

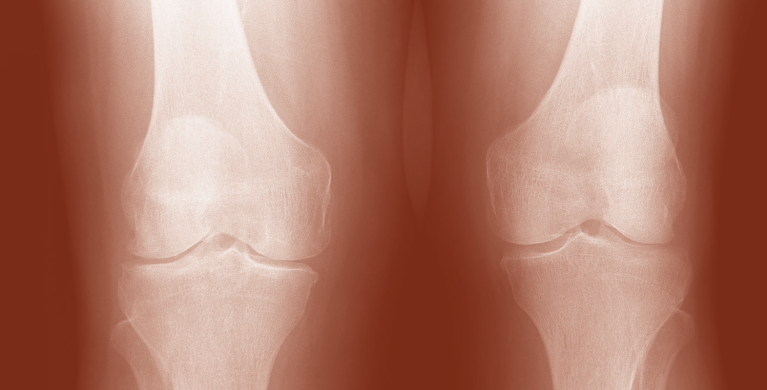
Forensics is the use of science and technology to investigate and establish facts, especially in criminal and civil courts of law. Forensic scientists, or criminalists, study the evidence from crime scenes to find out “Whodunit?”. Forensics involves many branches of science, including:

- Anthropology—remains of bodies, especially skeletons
- Ballistics—evidence from weapons
- Botany—qualities of plants, seeds and pollen
- Chemistry—analysis of unknown substances
- Dactylography—fingerprints, palm prints and footprints
- Entomology—presence and effects of insects, especially during decomposition
- Genetics—DNA code and family genealogy
- Geology—qualities of the soil, rocks and earth

- Pathology—autopsies and other post-mortem examinations
- Phonetics—speech and writing style
- Psychological Profiling—mental characteristics of suspects
- Toxicology—poisons and other harmful substances

The influence of popular movies and television might give you the idea that criminalists are experts in all areas of science and spend most of their time investigating murder and other high-profile crimes. However, only about 1% of investigations involve murder. Most investigations involve robbery, assault and drunk driving. Each criminalist usually concentrates on only one branch of science.

.....► Approach the exhibits listed in this guide from the point of view of a criminalist. Investigate how these sciences apply to solving crimes. What other tools do you need to be a crime scene investigator?



X-RAYS → LIFE

Inquiry Starters: What does an X-Ray show about the animal’s body? Why do some objects show up dark and some objects show up bright? Just by examining the image, can you tell what animal is photographed? Is the animal male or female? How did the other objects in the X-Ray get there?

What’s Going On? X-Rays are high-energy light waves, invisible to the human eye, which can pass through the soft tissues of the human body. Dense objects, like bones, prosthetics and tooth fillings do not allow the light waves to pass through. When the invisible light waves are projected onto film, the dense objects show up bright. X-Rays allow doctors to detect broken bones and other abnormalities. X-Rays allow pathologists to see foreign objects, like bullets.

Try This: Take a bright flashlight into a darkened room and shine it through your fingers. Examine your hand. Can you see your skeleton? Does the light pass through all points on your fingers the same way? What other features can you see? Can you explain all the dark areas? Why are the bones dark instead of bright?

WIRED VOICE → LEVEL ONE HALLWAY

Inquiry Starters: Have you ever heard the sound of your own voice? How would you describe that sound? Make a recording of your voice. Can you change the sound of your voice? Why does it sound different? What about your voice sounds different when you talk versus hearing it played back? Are you sure it is still your voice?

What’s Going On? Our voices are sounds. Sounds are complex mixtures of vibrations. Our ears detect those vibrations. Wired Voice makes a digital recording of your voice and transforms it into mathematical waves. By changing the frequency, or number of waves in a set amount of time, our ears hear the vibrations differently. Each person’s voice has specific characteristics and patterns. Phonetic scientists can use these characteristics to positively identify a suspect whose voice has been recorded.

Try This: Go to Big Science Park and play with your voice at the Whisper Dishes and the Echo Well. How do the sound waves we produce travel? Can you change how you use your voice to get different sound effects?



DIGITAL POTTERY → GADGETS

Inquiry Starters: What can you shape the pottery into? How can you make a tall, thin vase? How can you look at the vase from a different direction? Can you describe what the pottery looks like to a friend, down to the smallest detail? How would you describe the shading or the sharpness of the angles?

What’s Going On? Computer Aided Design (CAD) programs are used to build models of three-dimensional (3-D) objects from a two-dimensional (2-D) description. By knowing just a few measurements or significant features, you can make a model that looks like the real thing. Facial features, like distance between eyes and size of lips, make human descriptions much more complicated than vase descriptions. Forensic artists can use these systems to take a victim’s memory of a suspect and create a realistic picture.

Try This: Head to Life with a friend and try the You and Me exhibit. Do you think your two faces are similar? We tend to think all faces are the same, but see if you can match up your face with your friend’s. Imagine how hard it is to describe faces accurately!

WATER CANNONS → OCEAN

Inquiry Starters: How does the water coming out of the water cannons feel? How can you hit a target with the water? What happens when two streams of water collide? What is the shape of the stream of water? How can you change the angle of the stream?

What’s Going On? The water cannons demonstrate laminar flow. Laminar flow occurs when there is no air mixed into a stream of liquid. The absence of turbulence-causing air allows the stream to flow very smoothly. Since there are fewer forces within the stream of liquid, the laminar flow is easier to control than a natural or turbulent flow of liquid. The increased pressure caused by laminar flow in a firefighter’s hose allows a firefighter to do his or her job effectively and precisely. The path the water takes coming out of the hose, and the angle of the arc of the water, is called the trajectory. The same patterns and movements are at work when weapons are fired. By knowing the pressure the weapon applies to the bullet and the range or distance that bullet can travel, ballistic experts can calculate the trajectory of the bullet. This can determine the location from which the weapon was fired, and can place a suspect at a scene.

Try This: Observe a bullet being fired at different speeds on the Spin Browser at the West Entry. Did it behave like you thought it would? Go to the Ball Launcher in Gadgets and to Figure 8 in Space. What other trajectories can you observe?



STOP MOTION ANIMATION → SPACE

Inquiry Starters: Can you create a movie with the props provided? What is the story? Do smaller or larger movements between frames make a better movie?

What’s Going On? Animations and movies are made of thousands of still pictures or frames, shown in rapid succession. There are usually 24-30 frames per second in film recordings. Our brains perceive a succession of pictures as moving due to short-range apparent motion—the brain is able to “stitch” the frames together into motion. The smaller the movements in the still pictures, the slower and smoother the object seems to move in the movie. Media specialists analyze recordings for small movements and subtle details by slowing a recording’s speed. This process is often used to solve robberies of banks and stores that have security cameras. What our eyes may not catch at normal speed could reveal startling details at another speed, even people or objects we could not see before.

Try This: Head to COSI’s West Entry, across from the Pendulum, and locate the Spin Browser. The large dial allows you to control the speed between frames. Try moving the dial to show the movie at “normal” speed. Try to remember everything you saw and how it happened. Now slow the movie down. Did you miss anything the first time you saw it?

DECOMPOSITION → LIFE

Inquiry Starters: What is happening to the food in the decomposition chamber? What is growing on it? Are there any bugs in there? Pay close attention to where a bite may have been taken out of something. Does this area look different? How long has the food been in there?

What’s Going On? Organisms, like bacteria, insects and mold, play an important role in decomposition. While we cannot see many of the organisms that feed off organic matter like food, these creatures are in the air and on surfaces all around us. When an organism dies, including animals like us, these bacteria, insects and mold go to work. Heat is often given off as they decay the material. While the decomposition chamber is airtight, fresh air is pumped in and filtered out to keep the population of microorganisms high. Without that fresh air, the material would not be broken down. By knowing factors about the air, temperature and location, pathologists can measure the amount of decomposition. Since microorganisms grow in predictable patterns and time periods, entomologists can use this data to determine time of death.

Fun Fact: Penicillin, a popular antibiotic, was discovered much the same way you discovered something growing on the food in the chamber. In 1928, Alexander Fleming noted that not only did bacteria grow on organic material, but that a certain mold also grew on the material. This mold, or fungus, stopped the bacteria’s growth. The microorganisms were competing for the same food and the mold won!

Forensics



EXPLORE
SCIENCE.
DISCOVER
FUN!

PLASTINATED TORSO → LIFE

Inquiry Starters: Is that a real human body? What organs can you find? Do the organs look like you thought they would? What diseases may the body have suffered from? Why are no organisms growing on the body?

What's Going On? Plastination is a process by which the body's water is replaced with a silicon-based polymer. This polymer keeps the body tissues well preserved and does not contain any organisms that would cause decay. When bodies are donated to science, plastination can be used to keep a body stable for study for a long period of time. As a result, far fewer cadavers are required to teach criminalists and doctors about all the body's systems and organs. Pathologists, who perform autopsies to determine cause of death, rely upon these real human models. Merely the color and size of particular organs can indicate diseases and lifestyles.

Fun Fact: The human body contains more water than you might think! Babies are about 70-80% water. Men tend to be about 60-65% water. Women tend to be the least watery, at about 50-60%.

TRANSFORMATION → LEVEL ONE HALLWAY

Inquiry Starters: Where does trash go once it leaves your house? What can you do to reduce the waste stream? Do you think you could identify things that have been in the trash for a long time? How long does it take items in the trash to decompose?



What's Going On: Trash can be a gold mine for evidence of a crime. We all throw things away. Consider the path an item takes as it leaves your trash can, to a garbage truck, and to a landfill. Landfills are constructed very methodically. Investigators can track where shipments of trash have originated, back to the truck and to the neighborhood. However, every material decomposes on a different timeline, much like an environmental fingerprint. Knowing the decomposition rate of particular items can provide investigators with a complete picture of the entire ecosystem of a landfill. However, managing waste more effectively can reduce the amount of material that even goes to a landfill.

Try This: Practice the Five Rs at home! Rethink what you buy and purchase items that have a lower impact on the environment. Reduce the amount of disposable items. Reuse items instead of throwing them away. Recycle to save energy and resources. Use nature's recycling program—rotting—to dispose of yard and food waste in compost.

little KIDSPACE®

ACTIVITIES FOR KINDERGARTEN AGE AND YOUNGER
Parents, below you will find fun questions to ask your child as they explore the little kidspace exhibition area.

BUILD A HOUSE...

What kind of house will you build today? What tools will you need? What does each tool do? What does a house need inside it? What kind of furniture will you need? How will you keep the cold out? Where will you put everything?

As children play, matching shapes with holes, noises with animals, times of day with activities and objects with their functions helps them to learn about how the world works. This ability is essential for a forensic scientist too! Planning, designing and imagining help us to expand our knowledge base and add new levels of detail.

FIND THE BUTTONS THAT MAKE ALL THE NOISE BY THE GIRAFFE...

What happens when you press those buttons? What noises did they make? What caused those noises? Do those noises make you giggle? Who makes noises like that? (answer carefully!) If you like sounds like this, check out the full keyboard of Body Noises in the Life exhibition area.

Along the learning process, children are able to leap from seeing an object and noticing the sound it makes to just hearing the sound and identifying it. Learning to draw this conclusion, or inference, without a concrete example of what is producing the effect is very important to an investigator. Sometimes you have to imagine being there and put the story together based only on what you know, and not what you can see.

GO TO THE POWER PLANT...

What happens when you touch the big handprints by the tall tubes? What do you see and hear? What patterns can your voice and hands make on the other exhibits? Why is everything happening this way? Can you get the same result twice?

Being able to identify cause and effect is very important. Children learn that their actions usually get reactions, and they tend to repeat behaviors to see if they produce the same reactions. Children learn to predict and form guesses about similar actions. That's one reason why children, and scientists, ask so many questions!

TRY THIS... AT HOME!

Try this cool activity at home to learn even more about Forensics. Work together, adults and kids, to learn and have fun. It's amazing how much science is in things that you have around your house!

FINGERPRINT IDENTIFICATION

MATERIALS NEEDED

- Two pieces of paper and a pencil
- Washable markers
- Ruler
- Magnifying glass
- Baby wipes or paper towel for cleanup
- Your fingers



LOOP



WHORL



ARCH

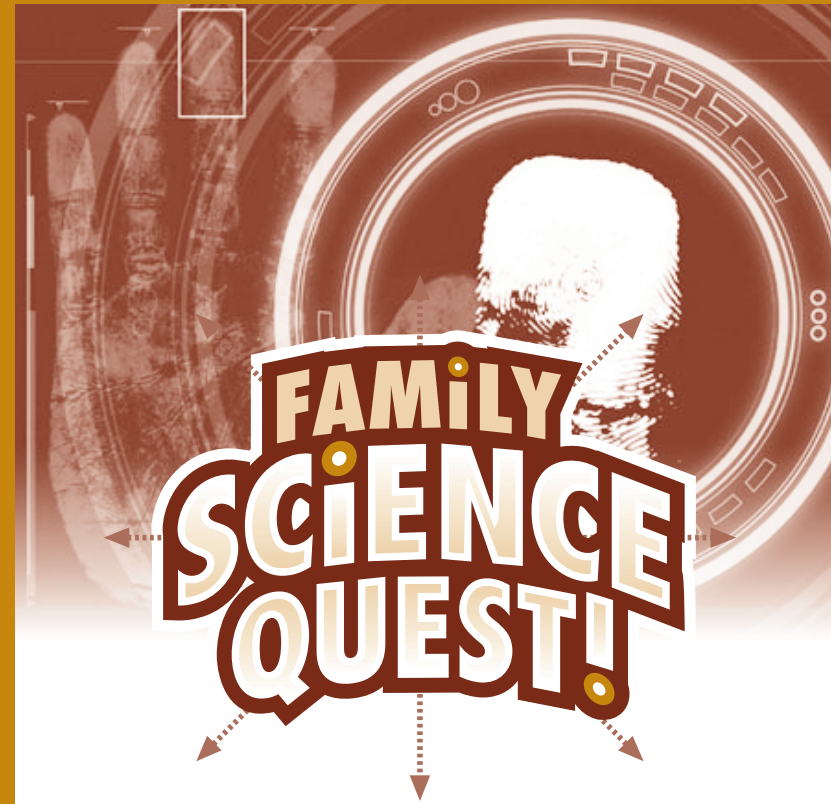
Take a look at the skin on your fingertips with the magnifying glass. The lines or ridges on your fingers, toes, palms and soles of your feet help you grip things and provide traction on slippery surfaces. These ridges pick up oil, dirt and dust. When you touch something, you leave a mark behind called a fingerprint. We are born with our own unique ridge patterns that will never change.

There are three general patterns of fingerprints: loop, whorl, and arch. A loop has ridges that come in on one side of the finger, make a sharp curve and exit out the same side. A whorl swirls around in circles. An arch enters on one side, rises and lowers in the middle and exits out the opposite side. Loops are most common, followed by whorls and arches.

Using the ruler, draw ten boxes on one piece of paper. Label each box with the name of each finger; left thumb, left index, etc. On the other piece of paper, draw a large ink dot with a marker. While the ink is still wet, lightly roll your finger in one direction across the ink spot. Do not rub or roll the finger back and forth or you will not get a readable print. Carefully roll your inked finger in the same direction into the appropriately labeled box on the other piece of paper. You may need a few practice rolls! It may be easier to roll finger away from your body and thumbs toward your body. Repeat for each finger and thumb.

Dactylographers analyze fingerprints left behind at a crime scene. The prints are dusted with powder and transferred to transparent tape. The prints are analyzed and compared to prints in a database or collected from suspects.

P A R E N T ' S G U I D E



HOW TO USE THIS GUIDE

Experience COSI exhibits in a whole new way by using the questions, information and activities found in this guide.

Get more out of your visit by making hypotheses, asking questions and using all your senses to observe the exhibit. What is going on around it? What do you hear? How does it feel? Inside, you'll find starting questions (Inquiry Starters), information (What's Going On?) and suggested directions on where to go next (Try This). The "Try This At Home" activities will further engage all the members of your group to continue learning at home.

WHAT IS INQUIRY LEARNING?

Many of COSI's exhibits are designed according to the principles of inquiry. The inquiry method of learning engages the learner by encouraging you to ask questions, make observations, and draw conclusions. This way, you truly learn the content and the processes of science.