-15 m or more. The Oceans of Kansas website (Mike Everhart) is a good free source on Kansas mosasaurs.

PRACTICE

1. **EASY** Where was the famous mosasaur skull found?
2. **MEDIUM** Name one way a mosasaur was built to catch slippery food.
3. **MEDIUM** Is "Mosasaur bones are found in chalk in Kansas" an observation or an interpretation?

Make it a game • Mosasaur Gulp. One player is the mosasaur and stands with arms out like big jaws. The others are fish and walk past. When the leader says "Gulp!" the mosasaur closes its arms. Any fish caught inside the jaws becomes a mosasaur too, and the jaws get bigger. Play gently.

Scripture. "Praise the LORD from the earth, ye dragons, and all deeps:" (Psalm 148:7, KJV)

In the King James Bible, "dragons" can mean great creatures of the sea. Even the fiercest sea lizard was made to praise the LORD.

Practice: answers

1. In a quarry under Saint Peter's Mount, near Maastricht in the Netherlands.
2. Any one: a jaw that bent in the middle; extra teeth on the roof of its mouth; sharp, curved teeth.
3. An observation: we can go and see the bones in the chalk.

2.4 PTEROSAURS: WINGS OF SKIN

OBJECTIVES

- Tell how a pterosaur’s wing was made: skin stretched from one very long finger.
- Say how pterosaurs were different from birds, bats and dinosaurs.
- Tell how the first pterosaur fossil puzzled the people who studied it.

Warm-up. Hold up one hand. Count your fingers from the thumb: one, two, three, four. Wiggle finger number four, your ring finger. Now imagine it growing longer than your whole arm. A pterosaur’s wing hung from a finger like that!

Video slot. Video coming. Pterosaurs for children: wings of skin on one long finger; Pterodactylus and Pteranodon; how pterosaurs walked and flew. Search approved channels (Natural History Museum London, Smithsonian, American Museum of Natural History, PBS Eons with preview); preview first.

KEY TERMS

pterosaur

A flying reptile with wings of skin (say “TEHR-oh-sor”; the p is silent). The name means “winged lizard.”

wing membrane

The thin, strong, stretchy skin that made a pterosaur’s wing.

Pterodactylus

The first pterosaur ever named (say “TEHR-oh-DAK-tih-lus”). The name means “wing finger.”

crest

A bony fin or ridge on top of an animal’s head.

CORE IDEAS

The story. In 1784, in a palace in the German city of Mannheim, a museum keeper named Cosimo Collini studied a strange fossil. It had come from the smooth stone quarries of Solnhofen in Bavaria. The skeleton had a long beak full of tiny teeth, a long neck, small legs, and arms with one finger so long it was almost silly. Was it a bird? A bat? Some kind of sea creature? Collini wrote down exactly what he saw, but he could not tell.

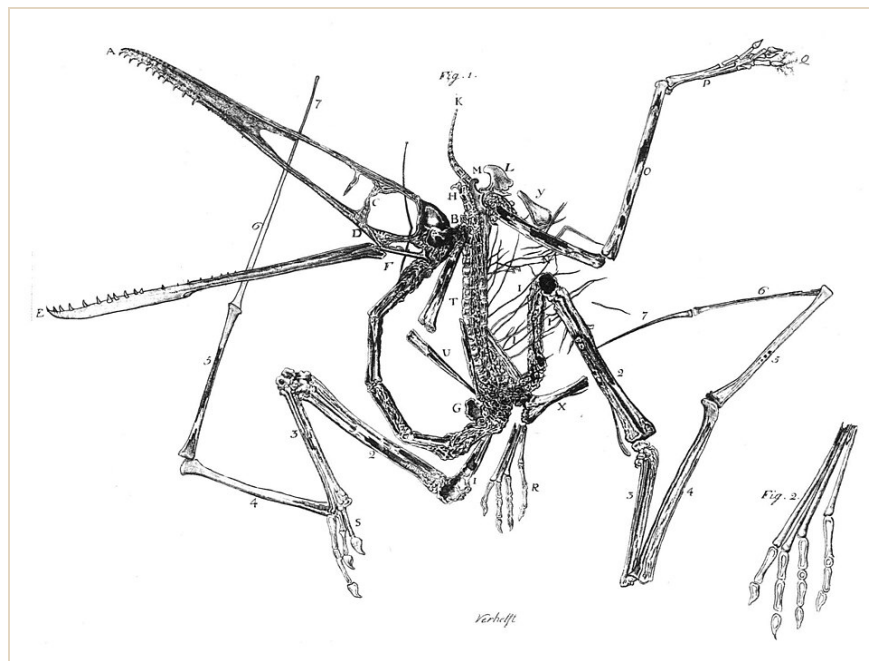
A flying reptile. Years later, the French scientist Georges Cuvier looked at the drawing of the fossil. He said the long finger held up a wing of skin. This was a reptile that flew! In 1809 he named it the “wing finger,” **Pterodactylus**. Since then, hundreds of kinds of **pterosaurs** have been found all over the world.

Not a bird, not a bat, not a dinosaur. A bird's wing is made of feathers. A bat's wing is skin stretched between four long fingers. A pterosaur's wing was skin stretched from just one finger, the fourth, down to its leg. This **wing membrane** was thin but strong. Pterosaurs had light, hollow bones and a fuzzy covering on their bodies. They lived alongside the dinosaurs, but they were not dinosaurs.

Big and small. Some pterosaurs were as small as a sparrow. Pteranodon, found in Kansas, had wings about 20 feet across, a beak with no teeth and a tall **crest** on the back of its head. Rhamphorhynchus had a long tail with a little flap at the tip, like a kite's tail. On the ground, pterosaurs folded up their wings and walked on all four limbs. Their footprints have been found in stone.

The open firmament. On the fifth day God said, "Let the waters bring forth abundantly the moving creature that hath life, and fowl that may fly above the earth" (Genesis 1:20). Museum signs often label pterosaur rocks **Jurassic** or **Cretaceous**, museum words for sets of rock layers. However high they flew, they flew in the sky God made.

PICTURE STUDY



The Mannheim fossil (the first Pterodactylus), Engraving made for Cosimo Alessandro Collini, 1784 · Copper engraving · From the Acta of the Palatine Academy, Mannheim; the fossil itself is in the Bavarian State Collection in Munich
Wikimedia Commons · Public domain

This is the very first picture ever printed of a pterosaur fossil. Collini did not know what the animal was, so he had it drawn just as it lay in the stone. Careful drawings like this let Cuvier, far away in Paris, work out that it was a flying reptile.

Look closely

- Find the skull and the long beak.

- Find the very long finger bones. Follow them back to the arm.
- Find the legs. Are they big or small next to the arms?

Talk about it

1. Why was it wise for Collini to draw exactly what he saw, even when he did not understand it?
2. If you were Cuvier, what clue would tell you this animal could fly?

HANDS-ON: THREE WINGS

Trace your own arm and hand to see how a bird, a bat and a pterosaur each make a wing.

You will need

- Three large sheets of paper (or one long roll)
- A pencil and crayons
- A grown-up to help trace

Steps

1. Lay your arm and hand on the first sheet, fingers spread, and have a grown-up trace around them. Do the same on the other two sheets.
2. Sheet one, the bird: draw long feathers growing from the arm and hand.
3. Sheet two, the bat: make all four fingers very long and color skin stretched between them.
4. Sheet three, the pterosaur: make only the fourth finger very long, then color skin stretched from its tip down to the hip. Label each sheet.

Check your work

- I made a bird wing, a bat wing and a pterosaur wing.
- My pterosaur wing hangs from one long finger.
- I can tell how a pterosaur is different from a bird and a bat.

FIELD NOTEBOOK

1. Draw a pterosaur flying. Label the long fourth finger, the wing membrane and the crest (if it has one).
2. Draw a pterosaur walking on all fours with its wings folded.

Did you know? The word “pterodactyl” is often used for all pterosaurs, but it really belongs to one kind, Pterodactylus. Scientists say “pterosaur” for the whole group. Some pterosaurs had bright crests that may have helped them recognize one another.

Goes deeper in. Life Science, the units on how animals fly and on reptiles (coming soon); and Art, for drawing from a careful observation.

For families. Collini described the Mannheim specimen in 1784 in the *Acta Academiae Theodoro-Palatinae* without deciding what it was; Cuvier identified it as a flying reptile (1801) and named it in 1809. The specimen is the holotype of *Pterodactylus antiquus*, now in the Bavarian State Collection of Palaeontology and Geology, Munich. Pteranodon wingspans are usually estimated at about 6 to 7 m in the largest individuals. Pterosaurs are close relatives of dinosaurs but not dinosaurs. The stop names “Jurassic” and “Cretaceous” as museum words and gives no dates.

PRACTICE

1. **EASY** What was a pterosaur’s wing made of?
2. **MEDIUM** How is a bat’s wing different from a pterosaur’s?
3. **EASY** Was a pterosaur a dinosaur?

Make it a game • Bird, Bat or Pterosaur?. The leader calls out a wing. For “Bird!” everyone flaps arms with fingers together like feathers. For “Bat!” everyone spreads all their fingers wide. For “Pterosaur!” everyone tucks in their fingers and points only the ring finger out long. Anyone who makes the wrong wing becomes the next leader.

Scripture. “And God said, Let the waters bring forth abundantly the moving creature that hath life, and fowl that may fly above the earth in the open firmament of heaven.” (Genesis 1:20, KJV)

God filled the sky with flying creatures. Birds, bats and pterosaurs each fly in a different way, and God designed every one.

Practice: answers

1. Skin stretched from one very long finger (the fourth) down to its leg.
2. A bat’s wing is skin between four long fingers; a pterosaur’s hangs from one long finger.
3. No. It was a flying reptile that lived alongside the dinosaurs.

2.5 QUETZALCOATLUS: GIANT OF THE SKY

OBJECTIVES

- Tell where and how Quetzalcoatlus was found.
- Compare the size of Quetzalcoatlus with things we know: a giraffe and a small airplane.
- Tell how scientists think such a big animal got off the ground.

Warm-up. Stand in a row with your family, arms stretched out, fingertip to fingertip. It would take about six grown-ups in a row to reach across the wings of Quetzalcoatlus!

Video slot. Video coming. Quetzalcoatlus, the giant pterosaur from Big Bend, Texas: its size and how it took off. Search approved channels (University of Texas Jackson School of Geosciences, National Park Service, Smithsonian, PBS Eons with preview); preview first.

KEY TERMS

Quetzalcoatlus

One of the largest flying animals ever found, a giant pterosaur from Texas (say “KET-sul-koh-AT-lus”).

wingspan

The distance from the tip of one wing to the tip of the other.

launch

To push off into the air to start flying.

Big Bend National Park

A desert park in Texas along the Rio Grande river, where Quetzalcoatlus was found.

CORE IDEAS

The story. In 1971, a young college student named Douglas Lawson was hiking through the hot, dry hills of Big Bend National Park in Texas, near the Rio Grande river. He was looking for fossils for his studies. Sticking out of the rock he found a bone, a hollow wing bone so big that at first it was hard to believe it came from something that flew.

A name from Mexico. Lawson and other searchers found more bones. In 1975 he named the animal **Quetzalcoatlus**, after Quetzalcoatl, the “feathered serpent” of the old stories of the Aztec people of Mexico. The name fits a flying giant found just across the river from Mexico.

How big? Quetzalcoatlus was a pterosaur, a flying reptile. Its **wingspan** was about 33 to 36 feet, about as wide as the wings of a small airplane. When it stood on the ground with its wings folded, its head may have been as high as a giraffe’s. Yet its bones were hollow, with thin walls, so it was very light for its size. It had a long, stiff neck and a long beak with no teeth.

Walking hunter. What did a giant like this eat? Scientists once thought it might skim fish from the water. Many now think it walked on all fours across open land and riverbanks, the way a stork does, and snapped up small animals with its long beak.

Up, up and away. How did something so big get into the air? Scientists who studied its bones think it crouched down and leaped with its strong arms and legs, jumping about 8 feet high. Then it swept its great wings down and was flying. God asks Job, “Doth the hawk fly by thy wisdom?” (Job 39:26). No person taught Quetzalcoatlus to fly. Its Maker gave it everything it needed.

PICTURE STUDY



Ideal Landscape of the Liassic Period, with pterosaurs, Édouard Riou, 1865 (English edition) · Wood engraving · From Louis Figuier, *The World Before the Deluge* (London); this copy is in the British Library
Wikimedia Commons · CC0

Édouard Riou drew pictures for a famous French book about fossils, and later he drew for Jules Verne’s adventure stories. In the 1860s people knew only small pterosaurs, so Riou drew them small, with wings like a bat’s. Nobody yet guessed that a pterosaur as big as Quetzalcoatlus would one day be found in Texas.

Look closely

- Find the flying reptiles. How many can you count? What is one of them chasing?
- Look at the shape of their wings. Do they look like the wings you drew in Stop E4?
- Find the plants. Are any like plants you know?

Talk about it

1. How would Riou have to change his picture to show Quetzalcoatlus?
2. Why do pictures of fossil animals change when new fossils are found?

HANDS-ON: LIFE-SIZE WINGS IN CHALK

Draw the wings of Quetzalcoatlus full size on a driveway, sidewalk or playground, and stand inside them.

You will need

- Sidewalk chalk
- A tape measure, or a string 3 feet long (one yard)
- A driveway, sidewalk or paved playground (a grown-up chooses a safe place away from cars)

Steps

1. With a grown-up, measure a straight line 35 feet long. With a one-yard string, that is about 12 string-lengths. Mark both ends.
2. Mark the middle. Draw a small body and a long neck and beak there.
3. Draw a long, narrow wing from the body out to each end of the line.
4. Lie down in the wings with your family, fingertip to fingertip. How many of you fit across? Then measure how tall a giraffe is (about 16 to 18 feet) and draw a line for that too.

Check your work

- My chalk wings are about 35 feet from tip to tip.
- I counted how many people fit across the wings.
- I can tell how scientists think Quetzalcoatlus took off.

FIELD NOTEBOOK

1. Draw Quetzalcoatlus standing next to a giraffe and a person. Label each.
2. Draw a map of Texas and mark Big Bend National Park near the Rio Grande.

Did you know? For many years Quetzalcoatlus was known mostly from a few bones, so scientists had to make careful guesses. In 2021 a team published a big set of studies on all the Big Bend fossils, the most complete look at this giant so far. The bones are kept at the University of Texas at Austin.

Goes deeper in. Life Science, the units on flight (coming soon); Geography, for Texas, the Rio Grande and Mexico; and Arithmetic, for measuring in feet and yards.

For families. Douglas Lawson found the first bones in 1971 and named *Quetzalcoatlus northropi* in 1975 (in *Science*); the 2021 Society of Vertebrate Paleontology Memoir (Andres, Langston and others) described the material and proposed the leaping launch (about 2.4 m). Wingspan estimates vary; about 10 to 11 m is common, and some sources give a little more. The “stork-like ground hunter” idea is from Witton and Naish (2008) and is widely but not universally accepted, so the stop says “many now think.” The animal

is named after Quetzalcoatl, a deity of Aztec religion; the stop calls it a figure of old Aztec stories. Riou's plate titles vary between editions of Figuier's book. The stop gives no dates.

PRACTICE

1. **EASY** Where was Quetzalcoatlus found?
2. **MEDIUM** How was such a big animal light enough to fly?
3. **MEDIUM** How do scientists think Quetzalcoatlus took off?

Make it a game • Leap and Soar. Everyone crouches on hands and feet like a resting pterosaur. When the leader calls "Launch!" everyone springs up as high as they can and spreads their arms wide to "soar" slowly across the room. When the leader calls "Land!" everyone folds their wings and walks on all fours. Play on a soft surface.

Scripture. "Doth the hawk fly by thy wisdom, and stretch her wings toward the south? Doth the eagle mount up at thy command, and make her nest on high?" (Job 39:26-27, KJV)

God asked Job these questions to show that the wisdom of flight comes from Him. The giant Quetzalcoatlus flew by God's wisdom, not by man's.

Practice: answers

1. In Big Bend National Park in Texas, near the Rio Grande.
2. Its bones were hollow, with thin walls.
3. It crouched and leaped about 8 feet high with its strong arms and legs, then flapped its wings.

2.6 WOOLLY MAMMOTHS: GIANTS OF THE ICE AGE

OBJECTIVES

- Name three ways a woolly mammoth was made for the cold.
- Tell the story of Lyuba, the baby mammoth found frozen in Siberia.
- Tell how many Christians read the Ice Age as coming after Noah's Flood.

Warm-up. Feel your ears. Now look at a picture of an African elephant's huge, flapping ears. A woolly mammoth's ears were small and furry. Small ears lose less heat, so they helped keep the mammoth warm.

Video slot. Video coming. Woolly mammoths for children: Lyuba the baby mammoth, mammoth fur and tusks, and cave drawings of mammoths. Search approved channels (Field Museum, Smithsonian, Natural History Museum London, National Geographic Kids); preview first.

KEY TERMS

woolly mammoth

A big, hairy member of the elephant family that lived in cold lands in the north.

tusk

A very long tooth that grows out of the mouth, like an elephant's.

permafrost

Ground that stays frozen all year long, even in summer.

Ice Age

A time when great sheets of ice covered much of the northern lands. Many Christians believe there was one Ice Age, in the years after Noah's Flood.

CORE IDEAS

The story. In the spring of 2007, a reindeer herder named Yuri Khudi was walking with his sons along a riverbank in Siberia, in the far north of Russia. There, lying on the frozen ground, was a baby mammoth, whole, with its skin, its little trunk and its eyes. It looked almost as if it were asleep. Scientists named the baby **Lyuba**, which means "love," after Mr. Khudi's wife. She was only about a month old when she died, and she had been kept frozen in the **permafrost** ever since.

Dressed for the cold. A **woolly mammoth** was about as tall as an elephant today. It wore two coats of hair: thick, soft wool next to the skin and long, shaggy hair on top. It had small ears, a short tail and a layer of fat under its skin. A hump of fat on its back stored food for the long winter. God gave the mammoth everything it needed for a cold, snowy land.

Tusks and teeth. Mammoths had long **tusks** that curved up and around in a great spiral. Some were more than 10 feet long. They may have used them to sweep snow off the grass and to defend themselves. Their back teeth were wide and ridged like a washboard, just right for grinding tough grass all day long.

People saw them. People hunted mammoths and drew them. On the walls of caves in France, people long ago painted and scratched pictures of mammoths with humped backs and long tusks. In some places people built huts using mammoth bones. Mammoths and people lived on the earth at the same time.

One Ice Age. Where did all that ice come from? Many Christian scientists think the Ice Age came after Noah's Flood. Warm oceans sent up lots of water into the air, and dust from volcanoes kept the summers cool, so snow piled up for hundreds of years and turned to ice. Mammoths roamed the cold grasslands at the edge of the ice. God asks Job, "Out of whose womb came the ice?" (Job 38:29). The answer is: from God.

PICTURE STUDY



Woolly Mammoths and Woolly Rhinoceroses, Charles R. Knight, c. 1929 · Oil on canvas (mural) · Field Museum of Natural History, Chicago
Wikimedia Commons · Public domain

Charles R. Knight was one of the first artists to paint fossil animals as if they were alive. He studied real elephants at the zoo and the bones of mammoths in the museum before he painted. This great mural shows a herd of woolly mammoths walking through the snow in a cold land.

Look closely

- Find the humps on the mammoths' backs. Can you find the baby?
- Look at the tusks. Which way do they curve?
- Find the other animals in the picture. What are they?

Talk about it

1. How did Knight show that this was a cold place?

2. Why would watching real elephants help an artist paint mammoths?

HANDS-ON: THE WOOLLY MITTEN TEST

Find out how fur and fat kept a mammoth warm.

You will need

- Three zip-top sandwich bags
- Cotton balls or yarn (the woolly coat)
- Vegetable shortening (the fat)
- A big bowl of ice water
- A towel

Steps

1. Fill one bag with cotton balls or yarn. Fill another with a thick layer of shortening (a grown-up helps spread it). Leave the third bag empty.
2. Put your hand inside a second, clean bag first so it stays dry, then slip it into the empty bag. Dip it in the ice water. Count how long until it feels too cold.
3. Try again with the woolly bag, and then the fat bag. Count each time.
4. Which bag kept your hand warm longest? Dry off with the towel and talk about how the mammoth had both wool and fat.

Check your work

- I tested all three bags.
- I can tell which kept my hand warmest.
- I can name three ways a mammoth was made for the cold.

FIELD NOTEBOOK

1. Draw a woolly mammoth in the snow. Label the hump, small ears, short tail, long hair and tusks.
2. Draw baby Lyuba and write one sentence about how she was found.

Did you know? Columbian mammoths, the cousins of the woolly mammoth, lived farther south in North America and were even bigger. They had less hair, and their bones have been found from Canada to Mexico. Many “mammoth” fossils in the United States belong to them.

 **What the sign says / What we observe / How Christians read it.**  **What the sign says:** “Woolly mammoths lived during the Ice Age, which began about 2.6 million years ago. The last mammoths died out about 4,000 years ago.” **What we observe:** mammoths frozen in the ground in Siberia and Alaska with hair, skin and even food in their stomachs; mammoth bones and tusks; and pictures of mammoths drawn by people on cave walls. **How Christians read it:** many young-earth Christians teach one Ice Age,

starting soon after Noah's Flood and lasting several hundred years, about 4,000 years ago; they say the Flood's warm oceans and volcanic dust made it happen. Other Christians accept the longer dates. Both can agree on what we see: mammoths lived in cold lands, and people knew them.

Goes deeper in. Earth Science, the units on glaciers and the Ice Age (coming soon); Geography, for Siberia; and History, for the cave paintings of early people.

For families. This stop carries the ⏳ box. Lyuba was found in May 2007 on the Yamal Peninsula by Yuri Khudi; she was named for his wife and is about one month old (Field Museum and others). Mud in her trunk and mouth suggests she sank in mud; the stop says only that she died. The post-Flood Ice Age model is taught by creation geologists such as Michael Oard; mainstream science dates many glacial cycles, the last ending about 11,700 years ago, with mammoths surviving on Wrangel Island until about 4,000 years ago. Cave images of mammoths are found at Rouffignac and Chauvet in France; mammoth-bone dwellings at sites such as Mezhyrich in Ukraine.

PRACTICE

1. **EASY** Name two ways a woolly mammoth was made for the cold.
2. **EASY** Who was Lyuba?
3. **MEDIUM** How do we know people and mammoths lived at the same time?

Make it a game • Mammoth March. Everyone is a mammoth in a herd, walking in a line through the "snow." The leader calls out a job: "Sweep the snow!" (swing your arms like tusks), "Grind the grass!" (chew), "Storm!" (huddle close together to stay warm). The last one to do it becomes the leader.

Scripture. "Out of whose womb came the ice? and the hoary frost of heaven, who hath gendered it? The waters are hid as with a stone, and the face of the deep is frozen." (Job 38:29-30, KJV)

God asked Job who made the ice and frost. The answer is God Himself. He rules over the snow and ice, and He made the mammoth to live in it.

Practice: answers

1. Any two: two coats of hair, small ears, a short tail, a layer of fat, a fat hump on its back.
2. A baby woolly mammoth found frozen in Siberia in 2007.
3. People painted and carved mammoths on cave walls, and built huts with mammoth bones.

2.7 SABER-TOOTHED CATS: SMILODON

OBJECTIVES

- Describe Smilodon: its long teeth, strong front legs and short tail.
- Tell why “saber-toothed tiger” is not quite the right name.
- Tell how Smilodon used its strong arms and wide-opening jaws.

Warm-up. Open your mouth as wide as you can. A grown-up can measure the gap with a ruler. A Smilodon could open its mouth so wide that its jaws made a corner wider than the corner of a square!

Video slot. Video coming. Smilodon, the saber-toothed cat, for children: its teeth, its jaws and the Smilodon fossils of La Brea. Search approved channels (La Brea Tar Pits and Museum, Natural History Museum of Los Angeles County, Smithsonian, PBS Eons with preview); preview first.

KEY TERMS

Smilodon

The best-known saber-toothed cat (say “SMY-loh-don”). The name means “knife tooth.”

canine tooth

One of the long, pointed teeth near the front of the mouth. You have four.

predator

An animal that hunts other animals for food.

state fossil

A fossil chosen by a state as its special symbol. Smilodon is the state fossil of California.

CORE IDEAS

The story. Evening is coming over a grassy plain. Near a pond, a big cat crouches low in the tall grass. It is heavy and strong, with a short, stubby tail like a bobcat’s. When it opens its mouth to yawn, two long, flat fangs flash in the last of the sunlight. This is **Smilodon**, the saber-toothed cat.

Not a tiger. People often call it a “saber-toothed tiger,” but it was not a tiger at all. It was a cat of its own kind. It was about as big as a lion, but stockier, with thick, powerful front legs and big paws. A saber is a long, curved sword, and that is what its teeth looked like.

Knife teeth. Smilodon’s two upper **canine teeth** showed about 7 inches below its lip, about as long as a grown-up’s hand. They were flat like knife blades, and the edges had tiny bumps like a steak knife. But flat teeth can snap if they hit hard bone. So scientists think Smilodon first held big animals still with its strong arms, and only then used its teeth. Its jaws could open very, very wide to make room for them.

Fossils in California. More Smilodon fossils have come from the La Brea Tar Pits in Los Angeles than from anywhere else in the world: bones of more than two thousand cats (Stop E9). Some of the bones show old injuries that had healed. In 1974 Smilodon was made the **state fossil** of California.

Meat from God. “The young lions roar after their prey, and seek their meat from God” (Psalm 104:21). Even a fierce **predator** depends on God for its food. Many Christians believe animals did not hunt each other before Adam’s sin, and the Bible promises a day when “the lion shall eat straw like the ox” (Isaiah 11:7).

PICTURE STUDY



Smilodon (Saber-Toothed Cat), Charles R. Knight, 1903 · Oil on canvas · American Museum of Natural History, New York
Wikimedia Commons · Public domain

Charles R. Knight loved big cats. He spent many hours at the zoo drawing lions and tigers so he could make his Smilodon look real. In this painting a saber-toothed cat snarls on the edge of a rocky cliff.

Look closely

- Find the two long fangs. How wide is the mouth open?
- Look at the front legs and paws. Are they thin or thick?
- Look for the tail. Is it long or short?

Talk about it

1. How did Knight make this cat look strong?
2. Knight used living lions to help him paint. What living animal would you study to draw a Smilodon?

HANDS-ON: HOW LONG IS A SABER?

Make a paper saber tooth and compare it with your own teeth and a pet cat's.

You will need

- White cardstock or paper
- A ruler
- A pencil, crayons and scissors (with a grown-up)
- A mirror

Steps

1. With the ruler, draw a long, flat, curved tooth 7 inches long. This is the part that showed below the lip.
2. Add 4 more inches at the top for the root hidden in the jaw, in a different color. The whole tooth is about 11 inches!
3. Cut it out and add tiny bumps along the back edge, like a steak knife.
4. Look at your own canine teeth in the mirror. Hold your paper saber next to your face. If you have a cat, look (gently!) at its fangs too.

Check your work

- My saber tooth is 7 inches long, plus a root.
- I compared it with my own canine teeth.
- I can tell why Smilodon held its food still before biting.

FIELD NOTEBOOK

1. Draw Smilodon. Label the saber teeth, the strong front legs and the short tail.
2. Draw your paper saber next to a drawing of your own tooth, and write how long each is.

Did you know? The biggest saber-toothed cat lived in South America and may have been heavier than any lion living today. Smilodon was not the only animal with saber teeth. Several other kinds of animals, even some that were not cats, had long fangs too.

Goes deeper in. Life Science, the units on mammals and on predators and prey (coming soon); and Art, for drawing animals from life.

For families. Figures are commonly cited by the La Brea Tar Pits and Museum: upper canines up to about 7 in (18 cm) exposed and about 11 in (28 cm) with the root; remains of more than 2,000 Smilodon individuals from La Brea. Gape estimates are about 110 to 120 degrees. Smilodon was designated California's state fossil in 1974. The largest species, *Smilodon populator*, lived in South America. The hunting description is kept gentle; the stop does not describe kills. The note on Genesis 1:29-30 and the Fall reflects

a common young-earth reading. Knight's 1903 painting is in the AMNH collection; this stop gives no dates.

PRACTICE

1. **EASY** Was Smilodon a tiger?
2. **MEDIUM** Why did Smilodon need to hold its food still before biting?
3. **EASY** Which state has Smilodon as its state fossil?

Make it a game • Saber Statues. Everyone prowls slowly around the room like a big cat. When the leader calls “Saber!” everyone freezes with their mouth open as wide as they can and two fingers pointing down from the top lip like fangs. The leader picks the best saber statue to lead the next round.

Scripture. “The young lions roar after their prey, and seek their meat from God.” (Psalm 104:21, KJV)

Even the strongest cat cannot feed itself without God. He cares for every creature He made.

Practice: answers

1. No. It was a saber-toothed cat of its own kind.
2. Its long, flat teeth could snap if they hit hard bone.
3. California.

2.8 GIANT GROUND SLOTHS: MEGATHERIUM AND MEGALONYX

OBJECTIVES

- Describe a giant ground sloth and compare it with a tree sloth today.
- Tell the story of the Megatherium skeleton set up in Madrid.
- Tell what Thomas Jefferson thought the giant claw belonged to, and what it really was.

Warm-up. Pretend to hang upside down from a branch like a tree sloth, slowly, slowly. Now imagine a sloth as big as an elephant. Could any tree hold it? Giant ground sloths stayed on the ground!

Video slot. Video coming. Giant ground sloths for children: Megatherium, Megalonyx and sloth fossils in caves. Search approved channels (Smithsonian, Natural History Museum of Los Angeles County, La Brea Tar Pits and Museum, National Park Service, PBS Eons with preview); preview first.

KEY TERMS

ground sloth

A big cousin of today's tree sloths that lived on the ground. Some were as big as elephants.

Megatherium

One of the biggest ground sloths (say "meg-uh-THEER-ee-um"). The name means "great beast."

Megalonyx

A ground sloth named from claw bones studied by Thomas Jefferson (say "meg-AL-oh-nix"). The name means "great claw."

skeleton mount

A set of fossil bones put together and held up on a frame so it stands as the animal did.

CORE IDEAS

The story. In 1787, beside the Luján River in Argentina, a priest came upon some enormous bones in the riverbank. They were packed into seven big wooden crates and sent across the ocean by ship to the king of Spain. In Madrid, a museum worker named Juan Bautista Bru unpacked them and began to fit them together, bone by bone. When he was done, a giant skeleton stood on its own. It was the first big fossil animal ever set up to stand as it had in life.

The great beast. No one had seen anything like it. The French scientist Georges Cuvier studied Bru's drawings and saw that the bones were like the bones of a sloth, only far, far

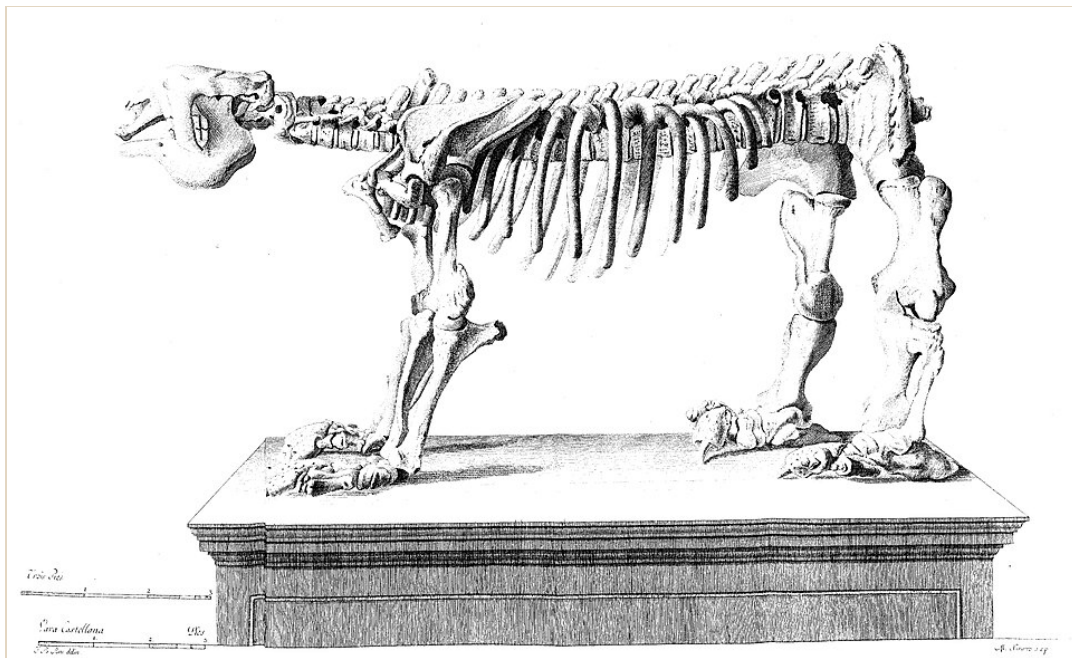
bigger. In 1796 he named it **Megatherium**, “great beast.” It was as big as an elephant. It could rear up on its back legs, leaning on its thick tail like a stool, and pull down tree branches with its long, curved claws to eat the leaves.

Jefferson’s claw. In America, Thomas Jefferson was sent some big claw bones from a cave in what is now West Virginia. At first he thought they came from a giant lion! In 1797 he told other scientists about them and called the animal **Megalonyx**, “great claw.” Later it was shown to be a ground sloth too, and it was named *Megalonyx jeffersonii* in his honor.

Walking on the sides of its feet. Ground sloths had claws so long and curved that they could not put their feet down flat. They walked on the sides of their feet and the backs of their knuckles. Some had tiny pebbles of bone in their skin, like armor under the fur. In dry caves near the Grand Canyon, explorers even found the dried droppings and hair of ground sloths. The droppings showed which desert plants they had eaten.

Many works. Today’s sloths are small and live in the trees of Central and South America. Their giant cousins walked the ground of both Americas. “O LORD, how manifold are thy works!” (Psalm 104:24). Manifold means many and different. Big sloths and little sloths, ground sloths and tree sloths: God made them all in wisdom.

PICTURE STUDY



The skeleton of the Megatherium in the Royal Cabinet, Madrid, Juan Bautista Bru (drawing), engraved by Manuel Navarro, 1796 · Engraving after a drawing · From José Garriga’s description of the skeleton (Madrid, 1796); the skeleton is in the National Museum of Natural Sciences, Madrid
Wikimedia Commons · Public domain

Juan Bautista Bru put the Megatherium skeleton together and drew it carefully. These pictures were printed and sent to scientists in other countries. Cuvier named the animal

from them, and even Thomas Jefferson saw them. The skeleton still stands in a museum in Madrid.

Look closely

- Find the skull. Is it big or small next to the body?
- Find the claws on the feet.
- Look at the legs. Are they thin like a deer's or thick like an elephant's?

Talk about it

1. Why did scientists far away need a careful drawing?
2. Today scientists think Bru set up some bones a little wrong. Why is it all right to fix a mistake later?

HANDS-ON: SLOTH CLAWS

Wear cardboard claws and find out why ground sloths could not walk flat on their feet.

You will need

- Thin cardboard (a cereal box)
- An old pair of gloves or two socks
- Tape
- Scissors and a pencil (with a grown-up)
- A towel hung over a door or chair (the "branch")

Steps

1. Draw and cut out six long, curved claws, about as long as your hand.
2. Tape three claws to the fingers of each glove or sock. Put them on.
3. Try to walk on all fours with your palms flat. Now try curling your hands and walking on the sides and knuckles. Which works with long claws?
4. Stand up tall and use your claws to hook and pull down the towel "branch." Then try to pick up a coin. What are sloth claws good for, and what are they bad for?

Check your work

- I made claws and wore them.
- I tried walking flat and walking on my knuckles.
- I can tell why ground sloths walked on the sides of their feet.

FIELD NOTEBOOK

1. Draw Megatherium standing up on its back legs and tail, reaching for a branch.
2. Draw a tree sloth hanging from a branch beside it. Write: "Manifold are thy works."

Did you know? Bones of Megalonyx have been found as far north as Alaska and the Yukon. A smaller ground sloth, Harlan's ground sloth, is one of the animals found at the La Brea Tar Pits (Stop E9). Megalonyx jeffersonii is the state fossil of West Virginia.

Goes deeper in. Life Science, the units on mammals (coming soon); History, for Thomas Jefferson; and Geography, for Argentina and Spain.

For families. The Luján skeleton was found in 1787 and reached Madrid in 1788; Bru mounted it and, with Joseph Garriga, published a description in 1796 with engravings by Manuel Navarro. Cuvier named *Megatherium americanum* in 1796 from Bru's drawings. Jefferson presented his paper on *Megalonyx* to the American Philosophical Society in 1797; the bones came from a cave in Greenbrier County, now West Virginia; Desmarest named *M. jeffersonii* in 1822. The dung finds are from Rampart Cave in the Grand Canyon (Shasta ground sloth). The stop gives no dates.

PRACTICE

1. **EASY** What does Megatherium mean, and how big was it?
2. **MEDIUM** What did Thomas Jefferson first think his giant claw came from?
3. **MEDIUM** Why did ground sloths walk on the sides of their feet?

Make it a game • Slow Sloth Race. Everyone lines up and "races" across the room, but the slowest one wins! Players must keep moving all the time; anyone who stops still is out. The last sloth to reach the other side is the winner.

Scripture. "O LORD, how manifold are thy works! in wisdom hast thou made them all: the earth is full of thy riches." (Psalm 104:24, KJV)

"Manifold" means many and different. God made giant sloths and little ones, and the earth is full of the riches of His creation.

Practice: answers

1. "Great beast"; it was as big as an elephant.
2. A giant lion. It really came from a ground sloth, Megalonyx.
3. Their long, curved claws kept them from putting their feet down flat.

2.9 THE LA BREA TAR PITS: FOSSILS IN THE CITY

OBJECTIVES

- Find Los Angeles on a map and tell what the La Brea Tar Pits are.
- Explain how sticky asphalt trapped animals and kept their bones.
- Name four animals whose fossils have been found at La Brea.

Warm-up. Put a spoonful of honey or syrup on a plate. Press your fingertip in and pull it out slowly. Feel how it holds on? Now imagine a pool of something much stickier that could hold a mammoth's foot.

Video slot. Video coming. The La Brea Tar Pits for children: how the asphalt trapped animals, the fossil lab and Project 23. Search approved channels (La Brea Tar Pits and Museum, Natural History Museum of Los Angeles County, Smithsonian); preview first.

KEY TERMS

asphalt

Thick, sticky, black oil that oozes up from the ground. People often call it tar.

seep

A place where a liquid slowly oozes up out of the ground.

dire wolf

A big wolf, heavier than a gray wolf, whose bones are the most common large fossils at La Brea.

excavate

To dig carefully to uncover something buried, like fossils.

CORE IDEAS

The story. In the middle of the big city of Los Angeles, California, cars rush past a grassy park. But in the park is a dark pond that bubbles: *plop ... plop*. Shiny black **asphalt** oozes up out of the ground in sticky puddles. At the edge of the pond stand statues of mammoths. Under the grass lie millions of fossils.

Known for a long time. The people who lived there long ago, the Tongva and the Chumash, used the sticky asphalt to seal their baskets and canoes so they would not leak. In 1769, Spanish explorers wrote about springs of tar in their journals. In Spanish, *la brea* means “the tar.” Later, workers digging out the asphalt for roofs and roads kept finding bones. In 1913, scientists began to **excavate**, and they pulled out thousands of bones.

A sticky trap. Asphalt **seeps** up through cracks in the ground. Sometimes leaves, dust or a shallow layer of water hid the sticky puddles. A horse or a bison stepped in and could not pull its feet out. Its calls brought wolves and big cats looking for an easy meal, and they got

stuck too. That is why La Brea has more meat-eaters than plant-eaters. Thousands of **dire wolves** have been found there, more than any other large animal, and more than two thousand saber-toothed cats.

What has been found. Scientists have found mammoths, giant ground sloths, camels, horses, bison, dire wolves, saber-toothed cats and huge birds like vultures. They have also found tiny things: insects, seeds, snails and bits of wood. In 2006, workers building a parking garage next door found so many fossils that they packed the dirt into 23 big wooden boxes, called Project 23. One box held a nearly complete Columbian mammoth, nicknamed Zed. Today you can visit the museum and watch scientists clean bones through a glass window.

Out of the pit. King David once felt stuck, like an animal in a sticky pit. Then he wrote, “He brought me up also out of an horrible pit, out of the miry clay, and set my feet upon a rock” (Psalm 40:2). We cannot pull ourselves out of sin by ourselves. God rescues us and sets our feet on solid ground.

PICTURE STUDY



Rancho La Brea Tar Pit, Charles R. Knight, 1921 · Oil on canvas (mural) · American Museum of Natural History, New York (hung in the Hall of the Age of Man)
Wikimedia Commons · Public domain

Charles R. Knight painted this mural to show what scientists thought the La Brea Tar Pits looked like long ago. He used the bones found in the tar to help him paint each animal. It hung in a museum in New York for more than forty years.

Look closely

- Find the ground sloth. What is happening to it?
- Find the saber-toothed cats and the big birds in the tree. Why are they there?
- Look far into the background. What other animals can you find?

Talk about it

1. How does this painting help explain why La Brea has so many meat-eaters?
2. What would you paint differently if you painted La Brea today, with the city around it?

Safety first. Use only cold kitchen syrup for the project and never heat it. Real asphalt seeps are sticky and can be hot in summer: at La Brea, stay behind the fences and never touch the tar.

HANDS-ON: TAR PIT IN A PAN

Make a sticky “tar pit” and find out how it traps animals.

You will need

- A baking pan
- Thick syrup (dark corn syrup or molasses), cold
- A few small plastic animals that can be washed
- A little water and a few dry leaves
- Paper towels and warm soapy water for cleanup

Steps

1. Pour a thin layer of syrup into the pan. This is your asphalt seep.
2. Gently pour a little water on top and scatter some leaves. Can you still see the sticky syrup?
3. Walk a plastic animal into the “pond.” Leave it a minute, then try to pull it out. What happens?
4. Walk a second animal toward the first one, as a hungry wolf would. Does it get stuck too? Wash everything in warm soapy water when you are done.

Check your work

- I made a tar pit that was hidden under water and leaves.
- I tested at least two animals.
- I can tell why so many meat-eaters were trapped at La Brea.

FIELD NOTEBOOK

1. Draw a cross-section: the ground, a sticky puddle on top, and bones buried below. Label “asphalt” and “fossils.”
2. Make a list of four animals found at La Brea and draw one.

Did you know? The name “La Brea Tar Pits” really says “the tar tar pits,” because *la brea* already means “the tar.” The bubbles in the pond are gas coming up from deep underground. The asphalt still oozes up today, and sometimes it pushes up through the lawns and sidewalks of the park.

 **What the sign says / What we observe / How Christians read it.**  **What the sign says:** “The fossils at La Brea are between about 11,000 and 50,000 years old.”

What we observe: bones of mammoths, sloths, wolves, cats and birds soaked in asphalt, still real bone and not turned to stone, along with insects, seeds and wood; many more meat-eaters than plant-eaters. **How Christians read it:** many young-earth Christians place the La Brea animals in the centuries after Noah’s Flood, during the Ice Age, about 4,000 years ago. They point out that the method used for these dates (carbon dating) assumes the amount of carbon in the air has stayed steady over time. Both can agree on what we see: these animals lived in what is now Los Angeles, and the sticky asphalt kept their bones.

Goes deeper in. Earth Science, the units on fossils, oil and the Ice Age (coming soon); Geography, for California; and History, for the Spanish explorers of California.

For families. This stop carries the  box. Facts are from the La Brea Tar Pits and Museum (Natural History Museum of Los Angeles County): the asphalt seeps were used by the Tongva and Chumash; the Portolá expedition recorded them in 1769; systematic excavation began in 1913; Project 23 began in 2006 with 23 crates and includes “Zed,” a Columbian mammoth. The museum reports thousands of dire wolves and more than 2,000 Smilodon. Mainstream radiocarbon dates for most La Brea fossils run from about 50,000 to 11,000 years. Knight’s mural shows a ground sloth stuck in the tar with predators nearby; the picture study keeps the talk gentle, so preview it with a sensitive child.

PRACTICE

1.  What does “la brea” mean?
2.  Why have more meat-eaters than plant-eaters been found at La Brea?
3.  Name four animals found at La Brea.

Make it a game • Stuck in the Tar. Mark a “tar pit” on the floor with a blanket. Players walk around the room. Anyone who steps on the blanket is stuck and must freeze with one foot on it. A stuck player may call out “Help!” and the next player who comes to help is stuck too! The last free player wins.

Scripture. “He brought me up also out of an horrible pit, out of the miry clay, and set my feet upon a rock, and established my goings.” (Psalm 40:2, KJV)

An animal in the tar could not get itself out. We cannot rescue ourselves from sin either, but God lifts us out and sets our feet on a rock.

Practice: answers

1. “The tar.”
2. When a plant-eater got stuck, meat-eaters came to eat it and got stuck too.

3. Any four: mammoth, ground sloth, camel, horse, bison, dire wolf, saber-toothed cat, vulture or other big birds, insects.

2.10 BUILD A MUSEUM DISPLAY

OBJECTIVES

- Name the parts of a good museum display: a specimen, a picture, a label and a story.
- Tell how Charles Willson Peale set up the first big fossil skeleton in America.
- Build a museum display about one animal from this trail, with an honest sign.

Warm-up. Think of a museum you have visited, or look at a museum website with a grown-up. What did you notice first: the bones, the pictures or the signs? What made you want to stop and look?

Video slot. Video coming. A behind-the-scenes look at how a museum builds a fossil display: preparing bones, making casts and writing labels. Search approved channels (Smithsonian National Museum of Natural History, Field Museum, American Museum of Natural History, La Brea Tar Pits and Museum); preview first.

KEY TERMS

specimen

A real object, such as a fossil bone, kept in a museum to be studied and shown.

cast

A copy of a fossil made by filling a mold, often with plaster.

label

A small sign that tells visitors what an object is and what we know about it.

curator

A person who takes care of a museum's collection and plans its displays.

CORE IDEAS

The story. In 1801, a painter named Charles Willson Peale heard that a farmer in New York had found giant bones in a muddy marsh. Peale traveled there and set up a huge wooden wheel. Men walked inside it like a hamster wheel to turn a pump that drained the water. Slowly, bone by bone, they dug out the skeleton of a mastodon, a cousin of the mammoth.

The first big display. Peale took the bones to his museum in Philadelphia. He carved wooden copies of the missing pieces and put the skeleton together so it stood tall. Crowds came to see it. It was the first fossil skeleton of a big animal ever set up in America. Peale was a good **curator**: he wanted every visitor to learn about the wonders of God's creation.

The parts of a display. A good museum display has four parts. A **specimen**, or a **cast** of one, shows the real thing. A picture or a model shows how the animal may have looked alive. A **label** tells its name, its size and where it was found. And a short story makes visitors want to learn more.

An honest sign. A good label tells visitors what we can see and measure, like “This tooth is 7 inches long.” If it tells what people think about the past, like how old something is, an honest label says so plainly. On this trail you have practiced keeping observations and interpretations apart. Now you will write your own sign.

Your museum. Choose one animal from this trail: an ichthyosaur, a plesiosaur, a mosasaur, a pterosaur, Quetzalcoatlus, a woolly mammoth, Smilodon, a ground sloth or a La Brea animal. Build a display about it and give your family a tour. “The works of the LORD are great, sought out of all them that have pleasure therein” (Psalm 111:2). A museum is a place for seeking out God’s works with delight.

PICTURE STUDY



The Artist in His Museum, Charles Willson Peale, 1822 · Oil on canvas · Pennsylvania Academy of the Fine Arts, Philadelphia
Wikimedia Commons · Public domain

When he was 81 years old, Charles Willson Peale painted himself inviting visitors into his museum. He lifts a heavy curtain to show the long room full of birds and animals. At the side, you can see some of the mastodon bones he dug up in 1801.

Look closely

- Find the curtain. What is Peale doing with it?
- Find the big bones. What else is near them?
- Look down the long hall. How are the birds displayed?

Talk about it

1. Why do you think Peale painted himself welcoming you in?
2. What would you put first in your museum, so visitors want to come inside?

HANDS-ON: MY TRAIL E MUSEUM

Build a museum display about one creature from this trail, and give a tour.

You will need

- Your clay model, chalk drawing, paper tooth or other project from an earlier stop (or a new drawing or clay model)
- A shoebox or a corner of a table
- Index cards and a pencil
- Crayons or colored pencils
- A small “rock” or real fossil if you have one (optional)

Steps

1. Choose your animal. Set your model or drawing in the shoebox or on the table. Add sand, blue paper for the sea or cotton for snow.
2. Draw a picture card of how the animal may have looked alive.
3. Write a label card with four lines: the name, how big it was, where its fossils are found and one true, surprising fact.
4. Write a second card in two parts: “What we observe” and “What people think.” Put one sentence under each.
5. Invite your family to your museum. Lift a “curtain” (a towel) like Peale and give them a tour.

Check your work

- My display has a model or drawing, a picture of the living animal and a label.
- My second card keeps “What we observe” apart from “What people think.”
- I gave a tour to at least one person.

FIELD NOTEBOOK

1. Draw your finished museum display and give it a title.
2. Copy your label card into your Field Notebook.

Did you know? Peale’s mastodon was only the second big fossil skeleton ever set up to stand in the world. The first was the Megatherium in Madrid (Stop E8). The Peale family is said to have held a small dinner party at a table set up under the mastodon’s ribs!

 **What the sign says / What we observe / How Christians read it.**  **What the sign says:** real museum signs often give a date, such as “This mammoth lived 20,000 years ago” or “This mosasaur lived 70 million years ago.” **What we observe:** the bones themselves, their size and shape, the rock or tar they were found in and where they were dug up. **How Christians read it:** many young-earth Christians read these creatures as made in the creation week, with many buried in Noah’s Flood and others living in the Ice

Age after it, thousands of years ago. A good sign, and a good student, can tell the observation apart from the interpretation. On your own sign, write what you observe first.

Goes deeper in. Art, for drawing and display; History, for Charles Willson Peale and early America; and Trail D, Stop D8 “Reading a museum sign.”

For families. This stop carries the ⏳ box. Peale excavated the mastodon on John Masten’s farm near Newburgh, New York, in 1801, using a large treadwheel-driven chain pump, and exhibited it in Philadelphia from 1801–1802; he painted the scene *The Exhumation of the Mastodon* (1806–1808, Maryland Center for History and Culture). *The Artist in His Museum* (1822) is at the Pennsylvania Academy of the Fine Arts. Calling it the second mounted fossil skeleton (after the Madrid Megatherium) follows common museum histories. The dinner under the ribs is a well-known family story (usually dated 1801–1802) whose details vary between accounts, so the stop says “is said to.” The museum display may reuse any earlier project from this trail, so the stop can be finished in 15–25 minutes or extended.

PRACTICE

1. **EASY** Name the four parts of a good museum display.
2. **MEDIUM** How did Peale get the mastodon bones out of the wet marsh?
3. **MEDIUM** Is “This tooth is 7 inches long” an observation or an interpretation?

Make it a game • Museum Guide. One player is the museum guide. Everyone else closes their eyes while the guide sets out three objects from the house. The visitors open their eyes and the guide gives a one-sentence label for each: one true observation about it. Then the visitors guess what each object is used for. Take turns being the guide.

Scripture. “The works of the LORD are great, sought out of all them that have pleasure therein.” (Psalm 111:2, KJV)

People who love God’s works enjoy searching them out. A museum is a place to seek out the great works of the LORD with delight.

Practice: answers

1. A specimen (or cast), a picture or model of the living animal, a label and a short story.
2. He built a big wheel that men walked in to run a pump and drain the water.
3. An observation: anyone can measure it.

TRACK 2 BADGE QUIZZES

The badge quizzes are optional. Read each question aloud; the child may answer by talking, pointing or drawing. Four right out of five earns each badge. Badges and the certificate are earned by doing the stops, not by scores.

Badge quiz 1 (Stops 1–5)

1. How were ichthyosaur babies born?
2. Where did Cope put the head of *Elasmosaurus* by mistake?
3. What kind of animal was a mosasaur?
4. What held up a pterosaur's wing?
5. Where was *Quetzalcoatlus* found, and how wide were its wings?

Badge quiz 2 (Stops 6–10)

6. Name two ways a woolly mammoth was made for the cold.
7. Was the saber-toothed cat a tiger?
8. What did Thomas Jefferson first think his giant claw came from?
9. Why did La Brea trap so many meat-eaters?
10. Name two things a good museum label tells.

TRAIL CERTIFICATE: MY SEA, SKY AND ICE AGE NOTEBOOK AND TRAIL E CERTIFICATE

Gather the Field Notebook pages from this trail into one booklet with a cover: "My Sea, Sky and Ice Age Notebook," your name and the dates you started and finished.

Add a photo or drawing of your museum display from Stop E10, with a copy of its label.

Add a "Sea, Sky, Ice" page: draw one sea reptile, one flying reptile and one Ice Age animal, each with its name.

When the booklet is done, a parent signs the Trail E certificate.

- **Ten stops:** At least one page for each stop, each with a title and a date.
- **Museum display:** A display with a model or drawing, a picture of the living animal and a label, shown on a tour.
- **Observe or interpret:** The child can tell what we observe from what people think on a museum sign.
- **Care:** Drawings are labeled and done carefully.

Answer key

1. Alive, right in the water, as dolphins are.
2. On the end of its tail.
3. A giant sea lizard, a cousin of monitor lizards like the Komodo dragon.
4. One very long finger (the fourth), with skin stretched from it to the leg.
5. In Big Bend National Park, Texas; about 33 to 36 feet, as wide as a small airplane.

6. Any two: two coats of hair, small ears, a short tail, a layer of fat, a fat hump.
7. No. Smilodon was a cat of its own kind.
8. A giant lion; it was really a ground sloth, Megalonyx.
9. They came to eat stuck animals and got stuck in the asphalt too.
10. Any two: the animal's name, its size, where it was found, a true fact; and it keeps what we observe apart from what people think.

GREAT BATTLES ✕ TRAIL E: THE WORLD WARS

The fifth trail of the Great Battles track visits eight battles of the two World Wars, from the Marne in 1914 to the Battle of the Bulge in the winter of 1944–1945: the taxis of Paris, Sergeant York in the Argonne, the little ships of Dunkirk, the Battle of Britain, the code-breakers of Midway, El Alamein in the desert, D-Day and Bastogne. Each battle is taught through **the map** (the land, sea or sky), **the plan, the people** (their courage and faith) and **why it mattered**.

This is the ● **Scout** level, for ages 7 to 9. A parent reads the story aloud, or a strong reader reads it alone. Every stop stands by itself. Battles are told plainly and gently: numbers of soldiers and losses are given as numbers, deaths are stated plainly but not described, and pictures are chosen for their story, not for violence. Both sides are described fairly, and the crimes of the Nazi government, including the murder of millions of Jewish people, are named plainly, without pictures.

Every stop has a **terrain map** to draw, a **tabletop** activity, and a “**Choose your move**” puzzle in which the child makes the commander’s choice before learning what happened. Five stops earn the **Battle Scout badge, part 1**; eight earn part 2 and the **Trail E certificate**. The badge quizzes are at the end of the trail and are optional.

BEFORE YOU BEGIN

- Listen to a story of about five minutes and tell it back.
- Find Europe, North Africa, the Atlantic Ocean and the Pacific Ocean on a globe (a grown-up may help).

MASTERY CHECKLIST

- ☐ I can put the eight battles of this trail in order on a timeline and say which World War each belongs to.
- ☐ I can find each battle on a map of Europe, North Africa or the Pacific Ocean.
- ☐ I can tell how taxis, little boats, radar, code-breaking, fake tanks or the weather helped win three of the battles.
- ☐ I can name a person from this trail and one virtue he showed, such as courage, faith, patience or steadfastness.
- ☐ I can draw a simple terrain map with a title, a key and both sides.

OPTIONAL BOOKS AND RESOURCES

- **The National WWII Museum (New Orleans)**
(<https://www.nationalww2museum.org>): Free articles, photographs and short videos on D-Day, Midway and the Battle of the Bulge.

- **Imperial War Museums (London)** (<https://www.iwm.org.uk>): Photographs and stories of Dunkirk, the Battle of Britain and El Alamein, and Paul Nash's paintings.
- **The National WWI Museum and Memorial (Kansas City)** (<https://www.theworldwar.org>): Pictures and stories of World War I for Stops E1 and E2.
- **Naval History and Heritage Command** (<https://www.history.navy.mil>): Free U.S. Navy photographs and the story of the code-breakers for Stop E5.

3.1 THE MARNE (1914): THE TAXIS OF PARIS

OBJECTIVES

- Find Paris and the Marne River on a map of France.
- Tell how the taxis of Paris helped carry soldiers to the battle.
- Explain why people called the battle “the Miracle of the Marne.”

Warm-up. Count how many people can fit in your family car. In September 1914, hundreds of little taxis in Paris drove through the night carrying soldiers four or five at a time to a great battle. Imagine a line of taxis stretching down the road as far as you can see!

Video slot. Video coming. The First Battle of the Marne, 1914, and the taxis of Paris, for young viewers. Search approved channels (Simple History, The History Guy, The National WWI Museum and Memorial, Imperial War Museums); preview first.

KEY TERMS

World War I

The great war of 1914 to 1918. France, Britain, Russia and later America (the Allies) fought Germany, Austria-Hungary and their friends.

Marne

A river in France that flows west to join the Seine near Paris (say “marn”).

flank

The side or end of an army’s line. It is often the weakest place.

retreat

To move an army back, away from the enemy.

CORE IDEAS

The map. In August 1914, a great war began in Europe. Germany’s plan was to win quickly in the west. Its armies marched through Belgium into France, swinging around like a giant door on a hinge, to come at Paris from the north. By early September the Germans were only about 30 miles from Paris. Just east of the city ran the Marne River, winding through farm fields and woods.

The plan. The French commander, General Joseph Joffre, had pulled his armies back, but he stayed calm and waited for the right moment. Then a German general, Alexander von Kluck, turned his army to pass east of Paris. That left his **flank**, the side of his army, open to French soldiers in Paris. On September 6, the French and a small British army turned around and attacked.

The people. The governor of Paris, General Joseph Gallieni, needed to rush more soldiers to the fighting, but there were not enough trains or trucks. So he called on the taxis of Paris! On the night of September 7, about 600 taxis lined up, filled with soldiers and drove them toward the front. The drivers kept their meters running, and the army paid the fares afterward.

What happened. For about a week the armies fought along the Marne. A gap opened between two German armies, and French and British soldiers pushed into it. On September 9 the German commanders ordered a **retreat**, and their armies pulled back about 40 miles. The battle was very costly. Both sides together lost about half a million men, killed, wounded or captured.

Why it mattered. Paris was saved, and Germany's plan to win the war quickly had failed. The French called it "the Miracle of the Marne." But after the battle both armies dug long lines of trenches across France and Belgium, and the war went on for four more years.

PICTURE STUDY



Paris taxis gathered to carry soldiers to the Marne, September 1914, Unknown French photographer, 1914 · Photograph · French archives (Bibliothèque nationale de France and others) Wikimedia Commons · Public domain

The taxis of Paris in 1914 were small Renault cars with tall, boxy bodies. Photographs of them lined up in rows became one of the most famous pictures of the war, because they showed ordinary city workers helping save their country.

Look closely

- Count the taxis you can see in the row.
- Look at the wheels and the roofs. How are these cars different from cars today?

- Find the people. Who do you think are the drivers and who are the soldiers?

Talk about it

1. Why do you think the French people loved this story so much?
2. If you were a taxi driver in 1914, how would you feel driving toward a battle at night?

HANDS-ON: TABLETOP MARNE: THE OPEN DOOR

Set up the armies on the floor and see how one turn left a German flank open.

You will need

- A long piece of blue yarn or ribbon (the Marne River)
- A small box (Paris)
- About 20 blocks or toy soldiers in one color (Germans) and 20 in another (French and British)
- Toy cars (the taxis)

Steps

1. Lay the blue yarn across the floor from east to west. Put the Paris box at the west end, just south of the river.
2. Start the German blocks up north (Belgium). Swing them down like a door opening, toward Paris.
3. Now turn one group of German blocks so it passes to the east of Paris. Is its side facing Paris now?
4. Load French soldiers into the toy cars, drive them out of Paris and push them against the open German side. Then push other French and British blocks into the gap between the German groups.
5. Move the German blocks back north, away from the river. That is the retreat.

Check your work

- My map has Paris, the Marne and both armies.
- I showed where the German flank was open.
- I can tell how the taxis helped.

FIELD NOTEBOOK

1. **Terrain map.** Draw the north of France with Belgium at the top. Mark Paris and draw the Marne River running east from near Paris. Draw arrows for the German armies coming down from Belgium, and one arrow turning east of Paris. Draw a line of little taxis driving out of Paris.
2. Write: "The Miracle of the Marne, September 1914."

Did you know? The taxis were made by the Renault company. Many drivers drove all night with few lights so the enemy would not see them. A real “taxi of the Marne” is kept today in the Army Museum in Paris. Historians say the taxis carried only a small part of the soldiers, but the story gave all of France courage.

Goes deeper in. History, the modern history unit “The World Wars” (coming soon); and Geography, France and the rivers of Europe.

For families. The First Battle of the Marne was fought September 5–12, 1914; the main Allied counterattack began September 6. The number of taxis is usually given as about 600, and estimates of the soldiers they carried range from about 3,000 to 6,000; most reinforcements came by train and on foot. Casualty totals are estimates (roughly 250,000 on each side). Many “Marne taxi” photographs online are later re-creations or show other vehicles; choose one dated 1914 from a museum or archive. The stop describes the German army fairly and explains its plan (often called the Schlieffen Plan) in its own terms.

PRACTICE

1. **MEDIUM Choose your move.** You are General Gallieni, the governor of Paris. Soldiers must reach the battle tonight, but there are not enough trains or army trucks. Will you (a) make the soldiers march all night on foot, (b) gather the taxis of Paris to drive them, or (c) keep the soldiers in Paris to guard the city?
2. **EASY** Which city did the Battle of the Marne save?
3. **MEDIUM** Why did people call it “the Miracle of the Marne”?

Make it a game • Taxi Relay. Put 20 “soldiers” (socks, clothespins or blocks) at one end of the room and a box or toy car (the taxi) next to them. Each driver may carry only five soldiers at a time to the “front” at the other end. How many trips does it take? Race the clock, then try again with two taxis.

Scripture. “Some trust in chariots, and some in horses: but we will remember the name of the LORD our God.” (Psalm 20:7, KJV)

Armies in 1914 trusted in trains, guns and even taxis, which were their “chariots.” David reminds us that our true trust belongs to God.

Practice: answers

1. Gallieni chose (b). About 600 taxis carried thousands of soldiers toward the front during the night of September 7, 1914.
2. Paris.
3. The Germans were very close to Paris and seemed to be winning, but the French and British turned around, attacked and made them retreat.

3.2 SERGEANT YORK IN THE ARGONNE (1918)

OBJECTIVES

- Find Tennessee on a map of America and the Argonne Forest on a map of France.
- Tell how Alvin York and his patrol slipped around behind the enemy guns.
- Tell how York used the Bible to decide what was right.

Warm-up. Alvin York grew up in the hills of Tennessee, where he hunted squirrels for his family's supper and won turkey-shooting contests. Find Tennessee on a map. Now find France, far across the Atlantic Ocean. That is how far a mountain boy traveled in 1918.

Video slot. Video coming. Sergeant Alvin York, the Meuse-Argonne Offensive and his Medal of Honor, for young viewers. Search approved channels (Simple History, The History Guy, The National WWI Museum and Memorial, the U.S. Army Center of Military History); preview first.

KEY TERMS

Argonne Forest

A forest of steep hills and deep valleys in northeastern France, where Americans fought in 1918.

patrol

A small group of soldiers sent out on a special job.

machine gun

A gun that fires many bullets very quickly, one after another.

Medal of Honor

America's highest award for courage in battle.

CORE IDEAS

The people. Alvin York grew up poor in the mountains of Tennessee. As a young man he drank and fought, until in 1915 he gave his life to Christ and changed. When America entered the war and York was called into the army, he was troubled, because the Bible says, "Thou shalt not kill." His officers read the Scriptures with him, and after praying alone on a mountainside at home, York decided he could serve his country with a clear conscience.

The map. In the fall of 1918, the American army attacked through the Argonne Forest in France, a land of steep hills, deep ravines and thick woods. On October 8, York's company tried to cross a valley, but German **machine guns** on a hill fired down on them. The soldiers had to lie flat in the open.

The plan. Sergeant Bernard Early took a **patrol** of 17 men, York among them, through the woods to come up behind the guns. They surprised a group of German soldiers and captured

them. But then other machine guns on the hill turned toward them. Six Americans were killed and three wounded, Sergeant Early among the wounded.

What happened. Corporal York was now in charge. Lying in the brush, he aimed carefully, as he had in the turkey shoots at home, and the German guns went quiet one after another. About 25 German soldiers were killed. Then a German officer offered to surrender. York and his seven remaining men marched 132 prisoners back to the American lines.

Why it mattered. The battle in the Argonne was the biggest American battle of the war, and it helped bring the war to an end on November 11, 1918. York was given the Medal of Honor and made a sergeant. When he came home a hero, he turned down offers to get rich. Instead, he raised money to build a school for the mountain children of Tennessee.

PICTURE STUDY



*Sergeant Alvin C. York on the hillside in the Argonne where he fought, U.S. Army Signal Corps photographer, 1919 · Photograph · U.S. National Archives
Wikimedia Commons · Public domain*

A few months after the war ended, an army photographer brought York back to the hill where he had fought, so the place could be recorded for history. This photograph shows the real ground of the battle.

Look closely

- Look at the ground and the trees. Is this open land or rough land?
- Find York's helmet and uniform. What is he holding or wearing?
- Look at his face. How would you describe it?

Talk about it

1. Why would thick woods and hills make it possible for a small patrol to sneak around the guns?
2. Why do you think the army wanted a picture of York in this exact place?

HANDS-ON: TABLETOP ARGONNE: AROUND THE BACK OF THE HILL

Build the valley and the hill and find a hidden way around.

You will need

- A pillow under a towel (the hill)
- Green paper scraps or toy trees (the woods)
- Six blocks or toy soldiers in one color (the German guns)
- About 17 small figures or beans in another color (the patrol)

Steps

1. Make the hill with the pillow and towel. Set the German guns on top, all facing one way, toward an open “valley” on the floor.
2. Put the rest of the American company in the open valley in front of the guns. Can they cross safely?
3. Lay the green woods along one side of the hill. Move the 17-man patrol through the woods and around to the back of the hill.
4. Which way are the guns facing now? Turn some guns around, the way the Germans did, and talk about why that was dangerous for the patrol.

Check your work

- My hill, valley and woods are set up.
- I moved the patrol around behind the guns through the woods.
- I can tell what happened after the guns turned.

FIELD NOTEBOOK

1. **Terrain map.** Draw an open valley with a hill on one side. Put small boxes for machine guns on the hill. Draw trees along the side of the hill and a dotted line for the patrol’s path through the woods to the back of the guns. Add a key and a title: “The Argonne, October 8, 1918.”
2. Copy Ecclesiastes 3:8 in your best handwriting.

Did you know? York was a corporal during the fight and was made a sergeant afterward. In 1941 a movie was made about his life, and York agreed only if some of the money went to his Bible school. The school he helped start, the York Institute in Jamestown, Tennessee, is still a school today.

Goes deeper in. History, the modern history unit “The World Wars” (coming soon); and

Geography, the Appalachian Mountains.

For families. Date: October 8, 1918, near Châtel-Chéhéry, during the Meuse-Argonne Offensive; York served in Company G, 328th Infantry, 82nd Division. The figures (17 men in the patrol, 6 killed and 3 wounded, 132 prisoners, about 25 Germans killed, about 35 machine guns taken) come from the army's investigation and York's diary; small details vary between accounts. York first sought exemption as a conscientious objector; Major George Buxton and Captain Edward Danforth discussed Scripture with him, and he was given leave home to pray before deciding. His conversion is usually dated to 1915. Deaths are stated plainly and not described.

PRACTICE

1. **MEDIUM Choose your move.** You are Sergeant Early. Machine guns on a hill have your company pinned down in an open valley. Thick woods run along the side of the hill. Will you (a) charge straight up the hill, (b) take a small patrol through the woods to come up behind the guns, or (c) pull everyone back?
2. **MEDIUM** Why was York troubled about going to war?
3. **EASY** How many prisoners did York and his men bring back?

Make it a game · Around the Back. One player is the “guard” and stands facing one wall, with eyes open but looking only forward. The others start in front of the guard and must sneak around to touch the guard's back without being seen. If the guard sees you moving, go back to the start. Walk slowly and quietly, the way the patrol crept through the woods.

Scripture. “A time to love, and a time to hate; a time of war, and a time of peace.” (Ecclesiastes 3:8, KJV)

Alvin York loved peace. He searched the Scriptures and learned that there can be a time when good men must fight to protect others. When the war was over, he spent his life building a school.

Practice: answers

1. Early chose (b). His patrol of 17 men slipped through the woods and surprised the Germans from behind.
2. He was a Christian and the Bible says “Thou shalt not kill.” He prayed and studied the Bible and decided he could serve with a clear conscience.
3. 132.

3.3 DUNKIRK (1940): THE LITTLE SHIPS

OBJECTIVES

- Find England, France, the English Channel and Dunkirk on a map.
- Tell how hundreds of little boats helped rescue a trapped army.
- Tell how the people of Britain prayed and what happened next.

Warm-up. Think of the biggest crowd you have ever seen. At Dunkirk in 1940, more than 338,000 soldiers had to be carried across the sea in only nine days. That is about as many people as live in a big city!

Video slot. Video coming. The Dunkirk evacuation (Operation Dynamo), 1940, and the little ships, for young viewers. Search approved channels (Imperial War Museums, Simple History, The History Guy, the Association of Dunkirk Little Ships); preview first.

KEY TERMS

evacuation

Moving people out of a dangerous place to a safe one.

English Channel

The narrow sea between England and France.

mole

A long wall of stone and wood that reaches out into the sea, where ships can tie up.

little ships

The fishing boats, yachts, lifeboats, ferries and other small boats that helped at Dunkirk.

CORE IDEAS

The map. In May 1940, Germany, ruled by Adolf Hitler and his Nazi party, invaded the Netherlands, Belgium and France. German tanks raced through the forests and reached the sea, cutting the British army and many French soldiers off from the rest of France. They were trapped around Dunkirk, a French port on the English Channel, with the sea behind them. The beaches there are long, flat and shallow, so big ships could not come close to shore.

The plan. In tunnels under the white cliffs of Dover, Admiral Bertram Ramsay planned a rescue called Operation Dynamo. Navy ships would load soldiers from the long harbor wall, the **mole**. But small boats were needed to carry men from the shallow beaches out to the bigger ships. So the call went out across England for fishing boats, pleasure yachts, lifeboats, paddle steamers and barges: the **little ships**.

The people. On Sunday, May 26, King George VI asked the whole nation to pray, and churches were full. On the beaches, soldiers waited in long, patient lines and waded out into

the water up to their shoulders to reach the boats. French soldiers bravely held the line around the town so that others could get away, and many of them were captured. Royal Air Force pilots fought overhead.

What happened. For nine days, from May 26 to June 4, ships and boats went back and forth across the Channel. For most of those days the sea stayed unusually calm. Some ships were sunk, and the army had to leave its tanks and trucks behind. But about 338,000 soldiers were carried to safety, more than 100,000 of them French.

Why it mattered. Prime Minister Winston Churchill called the rescue “a miracle of deliverance,” but he also warned that “wars are not won by evacuations.” The saved soldiers lived to fight again. Britain did not give up, and the courage of ordinary people with ordinary boats became known as “the Dunkirk spirit.”

PICTURE STUDY



British soldiers on the beach at Dunkirk waiting to be rescued, British official photographer, May 26–29, 1940 · Photograph · Imperial War Museums, London
Wikimedia Commons · Public domain

British army photographers took pictures of the soldiers waiting on the sand at Dunkirk. The long lines of men show how patient and orderly they had to be while they waited for the boats.

Look closely

- Find the long lines of soldiers. Where are the lines going?
- Look out at the sea. Can you see any ships, or only water?
- Look at the sand. How wide and flat is the beach? Why couldn't big ships come right up to the shore?

Talk about it

1. How do you think the soldiers felt waiting in line for many hours?
2. Why would small boats be just as important as big ships here?

HANDS-ON: TABLETOP DUNKIRK: FERRY THE ARMY

Find out why the big ships needed little boats.

You will need

- A blue towel (the sea) and a strip of yellow paper (the beach)
- A ruler (the mole)
- One big toy boat or a shoebox lid (a navy ship)
- Four or five bottle caps (the little ships)
- About 40 dried beans (the soldiers)

Steps

1. Lay the yellow beach along one edge of the blue sea. Put the ruler out into the sea at one end of the beach as the mole.
2. Put the big ship out in the “deep water,” a hand’s width from the beach. It may not touch the sand.
3. Load beans into the bottle caps, a few at a time, and carry them out to the big ship. Load some beans straight onto the big ship at the mole.
4. Time yourself. Then try with only one bottle cap. How much slower is it? Why did Admiral Ramsay need so many little ships?

Check your work

- My map has a beach, a mole, a big ship and little boats.
- I moved all the soldiers to the big ship.
- I can tell why big ships could not reach the beach.

FIELD NOTEBOOK

1. **Terrain map.** Draw the bottom of England and the top of France with the English Channel between them. Mark Dover and Dunkirk. Draw the long beaches and the mole at Dunkirk. Draw arrows going back and forth across the Channel, and lots of tiny boats.
2. Draw one little ship: a fishing boat, a yacht or a paddle steamer. Give it a name.

Did you know? The smallest of the little ships was a fishing boat called *Tamzine*, only about 15 feet long. Many of the little ships still sail today, and every few years some of them cross the Channel to Dunkirk again to remember. Most of the soldiers were actually

taken off from the mole by navy ships, but the little ships rescued many thousands from the beaches.

Goes deeper in. History, the modern history unit “The World Wars” (coming soon); and Geography, the British Isles and the English Channel.

For families. Operation Dynamo ran from May 26 to June 4, 1940; official figures give 338,226 men landed in Britain, including well over 100,000 French. The German armored advance halted for about two days from May 24 (Hitler’s “halt order”), which historians agree gave time to organize the perimeter. The National Day of Prayer was Sunday, May 26, 1940. Churchill’s words are from his June 4, 1940, speech to the House of Commons. The number of little ships is uncertain (often given as about 700 private craft); the stop says “hundreds.” British official photographs from 1940 are out of Crown copyright.

PRACTICE

1. **MEDIUM Choose your move.** You are Admiral Ramsay. Hundreds of thousands of soldiers are on a shallow beach, and your big ships cannot get close. Will you (a) tell the soldiers to march to another port, (b) load ships at the harbor wall and call for hundreds of small boats to ferry men from the beaches, or (c) wait for better weather?
2. **EASY** Name two kinds of little ships.
3. **EASY** What did King George VI ask the people to do on May 26, 1940?

Make it a game • Little Ships Relay. Put a pile of cotton balls (soldiers) on a “beach” at one end of the room and a laundry basket (the big ship) at the other. Each player carries soldiers on a spoon (a little ship), one or two at a time. If a soldier falls off, go back and try again. Work together until everyone is rescued.

Scripture. “The LORD shall fight for you, and ye shall hold your peace.” (Exodus 14:14, KJV)

Moses said this when Israel was trapped with the sea behind them. At Dunkirk, too, an army was trapped by the sea, and a whole nation prayed for help.

Practice: answers

1. Ramsay chose (b). Navy ships loaded at the mole, and the little ships carried men from the beaches out to the bigger ships.
2. Any two: fishing boats, yachts, lifeboats, paddle steamers, ferries, barges.
3. Pray.

3.4 THE BATTLE OF BRITAIN (1940)

OBJECTIVES

- Find southern England, London and the English Channel on a map.
- Tell how radar and watchers helped British fighter pilots meet enemy planes in time.
- Explain why Churchill called the pilots “the Few.”

Warm-up. Close your eyes. A grown-up claps softly somewhere in the room. Without peeking, point to where the sound came from. In 1940, British radar stations used invisible radio waves to “hear” enemy planes long before anyone could see them.

Video slot. Video coming. The Battle of Britain, 1940: radar, Spitfires and Hurricanes, for young viewers. Search approved channels (Imperial War Museums, the Royal Air Force Museum, Simple History, The History Guy); preview first.

KEY TERMS

RAF

The Royal Air Force, Britain’s air force.

Luftwaffe

The German air force (say “LOOFT-vaf-uh”).

radar

A way of finding faraway planes or ships by sending out radio waves and catching the echoes.

Spitfire

A fast British fighter plane. The Hurricane was the other main British fighter.

CORE IDEAS

The map. After Dunkirk, Britain stood almost alone against Nazi Germany. Hitler planned to send an army across the English Channel, which is only about 21 miles wide at its narrowest. But first his air force, the **Luftwaffe**, had to beat Britain’s Royal Air Force. From July to October 1940, the battle was fought in the skies over southern England.

The plan. Air Chief Marshal Hugh Dowding had built a clever system. **Radar** stations along the coast spotted planes far out over the sea. Volunteers on hilltops watched and listened once the planes crossed the coast. Their reports went to operations rooms, where men and women moved markers across big map tables. Then the fighter pilots were sent up in their Spitfires and Hurricanes just in time to meet the raiders.

The people. Many of the pilots were barely 20 years old. They came from Britain and from Canada, New Zealand, Australia, South Africa, Poland, Czechoslovakia and other lands. Some flew three or four times a day. Ground crews worked through the night to fix the

planes. Churchill said, “Never in the field of human conflict was so much owed by so many to so few,” and the pilots became known as “the Few.”

What happened. At first German bombers attacked the RAF’s airfields, and the RAF was almost worn out. Then in September Germany began bombing London instead. Families slept in shelters and underground train stations, but the airfields had time to recover. On September 15, the RAF met two huge raids and turned them back. Two days later, Hitler put off his invasion. About 1,900 German planes and about 1,000 British fighters were lost.

Why it mattered. It was the first time Hitler’s forces had been stopped. Britain stayed free, and four years later the great D-Day invasion of France would sail from its shores. September 15 is still remembered in Britain as Battle of Britain Day.

PICTURE STUDY



Battle of Britain, Paul Nash, 1941 · Oil on canvas · Imperial War Museums, London
Wikimedia Commons · Public domain

Paul Nash was a British artist who had been a soldier in World War I. In World War II he was asked to paint the war in the air. Instead of showing one fight up close, he painted the whole battle from high above, as a pattern of white trails over the land and the sea.

Look closely

- Find the river winding down to the sea.
- Follow the white trails with your finger. Where do they curve and loop?
- Find the dark shapes in the sky. What do you think they are?

Talk about it

1. Why do you think Nash painted the battle from so high up?

2. Does this painting feel calm or busy? Why?

HANDS-ON: TABLETOP BATTLE OF BRITAIN: THE MAP TABLE

Run an operations room like the ones that guided the British pilots.

You will need

- A large sheet of paper with southern England, the Channel and the coast of France drawn on it
- Six counters or toy planes in one color (German raids) and six in another (RAF squadrons)
- A ruler or wooden spoon (for pushing markers, as the plotters did)
- Three players: a radar watcher, a plotter and a controller

Steps

1. Put the RAF squadrons at airfields near London. Put the German raids over France.
2. The radar watcher calls out, “Raid of 20 planes over the Channel, heading for London!” The plotter pushes a German marker to that spot.
3. The controller decides which squadrons to send up and calls, “Scramble!” Move them out to meet the raid.
4. Play three raids. Did your controller keep some squadrons resting on the ground? Why might that matter?

Check your work

- My map table has England, the Channel, airfields and London.
- Each player did a job.
- I can tell how radar helped the RAF.

FIELD NOTEBOOK

1. **Terrain map.** Draw southern England, the English Channel and the coast of France. Mark London, Dover and Calais. Draw small towers along the English coast for radar stations and arrows for German planes crossing the Channel. Add a key.
2. Draw a Spitfire from above, with its wide, rounded wings.

Did you know? The Polish pilots of No. 303 Squadron shot down more enemy planes than any other RAF fighter squadron in the battle. Thousands of ordinary people, many of them women, worked as plotters and radar operators. Children collected old pots and pans so the metal could be used to build planes.

Goes deeper in. History, the modern history unit “The World Wars” (coming soon); and Art, Paul Nash and the war artists.

For families. British historians date the battle July 10 to October 31, 1940. Loss figures vary by source: roughly 1,000 to 1,100 RAF fighters and roughly 1,600 to 1,900 German aircraft; about 540 Fighter Command aircrew were killed. Churchill's "so few" line is from his speech of August 20, 1940. Operation Sea Lion was postponed on September 17, 1940. In May 1940 Dowding wrote to the government asking that no more fighter squadrons be sent to France, so that enough would remain to defend Britain. Paul Nash died in 1946, so his work is in the public domain in most countries.

PRACTICE

1. **MEDIUM Choose your move.** You are Air Chief Marshal Dowding in May 1940. France is falling, and the French ask for more British fighter planes. Will you (a) send all your fighters to France, (b) send a few but keep enough at home to defend Britain, or (c) send none and keep them all safe?
2. **EASY** What did radar do for the RAF?
3. **EASY** Who were "the Few"?

Make it a game • Scramble!. The "pilots" sit or rest on the floor at their "airfield." The "radar watcher" stands by a window and calls out raids: "Ten planes, coming from the kitchen!" The controller points and shouts "Scramble!" and the pilots fly (arms out) to meet the raid and touch the spot. Then back to rest. Watch out: the radar watcher may call two raids at once!

Scripture. "Thou shalt not be afraid for the terror by night; nor for the arrow that flieth by day;" (Psalm 91:5, KJV)

In 1940, enemy planes came by day and bombs fell by night. Many families in London read Psalm 91 in the shelters, trusting God to keep them.

Practice: answers

1. Dowding argued for (b). He warned that sending more fighters to France would leave Britain defenseless, and the squadrons he kept were ready for the Battle of Britain.
2. It spotted enemy planes far away so the fighters could take off in time to meet them.
3. The RAF fighter pilots of the Battle of Britain.

3.5 MIDWAY (1942): CODE-BREAKING AND FOUR CARRIERS

OBJECTIVES

- Find Hawaii and Midway on a map of the Pacific Ocean.
- Tell how American code-breakers found out where Japan would attack.
- Explain why sinking four aircraft carriers changed the war in the Pacific.

Warm-up. Make a secret code: A = 1, B = 2, C = 3, and so on. Write your name in numbers and ask someone to crack it. In 1942, American code-breakers cracked part of a much harder code, and it helped win a great battle.

Video slot. Video coming. The Battle of Midway, 1942: code-breaking and dive bombers, for young viewers. Search approved channels (Naval History and Heritage Command, The National WWII Museum, Simple History, The History Guy); preview first.

KEY TERMS

aircraft carrier

A huge ship with a flat deck where airplanes take off and land.

code

A secret way of writing a message so only the right people can read it.

code-breaker

A person who works out how to read the enemy's secret messages.

dive bomber

A plane that dives steeply down at its target before dropping its bomb.

CORE IDEAS

The map. Midway is two tiny islands in the middle of the Pacific Ocean, about 1,300 miles northwest of Hawaii. Six months after Japan's surprise attack on Pearl Harbor, the Japanese navy planned to capture Midway. Admiral Isoroku Yamamoto hoped the attack would draw out the American **aircraft carriers** so his own carriers could sink them.

The plan. In a basement at Pearl Harbor, Navy **code-breakers** led by Commander Joseph Rochefort worked day and night on Japanese radio messages. They learned that the next target was called "AF." Rochefort thought AF was Midway. To check, Midway sent out a message saying its machine for making fresh water had broken. Soon the code-breakers heard a Japanese message: "AF is short of water." Now Admiral Chester Nimitz knew where the enemy was going, and he sent his three carriers to wait in ambush.

The people. On the morning of June 4, 1942, American torpedo planes flew in low over the water to attack the Japanese carriers. The skilled Japanese pilots shot down almost all of them. Of the 30 men of Torpedo Squadron 8, only Ensign George Gay lived, floating in the

sea and watching the battle. But their brave attacks pulled the Japanese fighter planes down low.

What happened. Just then, American **dive bombers** from the *Enterprise* and the *Yorktown* arrived high above, while the Japanese carriers were refueling planes on their decks. In about six minutes, three carriers, the *Akagi*, *Kaga* and *Soryu*, were on fire. That afternoon a fourth, the *Hiryu*, was hit too. Planes from the *Hiryu* had already badly damaged the *Yorktown*, and it later sank. About 300 Americans and about 3,000 Japanese were killed.

Why it mattered. Japan lost all four carriers that attacked Midway and many of its best pilots, and it never fully recovered. The battle was the turning point of the war in the Pacific. After Midway, America was no longer only defending; it began to push back.

PICTURE STUDY



Dauntless dive bombers at the Battle of Midway, U.S. Navy photographer, June 6, 1942 · Photograph · U.S. National Archives; Naval History and Heritage Command
Wikimedia Commons · Public domain

This photograph was taken from an American plane near the end of the battle. The SBD Dauntless dive bombers in it are the same kind of plane that hit the four Japanese carriers. Far below is a Japanese cruiser, the *Mikuma*, which was also sunk.

Look closely

- Find the planes. Count them.
- Look at the ocean below. How high up do you think the photographer was?
- Find the ship and the smoke. Is it near or far?

Talk about it

1. Why do you think dive bombers flew so high before they attacked?
2. How do you think the pilots found the enemy ships on such a big ocean?

HANDS-ON: TABLETOP MIDWAY: SET THE AMBUSH

Lay out the ocean and see why knowing the enemy's plan made such a difference.

You will need

- A blue sheet or towel (the Pacific)
- Two pebbles (Midway's islands)
- Four shoebox lids or blocks in one color (Japanese carriers)
- Three in another color (American carriers)
- Paper airplanes or folded paper strips (planes)

Steps

1. Put the Midway pebbles in the middle of the sheet. Put the four Japanese carriers on the northwest side, heading toward Midway.
2. Hide the three American carriers to the northeast of Midway, off to the side. This is the ambush.
3. Put paper planes on the Japanese decks: they are refueling. Fly American planes from the side to reach them while the decks are full.
4. Now try it again, but this time the Japanese know where the Americans are. What changes?

Check your work

- My ocean has Midway, four Japanese carriers and three American carriers.
- I set the American carriers in ambush to the side.
- I can tell how breaking the code helped.

FIELD NOTEBOOK

1. **Terrain map.** Draw the Pacific Ocean with Hawaii in the lower right. Mark Midway northwest of Hawaii. Draw the Japanese carriers coming from the northwest and the American carriers waiting northeast of Midway. Label the spot "Point Luck." Add a key.
2. Write "AF is short of water" in a secret number code. Write the answer underneath.

Did you know? The American carriers met at a spot in the ocean the admirals named "Point Luck." The *Yorktown* had been damaged a month earlier, and workers at Pearl Harbor repaired it in only about three days so it could join the battle. George Gay was picked up by a seaplane the next day.

Goes deeper in. History, the modern history unit "The World Wars" (coming soon); Geography, the Pacific Ocean and its islands; and Arithmetic, codes and number patterns.

For families. The main carrier battle was June 4, 1942 (June 5 in Japan, across the date line); the battle ran June 4-7. The “AF is short of water” ruse is well documented; historians still discuss who first proposed it. Torpedo Squadron 8 (from USS *Hornet*) lost all 15 planes, with Ensign George Gay the only survivor of 30 men. The dive bomber strikes were led by Lt. Cmdr. Wade McClusky (*Enterprise*) and Lt. Cmdr. Max Leslie (*Yorktown*). Losses: about 307 American and about 3,000 Japanese dead (figures vary slightly). The *Yorktown* was finished by a Japanese submarine on June 7. U.S. Navy photographs are in the public domain.

PRACTICE

1. **MEDIUM Choose your move.** You are Admiral Nimitz. Your code-breakers say the enemy will attack Midway, but some officers think the target is somewhere else. Will you (a) keep your carriers near Hawaii to be safe, (b) trust the code-breakers and hide your carriers near Midway in ambush, or (c) send your carriers home to California?
2. **MEDIUM** How did the Americans find out that “AF” meant Midway?
3. **EASY** How many Japanese carriers were sunk at Midway?

Make it a game • Code-Breakers. One player writes a short secret message using a number code (A = 1, B = 2...) but gives it a twist, such as A = 2, B = 3. The others get one clue: the name of a family member in the message. Use the clue to crack the rest, just as the code-breakers used “AF is short of water.”

Scripture. “He revealeth the deep and secret things: he knoweth what is in the darkness, and the light dwelleth with him.” (Daniel 2:22, KJV)

Code-breakers worked hard to learn one secret. God knows every secret thing, and nothing is hidden from Him.

Practice: answers

1. Nimitz chose (b). He trusted Rochefort’s code-breakers and set an ambush northeast of Midway.
2. Midway sent a message that its water machine had broken, and then the Japanese reported that “AF is short of water.”
3. Four.

3.6 EL ALAMEIN (1942)

OBJECTIVES

- Find Egypt, the Mediterranean Sea and El Alamein on a map.
- Tell why the land at El Alamein made it impossible to go around the enemy.
- Tell how fake tanks and cleared paths through the minefields helped win the battle.

Warm-up. Hide ten buttons in a tray of sand or rice. Now find them without digging with your hands: only gently poke with a pencil, slowly, row by row. That is how soldiers searched for buried mines in the desert at El Alamein.

Video slot. Video coming. The Second Battle of El Alamein, 1942: Montgomery, Rommel and the desert war, for young viewers. Search approved channels (Imperial War Museums, Simple History, The History Guy, Kings and Generals); preview first.

KEY TERMS

minefield

A piece of ground with many hidden bombs (mines) buried in it to stop an enemy.

Eighth Army

The British army in the North African desert, with soldiers from many lands.

Desert Fox

The nickname of the German general Erwin Rommel, because he was quick and clever.

deception

Tricking the enemy into believing something that is not true.

CORE IDEAS

The map. In 1942 the war reached the deserts of North Africa. A German and Italian army pushed east into Egypt, aiming for the Suez Canal. The British Eighth Army stopped them near a little railway stop called El Alamein. There the sea lay to the north and the Qattara Depression, a huge low land of soft sand and salt marsh, lay to the south. Between them was a gap only about 40 miles wide. No army could go around; it had to go straight through.

The people. The German commander, Erwin Rommel, was called the “Desert Fox.” He was daring and clever, and even his enemies respected him. The new British commander was General Bernard Montgomery, a bishop’s son and a careful planner. His soldiers came from Britain, Australia, New Zealand, South Africa and India, with Greek and Free French soldiers too. Before the battle, Montgomery told his men, “Let us all pray that ‘the Lord mighty in battle’ will give us the victory.”

The plan. Rommel’s men had buried about half a million mines, in fields they called the “Devil’s Gardens.” Montgomery planned for engineers to clear narrow paths through them at

night, so the tanks could follow. He also tricked Rommel. In the south he set out fake tanks made of wood and canvas, and he built a fake water pipeline very slowly, so the attack seemed far off. In the north, real tanks were covered to look like trucks.

What happened. On the night of October 23, 1942, about 900 British guns fired at once. Engineers crept forward by moonlight, feeling for mines. For twelve days the two armies fought hard. Rommel, who had been away sick in Europe, rushed back to take command. On November 4, his army began a long retreat west. About 13,500 soldiers of the Eighth Army were killed, wounded or missing, and about 30,000 of Rommel's men were captured.

Why it mattered. Egypt and the Suez Canal were safe. Churchill said, "Now this is not the end. It is not even the beginning of the end. But it is, perhaps, the end of the beginning." Church bells rang all over Britain to celebrate, for the first time in more than two years.

PICTURE STUDY



General Montgomery in the turret of his tank at El Alamein, Captain G. Keating, No. 1 Army Film and Photographic Unit, November 5, 1942 · Photograph · Imperial War Museums, London
Wikimedia Commons · Public domain

Montgomery liked to be seen by his soldiers. He rode in a tank and wore a black tank beret with two badges on it. This photograph was taken on the day after the battle ended, as he watched Rommel's army begin to retreat.

Look closely

- Find Montgomery's beret. How many badges can you see? How is it different from a helmet?
- Find the binoculars. How many pairs can you count?
- Look at the tank. Can you see the bolts in its metal?

Talk about it

1. Why would soldiers feel braver when they saw their general nearby?
2. Why would a general need binoculars in a flat, open desert?

HANDS-ON: SAND TABLE EL ALAMEIN: LANES AND FAKE TANKS

Build the narrow gap in a tray of sand, hide the mines and make your own fake army.

You will need

- A baking tray of sand or dry rice
- A strip of blue paper (the sea) and a dish of wet sand or a damp sponge (the Qattara Depression)
- Twenty buttons or pennies (mines)
- Toothpicks or a pencil (mine probes)
- Toy tanks or blocks, plus folded paper “covers” and cardboard cut-out tanks (fakes)

Steps

1. Put the blue sea along the top of the tray and the wet sand at the bottom. The dry sand between them is the narrow gap.
2. Bury the buttons across the middle of the gap. These are the Devil’s Gardens.
3. Set cardboard fake tanks in the south. Cover real tanks in the north with paper so they look like trucks.
4. With a toothpick, gently probe a narrow lane through the mines in the north and lift out each button you find. Then drive the real tanks through the lane.

Check your work

- My sand table has the sea, the Qattara Depression and the gap between them.
- I cleared one lane through the mines.
- I can tell how the fake tanks fooled Rommel.

FIELD NOTEBOOK

1. **Terrain map.** Draw the coast of Egypt with the Mediterranean Sea at the top. Mark El Alamein near the coast and the Qattara Depression to the south. Draw dots for the minefields between them, a lane through the dots in the north, and fake tanks in the south. Add a key and the title “El Alamein, October 1942.”
2. Draw a fake tank made of wood and canvas, then draw a real tank dressed up as a truck.

Did you know? The fake pipeline was built of empty gas cans and was laid so slowly that it looked as if it would not be finished until November. One of the mine detectors used by the British was invented by a Polish officer. Church bells in Britain had been kept silent

since 1940, to be rung only as a warning if the enemy landed, so ringing them for a victory was a great joy.

Goes deeper in. History, the modern history unit “The World Wars” (coming soon); and Geography, Egypt, the Sahara and the Suez Canal.

For families. This is the Second Battle of El Alamein, October 23 to November 4, 1942 (the First Battle, in July 1942, stopped Rommel’s advance). The deception plan was called Operation Bertram. Rommel was on sick leave in Austria when the battle began; his stand-in, General Stumme, died of a heart attack on October 24. Montgomery’s quotation is from his personal message to the Eighth Army before the battle, quoting Psalm 24:8. Casualty figures are approximate (Eighth Army about 13,500; Axis losses, including about 30,000 prisoners, are less certain). Churchill’s words are from his Mansion House speech of November 10, 1942; the bells rang on November 15. British official photographs from 1942 are out of Crown copyright. The stop describes Rommel fairly as a respected commander; his later story is left for older levels.

PRACTICE

1. **MEDIUM Choose your move.** You are General Montgomery. The enemy line stretches from the sea to the Qattara Depression, behind thick minefields. Will you (a) swing your tanks around the southern end, (b) clear paths through the mines at night in the north and trick the enemy into watching the south, or (c) wait and hope the enemy attacks you?
2. **EASY** What was Rommel’s nickname?
3. **MEDIUM** Why couldn’t either army go around the other at El Alamein?

Make it a game • Clear the Lane. Scatter paper squares (mines) across the floor. One player, the engineer, has one minute to pick up mines and make a clear lane from one side to the other. Then the “tanks” must walk only in the cleared lane without stepping on a square. Take turns being the engineer. Can you make the lane faster each time?

Scripture. “When thou goest out to battle against thine enemies, and seest horses, and chariots, and a people more than thou, be not afraid of them: for the LORD thy God is with thee, which brought thee up out of the land of Egypt.” (Deuteronomy 20:1, KJV)

God spoke these words to Israel, whom He had brought out of Egypt. Thousands of years later, soldiers in Egypt’s desert faced a strong enemy and were told to pray to “the Lord mighty in battle.”

Practice: answers

1. Montgomery chose (b). Going around was impossible because of the Qattara Depression, so he cleared lanes in the north and used fake tanks and a fake pipeline to fool Rommel.
2. The Desert Fox.

3. The sea was on one side and the Qattara Depression, soft sand and salt marsh, was on the other.

3.7 D-DAY (JUNE 6, 1944)

OBJECTIVES

- Find Normandy and name the five D-Day beaches on a map.
- Tell how the moon, the tides, the weather and a fake army all mattered to the plan.
- Tell the courage of the Rangers at Pointe du Hoc and General Roosevelt at Utah Beach.

Warm-up. Look at the moon tonight, or find a picture of the moon's shapes. Is it full, half or a thin sliver? The D-Day planners needed three things on the very same day: a bright moon at night, a low tide at dawn and calm weather. That is hard to get all at once!

Video slot. Video coming. D-Day, June 6, 1944: the plan, the beaches, Pointe du Hoc and Utah Beach, for young viewers. Search approved channels (The National WWII Museum, the American Battle Monuments Commission, Imperial War Museums, Simple History); preview first.

KEY TERMS

D-Day

The day a big attack begins. The most famous D-Day is June 6, 1944, when the Allies landed in France.

Normandy

A part of northern France along the English Channel, with beaches, cliffs and farms.

paratrooper

A soldier who jumps from an airplane with a parachute.

tide

The rising and falling of the sea, twice each day. At low tide more of the beach shows.

CORE IDEAS

The map. For four years Nazi Germany had ruled France. Hitler built a long line of guns, concrete bunkers and beach obstacles along the coast called the Atlantic Wall. The Allies chose to land in Normandy, on five beaches with code names: **Utah** and **Omaha** for the Americans, **Gold** and **Sword** for the British, and **Juno** for the Canadians.

The plan. General Dwight Eisenhower was in command. **Paratroopers** would drop in the dark behind the beaches, then thousands of ships would bring soldiers ashore at low tide, when the obstacles could be seen. To fool Hitler, the Allies made a fake army in England pointed at Calais, far from Normandy, with rubber tanks, wooden planes and pretend radio messages. The trick worked so well that Germany kept many soldiers waiting at Calais for weeks. The landing was set for June 5, but a storm blew in. A weather officer, James Stagg, said there would be a short break in the storm. Eisenhower decided: go on June 6.

The people. At Pointe du Hoc, between Utah and Omaha, Lieutenant Colonel James Rudder's Rangers climbed 100-foot cliffs on ropes and ladders to reach big German guns. At the top they found the guns had been moved, so two sergeants searched inland, found them hidden and wrecked them. At Utah Beach, Brigadier General Theodore Roosevelt Jr., the son of a president, landed with the first wave at age 56, walking with a cane. The current had carried the boats about a mile off course. Roosevelt studied the ground and said, "We'll start the war from right here!"

What happened. At Omaha Beach the fighting was hardest, and for hours the soldiers were pinned on the sand until small groups worked their way up the bluffs. By nightfall about 156,000 Allied soldiers had landed by sea and air. About 4,400 of them were killed that day, and thousands more were wounded.

Why it mattered. D-Day opened the way to free France and the rest of Western Europe. The Nazis had done terrible evil: they had murdered millions of Jewish people and many others in prison camps. Less than a year after D-Day, Nazi Germany surrendered, on May 8, 1945.

PICTURE STUDY



Into the Jaws of Death, Robert F. Sargent, U.S. Coast Guard, June 6, 1944 · Photograph · U.S. National Archives

Wikimedia Commons · Public domain

A Coast Guard photographer, Robert Sargent, took this picture from a landing craft on the morning of D-Day as soldiers waded toward Omaha Beach. It is one of the most famous photographs of the war.

Look closely

- Find the edges of the boat in the front of the picture. Where is the photographer standing?
- Look at how deep the water is. How far do the soldiers still have to go?
- Look at the land ahead. What makes it hard to climb?

Talk about it

1. Why do you think the photograph is called “Into the Jaws of Death”?
2. What do you think the soldiers were thinking about as they stepped off the boat?

HANDS-ON: D-DAY PLANNING BOARD

Be the planners. Check the moon, the tide and the weather, then set out the beaches and the fake army.

You will need

- Poster board or a big sheet of paper
- Crayons or markers
- Three index cards for each day June 4, 5 and 6, labeled Moon, Tide and Weather
- Toy boats or paper boats, cotton balls (clouds) and small paper parachutes

Steps

1. Draw the south of England at the top and the coast of France at the bottom. Mark the five beaches from west to east: Utah, Omaha, Gold, Juno, Sword. Mark Pointe du Hoc between Utah and Omaha, and Calais far to the east.
2. A grown-up fills in the cards. June 4: bright moon, low tide at dawn, storm. June 5: bright moon, low tide at dawn, storm. June 6: bright moon, low tide at dawn, a short break in the storm.
3. Check each day. Which day has all three things you need? Choose your D-Day.
4. Set the paper fake army near Calais. Put paratroopers behind the beaches, then sail the boats across to the five beaches.

Check your work

- My board shows the five beaches in order and Pointe du Hoc.
- I checked the moon, tide and weather before choosing the day.
- I put the fake army in the wrong place on purpose and can tell why.

FIELD NOTEBOOK

1. **Terrain map.** Draw the Normandy coast with the English Channel above it. Label the five beaches from west to east: Utah, Omaha, Gold, Juno, Sword. Draw the cliffs of Pointe du Hoc with a tiny ladder. Draw arrows from England for the ships and little parachutes behind the beaches. Add a key and the date.
2. Write the five beach names and which country landed on each.

Did you know? On the night before D-Day, Eisenhower wrote a note in case the landing failed. It said that if there was any blame, “it is mine alone.” He kept it in his wallet and never had to use it. General Roosevelt’s son Quentin landed at Omaha Beach the same day. Roosevelt received the Medal of Honor; he died of a heart attack in July 1944 and is buried in Normandy beside his brother Quentin, a pilot killed in World War I.

Goes deeper in. History, the modern history unit “The World Wars” (coming soon); Earth Science, the moon and the tides; and Geography, France and the English Channel.

For families. Figures are approximate: about 156,000 Allied troops landed by sea and air on June 6, 1944, carried by roughly 5,000 ships and landing craft; the D-Day Center’s research counts about 4,400 Allied dead that day, with total casualties around 10,000. About 225 Rangers made the Pointe du Hoc assault; Sergeants Leonard Lomell and Jack Kuhn found and disabled the guns. The wording of Eisenhower’s go decision is reported differently by those present. The deception was Operation Fortitude; its fictitious army group was “commanded” by General Patton. Roosevelt landed about 2,000 yards south of the planned spot; his famous remark is reported in several versions. The stop names the Holocaust plainly and shows no images of it. The picture is a U.S. government photograph in the public domain; it shows soldiers wading ashore and no casualties.

PRACTICE

1. **MEDIUM Choose your move.** You are General Eisenhower early on June 5, 1944. A storm has stopped the landing. Your weather officer says there will be a short break on June 6. If you wait, the next good moon and tides are about two weeks away. Will you (a) go on June 6, (b) wait two weeks, or (c) call off the whole invasion?
2. **EASY** Name the five D-Day beaches.
3. **MEDIUM** What did the Rangers find when they reached the top of Pointe du Hoc?

Make it a game • Moon, Tide, Weather. Make nine cards: three say “Moon ✓,” three “Tide ✓,” three “Weather ✓,” and add six blank cards. Shuffle. Each player draws cards one at a time. The first player to hold a Moon, a Tide and a Weather card calls “D-Day!” and wins the round. Talk about it: why did the planners need all three?

Scripture. “Greater love hath no man than this, that a man lay down his life for his friends.” (John 15:13, KJV)

Thousands of young men crossed the sea on D-Day knowing they might not come home, to free people they had never met. Jesus showed the greatest love of all when He laid down His life for us.

Practice: answers

1. Eisenhower chose (a). It was a good choice: a much worse storm struck Normandy in the middle of June, during the next window.

2. Utah, Omaha, Gold, Juno and Sword.

3. The big guns had been moved. They searched inland, found them hidden and wrecked them.

3.8 THE BATTLE OF THE BULGE (1944–1945): BASTOGNE AND “NUTS!”

OBJECTIVES

- Find Belgium, Luxembourg and Bastogne on a map.
- Tell why the town where seven roads met was so important.
- Tell what General McAuliffe answered when he was asked to surrender.

Warm-up. Press your fist into a soft pillow. See the dent it makes, pushed in deep in the middle? In December 1944, a German attack pushed into the American line just like that, and on the map it made a big bulge.

Video slot. Video coming. The Battle of the Bulge, 1944, the siege of Bastogne and General McAuliffe’s “Nuts!”, for young viewers. Search approved channels (The National WWII Museum, the U.S. Army Center of Military History, Simple History, The History Guy); preview first.

KEY TERMS

Ardennes

A region of steep hills, thick forests and few roads in Belgium and Luxembourg (say “ar-DEN”).

crossroads

A place where roads meet. Armies need roads to move trucks, tanks and supplies.

surrounded

Closed in by the enemy on every side, so no one can get in or out.

airborne

Soldiers trained to go into battle by parachute or glider.

CORE IDEAS

The map. The Ardennes is a land of steep hills, dark pine forests and few roads in Belgium and Luxembourg. In the winter of 1944 it was covered with snow and fog. The Americans thought it was a quiet place, so they kept only a thin line of soldiers there, many of them tired or new.

The plan. Hitler secretly gathered a large army. He planned to attack in bad weather, when Allied planes could not fly, break through the forest, cross the Meuse River and reach the great port of Antwerp. On December 16, 1944, the Germans struck. They pushed the American line back into a huge bulge on the map. Near Malmedy, on December 17, German SS soldiers shot about 80 American prisoners who had already surrendered. It was a war crime.

The people. The town of Bastogne was where seven roads met, and the Germans needed those roads. Soldiers of the 101st **Airborne** Division rushed there in trucks, with tank soldiers beside them. By December 21 they were **surrounded**, short of food, ammunition, medicine and winter coats. On December 22, German officers came under a white flag with a letter asking them to surrender. General Anthony McAuliffe read it and said, “Nuts!” His written answer said: “To the German Commander. NUTS! The American Commander.” It meant: we will not give up.

What happened. On December 23 the skies cleared, and planes dropped food and ammunition by parachute. General George Patton had turned his Third Army north and pushed through the snow, and on December 26 his tanks broke through to Bastogne. Patton had asked his chaplain to write a prayer for good weather. By late January 1945 the bulge was pushed back. About 19,000 American soldiers were killed, and many more were wounded or captured. It was the biggest battle the U.S. Army fought in the war.

Why it mattered. The Battle of the Bulge was Hitler’s last great attack in the west. He used up his last tanks and soldiers, and he never reached Antwerp. A few months later, in May 1945, the war in Europe was over.

PICTURE STUDY



Supplies parachuted to the soldiers at Bastogne, U.S. Army Signal Corps photographer, December 26, 1944 · Photograph · Pritzker Military Museum and Library, Chicago · Wikimedia Commons · Public domain

When the skies cleared over Bastogne, hundreds of transport planes flew over the town and dropped supplies on parachutes. Army photographers took pictures of the soldiers in the snow watching the help come down.

Look closely

- Find the planes and the parachutes.
- Look at the ground and the trees. What season is it?
- Look at the soldiers. Where are they looking?

Talk about it

1. How do you think the soldiers felt when they saw the parachutes?
2. Why was clear weather so important to the Americans?

HANDS-ON: TABLETOP BASTOGNE: HOLD THE CROSSROADS

Build the town where seven roads meet and see why both armies wanted it.

You will need

- A paper plate (Bastogne)
- Seven pieces of yarn or paper strips (the roads)
- Cotton balls (snow) and green paper or toy trees (the forest)
- Blocks or toy soldiers in two colors
- Small tissue parachutes tied to buttons, and a toy car or tank (Patton)

Steps

1. Put the plate in the middle of the floor. Lay the seven roads out from it like the spokes of a wheel. Add snow and forest between the roads.
2. Put the American soldiers on the plate. Put the German soldiers on the roads all around. Can any truck get in now?
3. Drop the tissue parachutes from above onto the plate. That is the supply drop on December 23.
4. Drive Patton's tank up a road from the south and push through to Bastogne. That is December 26.

Check your work

- My Bastogne has seven roads.
- I showed the town surrounded, the supply drop and Patton's rescue.
- I can tell why a crossroads matters to an army.

FIELD NOTEBOOK

1. **Terrain map.** Draw Belgium and Luxembourg with forests. Draw the American line as a straight line, then draw the German push as a big bulge into it. Mark Bastogne with seven roads coming out of it, the Meuse River to the west and Antwerp far to the north. Add an arrow from the south for Patton.
2. Write McAuliffe's answer in big letters: "NUTS!"

Did you know? The German officers did not know what “Nuts!” meant. An American colonel, Joseph Harper, had to explain to them that it meant no. The battle was fought in one of the coldest, snowiest winters in years. Patton’s prayer for good weather was printed on cards and handed out to his soldiers.

Goes deeper in. History, the modern history unit “The World Wars” (coming soon); and Geography, Belgium, Luxembourg and the rivers of Europe.

For families. The battle ran from December 16, 1944, to January 25, 1945. Bastogne was encircled about December 20–21; the surrender demand and McAuliffe’s reply came on December 22; the 4th Armored Division of Patton’s Third Army reached Bastogne on December 26. American losses are usually given as about 75,000 to 90,000 casualties, including about 19,000 killed; German losses were similar or higher. At the Baugnez crossroads near Malmedy on December 17, men of the Waffen-SS unit Kampfgruppe Peiper shot captured American soldiers; 84 died. The stop names this crime plainly without description. Patton’s weather prayer was written at his request by Chaplain James O’Neill in December 1944. U.S. Army photographs are public domain; choose any Signal Corps photograph of the Bastogne supply drop.

PRACTICE

1. **MEDIUM Choose your move.** You are General McAuliffe. Your soldiers in Bastogne are surrounded, cold and short of supplies, and the enemy asks you to surrender. Will you (a) surrender to save your men, (b) refuse and hold the crossroads until help comes, or (c) try to sneak everyone out at night?
2. **EASY** How many roads met at Bastogne?
3. **MEDIUM** Why did Hitler want to attack in bad weather?

Make it a game · Supply Drop. Make small parachutes from tissue or a napkin, with four strings tied to a button or clothespin. Put a hula hoop or a ring of string on the floor as Bastogne. Take turns dropping the parachutes from a safe height, standing on the floor with your arm stretched up high. How many can you land inside Bastogne? Try again near a fan for wind.

Scripture. “Thou therefore endure hardness, as a good soldier of Jesus Christ.” (2 Timothy 2:3, KJV)

The soldiers at Bastogne endured cold, hunger and danger without giving up. Paul tells every Christian to be like a good soldier: faithful and patient in hard times.

Practice: answers

1. McAuliffe chose (b). He answered “Nuts!” His men held Bastogne until Patton’s tanks broke through on December 26.
2. Seven.

3. So the Allied planes could not fly and help the soldiers on the ground.

TRACK 3 BADGE QUIZZES

The badge quizzes are optional. Read each question aloud; the child may answer by talking, pointing or drawing. Four right out of five earns each badge. Badges and the certificate are earned by doing the stops, not by scores.

Badge quiz 1 (Stops 1-5)

1. What did General Gallieni use to rush soldiers from Paris to the Battle of the Marne?
2. How did Alvin York decide whether it was right for him to fight?
3. What were the little ships at Dunkirk, and what did they do?
4. What helped the RAF see enemy planes coming from far away?
5. What message showed the code-breakers that “AF” meant Midway?

Badge quiz 2 (Stops 6-8)

6. How did Montgomery trick Rommel at El Alamein?
7. Name three of the five D-Day beaches.
8. Who landed at Utah Beach with a cane in the first wave?
9. What did General McAuliffe answer when the Germans asked him to surrender Bastogne?
10. What happened on December 23 that helped the soldiers at Bastogne?

TRAIL CERTIFICATE: MY BATTLE MAP BOOK AND TRAIL E CERTIFICATE

Gather the terrain maps from this trail into one booklet: “My Battle Map Book: The World Wars,” with your name and dates. Add a timeline page with all eight battles in order, from the Marne (1914) to the Battle of the Bulge (1944–1945), and mark which ones were in World War I and which in World War II.

Pick one person from the trail (General Gallieni, Alvin York, Admiral Ramsay, a Battle of Britain pilot, Joseph Rochefort, General Montgomery, General Roosevelt or General McAuliffe) and write or tell one sentence about a virtue he showed: courage, faith, patience, wisdom or steadfastness.

When the booklet is done, a parent signs the Trail E certificate.

- **Eight maps:** A labeled terrain map for each battle, with a title and a date.
- **Timeline:** The battles are placed in the right order, and the two World Wars are marked.
- **Virtue:** One person’s virtue is named and explained.
- **Care:** Maps are neat and labeled.

Answer key

1. The taxis of Paris.
2. He studied the Bible with his officers and prayed alone on a mountainside.

3. Fishing boats, yachts, lifeboats and other small boats; they carried soldiers from the shallow beaches out to the big ships.
4. Radar (and the watchers of the Observer Corps).
5. "AF is short of water," after Midway sent a message that its water machine had broken.
6. With fake tanks and a fake pipeline in the south, and real tanks disguised as trucks in the north.
7. Any three: Utah, Omaha, Gold, Juno, Sword.
8. Brigadier General Theodore Roosevelt Jr.
9. "Nuts!"
10. The skies cleared, and planes dropped food and ammunition by parachute.