



MARYLAND ZOO

140

YEARS YOUNG

2015-2016 ANNUAL REPORT





# our mission

engaging people with the wonder of the living world  
through personal encounters that  
foster lifelong harmonious relationships with nature

In 2016, The Maryland Zoo in Baltimore celebrated its 140th anniversary. As the sun rises on our 15th decade of continuous operation, it is worth stepping back and contemplating what this means. It means that since April 7, 1876, when the Zoo was founded, we have been here in Druid Hill Park in the heart of Baltimore, every single day without fail, caring for the animals entrusted to us and sharing their wonder with our visitors. That's 140 years, 51,100 days, and 1,226,400 hours of dedicated service.

The Zoo has changed considerably over the course of its 140 years and we have spent this anniversary year reflecting on that, honoring our past while evaluating it honestly to know where we need to continue to grow and improve as an institution. We are inspired by the guests we serve, the minds that we help to educate, the professional peers with whom we collaborate, and the citizens, governments, and other entities that value and support us. Most significantly, though, we are inspired by the animals. They remind us every day through their magnificent variability that biodiversity is truly one of this planet's great treasures, worth cultivating and preserving.

This annual report catalogues the work of the Zoo over a 12-month period from July 1, 2015 through June 30, 2016. During that time, 464,925 people visited the Zoo and nearly 13,000 member families supported the Zoo.





**HUGO J. WARNS III**

CHAIRMAN OF THE BOARD OF TRUSTEES

### *Letter from the Chairman*

As chair of the Zoo's Board of Trustees, it is my job to help the Zoo prosper and strategize for the future. Working with fellow trustees and executive staff, I think often about where the Zoo is headed and how we can continue to grow this incredible institution. One of the great joys of my service, though, has been learning more about the Zoo's history and mission. As I continue with my term as Chair, I can assure you that my enthusiasm and commitment to the Zoo have only grown stronger.

I had good opportunity to learn more about the Zoo's history this past year, as 2016 marked the Zoo's 140th anniversary! For me, a highlight of the year was Zoobilee, our festive anniversary party. Held on a cool September evening at Penguin Coast, it brought together friends and supporters of the Zoo to mark the special occasion. It was a fun and well-deserved celebration, and I extend my many thanks to the Board of Trustees, the Zoobilee Committee, and local restaurants and beverage donors for making it possible.

I am pleased to report that support for the Zoo remains strong. In FY2016, 464,925 people visited the Zoo. More than 13,000 families supported the Zoo through memberships, while several hundred more individual donors, corporate members, and foundations supported daily operations, capital projects, and education and conservation programs. I am also gratified to note that the State, the City, and the citizens and leaders of Baltimore, Carroll, and Howard Counties continued to show strong support for the Zoo.

Millions of people have visited the Zoo since its founding in 1876 and I fully expect that millions more will follow. The Zoo is a vibrant place to have fun and to learn and an important contributor to issues affecting wildlife conservation. I'm so impressed by our staff and volunteers, who care so deeply not only about the animals but also about our visitors and the experience they deserve to have every time they visit. We focus our resources on caring for animals, providing a great visitor experience, and contributing to the growing body of research and scientific knowledge that influences care, management, and conservation of wildlife. Much of this work is detailed in this annual report for your review.

I look forward to another inspiring year at the Zoo and in service to the Zoo.

A handwritten signature in black ink, appearing to read "H. J. Warns III". The signature is fluid and cursive.

Hugo J. Warns III, Chair, Maryland Zoological Society, Inc

### *Letter from the President*

In April 1876, The Baltimore Zoo was founded by an act of the State Legislature for “the recreation and education of the people.” The Zoo’s original collection of animals consisted of a herd of 52 deer and a flock of purebred Southdown sheep. An early inventory list included two stuffed flamingos, six bird cages, and one ‘lot’ of assorted natural curiosities.

In 2016, we celebrated the fact that 140 years after its founding, The Maryland Zoo in Baltimore remains dedicated to “the recreation and education of the people” but has grown in so many ways, particularly in our dedication to the animals and our conservation and science programs focused on saving animals from extinction. Our campus is 160 acres of rolling parkland, we employ 250 full- and part-time staff, and we care for more than 1,500 animals representing dozens of different species. This was a year to remember, to celebrate, and to plan for the future, and we are glad that so many of you came out to celebrate with us.

Annual reports can be a vital source of information, not only documenting one year’s developments, accomplishments, and challenges but also providing historical scope and context for an institution such as the Zoo. As a matter of fact, some of the early history of this zoo is documented in annual reports from the Park Commission dating to the 1880s and 1890s. A complete history of the Zoo is hard to come by, but we certainly know some interesting facts. The oldest animal enclosure at the Zoo -- the heavy wrought-iron Round Cage -- was built in 1876. Four camels were donated in 1879 by the King of Italy, Umberto I! That same year, two sea lions also were donated to the Zoo, although not by royalty as far as we can tell.

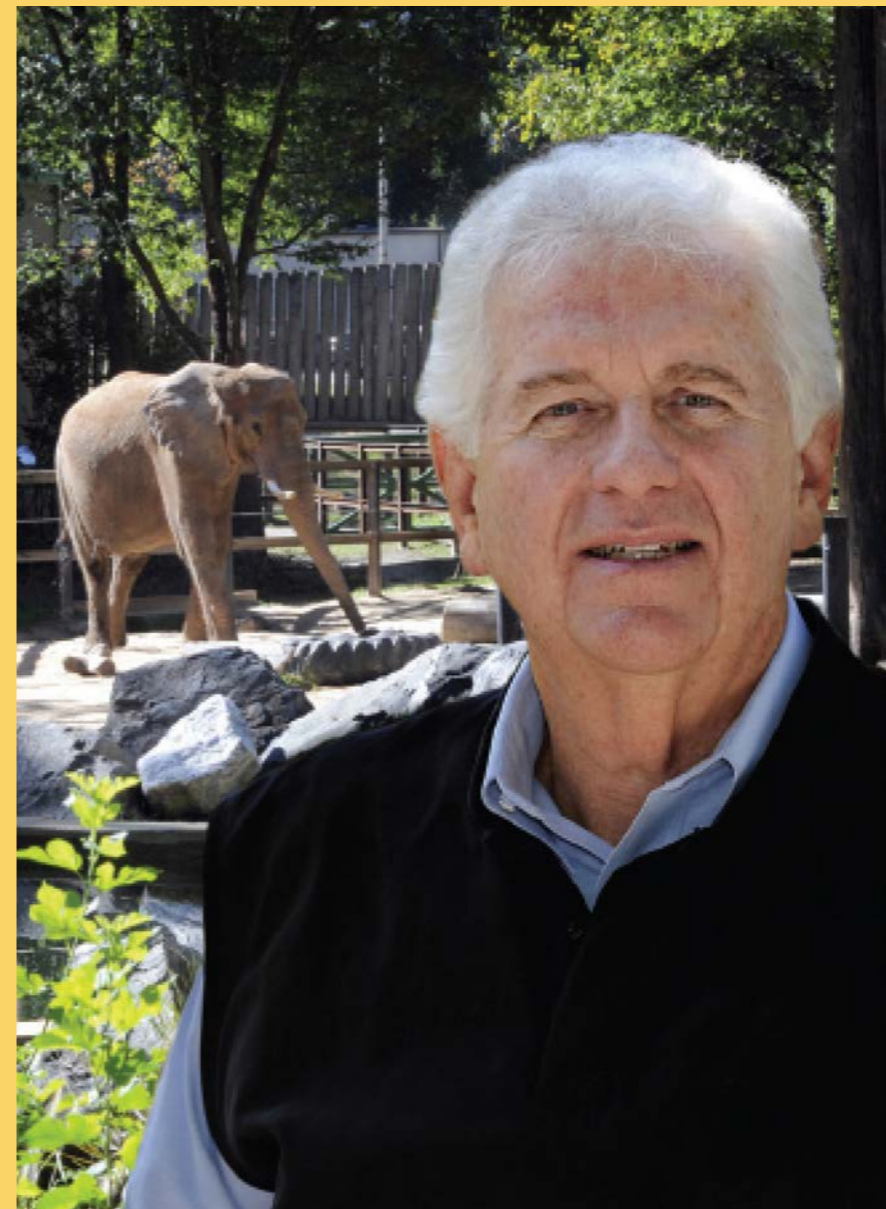
As daunting a task as compiling an annual report can be, we know we are providing important information for future generations. The programs, experiences, events, and other happenings that contribute to guest experience, animal welfare, and overall operation of the Zoo are documented in this publication and hopefully will be reflected upon in another 140 years.

As you read this report, please take pride in what the Zoo has accomplished with your support. We welcomed two new cheetahs, introduced three pink-backed pelicans to Penguin Coast, and brought two rambunctious young river otters into the Maryland Wilderness. We also made improvements to many Zoo buildings and exhibits. You can read about our busy year in the pages of this report.

We are grateful that this zoo continues to be a vibrant and vital part of Druid Hill Park and the surrounding communities. Thank you for your support, and we hope to see you here often this year and in the years to come.



Donald P. Hutchinson, President/CEO



**DONALD P. HUTCHINSON**  
PRESIDENT/CEO



# new at the zoo

Between July 1, 2015 and June 30, 2016:

- The Zoo prepared for and then began a yearlong celebration of its 140th anniversary, rolling out a new logo, on-grounds signage exploring the Zoo’s history, and public programs and events focused on the Zoo’s longtime presence in Baltimore and in Druid Hill Park.
- A trio of pink-backed pelicans landed in *Penguin Coast*, adding excitement and a new dose of African bird life to an already vibrant exhibit.
- Two new cheetahs – a pair of brothers – arrived at the Zoo and have adapted well to life along the Safari Boardwalk in *African Journey*.
- A young, wild sandhill crane – a species rarely seen in Maryland and new to the Zoo’s collection – took up residence in the *Maryland Wilderness* Marsh Aviary.
- Two new North American river otters – a male and a female – can now be seen cavorting together in *Maryland Wilderness*.
- Several waldrapp ibis, a species new to the Zoo, were brought into the African Aviary. The Zoo is now participating in the AZA’s Species Survival Program (SSP) for this critically endangered African bird, acting as a holding facility for males until they can be paired with females for breeding at other AZA institutions.
- Six penguin chicks hatched at *Penguin Coast*, building on previous breeding success in the new exhibit. Two more African penguins joined the Zoo’s colony from the Memphis Zoo.

- Several other animals representing more than two dozen species also took up residence at the Zoo, including smoky jungle frog, prehensile-tailed skink, eastern hognose snake, timber rattlesnake, corn snake, bog turtle, diamondback terrapin, emperor scorpion, virile crayfish, Waldrapp ibis, African pygmy goose, northern pintail, hooded merganser, northern shoveler, North American ruddy duck, hamerkop, military macaw, saw-whet owl, common barn owl, hadada ibis, little blue heron, northern ground hornbill, helmeted guineafowl, Arctic fox, Giant Flemish rabbit, and striped skunk.



- Two kudu calves were born at the Zoo and achieved instant acclaim as the first of their species ever to be born here.
- The Zoo celebrated the births and hatchings of several other new animals as well in FY16, including two sitatunga, one pygmy goat, a clutch of eastern box turtles, a clutch of trumpeter swans, and more than 100 Panamanian golden frogs.
- New interpretive signage was added to Creature Encounters, the Zoo’s outdoor education center, to orient visitors to the concepts of ecosystem, habitat, adaptation, and conservation.

- The Exhibits Team made improvements to several exhibits, adding new features such as a hot rock in the cheetah yard and fallen oak cover and climbing in the warthog yard.
- Several other exhibits also were improved, giving them a “new feel” and accommodating animal management and husbandry needs. These projects included:
  - Replacing guttering and doing roof work on the Crane Barn
  - Replacing the roofing and outdoor caging at Wading Bird
  - Expanding the polar bear yard to give the bear more terrain to explore
  - Redoing the Alpaca Barn roof
  - Renovating the African Aviary pool to improve filtration and appearance and to incorporate access points for the waterfowl
  - Completing renovations on the otter den
  - Completing renovations of the Water Snake and Tiger Salamander exhibits in the Giant Tree
  - Modifying exhibits in the Meadow to accommodate different species
  - Modifying training areas and access doors in the Giraffe House
  - Improving keeper work space in the Donkey Barn



WHETHER THEY ARE FACILITATING THE BREEDING OF AN ENDANGERED SPECIES, ANALYZING BIOLOGICAL SAMPLES, OR FERRYING DIETS ALL OVER CAMPUS, THE ZOO'S ANIMAL, VETERINARY, AND COMMISSARY STAFFS ARE NEVER BORED AND NEVER WANTING FOR A NEW CHALLENGE.

# animal report

Between July 1, 2015 and June 30, 2016:

- Three pink-backed pelicans joined the Zoo's collection and have added an exciting new dynamic to the *Penguin Coast* exhibit.
- A pair of cheetah siblings also arrived at the Zoo and transitioned nicely to their new territory along the Safari Boardwalk in *African Journey*. They both enjoy resting on a hot rock installed by the Exhibits Team where guests can easily see them.
- A young, wild sandhill crane joined the Zoo's collection after a referral from the Maryland Department of Natural Resources and now resides in the Marsh Aviary exhibit.
- Two North American river otters, a male and a female, joined the Zoo's collection, were successfully introduced, and are now on exhibit together in the *Maryland Wilderness*.
- In preparation for possible otter breeding, the Zoo completed renovations to its behind-the-scenes otter den, which included the addition of an isolation den for cubbing.
- Improvements to many other animal exhibits and behind-the-scenes spaces, including Polar Bear, Warthog, Giant Tree, Giraffe, Cow Barn, and Donkey Barn, were also completed in FY16.
- The Zoo celebrated births and hatchings of many new animals in FY16, including 2 kudu, 2 sitatunga, 1 pygmy goat, a clutch

of eastern box turtles, and more than 100 Panamanian golden frogs. In addition:

- The pair of trumpeter swans in the Farmyard pond bred for the first time and successfully reared one cygnet.
- The Zoo's African penguin colony welcomed 6 new chicks. Two more penguins also joined the colony from the Memphis Zoo.
- With extraordinary patience, persistence, and professionalism, the Chimpanzee Team successfully integrated "Jane," a female chimp who arrived at the Zoo last year, into the troop.
- With the help of the Cincinnati Zoo, artificial insemination was performed for the first time on the Zoo's female Amur leopard, a member of the world's rarest cat species. The attempt did not result in pregnancy but was still significant in that it contributed to the small but growing body of knowledge on this difficult procedure in felids.
- The Zoo's Elephant Team worked to facilitate successful natural breeding (which occurred more than once) between Tuffy and Felix, male and female African elephants. The team also began introducing the two elephants to each other for companionship between breeding cycles so as to enhance their bond.





# animal report (continued)



- Behavioral training programs continued to be an essential component of animal care at the Zoo, providing enrichment and facilitating husbandry and medical care for numerous species, including in FY16 African elephant, lion, warthog, cormorant, leopard, hornbill, otter, rhino, lemur, giraffe, okapi, sitatunga, and serval.
- The Zoo, for the first time in its history, now has three full-time staff veterinarians caring for its collection, which continues to grow in number and complexity. Additionally, staff veterinarians contribute integrally to the Zoo's conservation and research efforts, solving unknown medical dilemmas with scientific studies and participating in hands-on field work that benefits the wild counterparts of Zoo animals.
- Staff veterinarians examined 885 animals at the Zoo, ranging from the 15-gram bats in *Maryland Wilderness* to the 4,000-pound rhinoceros in *African Journey*.
- Veterinary staff cared for 212 wild animals rescued within the Zoo, within Druid Hill Park, or elsewhere in the state of Maryland. Wild patients ranged from warblers to bats to osprey and herons. Among them were two fledgling peregrine falcons from an Inner Harbor skyscraper, where this species often breeds. Both young birds were returned to the nest successfully in collaboration with U.S. Fish and Wildlife experts.
- The Zoo's three veterinary technicians examined 1,004 fecal samples, analyzed more than 1,600 blood and tissue samples, and took 250 x-rays of subjects ranging from tiny frogs to elephant tusks.
- The Zoo's four-person commissary team delivered food year-round to all of the Zoo's animals and began 7-day-a-week service in order to better provide for the nutritional needs of each animal at the Zoo. In FY16, the team delivered over 6,000 pounds of apples, 7,800 pounds of sweet potatoes, and more than 150 tons of hay! The Commissary team also provides Zoo staff with the many supplies that they need to do their jobs.

# conservation report

In FY2016, Zoo staff collaborated with the Maryland Department of Natural Resources and the U.S. Fish and Wildlife Service on several important wildlife conservation projects. Dr. Ellen Bronson, Senior Veterinarian, also secured funding to support potentially life-saving research on the critically endangered Panamanian golden frog, one of the Zoo's flagship species.

## Focus: Brown Pelican

In September 2015, veterinary and animal staff traveled to islands in the Chesapeake Bay to sample nestling brown pelicans in large breeding populations in conjunction with the Maryland Department of Natural Resources (DNR). Veterinarians and veterinary technicians collected blood and swabs from the birds to assess their health.

## Focus: Sandhill Crane

Also in September 2015, the Zoo took in a wild sandhill crane that had been rescued in Garrett County by the DNR. The young bird had been acting abnormally, coming much too close to humans, cars, and roads, and appeared to be imprinted on humans. For this reason, the DNR deemed it unreleasable and the Zoo volunteered to give it a permanent home. This species is rarely seen in Maryland but has made an amazing comeback in recent decades and is now expanding its range from the upper Midwest and Gulf Coast.

## Focus: American Black Bear

In March 2016, veterinary, animal, and education staff traveled to western Maryland to participate again in the annual Black Bear Sow Health Survey led by the DNR. Veterinary staff aided the DNR in the safe immobilization, examination, and sampling of seven female bears with cubs in Garrett, Allegheny, Washington, and Frederick counties. This project is vital in helping the DNR to manage Maryland's black bear population, which is healthy and thriving.

## Focus: Bog Turtle

In May 2016, Reptile Collection Manager Kevin Barrett and Area Manager Kyle Baumgartner participated in bog turtle survey trips sponsored by the DNR. They walked, waded, and crawled through bog turtle habitat in search of the elusive turtles. Information collected during these survey trips, conducted in spring and fall, helps the DNR determine how bog turtle populations are doing at particular sites and statewide. The presence or absence of bog turtles can also inform decisions about land use projects and how to conduct them (i.e. allow or disallow use of heavy equipment, depending on presence of turtles.)

## Focus: Peregrine Falcon

For more than 35 years, peregrine falcons have been nesting on the 33rd floor of the TransAmerica Building at 100 Light Street in



downtown Baltimore. Every now and then, a fledgling leaves the nest too soon and ends up on the sidewalk below. This happened twice in FY15, in July 2015 and again in June 2016. Both young falcons were brought by colleagues at the U.S. Fish & Wildlife Service (USFWS) to the Zoo's Animal Hospital for treatment and rehabilitation before being successfully returned to the nest. In partnership with USFWS, the Zoo has performed this service about a half dozen times over the past 15 years.

The recovery of the peregrine falcon in eastern North America over the past half century is a tremendous conservation success story. After a drastic population decline in the mid-20th century due to pesticide poisoning, peregrine falcons are now thriving again along the East Coast in urban and coastal areas.

## Focus: Panamanian Golden Frog

In FY16, Senior Veterinarian Ellen Bronson received a \$10,000 Wild Animal Health Fund grant and a \$1,000 International



# conservation report (continued)



Herpetological Symposium grant to conduct a research project investigating the drug effects (pharmacokinetics) of a widely-used antifungal drug in Panamanian golden frogs. This study is the first of its kind with this drug in any amphibian and will contribute significantly to scientific knowledge that will enable clinicians to guide treatment of fungal infections in frogs and to better manage cases of Chytrid fungus infection in the wild.

**In addition to its hands-on conservation work, the Zoo donates resources, knowledge, and support funding for field projects and conservation efforts of partner organizations. Maintaining direct and lasting**

**partnerships with proven conservation organizations upholds the Zoo's conservation-driven mission while also providing more resources for improved animal management and enhanced staff development. In FY16, the Zoo supported:**

- **The Madagascar Fauna Group (MFG):** MFG, founded by the Duke Lemur Center, is an international consortium of zoos and other institutions working to support conservation in Madagascar, one of the most biodiverse regions of the world. MFG's work includes captive breeding programs, field research programs, training programs for rangers and wardens, and acquisition and protection of

native habitat in Madagascar. Their work is critical to the survival of many lemur species, including those exhibited at the Zoo.

- **Turtle Survival Alliance (TSA):** TSA represents the largest and most active collection of zoo-based scientists and conservationists pooling resources to address critical issues facing turtles globally, such as habitat loss, population decline, and illegal collection of animals for the pet and/or food industry. TSA is comprised of organizations and individuals working together to transform passion for turtles into effective conservation action through a global network of living collections and recovery programs.
- **Southern African Foundation for the Conservation of Coastal Birds (SANCCOB):** SANCCOB is an internationally operating organization based in South Africa that is dedicated to seabird research, rescue, rehabilitation, and education. Since its founding in 1968, SANCCOB has saved more than 85,000 seabirds and is the primary conservation organization working with African penguins. For many years, SANCCOB and the Zoo have exchanged knowledge and collaborated to advance research, education, and conservation of African penguins.
- **International Elephant Foundation (IEF):** The mission of IEF is to support and operate elephant conservation and education programs in managed facilities and in the wild, with an

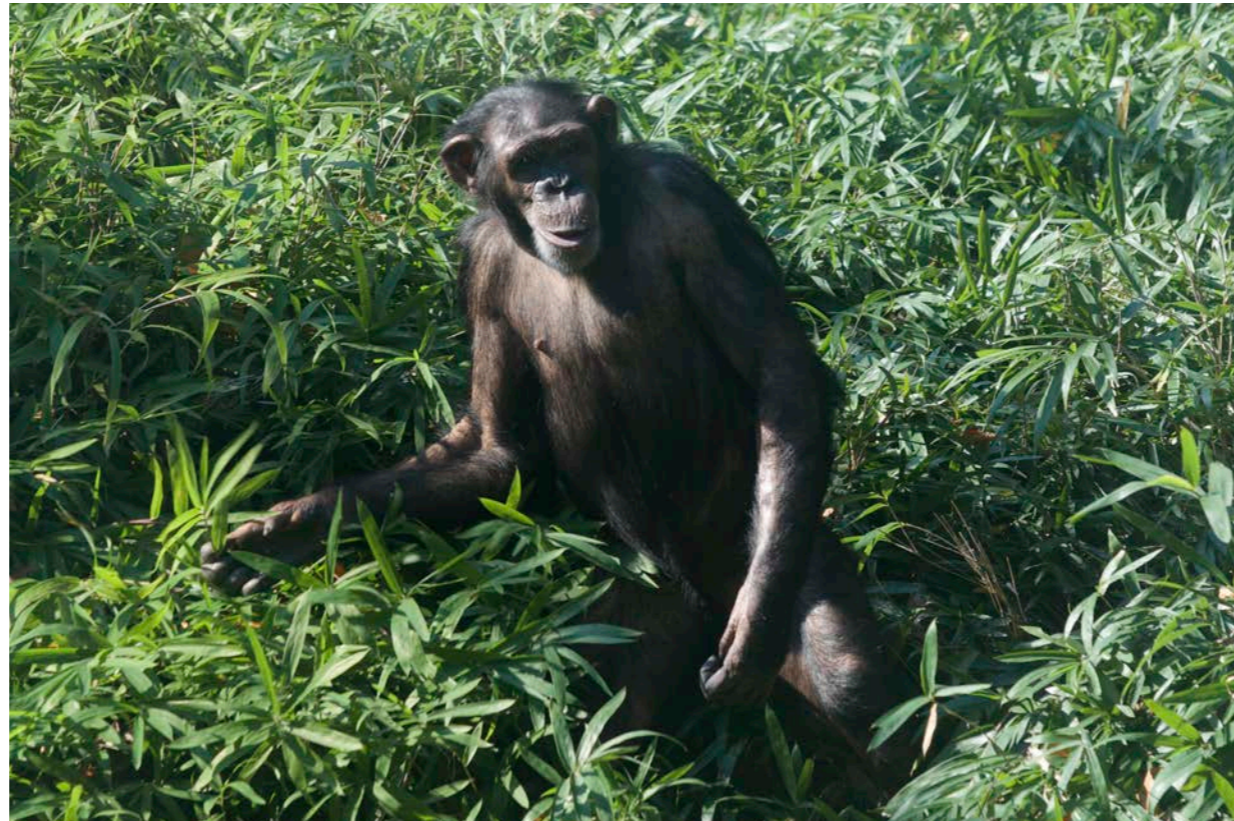
emphasis on management, protection, and scientific research. Since 1999, IEF has provided support to more than 80 elephant conservation projects worldwide and has contributed more than \$3 million in direct financial assistance. Zoo staff have attended several elephant-related conferences and workshops coordinated by IEF, all of which facilitate the sharing of current and developing knowledge among zoo professionals with regard to critical issues of elephant management.

- **The Cheetah Conservation Fund (CCF):** Since its founding in 1990, CCF has dedicated itself to saving cheetahs in the wild and is now the world's leading organization for cheetah conservation. The organization works with all stakeholders within the cheetah's ecosystem to develop best practices in research, education, and ecology and to create a sustainable model from which all other species, including people, will benefit.
- **The AZA (Association of Zoos and Aquariums) Conservation Grants Fund:** Established in 1984, the Conservation Grants Fund (previously known as the Conservation Endowment Fund) supports cooperative, conservation-oriented, scientific and educational initiatives of the AZA and AZA-accredited zoos and aquariums and their collaborators. Since 1991, the CGF has provided more than \$6 million to almost 340 projects worldwide.



# conservation report (continued)

- **Polar Bears International (PBI):** Polar Bears International is the world's leading polar bear conservation organization, dedicated to saving polar bears by saving their sea ice habitat. Their research, education, and action programs address the issues that are endangering polar bears. The Zoo has a longstanding partnership with PBI and supports its work through funding, on-grounds collaborations, and staff expertise and involvement.
- **Elephants for Africa (EFA):** EFA is a research organization and charity committed to protecting endangered African elephants and habitat in their range countries. Working in Botswana and South Africa, EFA conducts research to understand the ecological and social requirements of African elephants, puts this research into the context of human-wildlife conflict, and delivers scientific data to local decision makers. The Zoo provides funding support to EFA, exchanges elephant-related information with EFA and its founder, Dr. Kate Evans, and collaborates on research projects to better understand the threats to African elephants in their range countries.
- **The International Rhino Foundation (IRF):** IRF is dedicated to the survival of the world's rhino species through conservation and research. The Foundation works to protect particularly threatened rhino populations and their habitats in the wild, while also support-



ing management and research of captive populations in order to improve the chances for long-term species survival. At the heart of IRF's vision is the belief that rhinos should endure and that protecting rhinos also benefits many other species that share their habitat, including people.

- **Project Golden Frog/Panamanian Golden Frogs:** Project Golden Frog was created in the late 1990s to prevent the extinction of the Panamanian golden frog, an iconic species in its native country. The Zoo has supported this Panama-based conservation initiative since 1999

and has become a world leader in the breeding, care, and medical management of this highly endangered species. On behalf of the AZA, Dr. Ellen Bronson, the Zoo's senior veterinarian, acts as SSP veterinary advisor for the species and Collection Manager Kevin Barrett is the current studbook holder for the species.

- **The Goulougo Triangle Ape Project (GTAP):** The mission of GTAP is to promote the long-term conservation of chimpanzees and gorillas. It operates in an extremely unique

region of the world: the Goulougo Triangle, a 100-square mile region of protected, pristine forest outside of and at the southern end of Nouabalé-Ndoki National Park in the Democratic Republic of the Congo. The Zoo has supported GTAP since 2012. It is also supported by the AZA Chimpanzee TAG/SAP.

- **96 Elephants:** 96 Elephants is a conservation initiative organized by the Wildlife Conservation Society to spread public awareness about and put an end to elephant poaching and the ivory trade. The campaign and its name are premised on the fact that 96 elephants are killed illegally every day in Africa by poachers. By supporting this campaign, the Zoo is helping to spread awareness of the elephant ivory poaching crisis that threatens the continued existence of elephants and severely impacts other species in elephant range countries as well.
- **The Adkins Arboretum:** The Adkins Arboretum is a public garden and arboretum located on Maryland's Eastern Shore that, through its educational programs and science-based approach to land stewardship, promotes appreciation and conservation of native plants to more than 18,000 visitors annually. The Arboretum partners with the Zoo to supply sumac browse for our Coquerel's sifaka, an endangered species of lemur. Through their assistance, the Arboretum has become a critical partner in the ongoing success of the Zoo's sifaka breeding program.



# education report

Between July 1, 2015 and June 30, 2016:

- 87,197 individuals visited the Zoo in association with the Free Admission program supported by the legislature and funded by the Maryland State Department of Education, as follows:
  - 60,994 Maryland school children visited for free.
  - 17,185 teachers and chaperones visited for free.
  - An additional 9,018 people attended in association with a field trip at a reduced rate or were under the age of two and did not pay admission, for a total of 87,197 individuals.
- During their visits, students participated in themed ZooTreks and hands-on Pop-up Labs that made connections between Zoo content and state and national curriculum standards.
  - ZooTreks are themed, self-guided tours that facilitate discussion as students explore the Zoo by providing questions linked to specific animals and exhibits.
  - Pop-up Labs allow students to apply real-life skills of animal observation and data collection in Zoo exhibit areas.
- 1,904 students participated in 42 paid or grant-supported school programs (ZOOlabs and Zoo Introductions) that stimulate students' critical thinking, support reading skills, and address science, math, and life science topics. These programs are aligned with the Next Generation Science Standards and the

Maryland College and Career-Ready Standards as appropriate.

- Zoo educators delivered 6 classes to 21 Maryland home school students, aged 5 to 8, enrolled in our Cheetah Cubs program. Focusing on animal habitats, these young students examined what animals need to survive in different regions of the world.
- Zoo educators delivered 6 classes to 9 Maryland home school students, aged 9 to 12, enrolled in our Lion's Pride program.

Students explored a variety of STEM and conservation-focused topics ranging from bio-mimicry to sustainable design.

- 121 children enrolled in the Zoo's week-long summer camp programs for children entering grades 2 to 6.
- Through its grant-funded Climate Change Partnership Program, the Zoo teamed with 10 Maryland teachers to help their students become active agents for environmental change. Students conducted classroom energy

audits and developed action plans for reducing their collective carbon emissions. They also came to the Zoo on a field trip and participated in a ZOOlab to discover how the changing climates of the world impact habitats and species.

- School programs staff honed their scientific knowledge and teaching skills relating to climate change education by participating in the National Network for Ocean and Climate Change Interpretation (NNOCCI) Study





# education report (continued)

Circle. Funded by the NSF, the NNCOCCI Study circle brings together informal educators to learn strategies and content for teaching their audiences about climate change.

- The Zoo's Animal and Education Departments, led by Animal Keeper Becky Lynagh and School Programs Manager Sharon Bowen, partnered with local elementary school students on "Project Polar Bear," a contest sponsored by Polar Bears International that challenges young leaders to develop a plan for a community project that will reduce the carbon dioxide load in the atmosphere. The Zoo's project, which promoted re-usable water bottles over disposable plastic ones, won first prize and a \$750 grant.
- Outreach education staff, assisted by Zoo volunteers, delivered 837 outreach programs to 44,529 people in communities across Maryland and beyond. Of those programs, 185 were grant-funded and delivered at no cost to Title I elementary schools, early education centers, and libraries throughout Maryland.
- A new outreach program, Conservation Conversations, was developed specifically for adults and middle and high school audiences. The program offers participants an in-depth discussion of an endangered species' natural history, the conservation challenges it faces, and ways the Zoo and other organizations are working to protect the species. A portion of

every program's fees are donated to The Maryland Zoo's Conservation Fund. Program topics include African elephants, African penguins, black bears, bog turtles, cheetah, Panamanian golden frogs, polar bears, and rhinoceros.

- Zoo educators on the Public Programs team developed and delivered a variety of on-grounds experiences to engage Zoo visitors and enhance their learning.
  - More than 60,000 Zoo visitors participated in Education Stations, family overnights, puppet shows, walking tours, and other animal-centered activities facilitated by Zoo education instructors and volunteers.
  - Zoo educators worked with colleagues in other departments to organize and lead 8 Wild About days, with each day focusing on a particular endangered species, its conservation challenges, and action steps that people can take to prevent its extinction.
- Throughout the Zoo, interpretive signage was updated, revised, and added, enhancing exhibits with important information about animals, their habitats, and conservation concerns affecting their survival in the wild. Volunteers were given in-depth training on several exhibit areas to enable them to effectively teach guests in these areas of the Zoo and to deliver the penguin feeding narration.

- Education staff undertook a research study of staff and volunteers who narrate our penguin feeding to ensure that they are effectively delivering the presentation, including sharing the conservation message about the Monterey Bay Aquarium's Seafood Watch program.

We are also making Seafood Watch Pocket guides available and counting how many of them are taken during the presentation.





# volunteers

Between July 1, 2015 and June 30, 2016:

- 1,129 volunteers gave 38,000 hours of service to the Zoo, resulting in a payroll extension value of \$1 million.
- 360 people volunteered regularly throughout the year, interacting with guests and working behind the scenes.
- An additional 769 people volunteered for individual events and service projects.
- 87 teens participated in Junior Zoo Crew, the Zoo's service-learning program for youth aged 14 to 17. These students averaged 81 hours of service each, educating guests about wildlife, beautifying the campus, and caring for animals.
- 41 college interns worked alongside Zoo staff and completed projects in education, animal care, graphic design, new media, veterinary technology, and archive management. These students represented 24 institutions of higher learning, including Community College of Baltimore County (2), Colby College, Delaware Valley College (2), Elon University, Excelsior College, Johns Hopkins University (2), Loyola University of Maryland, Maryland Institute College of Art, Northern Michigan University, Ohio University, Old Dominion University, Oregon State University, Pennsylvania State University (2), Seton Hill University, St. Mary's College of Maryland, Stevenson University (2), State University of New York Cobleskill, Towson

University (6), University of Maine, University of Maryland (7), West Virginia University, College of William and Mary, Wilson College, and YTI Career Institute.

- Volunteer coordinators partnered with Education staff to deliver trainings to education and other volunteers and to revise on-grounds interpretive content for education volunteers.
- The Zoo held its fourth annual Teen Leaders Institute, a challenging eight-week program for underserved high school students who are considering a career in the non-profit sector. 24 participants explored a variety of career paths with senior Zoo staff, attended a dress-for-success presentation by representatives from Gap, Inc., and worked together to plan #Zoomania, a carnival fundraiser to support general operations at the Zoo. One participant was hired for a grant-funded paid summer externship in the Visitor Services department, and last year's extern returned as a seasonal Visitor Services Agent.
- The Zoo's team of volunteer coordinators extended its professional contributions beyond the Zoo. Kerrie Kovaleski, Director of Volunteer Programs, serves on the AZA's Volunteer Management Committee and presented on several topics at the AZA's annual conference, including Risk Management and Working With Generation Z. Allison Schwartz, Manager of Volunteers, acts as Communications Officer for the



Maryland Council of Directors of Volunteer Service. Kristi Giles, Manager of Volunteers, sits on the selection panel for the Governor's Office on Service and Volunteerism annual awards.

- The Maryland Zoo Conservation Club, jointly led by Kristi Giles and Public Programs Manager Hannah Rupert, completed its first full year as a forum for volunteers to raise awareness

and engage guests in green projects and practices. The club hosted an in-house Up-cycling Challenge to raise awareness about the need to live more sustainably. The up-cycled creations were shared with Zoo guests during Party for the Planet and World Ocean Day. The club also hosted a tour of the Baltimore County Recycling Center for Zoo volunteers.



# institutional advancement

Between July 1, 2015 and June 30, 2016:

- The Maryland Zoo continued to receive invaluable support from the State of Maryland, the City of Baltimore, and Baltimore, Howard, and Carroll counties. Together, these governments provided a substantial portion of the Zoo's operating funds and important capital improvements, with the State being the most significant contributor for capital projects. We remain deeply grateful for government leaders' recognition and appreciation of the Zoo as a high-quality institution serving the community.
- More than 13,000 member households supported the Zoo, resulting in more than \$1,400,000 in membership revenue. In exchange, those members received unlimited, year-round admission to the Zoo; reduced admission to more than 150 other AZA organizations; special offers at local attractions; invitations to special events; and more.
- 464,925 people visited the Zoo in FY16, resulting in a 9% increase over FY15 attendance.
- Revenue also increased by an impressive 8% in FY16, with earnings topping the FY15 mark by \$355,000.
- Many generous individual and corporate donors supported the Zoo through gifts to The Maryland Zoo Fund, the ADOPT program, and targeted capital improvements.

The Zoo was also the grateful beneficiary of gifts made in honor or in memory of loved ones.

- 123 donors made gifts exceeding \$1,000, totaling more than \$620,000 for operating expenses.
- New individual donors contributed 313 first-time gifts to the Zoo.
- Giving ZooDay, hosted on December 2, 2015, exceeded even ambitious expectations by raising more than \$35,000 in 24 hours!
- Foundations and philanthropic funds in the region granted monies for the vital services of our day-to-day operations, educational programming, and capital projects.
  - Operating and restricted funding received from grants totaled almost \$330,000.
  - Grants for capital projects included funding to be used for *Penguin Coast*, a heated rock for the Cheetah exhibit, a new ZOOMobile van, and the removal of architectural barriers to allow for accessibility on the ground floor of the Mansion House.
- The Zoo's Events Team offered a full and compelling array of special events that continued to break attendance and revenue records for the Zoo.
  - Attendance this year at the "BB& T Bank presents Brew at the Zoo," the Zoo's largest fundraiser of the year, grew to more than 11,000 guests and brought in more than \$500,000 in revenue, making it the most successful event in Zoo history.

- More than 30,000 enthusiastic participants turned out for perennial favorites such as Bunny BonanZOO, Oktobearfest, ZooBOOO!, Zoo Zoom, Sex at the Zoo, Where the Wild Things Art Paint Nights, and the "Constellation presents Breakfast with the Animals" series.

- Children enamored of dump trucks, front-end loaders, and backhoes were thrilled to get up close and personal with their favorite large machinery at Trucks for Tots, a brand new event introduced in FY16.





# institutional advancement (continued)

- Corporate membership finished one of its strongest years in recent history. A total of 115 businesses contributed \$417,500, a 13% increase from the previous year and a 49% increase over two years. Thank you to our corporate supporters who chose to not only invest in the Zoo, but also provide a cost effective benefit to their employees.
- The Zoo's Group Sales Team had another strong year, successfully filling the calendar with private, nonprofit, and corporate rentals and retreats; fundraising walks and picnics; group visits, group tours, and behind-the-scenes tours; birthday parties; and visits from

consignment ticket holders, including those who serve in the military along with their families.

- Group Sales revenue has grown by more than 120% over the past 5 years.
- Large corporate events have been a huge catalyst to revenue growth, with two large corporate events contributing 10% of Group Sales revenue in FY16.
- The Group Sales team has continued to market the Zoo's Mansion House Porch and Lakeside Pavilion very successfully for wedding ceremonies and receptions and has

followed through with exceptional customer service to make many couples extremely happy on the big day.

- The Zoo became a repeat winner of Wedding Wire's Couples Choice Award, receiving the special recognition again in 2016. The Zoo's average Wedding Wire review rating in FY16 was 4.9 out of 5, with 13 reviewers giving a 5 out of 5.
- The Zoo's Marketing Team continued to work strategically and creatively on many fronts to generate buzz and excitement for the Zoo.
  - A newly introduced 140th logo identity helped to brand the year-long 140th anniversary celebration and promote the many milestone events, programs, and giveaways.
  - Building public awareness of *Penguin Coast*, the Zoo's newest premier exhibit, continued to be a focus of marketing efforts. Media campaigns across channels including television, radio, billboard, and digital helped to promote up-close penguin experiences and membership, which resulted in increased attendance and member families.
  - Social media outreach continued to grow audiences and break records. Facebook followers increased by more than 42,000 (a 42% increase) and totaled 143,930 fans at the end of the fiscal year.

- The Zoo's followers on other social media channels, including Twitter, Google+, Periscope and Pinterest, also increased significantly. Notably, Zoo Instagram followers increased by more than 100% to a new high of 23,000.
- Close to 3 million emails were sent to members, donors, event attendees, and newsletter recipients. The average open rate of 25% continues to far exceed the industry average.
- Visits to the Zoo's website totaled 1,017,511, marking a 5% increase. The number of website page views – 2,700,000 – was record-breaking.
- The Zoo's Public Relations team maintained close and productive lines of communication with local and national media outlets in order to keep the Zoo in the public eye and top of mind.
  - The Zoo continued its monthly, live, in-studio appearances on WJZ-TV, WBAL-TV, and FOX 45, as well as regular appearances on WBAL Radio, 98 Rock, and the new QRadio 103.7.
  - Zoo Animal Ambassadors made multiple appearances on national television and Internet shows to promote Zoo programs and programs benefitting fellow member facilities around the country that are accredited by the Association of Zoos and Aquariums (AZA).





# financials

## Contributed Income

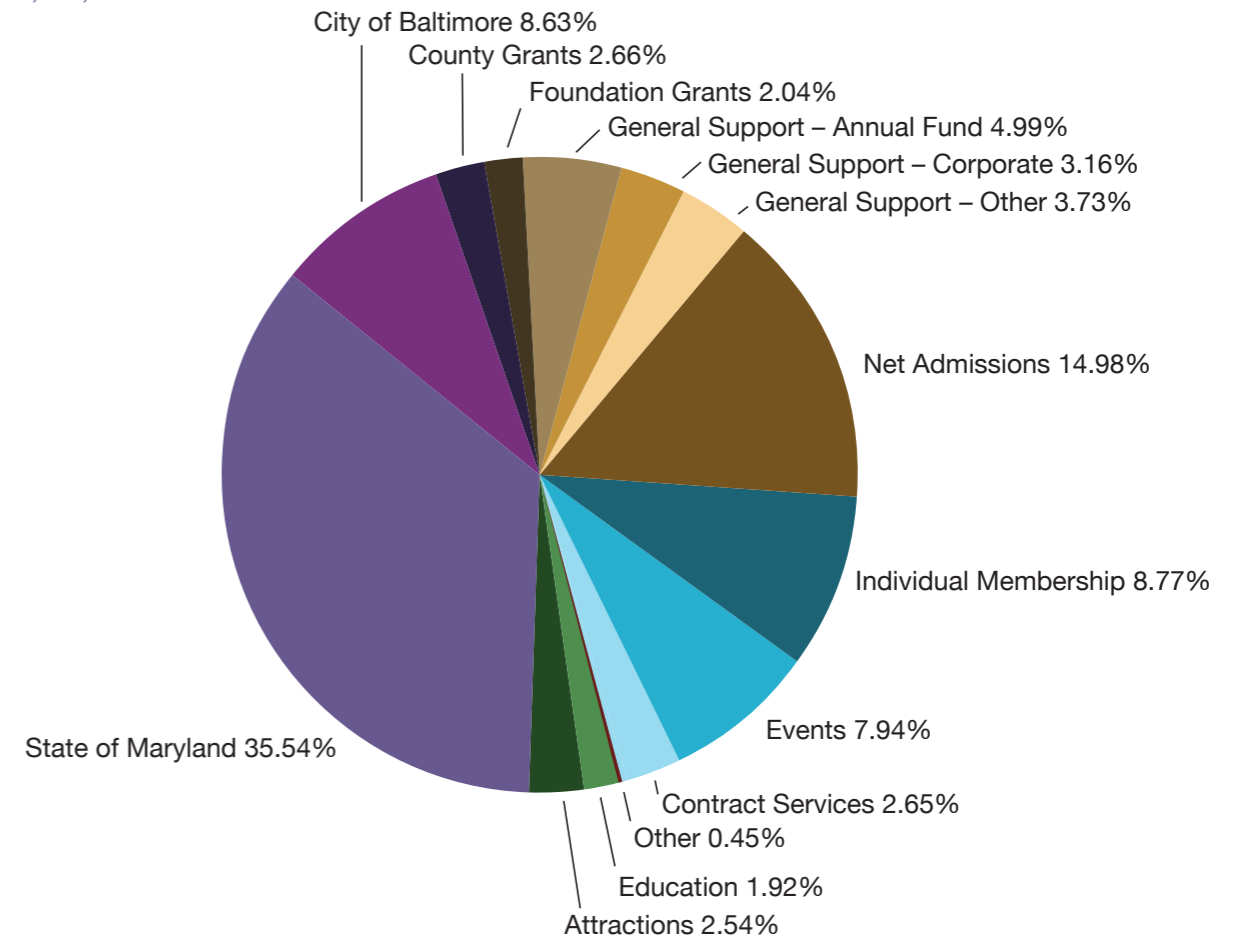
State of Maryland	\$ 5,627,380
City of Baltimore	1,365,956
County Grants	420,631
Foundation Grants	323,678
General Support	
<i>Annual Fund</i>	789,890
<i>Corporate</i>	500,880
<i>Other</i>	590,637
Total General Support	<u>1,169,826</u>
Contributed Income	<u>9,448,180</u>

## Earned Income

Net Admissions	\$ 2,372,504
Individual Memberships	1,387,900
Events	1,257,722
Contract Services	419,623
Attractions	402,539
Education	304,312
Other	70,626
Earned Income	<u>6,215,226</u>
Operating Revenues	<u>\$15,834,278</u>

## Support & Revenue

TOTAL REVENUE  
\$15,834,278



**Net Capital Support – used to fund capital projects** **\$2,888,393**



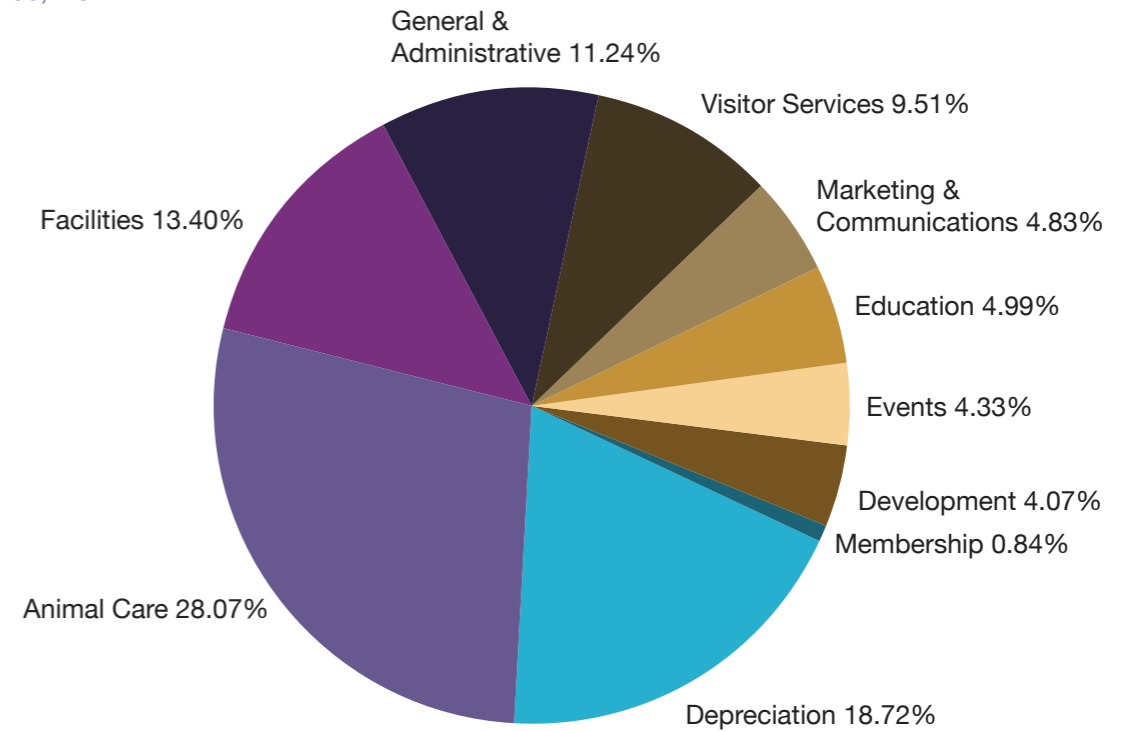
# financials



Expenses	
Animal Care	\$ 5,175,298
Facilities	2,470,026
General & Administrative	2,470,026
Visitor Services	2,073,394
Marketing/Communications	889,825
Education	920,495
Events	799,036
Development	750,419
Membership	155,745
<b>Operating Expenses Before Depreciation</b>	<b><u>14,987,070</u></b>
Depreciation	3,451,358
<b>Operating Expenses</b>	<b>\$18,438,428</b>

## Expenses

TOTAL EXPENSES  
\$18,438,428





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# staff research projects and publications

## RESEARCH PROJECT PARTICIPATION

### African Elephants

#### Body Composition and Inflammation and its Association with Ovarian Function and Metabolic Health in Zoo-Maintained African Elephants (*Loxodonta africana*)

- **Tim Nagy, Janine Brown, Daniella Chusyd, Kari Morfeld**

Fat secretes proteins and hormones into the body. High amounts are harmful and have been known to negatively impact reproductive function in several species. This study aims to determine whether there is a direct correlation between body fat and ovarian function in female African elephants by examining the relationship between body composition and the proteins and hormones associated with body fat in both cycling and non-cycling females.

#### Determination of Safe and Effective Dosing Regimens for Flunixin Meglumine and Firocoxib in African and Asian Elephants

- **Urusla Bechert, Dawn Booth, Mark Christensen, Jack Kottwitz**

This project will determine appropriate dosing regimens for two anti-inflammatory drugs used to treat elephants in captivity. In a recent megavertebrate analgesia international survey, 39 of 60 respondents stated that they had treated elephants with non-steroidal anti-inflammatories (NSAIDs). Flunixin meglumine (Banamine®) was the most commonly used

NSAID followed by phenylbutzone and firocoxib. Banamine doses were highly variable ranging from 0.43 to 2.0 mg/kg given once or twice daily. Firocoxib (Equioxx®) is a newer NSAID that preferentially inhibits Cox2 over Cox1 and is commonly used to treat pain and inflammation associated with osteoarthritis. Cox1 produces prostaglandins, which maintain normal gastric mucosa and affect kidney function; but Cox2 increases in response to inflammation so preferential inhibition of Cox2 is desired. Firocoxib is approved for veterinary use in the U.S. and is available in an injectable as well as two different oral formulations. It has a long half-life, good oral absorption, bioavailability, and distribution; however, like Banamine, dosing requirements for elephants are not known. In addition to the pharmacokinetic studies, the predicted safety of several NSAIDs in elephants will be screened based on in vitro Cox1:Cox2 ratios. Five drugs are to be studied, including phenylbutazone, ibuprofen, ketoprofen, Banamine and firocoxib. Determining the pharmacokinetics and Cox1:Cox2 ratios for Banamine and firocoxib will help veterinarians utilize these NSAIDs more effectively in the treatment of a variety of conditions affecting captive elephants, especially musculoskeletal disorders.

### Developing Genomic Tools for Elephant Conservation

- **Natalia Prado-Oviedo, Janine L. Brown, Jesus E. Maldonado, Michael Campana**

The ability to sequence whole genomes is revolutionizing our ability to manage animal populations and is providing new approaches for understanding how animals adapt to their environment. These data are important because the success of captive management can be impacted by genetic factors, such as gene diversity and function. Zoo elephants are no exception, and management has been challenging because of poor reproduction and health issues resulting in non-sustaining populations for both species of elephants. This project will generate the first high coverage (30X-60X) genome sequences of African and Asian elephants, which will be used to assess genetic variation and enable genomics projects in elephants to address fundamental questions about individual and population health and species survival. Genetic markers from these analyses will provide crucial information on the demographic history of our managed populations of elephants and will provide detailed estimates of how individuals are related to each other and eventually, how they are related to wild populations. This will include a detailed family tree of the North American population, which up to now has been impossible because of the ambiguity in importation records for individual animals. Genomic tools will be applied to address some of the questions that have puzzled elephant managers for decades, such as why do some elephants thrive more in captivity than others.

### Evaluating the Health of African and Asian Elephants in North American Zoos: Exploring Biomarkers of Disease and Musculoskeletal Condition

- **Katie L. Edwards, Janine L. Brown, Michele A. Miller**

This study is an extension of the IMLS funded project 'Using Science to Understand Zoo Elephant Welfare,' to assess the health status of individual elephants and explore the potential of several tools as indicators of health in zoo elephants. The first objective of this research is to process historical medical records to help better understand causes of morbidity and mortality in zoo elephants. Records will be used to categorize and summarize the pathologies present within the population and to assess past and current health status for each individual. The contribution of multiple factors (species, gender, age, social and physical environment, husbandry) to elephant health will then be assessed using additional data already collected during the IMLS Project. Secondly, a number of serum biomarkers will be investigated as potential diagnostic tools in elephants. The measurement of circulating markers indicative of inflammation provide an exciting avenue for the monitoring of health status and for helping to diagnose and treat health problems in elephants. Comparison between healthy individuals and those with known clinical conditions will help identify those markers with diagnostic and prognostic value. Samples will be collected opportunistically from any elephants that exhibit clinical signs of illness or trauma, and where



# staff research projects and publications (continued)

available, from those that have recently died. The final aspect of this research concentrates on musculoskeletal health. Foot and joint conditions have been documented among both African and Asian elephants, and previous research has found these conditions to be correlated with environmental factors such as time spent on hard surfaces and space availability. Data such as these are important to guide management changes to mitigate future health issues, and the ability to detect early changes in gait and assess the change in individuals' musculoskeletal conditions over time would be beneficial to the long-term health and welfare of zoo elephants. Although lameness is a common sign of underlying conditions, at present there is no standardized method to objectively assess musculoskeletal health within individual elephants over time, or across individuals at different facilities. A standardized and objective protocol for assessing elephant gait will be developed, which will provide an important tool to help animal care staff and veterinarians monitor foot and joint health, while also providing a means to assess the degree of problems on a population level. This will be developed during a pilot study at a sub-set of institutions using video-analysis of elephants walking and performing routine behaviors, to determine the best visual cues for assessing changes in musculoskeletal condition, before being rolled-out across all AZA institutions. Together, this research will have a positive influence upon zoo elephant welfare through a better

understanding of how different factors impact morbidity and mortality, providing a basis for expanding our knowledge of health processes in African and Asian elephants, and by developing tools to monitor some of the conditions faced by these species in zoos.

## **Metagenomic analysis of intestinal microbiota of African elephants**

- **Petra Tsuji, Larry Wimmers, Brian Masters**

The intestinal microbiome has been studied extensively in humans and mice and has been shown to be responsive to diet, environment, health, and other not-yet-identified factors. Furthermore, these studies have underlined the importance of intestinal bacterial communities for host survival, physiology, and nutrient utilization. A literature search indicated that the intestinal (fecal) microbiota of other mammals, including cow, reindeer, seal, wallaby, yak, giant panda, buffalo, and two Asian elephants, has been investigated using next-generation sequencing technology; however, the composition of the intestinal microbiota of African elephants is currently unknown. Bacterial DNA was isolated from sterilized elephant dung samples, provided by the MZiB during routine husbandry procedures, and bacterial genome was sequenced and analyzed. Results from this study allow insights into the phylogeny and genetic potential of the intestinal microbiome.

## **Serum osmolality in captive African elephants (*Loxodonta africana*)**

- **Ramiro Isaza**

Serum from healthy, captive African elephants (*Loxodonta africana*) will be evaluated with measured osmolality. Serum osmolality is valuable in determining patient hydration status, electrolyte balance, and response to fluid therapy. Serum osmolality measurement by methods such as freezing point osmometry and vapor pressure osmometry is a useful adjunct to routine clinical tests in the diagnostic evaluation of elephants and permits the clinician to assess response to medical treatment and husbandry methods. Most mammals have normal measured serum osmolality values around 300 mOsm/kg. Normal serum osmolality values were recently studied and measured in the Asian elephants (*Elephas maximus*). Serum osmolality has not been scientifically evaluated in African elephants in any state, healthy or dehydrated. Measured serum osmolality results from African elephants will be identified by freezing point osmometry and by vapor pressure osmometry. The goal of this study is to develop normal serum osmolality in the African elephant (*Loxodonta africana*) population and compare the serum osmolality values with those of Asian elephants and other species.

## **African Penguins**

### **Environmental Biomes: Maryland Zoo Penguin Coast**

- **Forrest Spencer, Joel Schildbach, James Taylor, Karl Kranz**

Recent technical advances in DNA analysis allow detection of living organisms present in an environmental sample without need for laboratory culturing. This capability has initiated a host of new studies aimed at understanding the interactions between animals and the microbial organisms that live cooperatively within, on, and around them. Initial studies of microorganism communities living within and on human beings has strongly confirmed their relevance to health and disease. Animals living in a zoo environment will also interact with environmental microorganism populations and likely benefit from them in ways that are not yet understood. In this project, microbial community structures determined for environmental water samples taken from African Penguin environments at The Maryland Zoo will reveal the microorganism census present, allowing comparison across locations and time. The study will establish observations relevant to the successful breeding environment maintained by The Maryland Zoo and may form the basis of future work. Engagement of public interest in environmental science is a goal shared by The Maryland Zoo and Johns Hopkins University. Toward that end, a collaboration to involve undergraduate students in a research project that would introduce them to



# staff research projects and publications (continued)

cutting-edge concepts in environmental biology was proposed. The research will be embedded in a one-semester course designed to reinforce basic biological knowledge, expose students to modern research concepts, and provide an opportunity for contribution of novel information of interest to working scientists. This study covers a pilot year execution of this class and associated research.

## Identification of Sperm in BFP Eggs

- **Lauren Augustine**

For this study, which aims to identify possible sperm in egg membranes, The Maryland Zoo in Baltimore provided two eggs from their African penguin collection that were deemed infertile.

## Chimpanzees

### Validating WelfareTrak® as a Tool to Improve the Welfare of Individual Chimpanzees

- **Jessica C. Whitham, Lance Miller, Steve Ross, Mollie Bloomsmith**

Using WelfareTrak®, a web application that allows zookeepers to complete surveys for individual animals and then generates reports that “flag” potential shifts in welfare status, zoos will have the ability to enhance overall quality of life for chimpanzees in their care. The study will be conducted over a 12-month period beginning in March 2016. During months 1-6, chimpanzee keepers at The Maryland Zoo in Baltimore will collect behavioral and physiological data on all members of the troop, videotape each individual 3 days per week for 30-minute time periods,

and collect daily fecal samples for subsequent enzyme immunoassay analysis and to determine secretory immunoglobulin-A concentrations. During months 7-12, keepers will log into WelfareTrak® on a weekly basis to complete surveys for individual animals and will have monthly meetings to review welfare reports. During the monthly meetings, the workgroup will attempt to identify welfare issues, address issues by proposing feasible interventions, and evaluate the success of the interventions. This study aims to promote exceptional animal welfare by allowing keepers to focus on positive welfare indicators and the experiences, preferences, and needs of individuals in the troop.

## Honey Bees

### Bee for Baltimore

- **Josephine D. Johnson**

Honey bees collect pollen, nectar, and a sticky substance called propolis from plants within a three-mile radius of their hive. This study intended to examine pesticide residues and heavy metals (lead, cadmium, zinc, arsenic, and copper) in four hive mediums (wax, nectar/honey, pollen, and propolis) to assess the types of pollution that both honey bees and humans are subjected to in cityscapes. For this study, The Maryland Zoo in Baltimore tended to honey bee hives on its campus, which is located in an urban park.

## Snake Avoidance Training for K-9s

- **Robert Francis**

Dogs involved in search-and-rescue missions may encounter non-venomous and/or venomous snakes, depending on the location of the mission. An encounter with a venomous snake could prove lethal. Avoidance training is a proven way to minimize the risk of encountering unintended species. The Maryland Zoo in Baltimore provided snake sheds from venomous species in its collection to the Mid-Atlantic D.O.G.S. for use in avoidance training of search dogs.

## Panamanian Golden Frogs

### De novo genome sequencing and assembly of the Panamanian golden frog

- **Warren Johnson, Klaus-Peter Koepfli**

This project seeks to generate a high-quality de novo genome assembly of one individual for the Panamanian golden frog (*Atelopus zeteki*). The 7 Gb genome will be sequenced using two different but complementary approaches: 1) Illumina short-read sequencing of multiple shotgun and mate pair libraries sequenced to >40x coverage; and 2) Hi-C library construction and sequencing using a novel technology that results in large-scale sequence scaffolding during genome assembly. The genome will be annotated for genes and other genomic features and utilized for comparative genomic analyses. The Panamanian golden frog genome will provide an invaluable resource for ongoing conservation efforts undertaken at various

Smithsonian bureaus to save these animals that are thought to be extinct in the wild. Whole genome information will allow researchers and conservationists to maximize the potential for long-term maintenance and genetic viability of captive populations by identifying genes involved in inbreeding depression. A primary goal of current research at the Smithsonian involves a search for a solution to chytridiomycosis, the as yet incurable disease caused by Bd fungus. The genome sequence of Bd has already been published; thus, with a whole genome sequence of a highly susceptible host species such as the Panamanian golden frog, the whole genome-level responses in gene expression simultaneously in host and pathogen can be studied. Lastly, the Panamanian golden frog genome will serve as the reference genome against which sequencing reads obtained from other closely related species can be mapped.

### Effect of Temperature and Temperature Variability on Amphibian Declines

- **Jason Rohr, Matthew Venesky, Jeremy Cohen**

Between 1970 and 2005, approximately 100 species in the amphibian genus *Atelopus* went extinct in Latin America. These extinctions are thought to have been caused by the pathogenic chytrid fungus *Batrachochytrium dendrobatidis*, commonly referred to as chytrid. There is preliminary evidence that Panamanian golden frog (*Atelopus zeteki*) mortality increases linearly with temperature upon exposure to chytrid. This study would use data from further experiments to create models and determine whether climate may have contributed to these



# staff research projects and publications (continued)

extinctions. The Maryland Zoo in Baltimore provided a total of 160 Panamanian golden frogs (*Atelopus zeteki*) for this study: 60 for phase 1 and 100 for phase 2.

## **Exogenous Hormone Induction of Oviposition in Gravid Panamanian Golden Frogs (*Atelopus zeteki*)**

- **Ellen Bronson, Kevin Barrett**

The captive populations of Panamanian golden frogs at The Maryland Zoo in Baltimore and other zoological institutions have suffered a concerning amount of morbidity and mortality that appears to be at least partially related to the failure of gravid females to undergo oviposition. In FY16, The Zoo continued to conduct this ongoing research study, further optimizing the protocol used for ovipositioning of the frogs.

## **Microbiota and Innate Immunity of Amphibian Skin- Tadpoles & Metamorphs**

- **Microbiota and Innate Immunity of Amphibian Skin- Tadpoles & Metamorphs**

This study examines the importance of microbiota and innate immunity in defense of amphibian skin. Panamanian golden frogs are believed to be extinct in the wild, due primarily to the fungal disease chytridiomycosis. The goal of this project is to apply probiotic bacteria during tadpole development and to monitor changes in microbiota and immunity, which will advance captive husbandry techniques leading to species reintroductions. The Maryland Zoo in Baltimore will supply a total of 270 tadpoles for this study, which will be conducted in two phases: 1) tadpole and 2) metamorphs.

## **PGF Oviposition Study**

- **Erik D. Linquist, Micah Christensen, Olivia Deloglos**

Amphibians are important for ecosystem stability as well as the discovery and development of new pharmaceutical drugs. Unfortunately, at least 32% of amphibian species are in danger of extinction due to multiple causes worldwide. Without amphibians, excessive algal growth damages stream chemistry affecting the whole habitat. Losing amphibians also results in the declines of predators dependent on them for food. Since pharmaceutical drugs are often developed from compounds first discovered in nature, the loss of amphibians would likely cause many drugs to never be discovered. The Panamanian golden frog is an example of an amphibian that was thrust into critical endangerment due to over-collection, habitat destruction, and disease. Captive populations are currently being kept in a number of zoos and aquariums as a last resort in preventing extinction. Because of limited facility space, selecting only the most physically and genetically fit individuals for breeding is essential and is thus carefully planned, but captive breeding is only a temporary fix. The hope is to reestablish the species in the wild. In collaboration with The Maryland Zoo, this research project will look to find a link between the fitness of parent frogs and the resulting quantity and quality of their eggs. The data will then be used to fill gaps in mathematical models of reestablishment providing a part in planning for the reestablishment of Panamanian golden frogs in

the wild. The effect of parent traits such as size and age on reproduction will be analyzed. Results from this study will be critical in mathematically modeling population reestablishment scenarios in the Vortex Population Viability Analysis software application; an effort underway between Dr. Corinne Zawacki, Project Golden Frog, The Chicago Zoological Society, and Dr. Erik D. Lindquist. The Maryland Zoo in Baltimore is providing 15 clutches for this study.

## **Studying Disease Resistance to Reduce the Threat of Chytridiomycosis to Panamanian Golden Frogs**

- **Brian Gratwicke, Matthew H. Becker**

Gratwicke and Becker aimed to use this study to study defense mechanisms against *Bd* in Panamanian golden frogs. *Bd* causes chytridiomycosis, a serious fungal infection that affects over 200 amphibian species worldwide and is the main cause of the extinction of Panamanian golden frogs in the wild. 200 captive Panamanian golden frogs will be screened using a non-invasive skin swab and molecular tools to characterize the skin microbiome. With the microbiota data, a subgroup of animals may be able to be identified that will clear a *Bd* infection based off of microbiota data that was discovered in a previous study. This study will help predict *Bd* susceptibility of golden frogs and aid in reintroductions into their native habitat.

## **The Accumulation and Half-Life of Itraconazole in Panamanian Golden Frogs (*Atelopus zeteki*)**

- **Amy Rifkin, Marike Visser, Kevin Barrett, Dawn Boothe, Ellen Bronson**

Itraconazole is an antifungal drug customarily used to treat chytridiomycosis and other fungal infections in amphibians. In summer 2014, this group studied the pharmacokinetics of a one time dose of itraconazole in Panamanian golden frogs and found that the drug acts systemically despite being applied topically and discovered that the standard protocol of itraconazole treatment of *Bd* may be too high (causing adverse toxic side effects in treated frogs). This second phase of the study aims is a multidose study to determine the proper dosing protocol by exposing different groups of frogs to two different doses for varying lengths of time over 10 days. The study will result in the determination of the proper and safest dosing regimen for fungal diseases, including the Chytrid fungus, and will be the first of its kind in any frog species.

## **Polar Bears**

### **Application of 2D and 3D Photographic Technology to Estimate Body Size and Condition of Polar Bears**

- **Elizabeth Flaherty, Randy Creaser**

As part of a citizen science project developed by Dr. Steve Amstrup and Polar Bears International (PBI), with support from Dr. Elizabeth Flaherty



# staff research projects and publications (continued)

from Purdue University and Dr. Merav Ben-David from the University of Wyoming, methods to non-invasively monitor wild polar bear populations using photography are being developed. This study is specifically developing methods to collect morphometric measurements, such as body condition and body size, of free-ranging wildlife using two-dimensional (2D) and three-dimensional (3D) cameras. This technology has the potential to obtain highly accurate morphometric measurements related to body condition, animal physiology, and individual variation without chemically immobilizing wild animals. To test and calibrate the equipment, photographs of polar bears of known size and body condition from a variety of distances and angles are required, and zoos offer an ideal opportunity to collect these data. Recent studies indicate that the decline in sea ice availability and time when bears can hunt seals have resulted in decreased body condition, smaller body sizes, smaller litters, and lower cub survival. Tracking these declines in polar bear health through time will allow scientists to better understand polar bear physiology and potentially improve conservation efforts. Every year, thousands of visitors collect millions of pictures of wildlife. By developing methods to use these photographs, this study hopes to provide a robust protocol for tracking changes in bears and other wildlife species at many locations over extended time periods.

## Large Cats

### Tiger and Lion Vaccine Serologic Study

- **Tara Harrison, Scott Harrison, Douglas Armstrong, James Sikarskie**

This study will evaluate serologic titers for tigers and lions at AZA institutions from birth to two years of age. With support from the Tiger Species Survival Plan (SSP) and the AZA, the study was carried out during the calendar years 2013-2015. Preliminary studies have indicated that the Boehringer Ingelheim PCT+Calicivax is safe for use in tigers. This vaccine produces serologic titers to protect animals against herpes virus, parvovirus and both strains of calicivirus. It indicates that the vaccine is effective but there is a need to evaluate the development of serologic titers in naïve animals to better understand the duration of protective titers. Preliminary research is suggestive that serologic titers do not persist for greater than one year. The Maryland Zoo in Baltimore supplied serum samples from its three lion cubs for this study.

## Slender-Snouted Crocodiles

### Assessment of metal partitioning between shell, membrane and contents of crocodilian eggs (wild and captive)

- **Julia Gress**

The goal of this study is to create a reference database for use by field conservationists, veterinarians, and researchers. The following elements are being analyzed by ICP-AES: Ag, Al, As, B, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, K, Hg

(total), Mg, Mn, Mo, Na, Ni, Pb, Sb, Se, Sn, Sr, Tn, V and Zn. Currently, there are wide gaps in reference literature on metal concentrations in crocodilian eggs. St. Augustine Alligator Farm and The Maryland Zoo in Baltimore participated in this study to assess metal partitioning between the egg shell, membrane, and contents of non-viable crocodilian eggs from all species.

### Oocyte Membrane-bound Sperm Detection for Crocodile Conservation and Management

- **Lauren Augustine**

The female slender-snouted crocodile at The Maryland Zoo in Baltimore has laid eggs over the past few years, none of which appeared to develop. In FY15, this research study accepted 9 undeveloped eggs laid at The Maryland Zoo and used perivitelline membrane (PVM) sperm detection to determine the status of the undeveloped egg. Additional, seemingly undeveloped, eggs were provided during FY16. This study will aid in determining if the pair of crocodiles at The Maryland Zoo in Baltimore is copulating or if the eggs are truly infertile.

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Zong JC, Heaggans SY, Long SY, Latimer EM, Nofs SA, **Bronson E**, Casares M, Fouraker MD, Pearson VR, Richman LK, Hayward GS. 2016. Detection of quiescent infections with multiple elephant endotheliotripo herpesviruses (EEHVs), including EEHV2, EEHV3, EEHV6, EEHV7, within lymphoid lung nodules or lung and spleen tissue samples from five asymptomatic adult African elephants. *Journal of Virology*. 90: 3028-3043.

Miller, E. A., C. P. Driscoll, S. Davison, L. Murphy, **E. Bronson**, A. Wack, A. Rivas, J. Brown. 2015. Snowy owl (*Bubo scandiacus*) morbidity and mortality investigation in the DOS region in the winters of 2013-2014 and 2014-2015. *Delmarva Ornithologist*. 44: 4-12.

Hausmann, J. C., A. N. Wack, M. C. Allender, **M. R. Cranfield**, K. J. Murphy, **K. Barrett**, J. L. Romero, J. F. X. Wellehan, S. A. Blum, C. Zink, **E. Bronson**. 2015. Experimental challenge study of FV3-like ranavirus infection in previously FV3-like ranavirus infected Eastern box turtles (*Terrapene carolina carolina*) to assess infection and survival. *Journal of Zoo and Wildlife Medicine* 46: 732-746.

## PRESENTATIONS

**Bronson, E., K. Barrett**, K. Murphy, **M. R. Cranfield**. 2015. Reproductive management of the Panamanian golden frog (*Atelopus zeteki*). American Association of Zoo Veterinarians Conference. Portland, Oregon.



# staff research projects and publications (continued)

**Bronson, E.**, A. Wack, E. Miller, D. Brinker, C. Driscoll. 2015. The snowy owl irruption of 2013-2014: The zoo veterinarian's contribution to unexpected local conservation. American Association of Zoo Veterinarians Conference. Portland, Oregon.

Kline, S., **J. Kottyan, J. Phillips**, A. Wack, N. Pate, and **E. Bronson**. 2015. The anatomy and digestive mechanisms of captive African penguins (*Spheniscus demersus*). American Association of Zoo Veterinarians Conference. Portland, Oregon.

**Bronson, E.** and K. A. Terio. Veterinary Update. 2015. Felid Taxon Advisory Group Meeting. Pittsburgh, Pennsylvania.

**Studer, K.** The challenges of critical care through protected contact: Case study on a North American river otter (*Lontra canadensis*). 2015. Association of Zoo Veterinary Technicians Conference. Tacoma, Washington.

Keeper **Jon Murray** delivered a presentation on treating sepsis in African elephant "Samson" at The Elephant Manager Association conference in Nashville, Tennessee in October 2015.

Keeper **Chelsea Feast** delivered a presentation on voluntary net training with lemurs at the Animal Behavior Management Alliance conference.

## LECTURES

**Dr. Ellen Bronson:** Diseases of captive and free-ranging mammals. University of Maryland College Park. Undergraduate lecture for biology and animal science majors. Annual guest lecture, November 2015.

**Dr. Sam Sander:** It Takes a Village, Lessons in Zoo Medicine. 2016. One Health Academy lecture. Washington DC, January 2016.

**Dr. Ellen Bronson:** The zoo veterinarian's role in conservation. University of Pennsylvania School of Veterinary Medicine. Annual guest lecture, February 2015.

**Dr. Ellen Bronson:** Project Golden Frog: Multiple disciplines coming together to conserve a national symbol. Midwestern University College of Veterinary Medicine. Glendale, Arizona. Invited One Health guest lecturer, May 2016.

**Dr. Ellen Bronson:** Comparative physiology of the gastrointestinal tract. Midwestern University College of Veterinary Medicine. Glendale, Arizona. Invited guest lecturer for Veterinary Physiology course, May 2016.

General Curator **Mike McClure** taught both introductory and advanced elephant management techniques to more than 80 AZA professionals, including elephant care professionals, veterinarians, and zoo directors at classes in Wheeling, West Virginia; at Disney's Animal Kingdom; and at the Houston Zoo. He served as Course Administrator for *Principles of Elephant Management 1 and Principles of*

*Elephant Management 2*, which are offered by the AZA's Professional Development Programs.

**McClure** assisted in the development of, and was a featured lecturer in, the first *Recon: Reconnecting With Elephants* conference at the Cheyenne Mountain Zoo with Dr. Susan Friedman (Behavior Works) and with Steve Martin (Natural Encounters, Inc).

**McClure** participated in the development of, and was an instructor for, the *International Course on Animal Welfare and Training* in Guanajuato, Mexico to assist Latin American zoos in improving animal management practices.

**Lori Beth Finkelstein, VP of Education, Interpretation, and Volunteer Programs**, taught *Zoos and Communities*, a course for the Johns Hopkins University's Museums and Society undergraduate program. The course examined zoos and living collections from historical and contemporary perspectives, taking into account the potentially conflicting role of zoos as conservation organizations, educational institutions, and entertainment venues serving different communities. The course involved a partnership with SABES (STEM Achievement in Baltimore Elementary Schools), a NSF-funded collaboration between Baltimore City Public Schools and JHU designed to improve educational outcomes in STEM disciplines at several Baltimore City elementary schools.



# We could not do it without you!

Your generosity allows the Zoo to continue offering excellent animal, education, and conservation programs, to provide an exemplary visitor experience, and to assure a clean and safe environment for our animals, staff, and guests from all over Maryland and the region. Our genuine thanks go to you, our faithful friends, who year after year support the Zoo with your philanthropic donations, enabling us to make the wonders of wildlife accessible to the entire community.

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Linda Wrightson

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Jo Jarred  
Kathryn Jeans  
Shavaun Jenkins  
Zachary Johnson  
Sean Johnson  
Maya Jones  
Derek Joost  
Ruthanne Kaufman  
Anabel Kearley  
Kelly Kim  
Austin Knox  
Eileen Kuhl  
Glenn Lichtman  
Jeffrey Lifton  
Sierra Love  
Kathryn Lowe  
Kitty Maguire  
Natalie Maranto  
Rachel Maygers  
Mollie McGee  
Penny Metz  
Tina Montalvo  
Cyanne Morris  
Hansel Motiram  
Bethany Moyer  
Albert Muehlberger  
Kelly Myers  
Sue Nasuta  
Tom Nasuta  
Broadus Nesbitt III  
Steven O'Keefe



Nancy Padden  
Sherry Rast  
Jessica Rich  
Christine Roberts  
Abigail Rossman  
Arshdeep Sahi  
Alicia Schafer  
Barbara Schwartz  
Sara Service  
Kyle Sheetz  
Abigail Spratley  
Robert Stiefel  
Cynthia Stoltz  
Benjamin Stucke  
Teanna Tang  
Stephen Taylor  
Carole Taylor  
Kathy Thomas  
Kayla Trace  
Tyrone Walker  
Samantha Wentz  
Paul Wilson  
Sophie Wilson  
Juliana Zellers  
Adam Zurgable  
Anna Zwingelberg

**1-49 HOURS**

Autumn Aaron  
Corey Adams  
Jerisa Alexander  
Elizabeth Alicea  
Eddie Alvarez  
Tressa Andrews  
Jada Arca  
Chris Armor  
Elena Artimovich  
Lasonia Baden  
Timm Baldwin  
Alice Ball  
Brendan Bangay  
Holly Barnowich  
Alex Barnowich  
Marta Barrett  
Amanda Barteck  
Evelyn Bates  
Derek Baxter  
Rachel Beitter  
Linda Benamor  
Jessica Bentz

Heather Bertling  
Bernie Bishoff  
Beth Bishop  
Catherine Blake  
Claire Blevins  
Robin Bloomfield  
Matt Bocian  
Erica Boehm  
Janet Bonds  
Alexandra Bosworth  
John Bowie  
Aissatou Boye  
Frank Boyle  
Robin Boyle  
Dakota Bradley  
Jonathan Bratt  
Jessica Brownell  
Susan Browning  
Robert Browning  
Alyssa Browning  
Naomi Buie  
Scott Burch  
Holly Burkett  
Kimberly Butcher  
Clive Butler  
Asante Buzeneswatson  
Jazmin Byrd  
Amy Caballero  
Leslie Cain  
Sahrata Camara  
Hannah Campbell  
Amos Campbell  
Steven Carannante  
Glenda Carter  
James Carter  
Bernard Cataldo  
Alexis Ceasrine  
Micah Chandler  
Dave Chason  
Pat Chason  
Joshua Chatmon  
Remy Childers  
Emily Childers  
Jennifer Ching  
Michelle Chism  
Andrea Christ  
David Christopher  
Celina Cisneros  
McKenzie Clauss  
Theresa Clauss

Tucker Clauss  
Sandy Coho  
Gabriella Colarusso  
Mary Rose Cook  
Alyssa Cooper  
Joseph Copsey  
Demarcus Crawford  
Phillip Cress  
Hannah Crystal  
Rosa (Bonnie) Cummings  
Kristin Cunningham  
Mason Damareck  
Sabrina Davis  
Fred Debell  
Amanda Decker  
Tiffany Deel  
Michelle Delabrer  
Sharon Derby  
Sarah Donnelly  
Kiara Dorsey  
Shelley Downs  
Cathryn Doyle  
Andrew Doyle  
Christopher Duffy  
Alex Dumitrescu  
Sherry Durandetto  
Thomas Durandetto  
Judith Dwyre  
Nathaniel Dwyre  
Patricia Edens  
Jennifer Elam  
Lee Elder  
Vicki Elder  
Mary Jane Epley  
Christine Fahey  
William Fallon  
Justin Feeser  
Maryellen Ferlise  
Hope Fetty  
Christine Fichter  
Theresa Fichter  
Megan Fitzgerald  
Danielle Fleming  
Reece Fleming  
Austin Flowers  
Cristine Fluke  
Donta Fortune  
David Foster  
Marion Foster  
Shannon Foster

Victoria Fowler  
Anabelle Franks  
Anna Frazier  
Nicholas Fuhr  
Christopher Fusco  
Marie Gagne-Stacy  
Elizabeth Gale  
Becki Gannon  
Gretchen Garcia  
Victoria Garcia  
Beth Garner  
Jasmyynn George  
Katie Gerrity  
Beth Lacey Gill  
Eric Giuriceo  
Jean Glass  
Haley Golden  
Michael Golob  
Jessie Gordon  
Ethan Greenberg  
Katie Guercio  
Kathy Guins  
Cameron Haire  
Keith Hall  
Laurier Hampton  
Erin Hanmer  
Carolyn Harbach  
Jennifer Harmon  
Shelly Harper  
Monica Harried  
Charles Hart  
Mary Harty  
Mike Harty  
Shanoy Hawkins  
Jeff Hayes  
Yifei He  
Kylie Helmick  
Terry Higgins  
Merry Hildebrand  
Kerry Hill  
Rykarra Hill  
Ashlyn Hill  
Kathryn Hirsch  
Winnie Ho  
Erik Hohl  
Kelley Hohl  
Nikki Holcombe  
Linda Howard  
Elisabeth Hubbard  
Sarah Hutchinson

Sarah Ives  
Kristin Jackson  
Edward Jackson, Iv  
Kayla Jacobs  
Erin James  
Joshua Jarvis  
Cierra Jenkins  
Stephen Jenkins  
Marie Johnson  
Jessica Johnson  
Jashina Johnson  
Devon Jones  
Mia Jones  
Jimeka Joynes  
Melissa Karper  
Leah Karvelas  
Sierra Keller  
Erin Kemp  
Mary Kerns  
Ashley King  
Megan Knauff  
Taryn Knight  
Barbra Koczan  
Kara Korab  
Rachel Kostelec  
Joseph Kouneski  
Allison Krahe  
Amanda Laddie  
Eric Lee  
Amina Lee  
Katherine Leljedal  
Aja Lenyear  
Courtney Levy  
Lakia Lewis  
Anna Liberatore  
Marie Lilly  
Jonathan Lim  
Katie Litkowski  
Haley Little  
Jing Liu  
Allen Lloyd  
Donna Lloyd  
Angela Lopresti  
Katie Loukota  
Marie Lymon  
Teri Mack  
Margo Madsen  
Anna Magnaterra  
Joe Magnusson  
Gail Mahan

Sara Mahmood  
Keeley Mahoney  
Mercedez Maldonado  
Christine Manning  
Andrea Marquez  
Linda Martin  
Malee McCarthy  
Tia-Marie McCarthy  
Krista McCray  
Lori McDonnell  
Julianne McFarland  
Rebecca McWee  
Wesley Mericle  
Bria Merrick  
Marsha Meyd  
Patricia Meyer  
DeAnna Miles Brown  
Joseph Miletti  
Melissa Miller  
Randi Mitzel-Bines  
Angie Mogensen  
Alice Moore  
Brian Morelli  
Callie Morgan  
Grace Morris  
Derek Morvant  
Catherine Mudge  
Joshua Mudge  
Lauren Mueller  
Susan Mullikin  
Frances Murphy  
Quineshay Murphy  
Hannaa Mustapha  
Kamilah Mustapha  
Molly Myers  
Kathleen Naughton  
Samantha Neuman  
Rita Neuzil  
Alaya Norman  
Shelby Norton  
Delanie Ostrow  
John Michael Pacson  
Sandra Parobeck  
Linda Pate  
Mitsoo Patel  
Alyssa Pavignano  
Rob Peters  
Thomas Peters  
Melanie Pezzini  
Jacqueline Phillips

Nicholas Picciotto  
Ashley Pilgrim  
Janet Pogar  
Trisha Porter  
Erin Potter  
Ellen Powell  
Mansur President  
David Pugh  
Isabelle Pula  
Elias Ramos  
Andrew Rampolla  
Malayah Redmond  
Belinda Reed  
Lindsay Reich  
Samantha Rennalls  
Kathy Renzi  
Amanda Reyes  
Stephen Ricketts  
Matt Riggelman  
Tim Roark  
Chranisha Roberts  
Paige Roberts  
Mark Roberts  
Adonna Robinson  
Martha Robison  
Kia Rogers  
Erin Ruddy  
Michael Safko  
Megan Safko  
Lee Ann Salter  
Ryan Sammons  
Shannon Sanborn  
Sheri Sanford  
Gloria Santamaria  
Chris Schaeffer  
Jean Schaeffer  
Linda Schneider  
Karen Schonfeld  
Mike Schonfeld  
Claire Schwartz  
Adrian Sedano  
Jaquelyn Sheedy  
Monica Sheffo  
Luke Sheridan  
Nima Sherpa  
Paula Shevitz  
Cecile Shindell  
Rachel Sholar  
Tania Sholar  
Clary Simmonds

Anthony Sita  
Allison Smith  
Brittany Smith  
Peter Smith  
Cynthia Sorrell  
Peggy Spangler  
Caroline Spencer  
Arthur Starr  
Betty Stehman  
Melissa Stellfox  
Kelsey Stenta  
Kristina Stepanek  
Adia Stokes  
Helen Streimer  
Mason Surhoff  
Robert Swain  
Archana Swaminathan  
Sara Swart  
Tytianna Taylor  
Matt Taylor  
Mamie Teagle  
Kelly Thomas  
Narmier Thompson  
Jennifer Thompson  
Akira Tisdale  
Simon Torres  
Athena Towery  
Teresa Treadwell  
Tue Trinh  
Emily Trotter  
Mariah Tunstall  
Stefan Turner  
David Var  
Phillip Vaughn  
Heather Veale  
Niki Verrier  
Debora von Briesen  
Frederick Von Briesen  
Diane Walko  
David Wallace  
Shanshan Wang  
Ana Ward  
Marissa Ward  
Susan Waxter  
Laura Webb  
Susan Weil  
Jewel White  
Tanya White  
Mark Williams

Ramiel Williams  
Mercedes Williams  
Byron Wilson  
Loraine Wilson  
Steffi Wilson  
Carrie Wiskman  
Liz Witty  
Dave Wollner  
Sue Wollner  
Simon Wong  
Jessie Yang  
Peter Yao  
Hang Yin  
Chen Yu  
Dennis Zagurski  
Beco Zekic  
Yangming Zeng

#### **SERVICE GROUPS**

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Maryland Out of School Time Network  
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Stevenson University  
T. Rowe Price

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U.S. Air Force  
U.S. Coast Guard  
University of Maryland Baltimore  
County  
Volunteer Maryland  
Western Tech High School

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The Maryland Zoo in Baltimore is a non-profit organization accredited by the Association of Zoos and Aquariums.



# THE MARYLAND ZOO

## IN BALTIMORE

1876 Mansion House Drive, Druid Hill Park, Baltimore, MD 21217-4474

[www.marylandzoo.org](http://www.marylandzoo.org)

### HOURS OF OPERATION

Every day is a great day to be at the Zoo! Plan ahead and enjoy a day here soon. Before you visit, check the Zoo's website – [www.MarylandZoo.org](http://www.MarylandZoo.org) – to get up-to-date information on daily programming, exhibits, and upcoming events.

Open daily, 10 a.m. – 4 p.m.

*(Closed Thanksgiving Day and December 25, and Tuesday through Thursday in January and February.)*

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General Information	410-396-7102
Development	443-552-5290
Education	443-552-5300
Group Sales	443-552-5277
Membership	443-552-5281
Corporate Membership	443-552-5270
Adopt	443-552-5281
Rentals	443-552-5277
Volunteers	443-552-5266

