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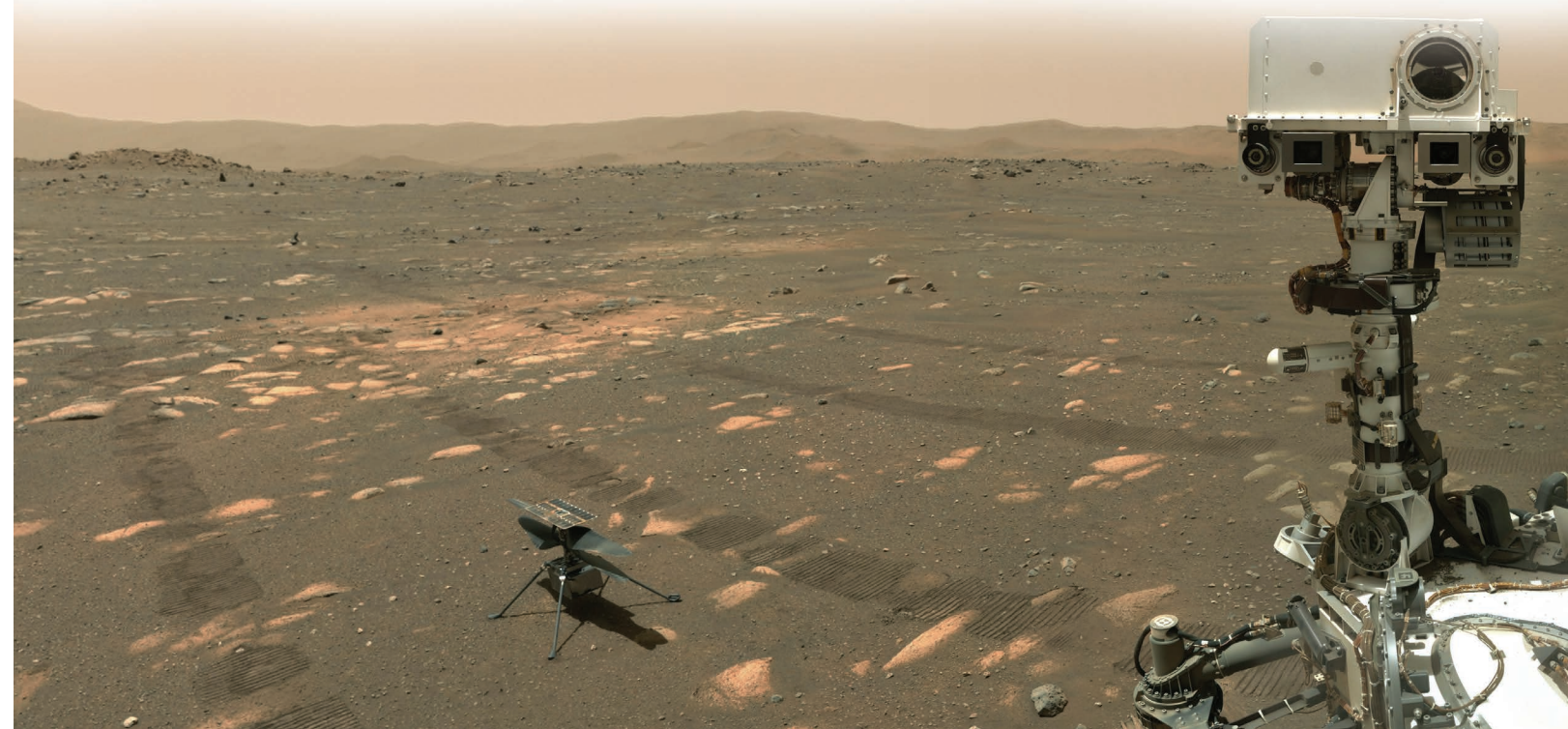
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ON THE COVER

NASA's Perseverance Mars rover took a selfie with the Ingenuity helicopter, seen here about 13 feet (3.9 meters) from the rover in this image taken April 6, 2021, the 46th Martian day, or sol, of the mission by the WATSON (Wide Angle Topographic Sensor for Operations and eNginneering) camera on the SHERLOC (Scanning Habitable Environments with Raman and Luminescence for Organics and Chemicals) instrument, located at the end of the rover's long robotic arm.
Credit: NASA/JPL-Caltech/MSSS



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Succulent Social with Lanipots on May 18, 2021 held in the Root Family Museum Train Station.



ANDREW SANDALL

What a gift it is to be moving into the summer with the Museum so busy and so many friendly faces back among us. It has been a wonderful boost to all our staff to see the response from the community since we reopened, and in recent months having so many of our volunteers coming back to work alongside us has been a real shot in the arm – alongside the literal shots in the arm many of us have been getting!

We have been taking things slowly and safely over the last couple of months as the vaccination numbers have been rising, but the difference is already noticeable. Our wonderful Guild has held some fantastic events before taking their break for the summer, and I know the Halifax Art Festival will be just amazing this year after its brief hiatus in 2020. Our ever-popular Summer Learning Institute summer camps have filled up at a record pace, and we have been able to offer more in-person classes than we predicted when we first started to put that program together. And even with increased capacity for our social events now, it is proving important to sign up as quickly as possible for programs like our regular Cocktails & Creations events or our recent Succulent Social to ensure you can get a seat.

The Museum will be busier than ever this fall thanks to the incredible generosity of our friends Lowell and Nancy Lohman, who recently announced their donation to Volusia

County Schools that will allow every 5th and 8th grader in Volusia County to visit MOAS and enjoy a full field study day with us, including a program in the Lohman Planetarium. Long time members of the Museum may remember that for a while there was a program in place that saw the Museum collaborating with Volusia County Schools to provide science enrichment programs to local students. Sadly, this program fell by the wayside in the early 2000s due to budget pressures. It is so wonderful that thanks to the foresight and philanthropy of the Lohmans, so many students will be able to come to the Museum and participate in our educational programs as we know from experience just how inspirational enrichment programs outside the classroom are to a student's progress.

Initiatives like this are a great tool to help us build and improve our region and we are blessed with so many passionate volunteers, donors, and advocates that share our belief in the importance of a museum within our community. The slow but steady rise in attendance and the demand for spaces at our programs gives me great optimism that people did not forget us during the last 12 months when everyone had much more on their minds, and what we are seeing with a rise in new memberships suggests that what we offered online during the pandemic made a new, larger audience aware of what we have to offer.

We are excited to be bringing back more and more of our in-person programs but can promise you that many of the online and virtual programs will be here to stay thanks to your feedback letting us know how much you enjoy them. I know many people across the country would be heartbroken if the weekly Sky Tonight shows that the staff of the Lohman Planetarium have been putting on our social media pages every Monday were to suddenly disappear! But as we continue to move forward with expanding our programming and exhibits back to where they were before, please keep checking with us regularly to see what we are scheduling. There are lots of great things in the pipeline that we can not wait to share with you all soon!



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Arts & Sciences is published quarterly by the Museum of Arts & Sciences, 352 S. Nova Road, Daytona Beach, Florida 32114, telephone 386.255.0285, website www.moas.org. Income from contributors helps offset a portion of the expense involved in the production of this publication.

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ABOUT THE
MUSEUM OF ARTS AND SCIENCES

The Museum of Arts and Sciences is a not-for-profit educational institution, chartered by the State of Florida in 1962 and accredited by the American Alliance of Museums. Museum collections and research include Cuban and Florida art, American fine and decorative arts, European fine and decorative arts, pre-Columbian and African artifacts, Pleistocene fossils, Florida history and regional natural history. Permanent and changing exhibitions, lectures, and classes highlight educational programs. The Museum houses changing arts and sciences exhibition galleries, permanent collection galleries, a gallery of American art, paintings, decorative arts and furniture, the Charles and Linda Williams Children's Museum, the Cici and Hyatt Brown Museum of Art, the Cuban Fine and Folk Art Museum, the Lowell and Nancy Lohman Family Planetarium, library, the Frischer Sculpture Garden, maintains nature trails in a 90-acre preserve in adjacent Tuscawillia Park, and operates Gamble Place in Port Orange.

The Museum of Arts and Sciences is recognized by the State of Florida as a cultural institution and receives major funding from the State of Florida, Department of State, Division of Cultural Affairs and the Florida Council on Arts and Culture.

Major Museum programs and activities for members, school children and the general public are also supported by grants from the County of Volusia, the Guild of the Museum of Arts & Sciences, Elfyn Community Fund, and over 30 Major Sponsors from the community.

MUSEUM HOURS:

10 a.m. – 5 p.m. Monday through Saturday
11 a.m. – 5 p.m. Sunday

The Museum of Arts and Sciences is committed to the Americans with Disabilities Act by making our facility and programs accessible to all people. If you have any special requirements, suggestions, or recommendations, please contact our representative, Executive Director, Andrew Sandall, at 386.255.0285. If you prefer, you may contact the Cultural Council of Volusia County representative at 386.257.6000, or the Division of Cultural Affairs, The Capitol, Tallahassee 850.487.2980, or TT 850.488.5779.

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FOCUS ON COLLECTIONS

NEW ATTRIBUTIONS

IN THE *Napoleonic
Decorative Arts*



[FIG. 1]
CIRCLE OF CHARLES PERCIER
(1764-1838) AND PIERRE-FRANÇOIS
FONTAINE (1762-1853) JACOB FRÉRES,
MANUFACTURER (ATTRIBUTED)
EMPIRE CHAIR
CIRCA 1815
DARK MAHOGANY WITH GOLD LEAF
GIFT OF KENNETH WORCESTER DOW
AND MARY MOHAN DOW
89.16.531

One of the interesting discoveries made during the research for the exhibition *In the Style of the Emperor: Napoleonic Decorative Arts in the Collection*, which was on display this past spring, was the connection between a small, gilded medallion and a set of Neoclassical chairs donated many years ago by Kenneth Worcester Dow and Mary Mohan Dow. The medallion bears the French title *Baptême du Roi de Rome* and was commissioned by Napoleon I to commemorate the baptism of his first son, Napoleon II.

Napoleon was fond of sponsoring medals and medallions to cement his authoritarian image - based on the tradition of Roman coins bearing the images of the Caesars - throughout his realm. For the design of this medallion, Napoleon turned to his favorite medal and medallion artist, Bertrand Andrieu.

Jean-Bertrand Andrieu (1761 - 1822) was a French engraver who came of age as an artist under Louis XVI but after the Revolution turned to designing medals and medallions when Napoleon I revived the demand for this type of commemorative art. He was entrusted with important commissions by the government and the Emperor and is responsible for commemorating many of the most important official moments for Napoleon I and the French State in bronze relief.

The *Baptême du Roi de Rome* [Fig. 2] is perhaps Andrieu's most famous medallion and it depicts the Emperor with laurel crown lifting his son Napoleon II (1811-1832) high as he about to be baptized. The baptismal font has an ewer with a fragrant myrtle branch atop it and a Bible leaning against it at its base. Napoleon I, in full Imperial dress, raises his son for all the world to see as if to proclaim that the future of the Holy Roman Empire is personified in the figure of his successor. Napoleon I is assured, through his son, that his legacy and authority will be secured (this wasn't to be, however, as Napoleon II never succeeded his father after his death).

Further emphasizing Napoleon's status in this medallion, is the addition of the chair of authority behind him. This chair, with prominent lion-headed griffin arms, was carefully chosen to symbolize that quite literally Napoleon I is the "seat of authority" in France during this era. Napoleon was careful to make sure he was not represented with a throne, which would have aligned him too closely with the corrupt *ancien régime* which preceded him. He wanted to make sure he is shown here as the ruler of the Holy Roman Empire but not a King.



[FIG. 2]
BERTRAND ANDRIEU (1761-1822)
BAPTEME DU ROI DE ROME
1811
WOOD, GILDED PLASTER,
LEATHER FRAME
GIFT OF KENNETH WORCESTER DOW
AND MARY MOHAN DOW
2006.02.109

Griffins are creatures of legend that are a hybrid of the body parts of a lion and eagle. Since ancient times, this mythical figure represented supreme authority as both these animals are considered the masters of their respective realms - the lion rules the land and the eagle, the skies. Since classical antiquity, griffins were known for guarding treasures and priceless possessions.

The griffin-legged barrel chair behind Napoleon in the medallion appears very similar to a Neoclassical chair in the MOAS collection [Fig. 1], except that the lion head is replaced with that of an eagle. Both of the chairs have the wings of an eagle and the legs of a lion finished with paw feet. The top of the barrel back of the MOAS chair is rimmed with a laurel wreath, again indicating the honored status of the sitter. The chair in the medallion has the prominent laurel wreath-encircled Napoleonic "N" placed between the two front legs.

The pair to this griffin-legged chair in the MOAS collection is another barrel-back chair with golden

swans for the arms. The swan was a symbol that became popular during the Napoleonic era as Napoleon's first wife, Josephine, adopted it as a symbol of elegance and fidelity. Instead of a laurel wreath, the back of this chair and the top of the armrests are adorned with the Fasces, a Roman symbol of the power of unity represented by a bound bundle of stalks.

Our MOAS Swan armchair [Fig. 3] is similar to a chair attributed to Charles Percier (1764-1838) and Pierre François Léonard Fontaine (1762-1853). These two were the most influential figures in the field of Empire architecture, decoration, and furnishings. They were the official architects to the court of Napoleon and designed many of the most famous monuments in Paris, including the Arc de Triomphe



[FIG. 3]
CIRCLE OF CHARLES PERCIER (1764-1838) AND PIERRE-FRANCOIS FONTAINE (1762-1853) JACOB FRÈRES, MANUFACTURER (ATTRIBUTED)
EMPIRE CHAIR
CIRCA 1815
DARK MAHOGANY WITH GOLD LEAF
GIFT OF KENNETH WORCESTER DOW AND MARY MOHAN DOW
89.16.531



[FIG. 4]
GONDOLA CHAIR WITH SWAN ARMRESTS (after an original in the National Gallery of Victoria, Australia)
JACOB FRÈRES, MANUFACTURER (ATTRIBUTED)
FRANCE 1796-1803
CHARLES PERCIER (Designer)
GILT AND PAINTED WOOD, VELVET, GOLD THRED
PHOTO IN THE PUBLIC DOMAIN

de l'Étoile. In addition, they were responsible for the renovation of the various royal residences and they designed whole interiors for Napoleon I and Josephine, including everything from furniture and wall treatments to drapes and small decorative arts. Highly-detailed sketches remain showing their attention to every detail in these interiors and their complete devotion to the Neoclassical style.

For the manufacture of their designs, Percier and Fontaine most often turned to the firm of Jacob Frères which was a duo of the brothers Georges II (1768-1803) and Francois-Honore Jacob (1770-1841). The Jacob brothers originally gained prominence producing luxury furnishings under Louis XVI but, after the Revolution, they became some of the leading manufacturers of the Neoclassical furnishings desired by Napoleon, Josephine, and their circles. This Percier and Fontaine swan chair [Fig. 4] was created for Josephine's boudoir at the Châteaux de Malmaison and is one of the most famous collaborations between the two firms.

Through his favorite Neoclassical artists, designers, and manufacturers such as Andrieu, Percier and Fontaine, and Jacob Frères, Napoleon I was able to complete a thorough saturation of imagery reflecting his authority as the Holy Roman Emperor throughout France and beyond. His stamp of approval for every detail related to the symbols, color scheme, chair type, design, and upholstery fabric was necessary before any of the elegant furnishings were created for his many residences. He was conscious of his own "brand" before there was this contemporary term for it. It is for this reason that the chair in Bertrand Andrieu's medallion is important art historically. If not actually specified by Napoleon himself for depiction in this very significant medallion, this chair was certainly approved by the Emperor as part of the symbolism meant to proclaim Napoleon's legacy through the birth and baptism of his son. So, by extension, we can safely say that, if the chair in Andrieu's medallion was preferred by Napoleon, then our similar chairs in the MOAS collection dated 1815 were as well. And if they were not present in his actual residences, they were at least present in those of the many privileged families in Napoleon's circle and those who wished to be. Therefore, a label of "Circle of" Charles Percier and Pierre François Fontaine, designers, and manufacture by Jacob Frères (attributed to) is appropriate. This represents a new attribution for these fine Neoclassical chairs in the MOAS collection and a new understanding of their place within the world of Napoleon I.

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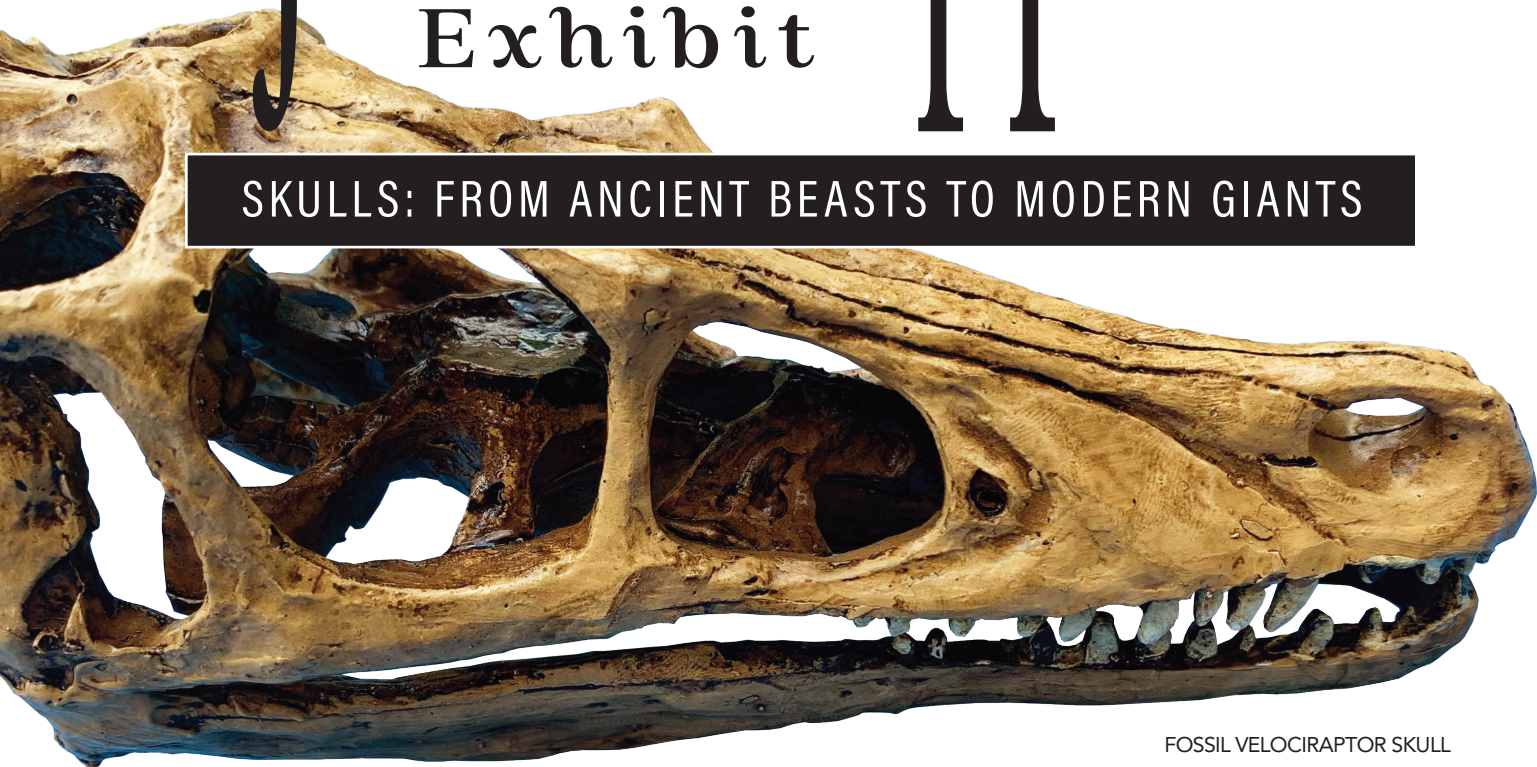
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A JAW DROPPING Exhibit

SKULLS: FROM ANCIENT BEASTS TO MODERN GIANTS



FOSSIL VELOCIRAPTOR SKULL
(VELOCIRAPTOR MONGOLIENSIS)
70 MILLION YEARS OLD
FOUND IN GOBI DESERT, CHINA

This summer, check out our new exhibit *Skulls: From Ancient Beasts to Modern Giants*, running from August 7, 2021 through October 31, 2021. All vertebrate animals have skulls, and the Museum has a nice collection of fossilized skulls from the last ice age, the Mesozoic Era, and currently living animals. Skulls can tell us a great deal of anatomical information, such as how an animal chewed its food, the type of vision the animal had, and whether it was a mammal or reptile. This biology exhibit will showcase the morphology of mammal and reptile skulls. Visitors can learn how to read a skull by some basic observation.



FOSSIL ELEPHANT SKULL
PLATYBELODON GRANGERI
MIOCENE EPOCH
10 MILLION YEARS OLD
CHINA

Are you predator or prey? Skulls can tell us the role animals play in an ecosystem. The key is the location of the eye sockets. Prey animals, like antelope, tend to have eyes placed on opposite sides of their heads. This provides a wide field of view close to 360 degrees. This allows them to survey a large swath of the landscape as they graze to detect any possible threats that might be moving towards them. In contrast, carnivores, like lions, have eye sockets placed in the front of the skull facing forward. This limits the field of view but what each eye sees overlaps with the other. Although this seems redundant, it allows the animal to have excellent depth perception with highly defined visual details. The predator brain more accurately perceives depth and distance which gives the carnivore a huge advantage when pursuing prey at a breakneck speed.

Teeth, jaws, and other skull features provide another visual clue about an animal's diet and how it captured its meals. Most carnivores have long dagger-like teeth in the front, usually called canines, that help capture, hold, and puncture the flesh of their prey. They have top and bottom premolars that are adapted to function like scissors that

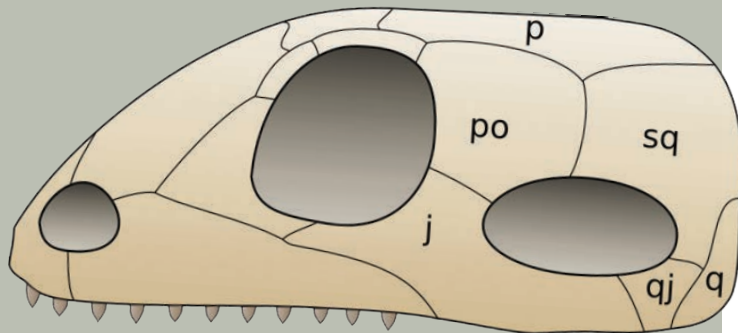
slice the meat and muscle they consume. Animals like alligators and other reptiles have rows of teeth of varying sizes throughout their jaw which allows them to grasp their prey, but they have a difficult time disassembling their food. These animals tend to gulp their food down in large chunks with no chewing. Crocodiles, alligators, and Tyrannosaurus Rex are excellent examples of these animals.

Block-like teeth can be seen in the skulls of herbivores. These teeth have a high crown above the gum line and are called "hypsodont" teeth. Herbivores primarily chew grasses which is a relatively new adaptation in the fossil record. Because grasses tend to have a low nutrient value and are abrasive, they lead to extreme wear on the teeth. Evolution's remedy for this is to have the herbivore teeth continuously grow throughout the animal's life. The modern and ice age horse is an excellent example of this as well as most elephant species living or extinct. At some point, the tooth wears down below the gum line and the animal can no longer feed and it dies. The visual clue in the skull of plant eaters is that they usually have very flat teeth.

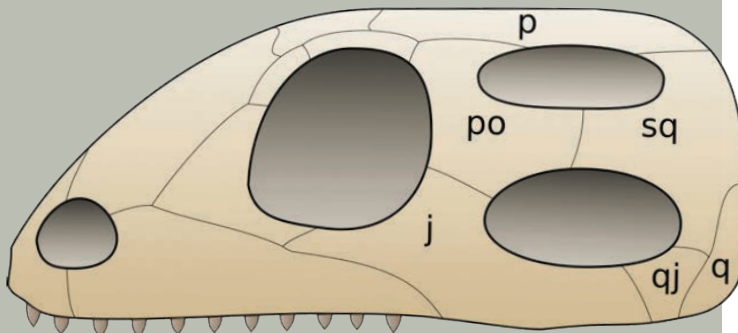
Animals known as browsers evolved teeth to better process heavier plant material like leaves, bark, and twigs. Although it seems this material should be tougher, the vegetation is far above the ground. It does not contain the abrasive silica that grazers deal with. In the skull, you can identify these browser teeth (molars) with high rounded cusps or crescent shaped teeth. The extinct mastodon molar is an excellent example of this. Browsers have different types of hypsodont tooth levels such as deer, antelope, camel, and llamas which differ from rhinoceros, humans, pigs, and other animals. One interesting observation is



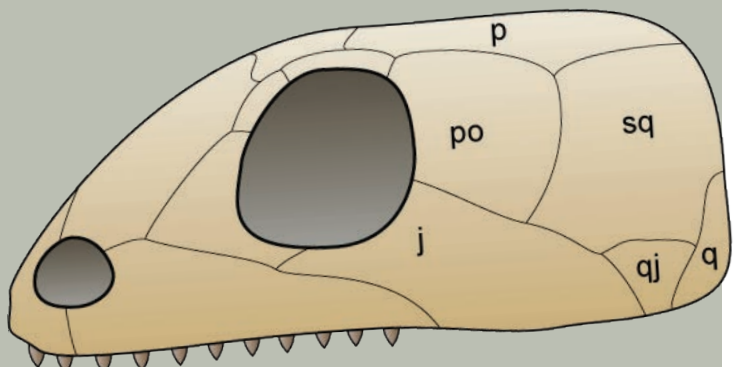
FOSSIL CAVE BEAR SKULL
URSUS SPELAEUS
PLEISTOCENE EPOCH
80,000 YEARS OLD
ROMANIA, EUROPE



SYNAPSID SKULL - THE DISTINGUISHING FEATURE OF SYNAPSIDES IS THE PRESENCE OF ONLY ONE HOLE IN EACH SIDE OF THEIR SKULL AROUND THE TEMPORAL BONE, WHICH ACCOUNTS FOR TWO HOLES IN TOTAL.



DIAPSID SKULL - ANY MAJOR VERTEBRATE WITH TWO MAJOR HOLES KNOWN AS TEMPORAL FENESTRAE IN THEIR SKULL.



ANAPSID SKULL - AN AMNIOTE WHO SKULL LACKS ONE OR MORE SKULL OPENINGS (FENESTRA) NEAR THE TEMPLES.

to look for the wear patterns on the teeth. If they are very worn, it is usually an older adult animal.

Omnivores like most bears, humans, opossums, and skunks have a more complex dental makeup of teeth. These animals tend to have a full complement of canines, incisors, premolars, and molars. It is hard to determine whether an animal is an omnivore based on a single tooth. Finding a complete or almost complete set of teeth gives a much better indication of the animal's diet. Omnivores are able to eat a greater range of food which allows the animal to live in a larger variety of environments. Observing the teeth of a skull and looking for sharp canines or a set of flat grinding teeth can tell a great deal about the diet and age of an animal.

Another interesting feature to look for is the openings on each side of the skull. These openings, called fenestra, are where the jaw muscles attach to the skull and enable the jaw to open and close. This is important for chewing. A skull with one opening or fenestra on each side of the skull is a mammal skull or synapsid animal. Remarkably, animals with this type of skull date back as far as the Permian Age, over 300 million years ago, long before the time of dinosaurs. A reptile skull has two holes or fenestra on each side of the skull which is called a diapsid animal. Only turtles have no holes or fenestra on each side of the skull. They are called anapsid animals. These animals are very ancient indeed and date back to a time before dinosaurs. Most animals that have fenestra or openings in the skull can be found behind the eye sockets, but some have openings in front of the eye sockets as well. These are usually carnivorous reptiles. There are always exceptions found in the fossil record and in evolution in regard to teeth, fenestra, and eye socket placement.

This August come to the Museum to see an unusual exhibit of skulls and discover our amazing natural world. Learn how the skulls of vertebrate animals have adapted and how they eat. This exhibit will showcase skulls like a velociraptor, sperm whale, saber tooth cat, cave bear, manatee, and more. Seeing all these skulls together will make your jaw drop!

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JACKSONVILLE SYMPHONY "Messiah"

FRIDAY, DECEMBER 17, 2021

POLAND PHILHARMONIC ORCHESTRA

Agata Szymczewska, violin
SATURDAY, JANUARY 15, 2022

TENORS & DIVAS

Teatro Lirico D'Europa
SATURDAY, JANUARY 29, 2022

RIGOLETTO

Teatro Lirico D'Europa
FRIDAY, FEBRUARY 4, 2022

RUSSIAN NATIONAL ORCHESTRA

Alexander Malofeev, piano
FRIDAY, FEBRUARY 11, 2022

SIBERIAN VIRTUOSI

State Ensemble of the Republic of Sakha
SUNDAY, MARCH 27, 2022

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SUMMER EXHIBITS



HOME: PAINTINGS BY SARA PEDIGO
OPENING THROUGH JULY 25, 2021
GARY R. LIBBY ENTRY COURT

An exhibit that highlights Sara's preference for painting her daily life around her, in particular, in her home. Her beautifully composed, unassuming scenes of her bedroom, living room, kitchen and porches

have a surprising depth and strength to them and remind us that "home" is a very powerful concept indeed. *Image Credit: Sara Pedigo, "Solitary Light," oil on canvas. Courtesy of the artist.*



A SYMPHONY OF COLOR: BEAUX ARTS OF CENTRAL FLORIDA
OPENING JULY 31, 2021
THROUGH NOVEMBER 28, 2021
GARY R. LIBBY ENTRY COURT AND ROOT HALL

This exhibition is the fourth installment of the annual Beaux Arts of Central Florida group exhibition at MOAS. Beaux Arts of Central Florida was founded in 1962 by the students of the late Lillian "Lu" Belmont of New York City. The group is comprised of 50 professional artists, working in all mediums, who place a strong emphasis on experimental creative approaches brought to quality design conception and techniques. The artists are encouraged to expand their horizons and constantly stretch their abilities. *Image Credit: Carson Kapp, Garden of Wisdom, Acrylic*



EYES IN THE SKY: THE WORLD OF AERIAL DRONES
OPEN THROUGH AUGUST 1, 2021
FORD GALLERY

Drones have rapidly made their way into every facet of our lives. From sophisticated drones flying in the military, aiding in search and rescue efforts after natural disasters, efficiently fertilizing farmer's crops, taking high resolution pictures and video from unique vantage points, nimbly maneuvering around obstacles in exciting races, and even flying on other worlds within our Solar System, these unmanned aerial vehicles, or UAVs, continue to progress and evolve in interesting ways. We explore this fascinating technology in this exhibit, as we display a diverse array of drones and illustrate how these vehicles are being relied upon for many different applications. *Image Credit: Seth Mayo / MOAS*



SKULLS: FROM ANCIENT BEASTS TO MODERN GIANTS
OPENING AUGUST 7, 2021
THROUGH OCTOBER 31, 2021
FORD GALLERY

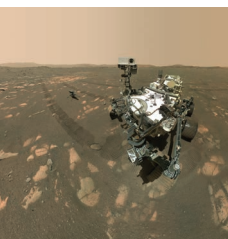
All vertebrate animals have skulls, and the Museum has a nice collection of fossilized skulls from the last ice age, the Mesozoic Era, and currently living animals. Skulls can tell us a great deal of anatomical information, such as how an animal chewed its food, the type of vision the animal had, and whether it was a mammal or a reptile. This biology exhibit will showcase the morphology of mammal and reptile skulls. Visitors can learn how to read a skull by some basic observation. Discover skulls such as ice age cave bear, velociraptor, saber tooth cat, extinct American lion, manatee, coyote, primates, and more. *Image Credit: North American Beaver Skull (Castor Canadensis)*



TIME HONORED: THE ART OF DEAN MITCHELL
OPEN THROUGH SEPTEMBER 12, 2021
KARSHAN CENTER FOR GRAPHIC ART

Dean L. Mitchell was born in 1957 in Pennsylvania and raised in Quincy, Florida. A graduate of the Columbus College of Art & Design in Columbus, Ohio, he has developed a style and vision in his body of work that shows the deep American South few have seen, and certainly, fewer have decided to record. While well known for

his figurative works, landscapes and still lifes, it is haunting scenes of rundown barns, abandoned farmscapes, and small towns in the rural South that seems to capture a time long past and resonate within the nostalgic memories of all of us. For even city folk at one time in their lives have had a rural experience that left its mark. Dean Mitchell's paintings - primarily in watercolor - remind us that this history belongs to all of us and these forgotten places have many stories to tell. *Image Credit: Dean Mitchell, "Tobacco Barn," 2018, watercolor on paper. Courtesy of the artist.*



DARE MIGHTY THINGS: EXPLORING MARS WITH PERSEVERANCE
OPENING SEPTEMBER 18, 2021
THROUGH NOVEMBER 7, 2021
KARSHAN CENTER FOR GRAPHIC ART

NASA's Mars 2020 mission has brought another rover down to the surface of the Red Planet — this time known as Perseverance. The Perseverance rover may help us answer if life ever arose on Mars as it allows scientists to search for signs of ancient microbes in a river delta within the 28-mile wide Jezero Crater. To celebrate the mission's achievements thus far, the exhibit highlights a collection of high resolution images captured by the rover as it remotely explores the planet. Dramatic views from Perseverance's harrowing landing, beautiful panoramas of the Martian surface, closeup shots of geologic points of interest, and photos of the Ingenuity Helicopter drone in flight during its technology demonstration, is on display to emphasize our continued drive to understand Mars. This spirit of exploration is captured in the mission's slogan: Dare Mighty Things. *Image Credit: NASA/JPL-Caltech/MSSS*



CHARTING THE CELESTIAL LANDSCAPE
OPEN THROUGH OCTOBER 10, 2021
NORTH WING CORRIDOR

The charts seen here are representative of the scientific creativity of the past. Attempting to grasp the mysteries of the universe, ancient civilizations and cultures have over thousands of years traced the myriad of stars in the heavens into intricate patterns or constellations that represented godly beings, beastly creatures, and a multitude of prominent objects. As these depictions became increasingly important in the daily lives of the observers as time passed, a methodical and scientific approach to observation began to take form. This unique astronomical collection at MOAS was purchased through the Mombello-Russo Art Acquisition Fund. *Image Credit: Alexander Jemieson (1782-1850), Celestial Chart - Andromeda, Perseus, Triangula. Gift of Malcom C. Babb.*



AMERICAN EMPIRE
OPEN THROUGH NOVEMBER 7, 2021
BOUCHELLE CHANGING GALLERY

Upon the establishment of the new Republic in the United States of America, its first citizens adopted much from French neo-classicism to give the new Republic the same dignified appearance they felt it deserved. Sometimes known as "American Federal," the first style adopted by our new country in the early 19th century clearly reflected the great style of the revolution in France. The Museum of Arts & Sciences brings together in this exhibition fine

examples of American Empire furniture, decorative arts, and period paintings from its collection to illustrate the transition from French to American in these works as the artists and craftsmen of the new United States attempted to make the style uniquely American. *Image Credit: Seth Thomas, American, 1785-1859, Shelf Clock, c. 1835. Wood and reverse-painted glass. Gift of Kenneth Worcester Dow and Mary Mohan Dow. 89.16.066*

CURRENTLY ON DISPLAY AT THE CICI AND HYATT BROWN MUSEUM OF ART



VOLUSIA COUNTY
Scenes from Volusia County and the importance of art schools and art venues in the development of culture within the county. *Featured painting: South Beach Street, Daytona, James Ralph Wilcox, Volusia County*



"THE LATEST NEWS FROM FLORIDA": WOOD ENGRAVINGS FROM 19TH CENTURY PERIODICALS
A. WORLEY BROWN & FAMILY GALLERY
Wood engravings from 19th century illustrated magazines and journals documenting events in the remote land of Florida - a state that few northerners knew a lot about or would ever visit. *Featured Painting: Harper's Weekly, Ft. Pickens 1861*



FLORIDA WEATHER
FRANCE FAMILY GALLERY
Experience a myriad of Florida weather in just one day. The Florida Weather gallery offers a look at Florida weather as represented by art. Florida is known for weather that changes with uncanny speed. Sun, rain, wind, clouds, storms, and fog all play a part in what the artist sees and wants to capture. The color, technique, rhythm, and texture are focused to evoke the full sensation of what is Florida's revealing environmental trait. *Featured painting: Naomi Duckman (Furth); Storm on Seven Mile Bridge, Florida Keys, 1935*



GONE FISHIN'
SENA H. AND THOMAS L. ZANE GALLERY
This exhibition emphasizes Florida's reputation for being one of the greatest sport fishing areas in the world. From locals with simple cane poles to celebrities on yachts decked out for challenging sailfish and tarpon. *Featured painting: Sam Stoltz, Strife of the Sea*



THE SEMINOLE AND THE EVERGLADES
FRANCE FAMILY GALLERY
The Everglades is a region of tropical wetlands that occupies the southern portion of Florida. Water leaving the vast, shallow Lake Okeechobee in the wet season forms a slow-moving river 60 miles wide and over 100 miles long. Human habitation in the southern portion of the Florida peninsula dates from 15,000 years ago. The region was dominated by the native Calusa and Tequesta tribes. After European colonization, both tribes declined. The Seminole nation emerged out of groups of Native Americans, mostly Creek, from what are now the northern Muscogee peoples. Artists from the early 19th century on have found the visual characteristics of the people and the land compelling subjects for artworks. *Featured painting: James F. Hutchinson; Seminole Man, 1992*

MUSEUM NOTICE:

Please note that any of these events are subject to change or cancellation. Please check the event calendar at MOAS.org for the latest updates on these upcoming events.

ONGOING EVENTS

Wednesday, Yoga in the Gallery

Wednesday, 5:30pm-6:30pm

Take a break from your busy day and enjoy weekly Yoga in the Gallery at the Cici and Hyatt Brown Museum of Art. Meet in the lobby to join registered yoga instructor, Ashley Brooks of Holistic Movements, for an hour-long session that will provide you with an opportunity to practice a series of gentle yoga poses. Class is open to all experience levels. Please bring a mat, towel, and water. Space is limited and registration is required. RSVP to the Museum at 386-255-0285. \$5.00 for members, \$10.00 for future members.

JULY

Wednesday, July 7

2:00pm-3:00pm

Eyes in the Sky: The World of Aerial Drones Tour by ERAU graduate student, Eduardo Morillo

Join Embry-Riddle graduate student of aerospace engineering, Eduardo Morillo, as he walks you through the exhibit to discuss the cutting-edge research that he is involved with on UAV technology. Mr. Morillo will provide an up-close look at the drones on display that come from the Advanced Dynamics and Control Lab within the MicaPlex at ERAU's research park. Free for members or with paid museum admission.

Thursday, July 8

11:00am-12:00pm

VIRTUAL LECTURE: Members-Only Coffee with a Curator | Vintage Postcard History of Florida

Grab your coffee and join Senior Curator of Education and History, Zach Zacharias virtually on ZOOM for a nostalgic visual tour of Florida's history from the Gilded Age to the 1950s through beautiful vintage postcards. Florida's vistas, beaches, landmarks, alligators, palm trees, and more are preserved through these tourist mementos which provide an important visual record. Crisscross the state from north to south and east to west for a unique look at Florida's history as tourism became the main economic engine of Florida. Register online at MOAS.org or by calling the Museum at 386-255-0285 ext. 315. Free for MOAS members. Must be a MOAS member to attend.

Saturday, July 10

7:00pm-9:45pm

Second Saturday Laser Rock Concert

7:00pm Electrolaze
8:00pm Rush 2112
9:00pm Laser Queen
\$5.00 for one show, \$7.00 for two shows, and \$9.00 for three shows. Seating for these concerts is very limited to allow for proper social distancing. Advanced purchase of tickets is recommended by calling the Museum at 386-255-0285.

Wednesday, July 14

2:00pm-3:00pm

Eyes in the Sky: The World of Aerial Drones Tour by ERAU's Dr. John Robbins

Join Embry-Riddle professor of aeronautical science, Dr. John Robbins, at the Museum of Arts & Sciences as he walks you through the *Eyes in the Sky: The World of Aerial Drones* exhibit to discuss UAV technology and training. Dr. Robbins will give a comprehensive look at how this technology is used for very important work in our society and how his UAS (unmanned aircraft systems) program at ERAU is training the next generation of drone pilots. Free for members or with paid museum admission.

Thursday, July 15

2:00pm-3:30pm

VIRTUAL Florida Vistas Book Club: Hitler's Soldiers in the Sunshine State by Robert D. Billinger, Jr.

Join us for our next Florida history book club meeting virtually on ZOOM where we will be discussing *Hitler's Soldiers in the Sunshine State*. In the first book-length treatment of the German prisoner of war experience in Florida during World War II, Robert D. Billinger, Jr., tells the story of the 10,000 men who were "guests" of Uncle Sam in a tropical paradise that for some became a tropical hell. Read more about the book at MOAS.org. Advanced RSVP for this virtual program is required by registering online at MOAS.org or by calling the Museum at 386-255-0285. Free for members, \$5.00 for future members.

Thursday, July 15

5:30pm-7:30pm

Wine Tasting: Wine Around the World

Join us at the Cici and Hyatt Brown Museum of Art for our quarterly wine tasting series with S.R. Perrott. Spend the evening among friends while you sip up knowledge on swirling, tasting, and describing wine while learning about different light appetizer pairings from Ravish Catering. This month's program will feature six different wines from around the world, comparing and discussing new world vs. old world wine. This event is for those ages 21 and older. Seating is limited. Register at MOAS.org or by calling the Museum at 386-255-0285. No refunds after July 9. \$30.00 for members, \$40.00 for future members.

Saturday, July 17

3:00pm-4:30pm

Afternoon with Florida History

Join us in the Root Family Auditorium for a presentation on Florida history. Free for members, \$7.00 for future members, or included with paid museum admission.

Florida's Patriot War: The Other War of 1812 with Historian, Brian Polk

While the United States was fighting the British during the War of 1812, a separate conflict was taking place in Spain's Florida colony. President James Madison allowed an ill-advised operation that some compare to the Bay of Pigs invasion of Cuba, to illegally invade Florida and capture it for the United States. There was international intrigue, subversion and coverup, alliances with the Seminoles, skirmishes and battles, runaway slaves finding refuge with the Spanish, double-crossing and retaliation – a true-to-life historical thriller.

Small Town Central Florida with Senior

Curator of Education and History, Zach Zacharias

Take a travel experience through many of the historic small towns that give Central Florida so much charm. Learn about the history and landmarks of small towns like Lake Helen, Micanopy, Macintosh, Eustis, and many more. Discover the natural beauty, the small-town charm, and how these towns evolved from small settlements.

Wednesday, July 21

12:00pm-1:30pm

Lunch and Learn: Curator's Choice with Special Guest Master Landscape Painter, Arnold Desmarais

Join Senior Curator of Education and History, Zach Zacharias and Master Landscape Artist, Arnold Desmarais at the Cici and Hyatt Brown Museum of Art and learn about many of the masterwork pieces in the collection. Learn about color theory, perspective, focal points, history, and nature in this unique joint presentation. Call the Museum at 386-255-0285 to RSVP and place your lunch order. Space is limited and advanced RSVP is required. Lecture is free plus the price of paid lunch for members. Lecture is \$5.00 plus the price of paid lunch for future members.

Monday, July 26

5:00pm-7:00pm

MOAS After Hours: In Partnership with The Locals Mix | Planetarium Night

Join us at the Museum of Arts & Sciences for exclusive after-hours access to all galleries, happy hour drink specials, and live music by Nealey Gail and DJ Jukebox Bully, in partnership with The Locals Mix. Guests can attend one, or both, of the featured planetarium shows – 5:30pm Live "The Sky Tonight" Show with MOAS Curator of Astronomy, Seth Mayo, or at 6:30pm one of our most popular laser night concerts, Laser Vinyl. Free for members, \$5.00 for future members.

Saturday, July 31

3:00pm-4:00pm

Final Gallery Tour – Eyes in the Sky: The World of Aerial Drones

Join Curator of Astronomy, Seth Mayo, at the Museum of Arts & Sciences for the last tour of the diverse array of drones we have on display in this exhibit. These small aerial vehicles have found a place in almost every aspect of our lives, all while being operated without a human on board. Seth will provide a comprehensive look at the technology behind these drones and how they are being used in interesting ways. Free for members or with paid museum admission.

AUGUST

Thursday, August 12

3:00pm-4:00pm

Ask a Planetarium Curator

Join us in the Lowell and Nancy Lohman Family Planetarium at MOAS for this audience guided show that can take you anywhere in the universe that you would like to go! Come with your questions, curiosities, and interests, as we navigate freely through the planetarium's vast universe. We cannot wait to explore the universe with you! Free for members or with paid museum admission.

Saturday, August 14

7:00pm-9:45pm

Second Saturday Laser Rock Concert

7:00pm Laser Vinyl
8:00pm Pink Floyd – The Wall
9:00pm Pink Floyd – The Dark Side of the Moon
\$5.00 for one show, \$7.00 for two shows, and \$9.00 for three shows. Seating for these concerts is very limited to allow for proper social distancing. Advanced purchase of tickets is recommended by calling the Museum at 386-255-0285.

Thursday, August 19

11:00am-12:00pm

VIRTUAL LECTURE: Members-Only Coffee with a Curator | Tuscawilla Nature Preserve

Grab your coffee and join Environmental Education Associate, Kelsey Hansen virtually on ZOOM for a walk through Tuscawilla Nature Preserve. Kelsey will tour you through the Preserve and discuss the importance of protecting areas like Tuscawilla while pointing out the comment plants and trees that can be found. Register online at MOAS.org or by calling the Museum at 386-255-0285 ext. 315. Free for MOAS members. Must be a MOAS member to attend.

Thursday, August 19

2:00pm-3:30pm

VIRTUAL Florida Vistas Book Club: Shadow Country by Peter Matthiessen

Join us for our next Florida history book club meeting virtually on ZOOM where we will be discussing *Shadow Country*. Killing Mister Watson, Lost Man's River, and Bone by Bone – Peter Matthiessen's great American epic about an Everglades sugar planter and notorious outlaw E. J. Watson on the wild Florida frontier at the turn of the twentieth century – were originally conceived as one vast, mysterious novel. Now, in this bold new rendering, Matthiessen has marvelously distilled a monumental work while deepening the insights and motivations of his characters with brilliant rewriting throughout. Advanced RSVP is required by registering online at MOAS.org or by calling the Museum at 386-255-0285. Free for members, \$5.00 for future members.

Wednesday, August 25

12:00pm-1:30pm

Lunch and Learn: Skulls: From Ancient Beasts to Modern Giants

Join Senior Curator of Education and History, Zach Zacharias, and Environmental Education Associate, Kelsey Hansen, in Root Hall at the Museum of Arts & Sciences for lunch and then discover the skulls that make up the unique exhibit, *Skulls: From Ancient Beasts to Modern Giants*. Learn about the morphology of the many animals in the collection from the giant sperm whale, American Lion to primate skulls. Call the Museum at 386-255-0285 to RSVP and place your lunch order. Space is limited and advanced RSVP is required. Lecture is free plus the price of paid lunch for members. Lecture is \$5.00 plus the price of paid lunch for future members.

Thursday, August 26

6:00pm-7:00pm

VIRTUAL LECTURE: Ask our Curator of Astronomy

Join MOAS Curator of Astronomy, Seth Mayo, digitally on ZOOM for this audience guided show that can take you anywhere in the universe that you would like to go! Come with your questions, curiosities, and interests, as we navigate freely through powerful universe software that you can enjoy anywhere. We cannot wait to explore the universe with you! Register online at MOAS.org or by calling the Museum at 386-255-0285. Free for members, \$7.00 for future members.

Saturday, August 28

10:00am-12:00pm

MOAS Brunch Social: Meteors & Mimosas

Join us in the Root Family Museum Train Station for a brunch social featuring various brunch cuisines and a create your own mimosa bar, catered by Ambers Jewels. Following brunch, create your own mimosa to take with you on a journey in our "Lohman Planetarium Spaceship" as MOAS Curator of Astronomy, Seth Mayo, virtually flies you through the universe. The trip will take a course through the diverse destinations within our Solar System, the colorful nebula many light years away, and all the way out to the furthest reaches of outer space. Admission includes brunch, two complimentary mimosas, and admission to the Museum for the rest of the afternoon to enjoy the galleries. Seating is limited and admision must be purchased in advance. Event attendees must be 21 and older. Register at MOAS.org or by calling the Museum at 386-255-0285. No refunds after August 24. \$25.00 for members, \$30.00 for future members.

Monday, August 30

5:00pm-7:00pm

MOAS After Hours: In Partnership with The Locals Mix

Join us at the Museum of Arts & Sciences for exclusive after-hours access to all galleries, happy hour drink specials, and live music by The Transfers and DJ Jukebox Bully, in partnership with The Locals Mix. Guests can also enjoy a presentation of the new Beaux Arts Collection by the exhibition curator, Peggy Banks. This exhibition is the fourth annual installment of work by the Beaux Arts group at MOAS. Beaux Arts of Central Florida was organized in 1962 to by the students of late Lillian "Lu" Belmont of New York City. They are 50 professional artists, working in all mediums, who place a strong emphasis on the experimental creative approach with a strong emphasis on quality work. The artists are encouraged to expand their horizons and constantly stretch their abilities. Free for members, \$5.00 for future members



SEPTEMBER

Thursday, September 9
11:00am-12:00pm
VIRTUAL LECTURE: Members-Only Coffee with a Curator | American Empire
Grab your coffee and join Chief Curator/Gary R. Libby Curator of Art, Ruth Grim, virtually on ZOOM for a discussion of the *American Empire* exhibition on view in the Bouchelle Changing Gallery. Sometimes known as “American Federal,” the first style adopted by our new country in the early 19th century clearly reflected the great style of the revolution in France. The Museum of Arts & Sciences brings together in this exhibition fine examples of American Empire furniture, decorative arts, and period paintings from its collection to illustrate the transition from French to American in these works as the artists and craftsmen of the new United States attempted to make the style uniquely American. Register online at MOAS.org or by calling the Museum at 386-255-0285 ext. 315. Free for MOAS members. Must be a MOAS member to attend.

Saturday, September 11
7:00pm-9:45pm
Second Saturday Laser Rock Concert
7:00pm Laser Spirit
8:00pm Laser Queen
9:00pm Laser Zeppelin
\$5.00 for one show, \$7.00 for two shows, and \$9.00 for three shows. Seating for these concerts is very limited to allow for proper social distancing. Advanced purchase of tickets is recommended by calling the Museum at 386-255-0285.

Thursday, September 16
2:00pm-3:30pm
VIRTUAL Florida Vistas Book Club: Florida Lore by Caren Schnur
Join us for our next Florida history book club meeting virtually on ZOOM where we will be discussing *Florida Lore*. Florida boasts mysterious tales that stretch back more than twelve thousand years. Dive into the lives of the proud Wahulla Pocahontas and the Ghost of Bellamy Bridge. Meet local lawbreakers like John Ashley, as well as transplants like Ma Barker and Al Capone. Stalk stumpy gators or Hogzilla as they prowl Florida’s swamps and suburbs. Discover the quintessential Cracker cowboy and the Barefoot Mailman, plus the origin of names like Boca Raton and Orlando. Advanced RSVP is required by registering online at MOAS.org or by calling the Museum at 386-255-0285. Free for members, \$5.00 for future members.



Saturday, September 18
10:00am-5:00pm
Smithsonian Magazine Museum Day
Enjoy free Museum admission when you present a Museum Day ticket. Visit Smithsonianmag.com/museumday for details and to download your ticket. Tickets will be available to download beginning at midnight on Wednesday, August 18, 2021. Ticket does not include planetarium admission. Free with Museum Day ticket.

Tuesday, September 21
3:00pm-4:00pm
Talk and Walk | Skulls: From Ancient Beasts to Modern Day Giants
Join MOAS Senior Curator of Education and History, Zach Zacharias Ford Gallery at the Museum of Arts & Sciences for a walkthrough of the exhibition, *Skulls: From Ancient Beasts to Modern Day Giants*. This exhibit features skulls from crocodiles, extinct Florida rhino, ice age cave bears, various primates, and more. Free for members or with paid museum admission.

Wednesday, September 22
2:00pm-3:00pm
Gallery Tour: Dare Mighty Things: Exploring Mars with Perseverance
In this inaugural tour, MOAS Curator of Astronomy, Seth Mayo, will explore the high resolution imagery on display that was captured by the Perseverance rover since its Mars landing on February 18, 2021. Seth will explain why the rover was sent to a dried-up river delta in the Jezero Crater on Mars, the science behind the mission's search for ancient microbial life, the technology demonstration flights of its Ingenuity Helicopter drone, and how this research is preparing the way for future human exploration. Free for members or with paid museum admission.

Saturday, September 25
1:00pm-3:00pm
Film Class: Filming with Digital Devices
Back by popular demand! Join award-winning filmmaker, Gary Lester at the Museum of Arts & Sciences to learn how to maximize video shoot capabilities on various devices such as smart phones, tablets, and iPads. Topics covered include shot composition, the best kinds of lighting, and what to do with the footage once it has been shot. Space is limited and advanced registration is required by calling the Museum at 386-255-0285. \$15.00 for members, \$20.00 for future members.

Monday, September 27
5:00pm-7:00pm
MOAS After Hours
Join us at the Museum of Arts & Sciences for exclusive after-hour access to all galleries, happy hour drink specials, and live jazz music by the Cody McCafferty Quartet, a group of young local musicians who are passionate to keep the jazz spirit alive in upcoming generations. Guests can also enjoy a special talk and tour with MOAS Curator of Astronomy, Seth Mayo, of the new exhibit, *Dare Mighty Things: Exploring Mars with Perseverance*. Explore the high resolution imagery that was captured by the Perseverance rover since its Mars landing on February 18, 2021. Seth will explain why the rover was sent to a dried up river delta in the Jezero Crater on Mars, the science behind the mission's search for ancient microbial life, the technology demonstration flights of its Ingenuity Helicopter drone, and how this research is preparing the way for future human exploration. Free for members, \$5.00 for future members.

Wednesday, September 29
12:00pm-1:30pm
Lunch and Learn: Local Flavor
Join Senior Curator of Education and History, Zach Zacharias at the Cici and Hyatt Brown Museum of Art and learn about the paintings of Volusia County. Many famous artist made their way to the Volusia County area to paint the many landmarks, vistas, and people who make up the history of our county. Call the Museum at 386-255-0285 to RSVP and place your lunch order. Space is limited and advanced RSVP is required. Lecture is free plus the price of paid lunch for members. Lecture is \$5.00 plus the price of paid lunch for future members.


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Relax, Refresh, Revive

A Restful Summer Before a Busy Fall

As we move into the summer months we are looking forward to restful days ahead. We will enjoy this time off as the fall months feature our largest fundraisers!

If you did not attend our High Society Garden Party Luncheon in April, you missed a beautiful occasion to meet members of the Guild and make new friends. A special thank you to LC Tobey who hosted this event along with her outstanding committee of Sandy Buckley, Sue Kim, Kathy Wilson, Sherry Erbe, Zayna Gibson, and Karrie Houlton.

This fall is shaping up to be an exciting time for the Guild.

Starting in September, our meetings will be held at the Cici and Hyatt Brown Museum of Art at 10:00 am on the second Tuesday of the month. Our meetings will continue to include social time, guest speakers, and announcements to keep you up to date on all of our activities. On Tuesday, September 14th our guest speaker will be businesswoman and philanthropist Nancy Lohman, who will be sharing her new book "Blossom: Cultivating More Joy and Success in Life and Business." Come and meet this very special woman who is a great supporter of our museum. September is also

our membership month when we will be collecting dues of \$40 for your 2022 membership. Please plan to join our terrific team.

See you in September!

Diane Rogers | President

IMPORTANT DATES TO REMEMBER

Children's Golf Classic
at Venetian Bay Golf Club
Friday, October 15, 2021

Halifax Art Festival
on Beach Street
Saturday, November 6, 2021
Sunday, November 7, 2021

High Society Garden Party Luncheon

THANKS TO ALL OF OUR SPONSORS

Café D'Amore
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Dream Art Glass
Frame of Mind
Ocean Art Gallery
Sally Nails & Spa
SeaCasas
Todd Patrick & Co. Salon
63 Sovereign

THE WRIGHT STUFF

Ingenuity Takes Flight on Mars

A new and exciting milestone in aviation has been achieved: the first powered flight on another planet. As part of the Mars 2020 mission, not only did NASA's Jet Propulsion Laboratory (JPL) successfully deliver the *Perseverance* rover down to the Martian surface, they also sent a sidekick: the *Ingenuity* helicopter. This small, robotic drone is designed to demonstrate the technology to execute the first flight on Mars.

IMAGE CREDIT: NASA/JPL-CALTECH/MSSS



To honor the legacy of the first powered flight on Earth, a small piece of cloth from the *Wright Flyer* is attached to *Ingenuity*, underneath the solar panel. "This fabric is from the original aircraft that flew at Kitty Hawk," said Bob Balaram, chief engineer and designer of NASA's *Ingenuity* helicopter. "With all our high tech materials and carbon fiber skins and exotic metals, we're very proud to honor that experimental aircraft from long ago by carrying a small piece of [its] fabric." The patch of material from the Wright brothers' first airplane was donated by the Carillon Historical Park, in Dayton, Ohio - home to the Wright Brothers National Museum. One could only guess at the exhilaration the Wright Brothers would feel if they knew their *Flyer* had a role in the first ever powered flights on Earth and Mars, a mere 118 years apart.

While *Ingenuity* does have a Chief Pilot, nobody actually operates the helicopter in real time like drone pilots using remote controls on Earth. Live control requires constant feedback of information and the ability to quickly adapt to the situation. Operating an aircraft on Mars is a very different story. Because of the great distance between Earth and Mars, varying between a minimum of 34 million miles and a maximum of 249 million miles, there is an inherent lag time for any communication. Even though radio signals transmitted through NASA's Deep Space Network travel at the speed of light, the fastest possible speed, they are still limited to a finite velocity. The shortest travel time for a radio signal from Earth to Mars is about 5 minutes; the longest is about 20 minutes. That's for one way travel. Imagine trying to have a conversation in which you have to wait 10 to 40 minutes for an answer. Now imagine trying to remotely fly a helicopter in those conditions. It's simply impossible. Instead, preprogrammed instructions are sent to *Ingenuity*.

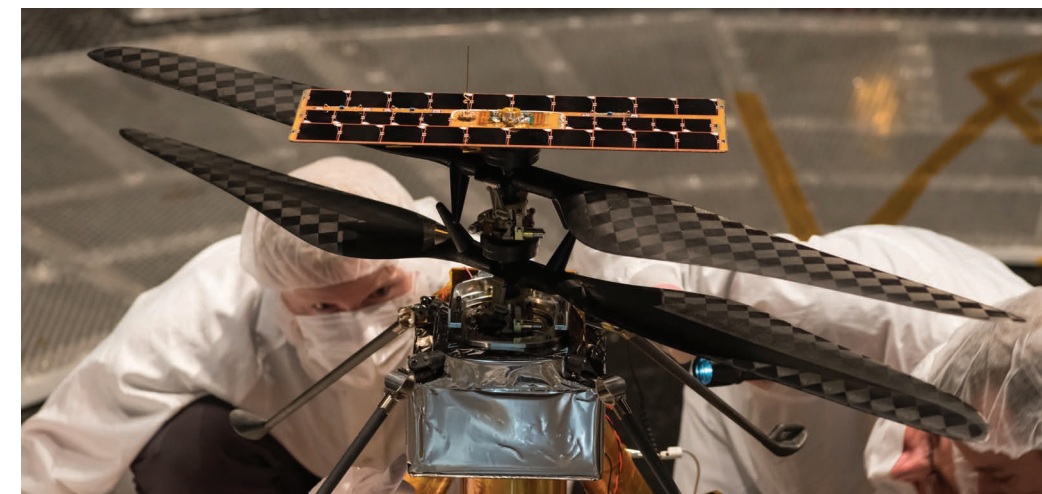
Before each of *Ingenuity's* test flights, the JPL team uploads instructions that describe precisely what the flight should look like. When it comes time to fly, the helicopter is on its own and relies on a set of flight control algorithms that were developed on Earth before *Ingenuity* was even launched to Mars. To develop those algorithms, they performed detailed modeling and computer simulations in order to understand how a helicopter would behave in a Martian



FIRMLY SECURED WITH POLYIMIDE TAPE, POLYESTER CORD AND EPOXY, A SWATCH OF MUSLIN FABRIC IS ATTACHED TO *INGENUITY*.
IMAGE CREDIT: NASA/JPL-CALTECH



THIS RESTORED AND COLORIZED PHOTOGRAPH SHOWS ORVILLE AT THE CONTROLS AND WILBUR RUNNING ALONGSIDE THE FIRST POWERED FLIGHT ON DECEMBER 17TH, 1903. WHEN VIEWED IN COLOR, THE SAND DUNES OF KILL DEVIL HILLS AREN'T TOO DISSIMILAR TO THE TERRAIN OF MARS. IMAGE CREDIT: JOHN T. DANIELS/WRIGHT STUF



MEMBERS OF THE NASA MARS HELICOPTER TEAM INSPECT THE FLIGHT MODEL (THE ACTUAL VEHICLE GOING TO THE RED PLANET), INSIDE THE SPACE SIMULATOR, A MASSIVE VACUUM CHAMBER AT NASA'S JET PROPULSION LABORATORY IN PASADENA, CALIFORNIA, ON FEB. 1, 2019. IMAGE CREDIT: NASA/JPL-CALTECH

environment. They then flight tested the drone in a massive 82-foot-tall, 25-foot-diameter vacuum chamber at JPL, which can replicate the Martian atmosphere. Packed with data and algorithms, *Ingenuity* can adapt to uncertain conditions on its own. In all of that work, though, the team could only approximate certain aspects of the environment. The true tests awaited on Mars.

On Earth, *Ingenuity* weighs 4 lbs, but only 1.5 pounds in the weaker gravity of Mars. A smaller planet with only 38% the gravity of Earth should be a great advantage for any vehicle meant to fly, but the low gravity is a dual-edged sword. That same low gravity is also responsible for the thin atmosphere on Mars. Investigations from the Mars Atmosphere and Volatile Evolution (MAVEN) spacecraft have shown us that the Red Planet has lost, and continues to lose, an enormous amount of atmosphere, at a rate of about 2.2-4.4 lbs per second!

In the ancient past, the atmosphere may have been relatively thick with hydrogen, oxygen and carbon dioxide. There would have been enough water to cover the planet with an ocean 75 feet deep. Today, the atmosphere of Mars is dry and very thin: less than 1% the density of Earth's.

This is equivalent to flying 87,000 feet above the surface of Earth, an altitude not yet reached by helicopters. This poses quite a challenge for powered flight then.

To fly, any aircraft must move air from one side of itself to the other. This “pulls” the aircraft through the medium. In a thick atmosphere, this is easy. The rotor blades have lots of available air molecules to displace and therefore propel the aircraft. In a thin atmosphere, with few available air molecules, the aircraft must then displace the air much faster to achieve the same result. *Ingenuity* must spin its rotor blades at 2,400 rpm (revolutions per minute), about five times what is needed to stay aloft on Earth.

Ingenuity uses a solar panel to capture and transfer energy to its six lithium-ion batteries, which can store enough to illuminate a 35-40 watt light bulb for one hour. This is not much electricity. Flight duration is not constrained by the wattage available,



AN ARTIST'S DEPICTION OF A SOLAR STORM STRIPPING AWAY IONS FROM THE ATMOSPHERE OF MARS. IMAGE CREDIT: NASA/GODDARD SPACE FLIGHT CENTER

though, but rather the large quantity of heat generated during flight. The motor for those high speed helicopter blades could overheat if it runs for more than a few minutes at a time.

As a proof of concept for flight on another world, *Ingenuity*'s team scheduled five technology demonstration phase attempts. Here are the flight statistics so far:

FLIGHT	DATE	DURATION (SECONDS)	PEAK ALTITUDE	TOTAL DISTANCE	FLIGHT ROUTE	RESULT
1	4/19/21	39.1	9.8 FT	0	Vertical takeoff, hover, land	Success
2	4/22/21	51.9	16 FT	14 FT	Vertical takeoff, hover, shift Westwards, hover, return, land	Success
3	4/25/21	80	16 FT	328 FT	Vertical takeoff, hover, shift, Northwards at 6.6 ft/s, hover, return, hover, land	Success
4	4/30/21	117	16 FT	873 FT	Vertical takeoff, hover, shift Southwards at 11.5 ft/s, hover, return, hover, land	Success
5	5/7/21	108	33 FT	423 FT	Vertical takeoff, hover, shift Southwards at 11.5 ft/s, rise to 33 ft, hover, land	Success

With the first five flights triumphantly completed from Wright Brothers Field, *Ingenuity* has finished the demonstration phase. “The *Ingenuity* technology demonstration has been a resounding success,” said Thomas Zurbuchen, associate administrator for NASA’s Science Mission Directorate. “Since *Ingenuity* remains in excellent health, we plan to use it to benefit future aerial platforms while prioritizing and moving forward with the *Perseverance* rover team’s near-term science goals.”

Having proven that powered, controlled flight is possible on the Red Planet, the *Ingenuity* experiment will transition to a new operations demonstration phase, exploring how aerial scouting and other functions could benefit future exploration of Mars and other worlds. Increasingly bold operation demonstration phase flights are scheduled for every two to three weeks through the end of August, 2021, pushing *Ingenuity* to its limits.

Leveraging the now proven rotorcraft systems and technologies from *Ingenuity*, NASA plans to launch the *Dragonfly* spacecraft in 2027. Following nine years of orbital travel to reach the outer parts of the solar system, *Dragonfly* will land in the Shangri-La dune fields of Saturn’s largest moon, Titan, in 2036. There, it will study the carbon-rich chemistry and abundant water, similar to the conditions found on a prehistoric Earth, to better understand the origins of life on our planet.

While *Dragonfly* will surely be an exciting future mission, *Ingenuity* will continue to provide astonishing sights and extraordinary feats on an alien world in the near term, with the JPL team giving it more and more daring flight instructions. In a few months, with its full mission completed, perhaps *Ingenuity* can fly off into the mild blue yonder of the Martian sunset.

FROM LEFT TO RIGHT

IMAGE 1 - *INGENUITY* WATCHES ITS SHADOW DURING FLIGHT 1. IMAGE CREDIT: NASA/JPL-CALTECH

IMAGE 2 - *PERSEVERANCE*’S MASTCAM-Z ZOOMS IN ON *INGENUITY*’S SECOND FLIGHT FROM A SAFE DISTANCE. IMAGE CREDIT: NASA/JPL-CALTECH/ASU/MSSS

IMAGE 3 - THE FIRST COLOR AERIAL VEHICLE IMAGE FROM MARS. NOTE THE TRACKS FROM *PERSEVERANCE* AND THE SHADOWY BLUR OF *INGENUITY*’S BLADES BELOW. IMAGE CREDIT: NASA/JPL-CALTECH

COME SEE A 3/4 SCALE MODEL OF *INGENUITY*, FEATURED IN **EYES IN THE SKY: THE WORLD OF AERIAL DRONES**, ON DISPLAY THROUGH AUGUST 1, 2021.



MARTIAN SUNSET, AS SEEN BY THE SPIRIT ROVER FROM GUSEV CRATER IN 2005. ON MARS, THE NOON SKY IS RED, BUT THE SUNSET IS BLUE. IMAGE CREDIT: NASA/JPL



ARTIST'S IMPRESSION OF THE ASTROBIOLOGY MISSION *DRAGONFLY* ON TITAN. IMAGE CREDIT: NASA



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