THE FOUNDATIONS OF SCIENCE

"Where were you when I laid the foundation of the earth?" —Job 38:4

The Foundations of Science series introduces students to the wonders of the natural world in light of God's providential care over creation.

Too often we hear messages that science is in conflict with faith, but Pope St. John Paul II wrote that faith and science "each can draw the other into a wider world, a world in which both can flourish." ***Foundations*** seek to spawn this flourishing in the hearts and minds of students, guiding them into a world that will delight their imaginations and inspire awe in the marvelous power of God.

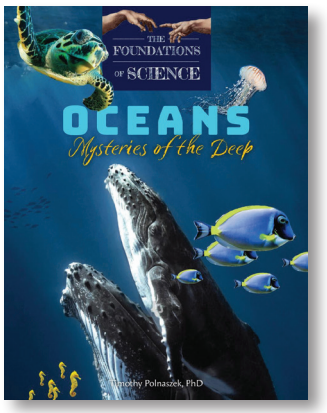
This eight-part series covers an extensive scope of scientific studies, from animals and plants, to the galaxies of outer space and the depths of the ocean, to cells and organisms, to the curiosities of chemistry and the marvels of our planet. Still more, it reveals the intricate order found beneath the surface of creation and chronicles many of the Church's contributions to science throughout history.

Take a journey back to when God laid the foundation of the world with this groundbreaking science resource!

Oceans: Mysteries of the Deep plunges students below the giant, blue seas of our planet, introducing them to a mysterious world that we know less about than the surface of the moon. This exploration of our oceans will reveal the incredible diversity found in coral reefs and the countless species of fish and other aquatic life, as well as examine the zones and currents of the seas and all the ways we depend on the oceans in our daily lives.

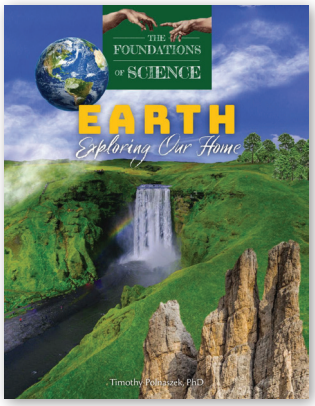
Did you know . . .

- The oceans' tides are caused in part by the gravitational forces exerted on it by the moon.
- The majority of all life on earth is aquatic.
- The world's largest mountain chain is under water.
- The Dead Sea gets its name because it is five times saltier than the ocean, making it very difficult for aquatic life to live there.
- Some leatherback sea turtles have been known to migrate ten thousand miles between egg-laying sites and feeding grounds.
- Kelp, a kind of brown algae, can grow over two hundred feet long.
- Ocean currents in the Northern Hemisphere flow in a clockwise direction, while in the Southern Hemisphere, they flow counterclockwise.



Catholic Permeation: What truly sets this text apart are the essential lessons that bring our Catholic faith to life. Students will encounter biblical miracles at sea, the power of the Sacrament of Baptism, Our Lady as *Stella Maris*, and the saintly fishermen who were the closest followers of Christ.

Earth: Exploring Our Home sends students out into the far corners of our planet to discover natural wonders, while along the way gaining new insights and understanding about the world in which they live. From the formation of mountain ranges caused by shifting tectonic plates, to the earth's tilt and our rotation around the sun which gives us the four seasons, from our many-layered atmosphere and the solar energy that permeates it, to a study of weather patterns and climate . . . young explorers will come to appreciate the beauty and intricate order of this fascinating home God has blessed us with.

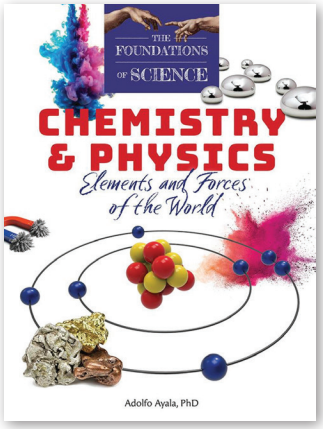


Did you know . . .

- The earth travels at a speed of around 67,000 miles per hour on its yearly trip around the sun.
- A national park in Kentucky holds a cave system that covers over 80 square miles.
- The earth's magnetic field is what allows us to navigate by using a compass.
- Our oceans are so vast and deep that there are enormous mountain ranges beneath the sea.
- The uppermost layer of our atmosphere—the exosphere—is over 6,000 miles thick.

Catholic Permeation: Most significantly, students will learn about the descent of the Holy Spirit as tongues of fire on Pentecost and revisit the many biblical events that unfolded in the desert. They will also be introduced to St. Damien of Molokai, who ministered to the lepers of Hawaii, and St. Kateri Tekakwitha, the patroness of the environment, along with other saints and faithful members of the Church whose lives and work have made vital contributions to science.

In ***Chemistry and Physics: Elements and Forces of the World***, Adolfo Ayala explores a hidden world that lives right in our very midst. His study begins with a look at physical matter and how we apply the Scientific Method to it, before moving into Newton's laws of motion, sound and light waves, the Atomic Theory, chemical reactions, and more. Students will discover the intricate balance and order that God has written into His creation.



Did you know . . .

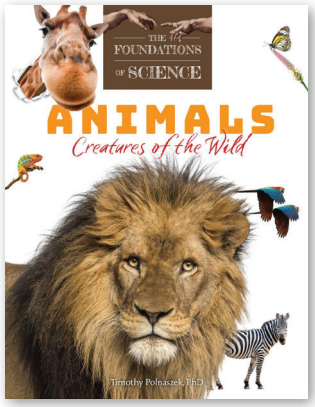
- The earliest study of motion began with attempts to understand the movement of the planets in the night sky.
- The reason it is more difficult to walk through a pool than on dry land is because of a force known as hydrodynamic drag.
- We can see lightning before we hear the clap of thunder because light moves at an astonishing 300,000,000 m/s, while sound only travels at 340 m/s.
- Echoes work better when they bounce off a hard surface instead of a soft one.
- A white-colored object is one that is reflecting the entire spectrum of light, while a black-colored surface is absorbing the whole spectrum of light.
- The word "electricity" is named after the Greek word for amber (electron).

Catholic Permeation: Above all, students will learn about the Church's teaching on Transubstantiation and the importance of sacred music in the liturgy. They will also come to see how sin brings disorder and decay into our lives—and why God's grace is essential to overcome it.

Animals: Creatures of the Wild offers a tour of the animal kingdom and the habitats in which mammals, birds, amphibians, reptiles, insects, and fish live and thrive. Students will discover how animals find and hunt for food, how and why they live in concert with other animals, why they migrate or hibernate, and more.

Did you know . . .

- Spiders eat more than 400 million tons of insects each year.
- Honey bees sometimes "dance" to communicate with each other.
- The olm salamander can go ten years without eating anything.
- Snapping turtles can use their tongue as bait, making it look like a worm, to lure fish close to their mouths.
- A bald eagle could read a newspaper from across a football field (assuming they could read, of course!).
- The arctic tern flies from Greenland to Antarctica (and back) each year, which means that it flies more than forty thousand miles per year.
- Cheetahs can run over sixty miles per hour.
- Certain species of ants count their own steps to find their way back to their anthill.

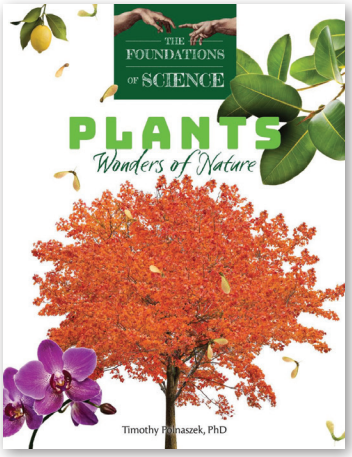


Catholic Permeation: Beyond this, students will learn about St. Francis, the patron saint of animals; the story of St. Brendan and the whales; St. Modomnoc and the bees; the serpent in Genesis; and the Church's teaching that caring for animals draws us closer to God.

Plants: Wonders of Nature explores the incredible diversity of the plant kingdom and all the ways plants help sustain life on earth. Students will discover what kinds of plants thrive in different habitats, how the fascinating phenomenon of photosynthesis works, and all the many ways plants help us—from the crops that we eat, to the air that we breathe, to the beauty and enjoyment they bring through gardens and nature hikes.

Did you know . . .

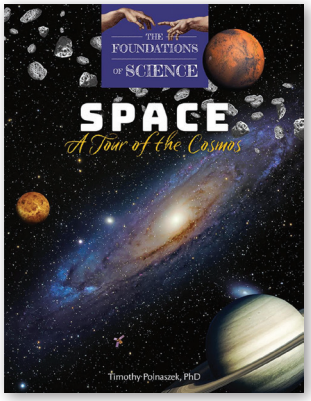
- There are around 375,000 species of plants described on earth, and likely even more we haven't even discovered yet.
- A pigment called chlorophyll gives plants their green color. When light hits a plant's chloroplasts (where the chlorophyll is contained), they absorb most of the light but reflect the green light, which our eyes detect as a green color.
- In the Kalahari Desert, there is a plant called the Shepherd plant whose roots can grow over two hundred feet deep into the ground.
- A bristlecone pine tree in eastern California, nicknamed Methuselah, is almost five thousand years old.
- More than a third of the earth's total land area is covered with grass species.
- Some giant kelp can grow one hundred feet up from the ocean floor.
- When we eat carrots, we are actually eating a root.
- Plants like corn can be used in the production of biofuels to help us run our cars.



Catholic Permeation: What's more, students will learn about the Fruits of the Holy Spirit, Jesus's Parable of the Sower, St. Patrick's use of the clover to explain the Trinity, and Catholics who made great contributions in the arena of science.

Space: A Tour of the Cosmos launches us into the distant reaches of our solar system, and beyond! On this cosmic exploration, students will visit and become familiar with each of the planets that orbit our sun, learn the fascinating history of the scientific field of astronomy, meet famous astronauts, and take witness to the wonder and mystery of what lies even beyond our own galaxy.

Did you know . . .

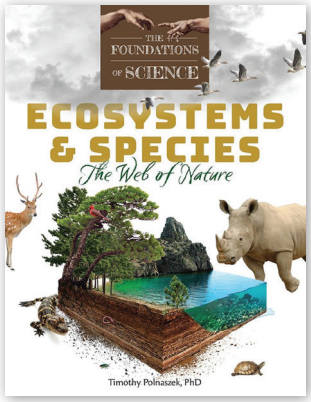


- Some say that astronomy was the first science because we have archeological evidence of ancient cultures recording their observations of the night sky.
- Molecular clouds are also called "stellar nurseries" because these regions of space are where new stars are born.
- Due to its slow rotation and short orbit, a *day* on Mercury is longer than a *year*.
- Venus rotates on its axis in the opposite direction of most planets—so the sun rises in the west and sets in the east.
- Olympus Mons, an ancient volcano on Mars, is the tallest mountain in our solar system—rising nearly 15 miles high, about three times the height of Mount Everest.
- There is a continuous storm raging on Jupiter, known as "the Great Red Spot," that is larger than Earth.
- The word astronaut comes from two Greek words that translate to *star sailors*.

Catholic Permeation: Even more, students will learn about St. Joseph of Cupertino, the patron saint of astronauts; meet Catholic astronomers, including some on the path to sainthood; explore famous astronomical events from the Bible; and discover how the teachings of our Catholic faith align with modern scientific theories about the universe.

In ***Ecosystems & Species: The Web of Nature,*** Dr. Timothy Polnaszek introduces students to the often overlooked but fascinating scientific branch of Ecology, showing how the myriad species found all over earth interact with one another and their environment. Students will learn how animals and plants adapt to harsh environments—sometimes competing, sometimes working together. By exploring nature and examining species, populations, communities, and entire ecosystems, the meticulous balance that God has written into His creation becomes apparent.

Did you know . . .



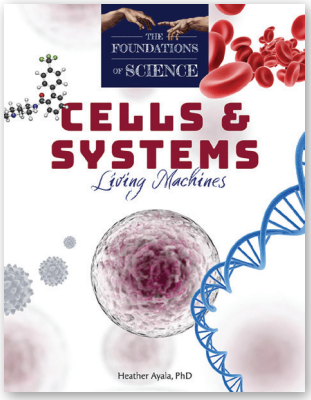
- Some mantises and spiders camouflage themselves as flowers to catch insect prey.
- Like animals, plants can also sweat.
- Wood frogs live throughout Canada and Alaska because they can survive frozen solid in winter (like a frog popsicle!), and simply thaw out in warmer months.
- Some tropical dry forest biomes can have as much as seventy-five inches of rain during its rainy season and as little as two inches in the dry season.
- The aptly named fat-tailed dwarf lemur stores fat in its tail to use as an energy source when it hibernates.

Catholic Permeation: Beyond this, students will meet heroic figures such as St. Anthony of Egypt and the Desert Fathers; explore the groundbreaking discoveries of the Augustinian friar Gregor Mendel and their lasting impact on modern genetics; reflect on St. Augustine's insights into the nature of animals; and recognize how science, far from conflicting with faith, points directly to God's creative power and governance.

In ***Cells and Systems: Living Machines***, Dr. Heather Ayala explores the fascinating depths found in the smallest of God's creations – the cell. The complex fabric and workings of the human body are presented vibrantly and clearly so that students can come to understand how they were created, from the division of their cells and the DNA instructions within them, to their muscles and bones, to their cardiovascular, respiratory, nervous, and other systems, to their five senses, to understanding why eating healthy foods and getting plenty of exercise is good for them.

Did you know . . .

- If you stretched out a single chromosome, it would be about 6 feet long.
- Our skin is our largest organ.
- A typical adult has 206 different bones in their body, from the largest, the femur in the leg just under twenty inches on average, to the smallest at only a few millimeters inside our ears.
- The human body has over 600 different muscles.
- A protein called hemoglobin found inside the red blood cells is what gives blood its red color.
- Taste and smell are deeply connected.



Catholic Permeation: In addition, your students will: meet heroic figures such as Saint Peregrine and Saint Damian; encounter amazing true accounts of Eucharistic miracles in which human flesh was found within the Sacred Host; explore biblical stories, including Jesus healing the blind and deaf and Ezekiel's vision of the dry bones; and receive lessons on the virtues, likened to spiritual muscles.

Dr. Timothy Polnaszek is an Assistant Professor at Belmont Abbey College. Previously, he worked at MacMurray College and was a postdoctoral research fellow at the University of Arizona within the Center for Insect Science. Dr. Polnaszek obtained his BS in Zoology from North Dakota State University and his PhD from the University of Minnesota where he conducted research on animal behavior, including on animal decision making in woodchucks, blue jays, bumble bees, crickets and other animals. He has presented this research at national and international conferences, as well as published journal articles on wildlife and animal behavior.

Dr. Adolfo Ayala is an Assistant Professor of Chemistry in the department of Biology and Biochemistry at Belmont Abbey College. He has been teaching high school science and math in some capacity for the past six years. He is a gifted teacher and makes learning math and science understandable and enjoyable. He has also taught courses in Chemistry and Engineering at various small colleges throughout the country. Dr. Ayala earned his MS in Chemical Engineering at the University of Notre Dame after completing his BS in Chemical Engineering at the University of Arkansas.

Dr. Heather Ayala is an Associate Professor of Biology and the Chair of the Department of Biology and Biochemistry at Belmont Abbey College. Over the past fifteen years she has worked at several small colleges throughout the country including one year at Wyoming Catholic College. Dr. Ayala received her PhD in Biological Sciences from the University of Notre Dame where she carried out research looking at the growth of Plasmodium falciparum, the parasite that causes malaria. At the college level Dr. Ayala has taught courses in Parasitology, Anatomy & Physiology, Genetics, and many others. She was awarded an annual award at Belmont Abbey College in the spring of 2022 for her excellent teaching.