SNOW LEOPARD (Uncia uncia) FUNCTIONAL GENOMICS INITIATIVE

Margaret Barr,1 Kristopher Irizarry,1 Janis Joslin,1 Todd Mockler,2 Jay Tetzloff,2 Katherine Mitsouras,3 and Valerie Kendall1

1 College of Veterinary Medicine, 1College of Osteopathic Medicine of the Pacific, and Graduate College of Biomedical Sciences, 2Western University of Health Sciences, Pomona, CA

Ongoing collaborative and integrative projects in four main themes:

- Utilization of functional genomics and transcriptomics to understand the role of genetics in health and disease.
- Use of genomic information in endangered species conservation.
- Challenges facing the management of endangered species.
- Use of genomic information in the development of management decisions.

ABSTRACT

With current technology, it is now feasible to sequence the genome of virtually any species for a reasonable cost; however, application of this knowledge to population management or prediction of individual traits is still a daunting task. Functional genomics, from a conservation standpoint, involves understanding how the genetic make-up of an animal or population of animals impacts the health of that individual or population.

The goal of the Snow Leopard Functional Genomics Initiative (SLFGI) is to develop a strategy for applying genomics information to problems encountered in conservation of endangered species and, in consultation with population managers, to apply these tools to enhance management of small captive populations of endangered species in order to maintain species diversity and robustness.

Although the snow leopard is the test population, the models developed and tested in this project will be broadly applicable to other small captive populations of endangered species. This poster summarizes the project including the progress that we have made in establishing SLFGI, sequencing the snow leopard genome, and determining genetic diversity in the US captive snow leopard population.

RESEARCH QUESTION & HYPOTHESES

Research question: Can genomic information be used to supplement or improve decisions concerning the management of captive endangered species?

Hypotheses: We hypothesize that genomic information combined with pedigree data can enhance management of captive populations compared to pedigree information alone. We further hypothesize that immune and reproductive functions in captive populations vary across individuals and correlate with gene diversity.

Problem: Collections of endangered species in North American zoos are managed by a variety of professionals working to ensure the health and safety of these animals with the goal of preserving genetic diversity in the captive populations. Population geneticists, conservation biologists, curators, veterinarians, studbook keepers, Species Survival Plan (SSP) coordinators, reproductive physiologists, biologists, bioinformatics, and many other experts play a role in this process. Breeding and husbandry decisions are based on the best available information on pedigree/lineage and current understanding of the physiological and behavioral needs of each species. The amount of information available for different species varies widely so decisions must sometimes be made with minimal knowledge of existing population genetics in a collection. Frequently, the genetic robustness of individual animals is unknown or information on founders is scarce. In addition, there is a need to identify genetically determined characteristics that might adversely affect the breeding population or otherwise impact management decisions.

COLLABORATIVE PLANNING WORKSHOP

This workshop was supported by a National Leadership Planning Grant, LG-54-09-0068-09, from the Institute of Museum and Library Services.

Scientists and leaders in several different fields including geneticists, immunologists, reproductive physiologists and members of the Snow Leopard SSP were brought together to discuss the potential for the use of functional genomics in management of captive species and to develop a comprehensive plan for one species (the snow leopard) to use as a test case for the model. The three plenary session themes included:

- Challenges facing the management of endangered species
- Use of genomic information in endangered species conservation
- Role of immunogenetics in health and disease of endangered species

The plenary sessions were followed by breakouts into groups to discuss the three conference themes and to identify management goals:

- Geneticists, population biologists, and SSP coordinators emphasized the importance of maintaining the highest possible level of genetic diversity, even if that meant maintaining apparently deleterious genes in the population.
- Zoo veterinarians, immunologists and reproductive physiologists countered that health and reproductive capability are of paramount importance to the successful growth maintenance of any captive population.
- In large populations with broad founder bases, ensuring genetic diversity will likely accomplish both goals; however, in small captive populations, inadvertent selection for medically harmful traits may occur. Genotype information could help inform management decisions.

Workshop organizers: Peggy Barr, Kris Irizarry, Janis Joslin, Todd Mockler, Jay Tetzloff

Keynote speaker: Dr. Oliver Ryder, Institute for Conservation Research, San Diego Zoo


Additional workshop sponsors:

- San Diego Zoo
- Montana Zoo
- Milwaukee Zoo
- Tautpath Park Zoo
- The Cat House
- Utah's Hogle Zoo
- Woodland Park Zoo
- University of Arizona
- UA Museum of Natural History
- The Snow Leopard Research Programme

HOW YOU CAN HELP!

Whenever you plan an exam, procedure, or necropsy on a snow leopard population, please consider including the following:

- Blood samples
- Stool samples
- Saliva samples
- Tissue samples
- Gene expression studies
- Immunogenetics
- Reproductive physiology


Acknowledgements

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- Akron Zoo, Albuquerque Zoo, Binder Park Zoo, Binghamton Zoo, Brookfield Zoo, Chattanooga Zoo, Cheyenne Mountain Zoo, Cincinnati Zoo, Dakoda Zoo, Denver Zoo, John Ball Zoo, Kansasville Zoo, Los Angeles Zoo, Mckee Grove Zoo, Mill Mountain Zoo, Milwaukee Zoo, Moonridge Zoo, Oklahoma City Zoo, Philadelphia Zoo, Potawatomi Zoo, Rolling Hills Wildlife Adventure, Sacramento Zoo, San Francisco Zoo, Santa Barbara Zoo, Tauphina Park Zoo, The Cat House, Utah’s Hogle Zoo, Woodland Park Zoo.