

The teachFASTly.com resources are not intended as a complete curriculum. The activities are designed to be woven into your existing teaching. This Quick Stop Lesson Plan is therefore not a single lesson plan, but rather a quick way of exploring the themes of an activity map. It includes one Discover activity, one Delve activity, and one Debrief activity. Together, these may take more than a class period, and you may want to add other activities between them. For more information visit www.teachfastly.com.

Newton's Laws

In the process of exploring Newton's three laws of motion this activity map explores how both "miracles" and "natural processes" represent God's active and sustaining power in creation, which in turn make possible our actions in creation and our participation in God's goodness and glory revealed through creation.

Modern culture assumes there is a clear distinction between miracles and natural processes. We often regard miracles as God's actions and see natural processes as happening without God. Or we assume natural processes require *less* divine action than miracles do. Each time science uncovers another natural process explaining something that was previously mysterious, we fear God is being pushed further out of the picture. Our classroom practices may unconsciously reinforce this picture, relegating God's activities to the gaps between accepted scientific theories. This happens especially when we express wonder about creation or make explicit connections to faith only when surprising, mysterious, or unexplained things are mentioned.

The assumption that science glorifies God best when it *cannot* explain nature, or that a science class is most Christian when it points out what science *cannot* explain is widespread. If students see the world in terms of inexplicable events that either happen, and thereby show God's presence, or don't happen, and thereby reveal his absence, then students learn to set God's miraculous actions in creation over and against a closed system of fully explainable natural laws that have nothing to do with God. Changing underlying pictures of the world is extremely difficult. This activity map offers multiple opportunities for students to engage with these matters using hands-on activity that allows learning to unfold gradually.

It is recommended that work on this topic be coordinated between science and Bible teachers, and that good communication with parents be practiced.

This Quick Stop Lesson Plan on **Newton's Laws** contains the following activities and attachments from www.teachfastly.com, which are combined for your ease of use in a downloadable ZIP file:

DISCOVER Activity: Miracles Versus Natural Process

Activity Attachment

- *Miracles versus Natural Processes PowerPoint*

DELVE Activity: Inertia—The Only Way To Travel To the Moon

Activity Attachment

- *Newton's Laws of Motion: An Overview and Christian Perspective Handout*

DEBRIEF Activity: Breaking the "Laws" of Nature

Activity Attachment

- *Newton's Laws of Motion: An Overview and Christian Perspective Handout*

DISCOVER

Activity: Miracles versus Natural Processes?

Time: 10 Minutes

In Brief

This activity explores why we think of various events in terms of God's participation in creation rather than in the two opposing categories of miracles and natural processes. This shift in thinking avoids building into our terminology from the outset the common assumption that God is involved in one set of events and not the other. It helps students to see how our categories and assumptions can make it either easier or harder to think about the relationship between faith and science.

Goals

Students will understand the difference between the popular view of divine action as consisting only or mainly of miraculous interventions and the Bible's view of God's involvement in natural processes.

Students will understand the relative merits of contrasting miraculous divine action versus natural processes and visible versus hidden divine action.

Thinking Ahead

This activity engages students in categorizing some biblical passages in ways that may challenge their habits of thought. As preparation for this activity, think about your own habitual choice of words when describing natural processes and your verbal practices as you talk about science and faith. Does your language imply a closed world of "nature" in which things proceed deterministically or by chance, balanced by occasional "supernatural" events in which God is active? Does the way you talk about the natural world leave room for the possibility that God is involved in sustaining the creation even when we can scientifically explain how things work? Might there be a way for the everyday workings of creation to participate in and reveal the glory of God? Does it help to make a distinction between God's action as being hidden versus discernable, and God as involved versus uninvolved? Do we need to separate the question of how to explain an event from the question of whether God is involved? For example, we do not need to invoke God to describe how photosynthesis works, but we can ask whether or not photosynthesis participates in God's purposes. Teaching FASTly involves intentional consideration of how our teaching practices invite or inhibit reflection on the relationship between faith and science, and between creation and the Creator. Consider what assumptions your students may bring to this activity, and ways in which they might struggle with the ideas. For example they may find it hard to separate God being hidden

from God being absent. Avoid debating these points with students. Counsel patience and give them time to process the new ideas.

Preparing the Activity

Be ready to display the following biblical passages which are listed in order by Bible reference. Use the **Miracles versus Natural Processes PowerPoint**. It also will be useful to have Bibles on hand.

- Abraham's servant finding a wife for Isaac (Genesis 24:10-21 selections)
- Pharaoh's dream and Joseph's release from prison (Genesis 39:20-41:40 selections)
- The immune system fighting off disease (Psalm 103:2-3)
- The development of a baby in the womb (Psalm 139:13)
- The water cycle producing rain (Psalm 147:8; Jeremiah 14:22)
- Shadrach, Meshach, and Abednego in the fiery furnace (Daniel 3:19-28 selections)
- Jesus healing blind people (Matthew 20:29-34)
- Jesus and Peter walking on water (Matthew 14:25-33)
- Jesus and the large catch of fish (John 21:3-6)
- Paul surviving a viper bite (Acts 28:1-6) Inform students that venomous snakes sometimes give "dry bites," which do not release venom.

Teaching the Activity

First, explain to students that they are going to read extracts from various Bible passages for an overview of how the Bible presents God's action in the world. This is important background for thinking about how God is related to the natural processes described by science. Then ask students to silently read each passage and decide for each whether they think the Bible says God is responsible for the events described. When the passages have been read, ask how many of the activities are presented in the Bible as examples of God's agency. After taking suggestions tell students that the Bible gives God credit for every event on the list even though they do not feel the same. How do the events differ?

Tell students that they are going to make distinctions in the list in a different way, based not on which events God did, but on whether God's agency is obvious or hidden. Have students work in pairs or small groups to arrange the items on the list in order from those in which God makes himself most obvious to those in which God remains more hidden

behind familiar, stable processes. If students need clarification, model the decision-making process using contrasting examples from the list, for example, seeing rain fall versus seeing someone walk on water. Which of these draws attention to God's agency? After a few minutes, have groups compare their lists with one another. Some variation is normal.

As a brief way of drawing the class's findings together it may be helpful to create three columns on the board under the overall heading "God's Actions in Nature." Label the first column, "God is Most Obvious," the second, "In-Between," and the third, "God is Most Hidden." Have each group suggest one clear example for any column until you have two examples in each column. Gather the examples quickly without much discussion.

Ask the class which of the examples should be called miracles and let students discuss this briefly. Point out the tension between wanting to label things that God does as miracles yet acknowledging that God is involved in ordinary processes. Similarly, ask which examples are natural processes, and discuss whether a miracle would stop being a miracle if we could show that God made use of some natural process to bring it about. The goal here is to help students see that Christian thought does not view God as only involved when the rules of nature appear to be broken, as if God is intervening occasionally but is otherwise absent. Rather, miracles are startling reminders that God is always in control of nature, a fact we easily take for granted. At the end of this exercise, if it has not been added to the list, ask the students to consider if God is most hidden or most revealed on the cross? Why?

As a final prompt for small group discussion or individual journaling ask, if God is involved in everything that happens in his creation, even when he is hidden, should we use the word miracle at all? If no, why? If yes, how?

DELVE

Activity: Inertia—The Only Way to Travel to the Moon

Time: 30 Minutes

In Brief

This activity introduces Newton's first law of motion, inertia, and connects it with the question of whether God is only active when miracles happen. It goes a step further to ask whether it is a sign of faith or of a lack of humility to conclude too quickly that an apparent breach of a law of physics is a miracle.

Goals

Students will understand the concept of inertia and that it is the subject of Newton's first law of motion.

Students will understand why an unexpected result does not immediately imply divine intervention.

Students will reflect on God's role in predictable natural processes.

Thinking Ahead

This activity engages students in hands-on learning that helps them to see theological and philosophical questions connect to the investigation of concrete phenomena. Consider how this activity models the relationship of faith questions to the practice of science. Do our classroom practices suggest to students that such theological and philosophical questions are abstractions added outside of learning science itself, or do they help students to see how faith questions can arise from within the practice of scientific inquiry? Teaching FASTly involves discovering how faith and science can be intertwined in a joint quest to participate in and declare God's glory, and not simply two separate sets of answers to life's questions.

Before doing this activity, it will be helpful to review **Newton's Laws of Motion: An Overview and Christian Perspective Handout** as part of your preparation.

Preparing the Activity

You will need: a soft lightweight ball such as a tennis ball, safety glasses, meter sticks, and two identical smooth blocks of wood or two weighted tissue boxes ready for the sliding activity below. Stick fuzzy fabric or Velcro to the bottom of one of them.

In preparation for the demonstration, practice tossing the ball straight up from waist height as you walk across the room talking. The ball should come back down into your hand without you reaching forward to catch it and should not hit your body. This is more difficult than it sounds and practice helps.

As students enter have this written on the board or projected: “Guess how much fuel the Apollo missions used to travel the distance to and from the moon—a distance of about 500,000 miles.”

Teaching the Activity

Draw students' attention to the question on the board, but do not yet fully explain the answer. Telling them, “This is a trick question! None!” will hold their interest.

When astronaut William A. Anders was asked who was driving the Apollo 8 module on its way back from the moon the day after Christmas in 1968, he replied, “I think Isaac Newton is doing most of the driving now.” (<http://www.nmspacemuseum.org/hallof-fame/detail.php?id=71>) Read this quotation to the class and tell students that today they will find out what he meant. Then use the following ball-tossing demonstration.

Walk back and forth across the room, tossing the ball and catching it as you walk. After a pass or two, ask, “Why is the ball not hitting me in the face? Once I toss it up, shouldn't I walk into it?”

Let students share ideas. They may accuse you of tossing it forward, so stop and toss it a few times to show that you are tossing it straight up. You can also demonstrate that it *will* hit you in the face if you stand still, toss it up, and step forward while it is in flight.

Eventually encourage students to watch only the ball and not you as you toss it while walking. Instruct them to see the path the ball traces against the background of the wall. They will notice that it is not going straight up and down but following a parabolic path, even though you are tossing it straight up. You can make this clear by tossing it up as you walk with it, then stopping while it is in upward flight. It will come down ahead of you.

If students have not done so already, explain that the ball has two motions: your toss upward and also the motion it has by being carried in your hand as you walk. Once it leaves your hand, you are not pushing it forward any more but *it keeps that motion*. Write “Newton's first law of motion: Inertia” on the board and explain the principle. For your own reference read **Newton's Laws of Motion: An Overview and Christian Perspective Handout**.

Point out that this is one of many mathematical rules describing the patterns God makes nature obey and is especially obvious when things move in outer space. To check your students' understanding, ask how a baseball thrown in outer space, far from any planet or star, will move. If gravitational pull from other objects is negligible, it will fly away at the same speed and in a straight line forever.

Next conduct the following sliding activity. Have students wear eye protection in case a ball hits someone in the face. Give each group of 2-3 students a pair of wooden blocks or weighted tissue boxes, one smooth underneath and one rough or fuzzy, with fabric or Velcro stuck to the bottom. Make both items as similar in size and mass as possible. Have students slide both objects at equal speed across a lab table or tile floor, comparing how far each one goes. If time permits, have students measure and record the distance each travels.

Have students experiment to see how fast they need to slide the objects to have them stop at the same distance. Ask them to consider if they could get both objects to stop at the same distance and at the same time if they are launched together. Let them figure this out. To go the same distance, they must be pushed with different speeds, which means their times must be different because $\text{speed} = \text{distance} / \text{time}$.

Conclude by gathering students as a whole class and discussing these questions:

- When an object stopped sliding, *did God stop the object?* (The answer would be No if we think in terms of miraculous intervention, but Yes in terms of God's sovereignty over natural processes.)
- Why does it seem as if the objects were *not obeying* Newton's first law? Did God intervene and change the rules? (The answer would be No. Newton's second law will explain this further. For now, it is enough to note that something else—friction—is affecting them *in addition to* inertia.)
- If we encounter an event that seems to violate nature's rules and assume God is intervening with miracles rather than governing through natural processes, we might instinctively think of that as a sign of having faith. In what way could it also show a lack of humility? For example, pride could make a person more confident than knowledge allows, leading to the claim that the event could only be accounted for in terms of a miracle. Would it diminish the place of faith if it turned out that God were governing his creation through natural processes we do not yet understand? What are some possible examples?
- Based on the difference between the smooth and rough objects, how might a perfectly smooth object on a perfectly smooth surface with no friction behave? The answer is it would slide forever.
- Return to the question about fuel for a moon trip, and why fuel is not being used in transit. You may like to share the story of how the crew of Apollo 8, the first people to orbit the moon, celebrated Christmas Eve 1968 by reading from Genesis (http://www.nasa.gov/topics/history/features/apollo_8.html).

DEBRIEF

Activity: Breaking the “Laws” of Nature

Time: 15 Minutes

In Brief

The word “law” implies a rule that cannot be broken. What do we mean when we refer to a pattern in nature, such as inertia, as a law? How should we understand these patterns in light of God’s rule over his creation?

Goals

Students will reflect on the implications of speaking of scientific “laws” and on how they relate to divine agency.

Thinking Ahead

Before doing this activity review **Newton’s Laws of Motion: An Overview and Christian Perspective Handout** as part of your preparation.

Preparing the Activity

Needed: 48 half sheets of colored paper: 16 each of three different colors, three small cards with different instructions that involve numbers, such as “Give one paper to any person wearing a small amount of red and two papers to anyone wearing a lot of red,” “Put two papers on each empty desk,” “Give a paper to every other person in each row.”

Select three student volunteers and give each volunteer an instruction card and 15 sheets of one color of paper.

Teaching the Activity

When the volunteers are ready, tell the class, “Each volunteer has been told to do something different with their paper. See if you can figure out what it is.” Once the papers are distributed, take guesses as to what the instructions were. Once the instructions have been guessed, discuss these questions, using them to check students’ understanding:

- Once you knew the instructions, each volunteer’s behavior was predictable. You saw no exceptions to the patterns. How could there have been an exception, even if each volunteer obeyed the instructions completely? Let students wrestle with this. As soon as someone thinks beyond the written instructions and realizes the teacher could have whispered new instructions to a volunteer, the solution is easy.

- Scientists use the term law, as in Newton's laws of motion, for mathematical relationships that have been observed to be true over and over. They are predictable, like the patterns our volunteers exhibited. How is this different from the way we use the word "law" when we talk about federal laws?
- Does it follow necessarily from the predictability of scientific laws that events that do not conform to Newton's laws are impossible? How? (No. God will do what he must to love, care for and bring to fulfillment his creation.) Ask the class to think of an example. The resurrection is the paradigmatic example that all other miracles point toward. The fact that God so rarely diverges from his normal patterns is a sign of his love and care for us, allowing us to meaningfully participate in his creation.
- Does using the term law of nature imply the existence of a lawgiver? Do natural laws lead one to ask where they come from?
- If God freely allows nature to follow the patterns we call laws of nature, but occasionally allows nature to operate differently, should we still call these normal patterns laws or do we need a better word? If so, what would be an alternative word?
- How would you respond to someone who said, "If God does miracles, scientific study and prediction are a waste of time. Either science works and miracles do not happen, or miracles happen and science is impossible, because anything could happen at any time!" This is a difficult question and more appropriate for older students. Another way to frame the question is, "In what way are Newton's laws of motion a gift to us, even if they are not rules that can never be violated?" "How might the law of love give us a frame for understanding God's action through natural processes?"