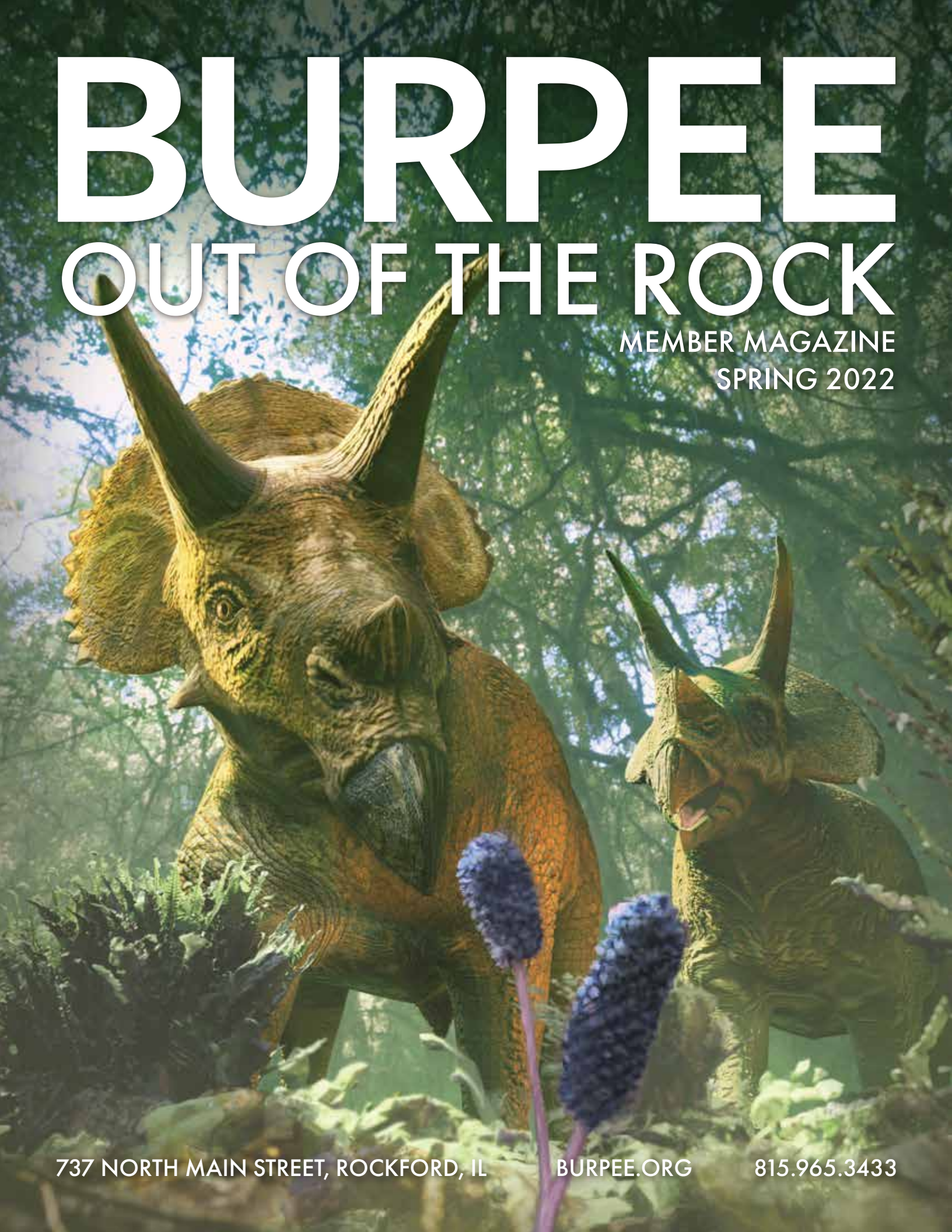
BURPEE

OUT OF THE ROCK

MEMBER MAGAZINE
SPRING 2022



737 NORTH MAIN STREET, ROCKFORD, IL BURPEE.ORG 815.965.3433

BURPEE
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Cover art by Steven Somers

Sparking the Fire
the broader impact of science

A Letter from the Executive Director:

One of the greatest pleasures I have at Burpee Museum is seeing a spark ignite in a young learner. I get to see this on a daily basis at the museum as experiences lead to a fire of questions! [From field trips with a room full of children amazed as they stand in the shadow of Jane the *T. rex*, to small groups of students learning taxidermy while digging right into the dissection, to adults as they hold objects from across the globe in their hand in amazement and joy at the diversity and history of human culture, each are exploring the depth of their encounters.] This is the essence of science and learning: digging into those questions!

PaleoFest 2022
One of our farthest reaching and most impactful events continues to be Burpee Museum's PaleoFest. PaleoFest 2021 brought nine countries together for a single event of sharing ideas, speaking to school classrooms, discussing research, and sparking the fire of learning. Burpee has organized this important event annually for over 20 years and continued virtually during the 2021 COVID pandemic year. In 2022 we boast an impressive line-up yet again, and are excited to bring this fuel of learning to the community.

Science Communication
Discovering answers is only half of the scientific process; advancing knowledge by communicating research to the community catalyzes the true broader impact of science. The essence of Burpee's mission is to inspire all people, of all ages, to engage in learning about the natural world. PaleoFest is a terrific example of the fine execution of that mission as researchers from around the world come to Rockford to speak about their groundbreaking work and research while people of all ages engage with the researchers and educators as they learn how science is happening RIGHT NOW!

Today we live in 'information overload' with a variety of resources at our fingertips. Perhaps one of the greatest challenges is sorting through the information and identifying great, reliable sources. We are committed to *not only* contributing to the published science sources for our community but to assisting learners interpret and understand the complex data at their fingertips. We want to spark questioning, discussion, and analysis: thinking like a scientist.

Out of the Rock
It is exciting to watch Burpee's team put together this magazine for our community. From complex research articles summarized and connected to our current museum work, to understanding the genetics or cellular biology of our animals' phenotypic characteristics, to interpretation of our collections, our team provides a fantastic scientific communication tool. This document itself is a catalyst of questioning!

The STEM Gap
Access to resources in Science, Technology, Engineering, and Mathematics (STEM) is not equitable. There are individuals with geographic, financial, and other barriers that prevent opportunity. This is one of the reasons Burpee is committed to reaching across that STEM gap and providing inclusive education through scholarships, outreach programming, and more. It is thanks to the volunteers and donors that we are able to do this, and in the past 3 years we have achieved over a 350% increase in the number of underrepresented or underprivileged individuals served by Burpee programming through scholarship.

Successes
As usual, my heart swells with pride. The Burpee Staff, Board of Trustees, Volunteers, Community Supporters, and Donors continue to carry us through difficult times during this pandemic and continue to support our growth. It is my honor to work with the community and the #BurpeeFamily as they continue to support Burpee's mission of scientific learning, research, and conservation.

Respectfully and Enthusiastically Yours,

Anne Weerda
Executive Director

Museum Mission:
It is the mission of Burpee Museum of Natural History to inspire all people to engage in a lifetime of discovery and learning about the natural world, through preservation and interpretation.

Josh Mathews teaches young volunteers how to plaster a fossil for the journey back to Burpee.

The key to science and learning: digging into questions with hands on expeeriences for all ages.

Executive Director Anne Weerda enjoys working with dino fossils in Utah with her daughter, Estella

LITHICS

Unearthing an Understanding of Ancient Tools

Maria Chiaberta

The Burpee Museum has a wide range of lithics, or stone tools, in our anthropological collection. In the collection lithics range from stone axes, celts, and discoidals, to projectile points. The earliest stone tools known date to between 2 million and 3 million years ago! Burpee's oldest ones are Levallois technology which is associated with a region of France and considered Neanderthal technology.

Making Stone Tools

Many of these tools were likely made using techniques collectively called flint knapping. There are multiple techniques of flint knapping from grinding to percussion. A wide range of tools can result including spear points, dart points, arrowheads, knives, scrapers, and blades.

We can tell this is man-made and not natural fissures. The smaller "flake" has a feature known as the bulb of percussion that result when impact force of the hammerstone compresses the flake, and ripple marks radiating around this point on the flake.

In flint knapping, one stone is hit against another with the intent to break off a piece. Commonly chert, flint, chalcedony, quartzite, and jasper are used due to the way these rocks naturally fracture. Whichever stone is used to strike the other is known as the **hammerstone**, while the stone that is being struck to be shaped is known as the **core**. When pieces come off the core they are called **flakes**. This part of the lithic reduction process is known as **percussion flaking**.

A Cahokia projectile point often used with arrows. This specimen was found in Southern Illinois (BMRA1966-01-1199)

We can tell that flakes were created by man-made strikes versus natural fissures because flakes have a feature known as the bulb of percussion. The **bulb of percussion** forms when the impact force of the hammerstone compresses the flake and recoils from the core, creating a "bulb" on the flake. Ripple marks often radiate around this point on the flake. For some tools, multiple flakes can be taken off of the core to create the final product.

In later stone technology, the flake itself can be worked to create smaller, finer tools. To create finer edges on stone tools a process known as **pressure flaking** is used. Instead of using a large, hard stone as the hammerstone, a soft hammerstone is used. A deer's antler is often used in both ancient flint knapping and modern! Using this technique, the tip of the antler is pushed against the edge of the flake, creating pressure. This pressure can create small chips, sharpening the edge of the flake tool. Some tools exhibit percussion and pressure flaking on both sides of the tool, making the tool bi-faced.

Cahokia Point

The methods used to create a tool, as well as specific flake patterns and styles can indicate to archeologists the approximate time period and style of a given stone tool, like the Cahokia points pictured. **Cahokia points** are a type of small projectile point associated with an indigenous site, Cahokia, in Collinsville, Illinois. Cahokia was a major mound building site occupied by up to 20,000 people during the Mississipian period . Their stone tool technology included making small, precise arrowheads using precision flaking techniques. Cahokia points are stylized by having **notches**, or indentations, at their base. It is most common for Cahokia points in the Upper Mississippi Valley to be double-notched, meaning these tools would have two notches present at their base. However, Cahokia points can feature single notches and triple notches at times. Cahokia as a cultural hub was abandoned by 1300 CE and the land was inhabited by new indigenous cultures that were not associated with the previous great civilization. As a result, archeologists are still trying to uncover the mystery of Cahokia using only artifacts like Cahokia points that were left behind.

A smaller Cahokia point with a slight double notch which is most frequently associated with Cahokia projectiles (BMRA1966-01-1195)

Nerd out with more research! https://burpee.org/magazine

Mike, Jennifer, and Maddie Turala at the Hanksville-Burpee Dinosaur Quarry.

The Turala Family

Field Spotlight

Josh Mathews

Going on summer expeditions to the American west is always the highlight of the Burpee paleontology crew. With it comes the joy of seeing familiar faces that have dedicated a week of their time, year after year, join us in the field and help us uncover the remains of animals lost in time, the Burpee team is thrilled. An even better feeling comes when younger participants who have longed to be part of a dinosaur dig join us for the first time and hit the jackpot!

Meet the Turalas!

Maddie Turala has wanted to be a paleontologist since she was a little girl. When Maddie was 10 years old, she met Paleo Joe Kchodl. After spending some time in the field together on one of Paleo Joe's family fossil hunts, he recognized her passion and offered to mentor her. Over the next several years, Paleo Joe hosted Maddie and family on digs in Ohio, Indiana, New York and Wyoming. He then told Maddie that for her to take the next step in her paleontology journey she should reach out to Josh Mathews and join Burpee Museums summer expedition. Maddie actually got permission from her high school to take a week off during her junior year so she could join the Burpee expedition, where she would work on homework every night in the motel room.

Maddie with a large Allosaurus premaxilla.

Digging in the Rain!

Depending on the location of a digsite, weather is an important factor that can severely impact the ability to work. In Utah and Montana, where Burpee crews search for dinosaurs, the sediments that enclose the fossils contain a type of clay called bentonite which is made primarily from the mineral montmorillonite. Bentonite is the resulting product of ash that spewed out of volcanoes long ago and has been subjected to intense weathering. Bentonite clay shrinks and swells as it gets wet and dries.

If you have ever tried driving over wet clay, you understand that it is a futile endeavor! When sediments containing bentonite get wet, it is like trying to drive on a road made of oil and grease, which can obviously be very dangerous.

Typically, the desert of Utah is hot and dry. Occasionally, however, storms roll through that prohibit us from driving to the digsite because of the bentonite clay found in the dirt roads. Unfortunately, on Maddie's first trip to the Hanksville-Burpee Dinosaur Quarry, rain nearly spoiled the adventure.

Maddie next to a saurapod humerus.

The beginning of the week began well with the crew arriving at the site for the first day of digging. Maddie, Mike and Jennifer were assigned spots in the quarry and immediately began work excavating bones. We made it back out Tuesday morning, however the work was short-lived as storms came through that afternoon and the next day dumped significant amounts of rain over the region. Because of these storms, the crew was unable to make it to the site to dig for dinosaur bones for most of the week. When the rain eased up attempts were made to return, but proved unsuccessful.

As the end of the week approached, the sun came out and quickly dried the road. Friday morning, the last day of the trip, we caravanned out with hope of making it to the quarry. Fortunately we only had one stuck vehicle! With a little muscle from the group we got it unstuck and successfully made it to the quarry safe and sound!

Jaw dropping discovery!

Burpee staff typically work in the quarry from Monday through Saturday, however the participants end their week on a Friday. This Friday, everyone returned to their spot in the quarry where they began excavating earlier in the week, eager to continue uncovering their fossils. Maddie had been working on a large sauropod humerus (upper arm bone) that morning, while Mike and Jennifer were nearby working on fossils of their own.

Maddie Turala holding the premaxilla of an Allosaurus.

Around mid-day, Burpee field assistant Dan Large approached me saying that Maddie found a theropod tooth and that he thought it may still be in the jaw. I headed over to see what she was working on and sure enough she had definitely found a large Allosaurus tooth that was at least partially in the jaw. We carefully instructed her on how to gently proceed removing the rock around it and she went back to work. Unfortunately as she worked around the jaw, it was going underneath the humerus that she was originally working on. To continue working on the jaw, we needed to jacket and remove the humerus, but alas, it was the end of the week.

The Turalas were supposed to leave Hanksville the next morning and head for Mesa Verde National Park. Since Burpee staff was going to be in the quarry on Saturday, Maddie asked if she and her parents could stay another day and continue working on the jaw, which we were more than happy to do. As she continued working on the jaw Saturday, tooth after tooth after tooth began emerging from the rock. It was an important, and exciting find, so the crew decided to return on Sunday to continue working. As daylight faded, we were able to remove what turned out to be a beautifully preserved left premaxilla (front part of the upper jaw) to a very large Allosaurus! It was definitely the find of the summer!

Back at it

Because of the COVID-19 pandemic, the expedition was canceled in 2020, however the Turalas returned in 2021 to continue working the quarry with the Burpee crew with more success. We want to thank Mike, Jennifer and Maddie for joining us in 2019 and continuing to support our summer digs. Maddie has since volunteered in the Paleo Viewing Lab here at Burpee and is now an undergraduate student at East Tennessee State University. We look forward to seeing them again this summer in Hanksville for another dinosaur adventure!

Model ORGANISMS

Using Little Fish to Answer Big Questions

Anne Weerda & James Marshall

Scientists ask all kinds of questions! Sometimes these questions are on BIG scales: *How fast is the universe expanding?* Sometimes these questions are on SMALL scales: *How does a cell repair?* Asking good questions is at the core of all scientific work.

Asking Questions

The same is true of questions scientists ask about humans. We ask questions on big scales: *What led to the development of human cities?* We ask questions on much smaller scales: *What is the function of this DNA segment?* When trying to discover the answers to questions about humans, we would ideally study the humans themselves. But sometimes that can be tricky or impossible. The same is true for other animals and plants. Imagine how big a tank you would need to study how whales dive! Imagine how long you might have to wait around for an agave plant (aka the century plant) to bloom! Hint: it isn't 100 years, but it isn't fast, either. Sometimes, in order to answer a question about one organism, we might need to study a different organism instead. That different organism is called a **model organism**.

Model organisms have properties that make them relatively easy to study. They grow fast, produce large numbers of babies quickly, and are relatively easy to raise in labs. They also have features that are shared with lots of other organisms. That way, if a scientist studies the features in a model organism, the scientist can learn something about the other organisms, too. What are some common model organisms?

Tools for Answering Questions

There are a variety of **model organisms** you might find when visiting a biological laboratory. You might see experiments with bacteria (*E. coli*), tiny worms (*C. elegans*), the common fruit fly (*D. melanogaster*), or the famous lab animal: the mouse (*M. musculus*). Another amazing tool for answering questions found in labs more recently is the small fish: the zebrafish (*D. rerio*) who shares over 70% of its genome with humans!

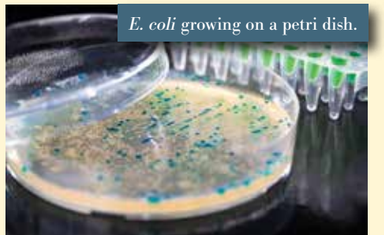
Why A Striped Fish?

Because they don't want to be spotted, of course! The Zebrafish (*Danio rerio*), is a freshwater member of the minnow family found in streams and ponds of the Himalayan region. A model organism since the 1960s, the zebrafish has been used in increasing frequency over the last 10 years. These awesome fish have been used to help unlock our understanding of multiple human issues including: muscular dystrophy, regenerating eye tissue, DNA regulation of cellular activity, and even cancer.

Several genetic sequences are unchanged in a variety of animals. We refer to these DNA codes as **Highly Conserved Sequences**: a genetic sequence that has remained the same far back up the phylogenetic tree and can be observed in multiple organisms. We find this in the Zebrafish!

The Zebrafish is a fantastic model organism. They have several physiological similarities to other animals including brain, digestive tract, circulatory system, and even musculature.

Zebrafish can regenerate not only their fins, but other body tissues including eyes, heart and brain! Embryos are nearly transparent and develop outside the mother allowing easy viewing and examination of internal structure. You can see blood vessels with just a low-power microscope! *Cool Fact: Zebrafish have even been sent to space!*



E. coli growing on a petri dish.

Movement

Birds, fish, and even humans move through the environment managing instability in some positions in exchange for overall movement efficiency. Birds are topheavy, but in flight compensate with correction through tail lift. As a human, your asymmetrical body is rather top heavy (think of the weight of your head and shoulders versus your legs). While you are standing still, you are a bit more unstable, but this asymmetry proves very efficient when walking or running. A worthwhile evolutionary trade off!

Studying the movement of animals provides useful insight to the development of balance. For example, in a Zebrafish balance study, scientists found that young fish learned to move when off-balance, showing control of balance is intentional: driven by choices the animals learn to make. The center of mass of a Zebrafish is not in the same place as the center of balance (it's actually closer to the head of the fish). So, by physics alone, a fish will angle downward without intention. In fact, fish that were temporarily put to "sleep" by scientists angled their heads downward like we would expect. But anyone who has watched a fish in an aquarium or pond knows healthy fish don't just sink downward. Scientists examined multiple ages and multiple clutches to see how the fish intentionally moved to compensate and change course. They found that the fish larvae made movements to restore their preferred angle for swimming: something critical to animals facing destabilization.

A very universal need to establish balance drives the initiation of movement. Young larva (4-14 days past fertilization) made movement to correct to a smaller degree, but by the end of the larval stage (21 days past fertilization) they made more effective, intentional compensations for natural rotations. These intentional movements must begin in the nervous system providing key information about neurological contributions in the development of balance.

Homology

One of the important insights of the genomic era has been how similar organisms are genetically. While you and zebra fish don't have identical genes, you share many very similar sequences. Why aren't you more like a fish or a zebrafish more like a human? Although we may have similar genes, the way we express those genes, especially in embryonic development, can be very different.

That said, even in development, we and zebrafish can have many similarities. Because we share a common ancestor many of our features, including developmental processes, can be very similar. Similarity derived from a shared ancestor is called **homology**. In development, it means many of the same cells and tissues develop in the same way but not identically. The same tissue may have different functions, like the wings of a bird and the front legs of a horse are both forelimbs but one developed for flying and the other for running.

Neurology & Neurodegenerative Disorders

Zebrafish produce the same neurotransmitters, or chemical signals, as humans do. Some of the more common ones are serotonin, dopamine, and histamine. The zebrafish nerve cells are similar to the human's microglia (immune cells of our central nervous system), astrocytes (cells found in brain and spinal cord), and motor neurons (central nervous system cells that control movement). Therefore, they provide a great model for looking at neurological disorders.

Neurodegeneration

When nerve cells lose function over time, we call it neurodegeneration. In human diseases that involve **neurodegeneration**, a patient will have worsening symptoms over time. Typically there is no cure. One example of this type of disease progression is Alzheimer's disease. Due to core similarities between human-zebrafish genes, particularly those genes with the Alzheimer's mutations passed in human families, Alzheimer's is being studied with Zebrafish. New approaches to treatment can be revealed through these models.

Dopaminergic Neurodegeneration

Dopamine is a super interesting neurotransmitter that is largely responsible for how humans experience pleasure. People get dopamine from engaging in new and interesting activities, pleasure through food, sex, shopping, etc. Activities that become mundane, or routine, actually show a drop in dopamine that we sometimes experience as boredom.

Dopamine is produced by the body's dopaminergic neurons and plays an important role in the control of multiple brain functions such as voluntary movement and multiple behavior functions such as mood, reward, addiction, and stress. Degeneration of these dopaminergic neurons leads to a cognitive and motor degenerative disease known as Parkinson's disease, and shows us another way Zebrafish may be helping scientists find important treatments and therapies.

Hypoxia

The lack of oxygen to a developing brain, known as hypoxia, is a complication of premature human birth associated with long term effects, particularly with motor function. Zebrafish exposed to hypoxia during embryonic development display reduced swimming ability, consistent with human reduced motor function after hypoxia. Digging deeper into the Zebrafish physiology, scientists found the embryo (prior to day 5 post fertilization) exposed to hypoxia: 1) have pathfinding errors in the signal sending/receiving part of the nerve cells called axons and 2) improper development of synapses (the gap between communicating nerve cells that are passing messages). Ultimately these young fish showed an impairment in swimming that persisted into their adulthood, suggesting this hypoxic injury leads to permanent changes in the elements that control movement. Surprisingly, those embryos that were 6 days post fertilization were not affected, showing when a developing brain is most impacted by lack of oxygen in these ways. While detailing how the pathways develop and how the dopamine nerve cells are critical to locomotor circuitry, it is only the tip of the iceberg in understanding how we can combat this type of injury in a developing human brain. Exciting research lies ahead.

Peeking into the Brain

While the Zebrafish brain is quite small, it shares many organizational features with mammalian counterparts and can be used to study the structure and function of the nervous system. Imaging the Zebrafish brain, scientists can produce three dimensional reconstructions of individual brain regions, as well as whole brain models, using magnetic resonance imaging (MRI) scans.

Using a technology that involves "staining" the parts of the brain, scientists can observe the brain through a microscope. This staining is done with a type of molecule found as part of our immune system: the antibody. By connecting a fluorescent marker to an antibody which will attach to a particular protein or tissue, scientists can use a sort of molecular highlighter on specific parts of the fish. For example, scientists have antibodies that detect and attach to specific nerve cells. This allows for a detailed, high-resolution image of how two neuronal systems work in an intact brain.

Heart Studies

Human heart and blood vessels (cardiovascular system) have many similarities to the Zebrafish as well. The fish provides a model for studying early heart development, the mechanisms of blood vessel development (angiogenesis molecular mechanisms), and injury to blood vessels. Scientists have even found Zebrafish develop a thickening/hardening of arteries (atherosclerosis) when eating a high fat diet, just like humans.

...article continued on page 13

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'TANKS of the Jurassic

The mystery of an armored dinosaur from the Hanksville-Burpee Dinosaur Quarry

Dan Large

The Burpee Museum first visited the Martian landscape of the Morrison Formation of Utah in the summer of 2007. A team led by former Curator of Earth Sciences Michael Henderson and Collections Manager Scott Williams hoped to continue the Museum's success after years of successful fossil hunting in the Hell Creek Formation of Montana. These expeditions to Montana, dubbed the "Highway to Hell Creek," have recovered thousands of fossils, including "Jane," a juvenile *Tyrannosaurus rex*, and the first described *Triceratops* bonebed. With guidance from Utah state paleontologist Dr. Jim Kirkland and Bureau of Land Management (BLM) geologist Buzz Rackow, this team discovered several large bones in the Jurassic age rocks and decided that a new opportunity lay buried in the ground! This site would eventually become known as the Hanksville-Burpee Dinosaur Quarry.

A Jurassic Journey

Following this discovery, in the summer of 2008, the "Jurassic Journey" program was developed. This program brought paleontologists, students, and volunteers from around the country to assist in the excavation of the bones discovered the previous year. What they had initially thought to only be a handful of bones turned out to be a full-scale dinosaur bonebed with over 200 bones discovered that summer alone!

To date, over 1,000 bones have been recovered by at least 20 individuals from the Hanksville-Burpee Dinosaur Quarry. The quarry is dominated by sauropod dinosaurs–the "long-neck dinosaurs." Burpee has found *Apatosaurus*, *Diplodocus*, and *Camarasaurus*, with a possible fourth sauropod, *Barosaurus*, still under investigation.

Burpee was also lucky to find the famous apex predator *Allosaurus* at the quarry, as well as elements from several small ornithopod dinosaurs identified as belonging to *Dryosaurus* and *Nanosaurus*. Recently, bones from the iconic *Stegosaurus* have also been discovered.

Mymoorapelta maysii osteoderm. Notice the keel running along the midline axis.

NEW Discovery!

In the summer of 2014, a new and strange dinosaur was discovered in the quarry. A student from McLennan Community College discovered a small, flat, circular bone with a ridge running along one side. This strange bone is called an osteoderm... a piece of "armor" from an ankylosaur!

The Armored Dinosaurs

Ankylosaurs, commonly referred to as the "armored dinosaurs," are among the earliest recognized dinosaurs. *Hylaeosaurus*, found in Britain, was described by Gideon Mantell in 1833. *Hylaeosaurus*, along with its more famous cousins *Megalosaurus* and *Iguanodon*, were the first three dinosaurs discovered, and were the foundation upon which Sir Richard Owen famously defined Dinosauria in 1842. Since the discovery of *Hylaeosaurus*, ankylosaurs have been discovered on every continent, including Antarctica, and span from the Middle Jurassic to the very end of the Cretaceous, when all non-avian dinosaurs went extinct.

Pop-culture depictions, such as those seen in Jurassic World and Walking with Dinosaurs, have cemented ankylosaurs as the "tanks" of the dinosaur world. This idea no doubt comes from their iconic bony armor and extensive weaponry. The armor, clubs, and spines of ankylosaurs are all bones called **osteoderms**. Osteoderms are bony deposits within the skin (Osteo=bone, dermis=skin) and these bones covered the skulls, necks, backs, hips, tails, and even sometimes the limbs and eye-lids of ankylosaurs and likely added to their defensive capabilities.

Ankylosaur Types

Ankylosaurs are split into two major groups: the **Ankylosauridae** and the **Nodosauridae**. Ankylosaurids like *Ankylosaurus*, *Euoplocephalus*, and *Zuul* are easily recognizable with their large club tails and are major components of Late Cretaceous ecosystems in North America and Asia. Nodosaurids like *Edmontonia*, *Sauropelta*, and *Borealopelta* lack the iconic tail club but make up for it with large spines that project from their shoulder and neck regions.

Ankylosaur fossils from the Late Cretaceous are relatively rare, compared to other ornithischian dinosaurs, but what remains have been uncovered highlight a diverse group of dinosaurs that managed to spread to every continent during their reign as the "TANKS" of the dinosaur world!

Jurassic Ankylosaurs

Despite the relative abundance and diversity of ankylosaur fossils in the Late Cretaceous, ankylosaurs from the Jurassic are exceedingly rare. Specimens from the Jurassic are often incomplete or even fragmentary. This lack of well-preserved specimens has led to confusion around the relationships of many of the early ankylosaurs.

A battle between the theropod Allosaurus and ankylosaur Mymoorapelta. Artwork created by Stephen Sommers.

Currently, there are only two recognized ankylosaurs from the Late Jurassic of North America: *Mymoorapelta maysi* and *Gargoyleosaurus parkpinorum*. *Mymoorapelta*, the first described North American Jurassic ankylosaur, was described by Dr. Jim Kirkland and Dr. Kenneth Carpenter in 1994 based on several disarticulated elements, including the holotype ilium (hip bone), from the Mygatt-Moore Quarry in Western Colorado. *Gargoyleosaurus* was described by Dr. Brandon Kilbourne and Dr. Kenneth Carpenter in 2005 based on a partial skeleton with a complete skull and *in situ* (found in their original position) osteoderms from the Bone Cabin Quarry in Wyoming.

Both *Mymoorapelta* and *Gargoyleosaurus* display characters seen in the Ankylosauridae and the Nodosauridae as well as characters that are more basal for ankylosaurs. These traits, along with the rarity of these species (excluding the Hanksville ankylosaur, there are currently four recognized *Mymoorapelta* specimens and only two *Gargoyleosaurus specimens*), has led to confusion around their placement on the ankylosaur family tree. This is a problem as the difficulty in placing these dinosaurs cladistically has led to many different interpretations of early ankylosaur evolution, with even a third major group, the Polacanthidae, being proposed to contain these "intermediate" ankylosaurs.

The only way to resolve this confusion among the early ankylosaurs is to find more specimens. More specimens mean more data and hopefully, more characters for resolving the ankylosaur family tree.

The Hanksville Ankylosaur:

So, what kind of ankylosaur is the one that was discovered in 2014 at the Hanksville-Burpee Dinosaur Quarry, and what does it tell us about the relationships of early ankylosaurs? Currently, we do not know! We have referenced this ankylosaur as *Mymoorapelta* in previous years. A detailed and thorough description, however, has not, until now, been conducted. As Burpee's Paleontology Lab Manager and Collections Assistant, I am doing just that; describing and attempting to identify this ankylosaur! **There is one problem: the Hanksville specimen is lacking any of the bones that are diagnostic to either *Mymoorapelta* or *Gargoyleosaurus*.**

Cabinet drawer housing ribs and other elements belonging to Mymoorapelta.

Without any diagnostic bones, how can we determine what kind of ankylosaur the Hanksville ankylosaur is? Currently, I am planning to utilize osteohistology, the study of microstructures in bones, to attempt to identify this ankylosaur. In 2014, Dr. Michael Burns and Dr. Philip Currie highlighted the potential systematic utility of the internal (histological) and external morphologies of ankylosaur osteoderms. Utilizing this methodology, I am hoping to see if the osteoderms from this specimen can hold the key to the identity of this important Jurassic ankylosaur!

Cabinet drawer housing the numerous osteoderms and limb elements of Mymoorapelta.

To learn more about this ongoing study, join us for our March Member's Night where Dan will be discussing this study to kick off PaleoFest 2022!

Nerd out with more research!
https://burpee.org/magazine

Tortilla, Burpee's *sulcata* Tortoise.

The African *sulcata*

Tortilla: Animal Spotlight

Aster Walbaum, Joshua Mathews & Anne Weerda

The largest reptile at Burpee museum is Tortilla, our African Sulcata Tortoise. African *sulcata* tortoises (*Centrochelys sulcata*) are the largest tortoises to inhabit the mainland with adults weighing in at about 100 pounds. The largest island dwelling tortoise is the incredible, and famous, Galapagos Tortoise with males tipping the scales at well over 700 pounds! While that may make the *sulcata*, also known as the African Spurred Tortoise, seem small in comparison, the *sulcata* remains the 3rd largest species of tortoise in the world!

Eating Machine!

As you might imagine, the 3rd largest tortoise in the world has quite an appetite, feasting on a diet of various greens, flowers, and even select fruits. In the wild, their primary sources of food are grasses. They generally consume high amounts of fiber and very low amounts of protein.

Our little Tortilla has an unusual name. She was named through a grade school contest! Her name is to suggest a tortoise that is female...not the delicious nacho chips! The name has grown in popularity as she has, and it stuck! Burpee adopted Tortilla when she became too large for her owners. These tortoises start out tiny and adorable, but quickly grow to very large and complicated pets with huge appetites and a habit of going to the bathroom wherever they want! Adults have been known to break through drywall and even push over toilets!

In the wild, the *sulcata* can be found in grasslands and shrublands of Central Africa. Unfortunately, wild African Sulcata tortoises are endangered. The highest threat to their survival is habitat fragmentation and loss. A second threat is competition with domesticated livestock for food. The overgrazing of zebu cattle, goats, donkeys, and camels has caused a significant decline in available resources for these tortoises. Other factors include habitat modification, desertification of the Sahel region, and tortoise hunting for local meat trade.

The Turtle Family

While tortoises and what we refer to as turtles appear to be similar in form, they typically inhabit different ecological environments in nature.

Most turtles are aquatic, leaving the water only to lay eggs or bask in the sun. ***Tortoises, on the other hand, are exclusively terrestrial*** (land) animals utilizing water only for bathing and drinking. Technically speaking, the tortoises are a family of turtles, the Testudinidae, that have adapted to life on land. They, along with all of the other families of turtles, make up the order, Testudines. Testudines are a very diverse group that include tortoises, sea turtles, box turtles, snapping turtles, pond turtles, soft-shell turtles, and many more! Come visit the museum where you can see 7 different species of turtles in our "turtle nook" and Windows to Wilderness exhibit!

Taxonomic Instability

It may surprise you to know that there is not a lot of information on the evolution of turtles, despite a rich fossil record and a great number of living species!!

For many years morphological data (shape, size, structure, and visible phenotypic differences) was the only way to classify and group living organisms. As scientists get better at sampling, sequencing, and using DNA to determine genomic differences between living species, we can add an additional dimension to the data! As new studies emerge, we can better separate two species that LOOK similar, but genetically are not as closely related, which is referred to as **cryptic speciation**.

Turtle Evolution

Did you know some of the oldest known turtle ancestors are from the Triassic Period, possibly even the Permian? The modern family of *Testudinidae*, the tortoises, originated in Asia during the late Eocene and dispersed across Europe, Africa, and the New World. Today's turtles and tortoises are part of what is referred to as the *Cryptodira clade*, which also include the orders *Emydidae* and *Geoemydidae*.

Gigantic Animals

Gigantism in evolution typically occurs in isolated populations (think islands such as the Galapagos) and is marked by a dramatic increase in size compared to mainland relatives. Mainland tortoises have grown quite large as well! It is believed that the gigantism of certain tortoise species is due to relaxed predation pressures, the removal of competitors from their niches, and an adaptation to environmental fluctuations.

Amazingly, tortoises evolved the ability to achieve their large sizes multiple times, independently! Giant tortoise body sizes evolved individually, in multiple mainland taxa, and are not linked to the isolation effects seen on island tortoises such as the Galapagos tortoise.

For African *sulcata* tortoises specifically, we can surmise that their increased size may have been selected to survive during long periods of drought and reduced resource availability. We also can observe sexual dimorphism in the species as males are significantly larger than females.

Growing in Captivity

Researchers have been able to study the growth rate of African *sulcata* tortoises in captivity. Studies show that captive African *sulcata* tortoises grow at a faster rate than those in the wild. This is because they have easy access to a balanced and nutrient rich diet in captivity.

Increased growth rates also mean increased sexual maturation. This means they are able to produce offspring sooner. However, a faster growth rate is not necessarily a good thing. Studies reveal that those released from captivity with a slower growth rate have a higher chance of survival.

KINGDOM: *Animalia*; PHYLUM; *Chordata*; CLASS: *Reptilia*; ORDER: *Testudines*; FAMILY:*Testudinidae*; GENUS: *Centrochelys;* SPECIES: *sulcata*

Make sure to visit Tortilla on your next visit to Burpee Museum!

Nerd out with more research!

Model ORGANISMS

...continued from page 7

A key difference, however, is the ability of zebrafish to regenerate damaged heart tissue. Humans don't do this, which is why heart attacks are so problematic – damaged heart tissue can't be regenerated. But if some of the genes we share with zebrafish are the ones that fix heart tissue, maybe we could figure out how to turn on our copies of those genes to repair hearts after heart attacks.

Endocrine Disease

The endocrine system is a series of glands that produce hormones: chemical messengers that travel throughout your body for many purposes from growth to reproduction, to metabolism.

Anthropogenic (human) activities that cause damage to our environment include the release of potentially harmful chemicals that can impact wildlife and humans. Particularly dangerous are those that have the ability to mimic hormones produced by our bodies, and thus interfere with our body's metabolism and function. Because these chemicals interfere with the functioning of the endocrine system they are called **endocrine-disrupting components (EDCs)**. Some examples include industrial solvents and polychlorinated biphenyls (PCBs).

One of the roles of hormones is to regulate gene expression, turning up or down that expression in response to growth and development, or in response to cues from the environment. When EDC's are present, however, it can wreak havoc on the body's ability to respond properly. Zebrafish are particularly sensitive to EDC's. Scientists can use genomic tools like micro-arrays and whole-genome sequencing to predict how we might respond to EDC's based on what happens when zebrafish are exposed.

Answering Questions

Good questions are at the core of all scientific work! The zebrafish provides a great model for scientists to find answers, but there so many critical questions still unanswered. What would YOU ask of the little striped fish?

Nerd out with more research!
https://burpee.org/magazine

Meet Maddie!

Staff Spotlight

Anne Weerda

A critical member of the Burpee Visitor Services Department is Madison Starr Hicks. Maddie has been greeting visitors as they arrive and helping guests on the phone or email since 2019.

Burpee Magic

"I started working at Burpee because I finished school and was looking for work. I got involved with the WEX (Work Experience) program, where they helped me get a job. There was a long list of companies to choose from, but I chose Burpee because I've always loved it here! I used to come to the museum all the time growing up, and I always wanted to be a part of "the magic"...I wanted to help Burpee be Burpee! Every time you come here, there's something new to learn, it's very rewarding being a part of that." Maddie shared.

Thanks to people like Maddie, Burpee is a welcoming place. Maddie really does help with the "magic" as we watch her make each visitor a priority, share fun stories with our youngest visitors, and listen to visitors share stories of Burpee from long ago.

"I love to answer visitor questions and give them the information they need, all while being nice about it. If I can make someone's day just by being nice to them, that would make me happy. I want to spread kindness and help the community."

Burpee Family

Working at Burpee, or any not-for-profit organization, especially during a global pandemic requires patience and teamwork. Maddie's support and kindness to Burpee's other staff and volunteers is readily evident.

"Over the years, I've noticed that we are like family here. This is a job, and I love every part of it, but there are times when our personal lives interfere. We don't have to worry about it though, because our Burpee family ALWAYS has our backs, no matter what. We do a lot for each other at work, as well as outside of work. That's hard to find in a job, so I am very grateful I get to experience it!" Maddie said. "Burpee has a great staff that really do care about each other and the work that they do. Everybody does their part to keep Burpee running."

For the Future

Working in a museum that has been a cornerstone of the community for nearly 80 years is a big job because staff needs to understand that the museum was here before all of us were born and our job is to keep the institution successful and growing so it can be here long after we are finished working at the museum.

Maddie is no exception to that attitude as she shares her hopes for Burpee in the future: "I hope that Burpee will be here long after I'm gone. This is such a wonderful place to be, and a lot of love, pride, sweat, and tears go into making Burpee so great. Burpee should be around forever and hopefully loved by all who step foot through the doors. I just hope that as I continue to get older, I will still be involved in helping my community. I want to help Burpee as much as possible and be there for those who really need it."

Challenges

Being the first and last face guests see, answering questions, and fielding phone calls at the museum requires an extensive knowledge of every department, program, and event!

"For me, the greatest challenge working at Burpee is keeping up with the constantly growing and evolving museum. We have a lot of events, classes, and special things happening all the time here and sometimes it gets a bit overwhelming to keep it all at your fingertips." Working at the front desk and answering phones, guests expect her to have an understanding of every aspect of the museum. "I don't have to worry much though because I'm never alone!"

Thanks

"I want to say thank you to Burpee for allowing me to be part of the family, part of the magic. This has been the best job I've had by far and it's mainly because of the people I work with. They have helped me in more ways than they know. So, thank you Burpee, and thank you to my Burpee family."

Thank YOU, Maddie, for being a critical part of Burpee Museum and positive guest experiences. Burpee is lucky to have YOU as part of the team!!

COMING JUNE 2022
NEW EXHIBIT

Burpee Museum is excited to announce a new Special Exhibit opening this summer!

The exhibit will feature contemporary artworks created and curated by Sac and Fox, Ho-Chunk, Anishinaabe, and Potawatomi collaborators. Generously supported by the Chicago Blackhawks Foundation and BMO Harris Bank, artists from these communities will create works inspired by visits to Rockford and Burpee Museum collections and share through 2D and 3D art, historic objects, photography, images, audio, and so much more! More details will provided in the upcoming months!

Presenting Sponsors:

The Chicago Blackhawks Foundation
BMO Harris Bank

Supporting Sponsors:

The Community Foundation of Northern Illinois
The DAO Foundation
Brubaker Charitable Foundation

OUCH!

What can we learn from dinosaur injuries?

Dan Large & Josh Mathews

Pathology is the study of causes and effects of injuries and disease. Did you know we study pathologies on animals that have been dead for millions of years? Dozens of dinosaur specimens have been discovered that exhibit multiple pathologies that illustrate that diseases and infections occurred just as much in the past as they do today. Pathology applied to paleontology provides us with information about damage found within fossil specimens as a result of injury or disease.

Puncture Wounds

Jane, our juvenile T. rex, is a prime example of pathology in action! Just in front of Jane's left antorbital fenestra (the large triangular shaped hole in the skull) on her left maxilla are two openings that should not be there. These are actually puncture wounds! How did they get there? Interestingly enough, it turns out that they are the right size, shape, and distance apart to match the tooth pattern from a similar size T. rex, suggesting that Jane was likely bitten in the face by a conspecific, another animal belonging to the same species! Luckily for her, the rounded nature of these wounds indicate that they healed over time, so she did not die from this injury!

Play Fights

Fighting as a form of social interaction and even play is common in many animals today from dogs to cats to crocodiles. While this bite was a hard one–it went all the way to the bone–we know that Jane did not die from this injury because the bone healed. Thus,we can say it is unlikely that these wounds are the result of a hunting attempt on Jane.
Possibly more dire for Jane is a pathology that can be seen on her left foot.

Painful Infections

On the inside toe of Jane's left foot is a large bumpy knob. Like the wounds on Jane's face, this should not be there either. Burpee friend and Board of Trustee member, Dr. Christopher Vittore, CT scanned this bone and determined that it is the result of a bone infection called osteomyelitis. Osteomyelitis is found today in many animals including humans. While this infection likely did not directly lead to Jane's demise, it would have made walking or running extremely painful, which may have, in turn, made her less successful in hunting. A T. rex that can't hunt, can't eat. It is difficult to say for certain what actually led to Jane's death, but this infection is a plausible explanation!

Pathology is an important area of study in paleontology as it provides us with a better understanding of the lives of these prehistoric animals. We can see diseases that are still around today, and for Jane, we can see she definitely had a rough time 66 million years ago! Burpee has another dinosaur with a bunch of pathologies that is currently under study. Stay tuned for more information as we learn more!

Nerd out with more research!
https://burpee.org/magazine

THE EARTH BELOW OUR FEET

Join us on a journey.

Exhibit Contributors:
Steve Simpson
Benson Stone Lonnie's Stonecrafters
IDNR (Illinois Department of Natural Resources)
Homer & Linda Eshbaugh
Drs. Robert & Marianne Firlit
Josh Mathews
Anne Weerda
Maria Chiaberta
Stacey Farrell

Exhibit Development Process

Geology: What's Beneath our Feet?

Anne Weerda & Josh Mathews

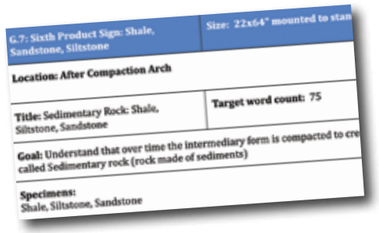
Taking down the old Geology Exhibit and reimagining the 2021 version was a long process with many hands and minds involved. It was important to link the elementary and middle school standards for Next Generation Science to the exhibit in a clear way for field trips, while also incorporating more advanced geology and chemistry for our High School and adult learners.

Exhibits need to function as "self-guided" exploration experiences for multiple age groups as well as the basis for discussion and group learning in field trips. Therefore, the exhibit development process, from the creation of themes and master plans to fabrication and design, takes a combination of creativity, ingenuity, science, knowledge, and experienced fundraising! Let's take a look behind the scenes!

The Rock Cycle

In an attempt to move away from the simplistic, circular view of the rock cycle (igneous, to sedimentary, to metamorphic rock), the team designed an "open flow plan." This would allow conversations to occur about intermediaries such as sand and silt or the impact of life in the creation of limestone which is so abundant in Illinois and Wisconsin. The team wanted to express the ability to move in multiple directions within the cycle, as well as the variables we see in our backyard soils.

Consulting with long time Burpee board member, volunteer, professor, and geologist, Steve Simpson, Burpee came up with a master plan for following specific minerals abundant in the rocks of Illinois: Feldspars, Micas, and Quartz. To engage learners of all ages, the exhibit development team wanted to have as many touchable specimens as possible, a chemical explanation, and movement driven learning. So began a layout of rocks and minerals that could be touched and examined up close without a glass covering and large signs.



BEFORE:
Burpee's previous geology exhibit.

Visitor Movement

Large archways were selected to represent processes such as extreme heat and weathering. The product of the force was placed directly under the archway. As visitors move between archways they move through the forces of the Earth and examine the products, always following the thread of the same minerals: Feldspars, Micas, and Quartz.

IN PROGRESS: Each exhibit element was installed over a period of six months.

Cooling Fast or Slow

The visitor starts at Magma and experiences fast or slow cooling (resulting in obsidian or granite, respectively).

Because obsidian cools quickly, the internal structure looks different than most minerals. Instead of having a crystalline structure, obsidian is more like glass and breaks in an interesting and unusual way called a conchoidal fracture, showing smooth, curved surfaces that resemble the inside of a seashell.

Walking through the "cooling slowly" archway, the visitor finds granite. Granite's crystal structure is visible to the naked eye because the cooling process for granite begins underground and takes thousands to millions of years to complete. Because it forms inside the Earth, Granite is called an "intrusive igneous rock".

Quartz, Feldspar, and Mica are the primary minerals that make up granitic rocks. The amount of each mineral determines the granite's color. Quartz can be milky white, while Mica is gray, brown or black, and Feldspar is a pink or white color. Visitors are encouraged to compare granite samples and find minerals!

Erosion

The incredible force of moving water (such as rivers and rain) and wind causes the breaking down of rocks, like Granite, into smaller particles. The visitor is standing at the archway of erosion. The result is an intermediary "Sand, Silt, and Clay" display. The size of the rock particles affects how it feels in our hands. Large boulders, cobbles, and gravels are part of this scale, however the three most common sizes are sand, silt, and clay. Can you feel the difference?

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Compaction
Over time, passing through another force archway, compaction is played out. Sand, silt, and clay are deposited based on the velocity of the water. As sediments build up over time, increased pressure from the sediments above begin to compact the layers below. Continued pressure on the sediments leads to a process known as **compaction**. Over thousands to millions of years of compaction, minerals can precipitate out of water, "gluing" particles together. As compaction and cementation of these particles progress, the resulting product is sedimentary rock. A sedimentary rock composed primarily of sand is called sandstone. Those made of primarily silt are called siltstone and rock made of primarily clay is called shale or mudstone which are presented to visitors to touch and examine.

Non-Linear?
The visitors can walk backwards through the erosion archway and once again arrive at the small particles of sand, silt, and clay showing that sedimentary rock can yet again be eroded and broken down into smaller pieces.

Life Line
With the Ordovician exhibit barely visible from the 2nd floor, we are reminded of the impact of life. The visitors turn to another archway: LIFE to see how living animals are key to another mineral: Calcite. Feldspar minerals within Granite, such as plagioclase, contain calcium. Free calcium ions are released into waterways and ultimately find their way into our oceans. Several organisms such as corals, snails, and microscopic coccolithophores pull these calcium ions out of the water along with the already present carbonate ions to produce calcium carbonate! Organisms use this to build the calcite or aragonite shells and exoskeletons that protect their bodies!

The Agate Display.

Limestone
The compaction archway after the life line looks different from the neighboring compaction archway. The result is Limestone, a sedimentary rock primarily formed in warm, shallow bodies of water when marine organisms, such as coral, foraminifera, and mollusks, die and leave behind their calcium carbonate exoskeletons on the seafloor. Despite the current environment, limestone can still be found in Illinois! This is because 470 million years ago during the Ordovician period, an ocean covered Illinois and marine life dominated the seafloor.

Extreme Heat & Pressure
The last set of archways takes us to the result of extreme heat and pressure causing dramatic changes in objects regardless of how strong they are!! Metamorphic rock forms due to extreme pressure and intense heat acting on sedimentary, igneous or even existing metamorphic rock. The rock does not get hot enough to melt, like magma but often reaches temperatures greater than 200 C, making it "soft" and malleable. The heat and pressure can alter the physical or chemical makeup of the rock, leading to recrystallization of the minerals within, leaving a dense and often banded appearance. The exhibit movement demonstrates that extreme heat and pressure can change Shale to Slate or Schist, Sandstone to Quartzite, Slate to Phyllite, and Limestone to Marble!

Chalcedony Art
Don't miss the special backlit display of Agate. The Burpee team lights up agate slices to show the multitude of colors and banding patterns in what almost looks like an art display! Agate is a translucent variety of microcrystalline quartz called Chalcedony. The deposition in concentric layers, around the walls of the cavity, creates the banded patterns characteristic of agate. Impurities within the silica cause agates to occur in a wide variety of colors from pink, to white, to brown, to yellow. Over time, as water with different composition seeped into the cavity, the beautiful banding that you now see is a record of water chemistry changing through time.

Special Features
While the core of the exhibit focuses on rocks resulting from the forces of the Earth and component minerals, there are several smaller displays that do a deep dive into amazing aspects such as fluorescence, mineral variability, and the multitude of ways impurities can make the same chemical structure (SiO_2, or quartz) look vastly different in shape and color!

AFTER:
Burpee's new geology exhibit.

Meet Melinda!

Volunteer Spotlight
Aster Walbaum

One of our most experienced, and treasured volunteers is Melinda Peterson-Fluaitt. Volunteering at Burpee for more than five years now, the museum has been a part of her life since she was a little girl. As a child, Melinda would visit the Manny Mansion to take art classes, long before the Solemn expansion was constructed as the museum we see today. She was employed at the museum from 2006-2008, and continued to stay involved afterwards through volunteering.

"I've seen it all," she tells us. "Everything keeps changing, but in a positive way. There's so much opportunity for learning. I keep saying this is a teaching museum and is far different from a regular museum."

While Burpee may have changed a great deal over time, one constant is knowing you can find Melinda at the museum!

Teaching Through Art
Art has always been an important part of Melinda's life. Even more important is her ability to use her art skills to educate others, especially children. Melinda earned a Masters degree in Special Education from Grand Canyon University, which led her to working in schools for over 10 years throughout the Rockford area. Her work provides an environment for students to learn about art, increase their motor skills, and have a safe space to grow.

Outside the Museum
Melinda retired from teaching 5 years ago, but is still an active member of the community. She is on the artistic board for Stepping Stones and an advocate for mental health. She participates in Art Scene as a children's artist, and is an active member of the Swedish Historical Society.

"I write articles, poetry or prose and am a founder of the newspaper Market Street Press."

Melinda is also a member of the Native American Area Council (NAAC) providing the museum connections to local indigenous people, including herself. We are proud to share such a special volunteer with so many organizations, and see Melinda's influence throughout the community of Rockford.

Ready to Draw
With paper and pencils out, Melinda spends her time as a volunteer sitting at a table in our turtle nook, ready to draw with anyone who stops by. Twice a week she volunteers to create illustrations of local wildlife, reptiles, and even our dinosaurs while teaching our guests about these incredible animals. Melinda loves being a guiding hand for children to develop art skills and motor functions. Melinda describes art as not only a good outlet for kids, but also a method to teach them focus, patience, and creativity.

Melinda shares her art from her usual station, in the Burpee's Windows to the Wilderness.

"Just come learn, and have fun with us!" Melina exclaimed. "We are a wealth of information. The museum is a wonderful place to get your kids interested in the outdoors and STEM activities. It's great for adding new chapters of learning and it's a great place to take your family."

Fun Fact: Melinda is ambidextrous and can draw with both hands. Sometimes if she gets tired of using one hand in the middle of a drawing, she will simply switch to her other hand and continue!

join us on the DINOSAUR HUNT

Have you ever wanted to dig up real dinosaur bones?

Every summer, crews from Burpee Museum lead expeditions to the Badlands of Utah and Montana to participate in fossil excavations. Team members prospect for new bones eroding out of the hills, learn how to properly excavate fossils and how to protect them for their journey back to the Burpee paleontology lab where they will be cleaned by skilled fossil preparators for research and exhibit.

No Experience Needed

No Experience is needed to join the team. Our paleontologists will provide hands-on training in the field on how to recognize dinosaur bones and proper excavation techniques to safely remove them from the rock.

2022 Season Dates

Utah
Week 1: May 16-20
Week 2: May 23-27
Week 3: June 6-10

Montana
Week 1: August 1-5
Week 2: August 8-12

Learn More at Burpee.org

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SAVE THE DATE
May 28, 2022
Burpee's Birthday Bash

MUSIC ON THE ROCK
SUMMER CONCERT SERIES

June 8 Mike Wheeler
June 15 Ivy Ford
June 22 Jimmy Nick
June 29 Chris O'Leary
July 6 Dave Weld & The Imperial Flames
July 13 Russ Green
July 20 Rev Raven & The CSABs with Westide Andy Linderman
July 27 Kilborn Alley Blues Band
August 3 Grand Groove Hotel
August 10 Cash Box Kings

Have a "Dino"-mite time on the Rock!

WEDNESDAYS
5:30PM - 8:30PM

SPONSORED by the Crossroads Blues Society. Beverages provided by Prairie Street Brewing Company. Food provided by local food trucks & vendors.