Bela Lugosi

Proposed Senior Practicum:

Sperm Morphology Assessment of the Dama Gazelle (*Nanger dama*)

Signature Page

Student: ________________________________________________________________

Date: ________________________________________________________________

Academic Advisor: ____________________________________________________

Date: ________________________________________________________________

Practicum Mentor: _____________________________________________________

Date: ________________________________________________________________

Faculty Mentor: _______________________________________________________

Date: ________________________________________________________________
Bela Lugosi

_Proposed Senior Practicum:

Sperm Morphology Assessment of the Dama Gazelle (Nanger dama)

_Proposed coursework specialization:

Conservation and Reproductive Biology

_Mentor:

Bela Ferenc Dezso Blasko, BVSc, Ph.D., DVM
Ungulate Scientist
Center for Species Survival
Department of Reproductive Sciences
Smithsonian Conservation Biology Institute
1500 Remount Road
Front Royal, Virginia  22630

_Faculty Mentor:

_Academic Advisor:

Professor Edwin Lewis
Departments of Nematology and Entomology

_Projected Graduation Date:

June 2012

_October 2010
**Project Description**

**Title:** Sperm Morphology Assessment of the Dama Gazelle (*Nanger dama*)

**Background Information**

The Dama gazelle (*Nanger dama, formerly Gazella dama*) is the largest and rarest of all the gazelles (Anonymous, 2010b; Villarreal and Myers, 2006). This species has two extant subspecies, known as the Mohor or Mhorr gazelle (*Nanger dama mhorr*) and the addra gazelle (*Nanger dama ruficollis*) (Dolan, 1981). The Mohor subspecies is extinct in the wild, and as a species, the Dama gazelle is categorized as “Critically Endangered” by the International Union for the Conservation of Nature, which estimates the total wild population at less than five hundred individuals due to overhunting, drought, and habitat loss (Newby et al., 2008; Roldan et al., 2006). This means that captive breeding coupled with habitat restoration is the best, and perhaps only, chance to save this species from extinction. However, a major problem facing the captive propagation effort is inbreeding. Captive populations generally descend from only small numbers of founder animals – for example, all captive Mohor gazelles today are descended from a founder population of just four males and thirteen females (Abagair et al., 2001). When the animals in a population are closely related, reproductive success is compromised and it has been shown in Dama gazelles that the more inbred a male is, the more abnormal sperm he will produce (Cassinello et al. 1998; Roldan et al. 2006). The average coefficient of inbreeding for Dama gazelles, a measure of how inbred an animal is, is .121, which is just smaller than it would be for an individual whose parents were half siblings (Cassinello, 2005; Anonymous, 2010a). This “inbreeding depression” leading to reduced fertility explains why in one study, only 64.7% of Mohor gazelle sperm that were counted had intact acrosomes, and 80% were motile (Abagair et al., 2001). The most frequently observed abnormalities were acrosomal (misshapen acrosomes), head (macrocephaly, microcephaly, detached heads), midpiece (defects or double midpiece), and tail (coiled or bent) abnormalities (Saad et al., 2010).

This is where assisted reproductive technologies (ARTs) come in. Often it is too difficult or stressful to move animals around the world to breed, so transporting sperm and eggs is a promising alternative. By developing technologies such as artificial insemination, scientists can promote gene flow among captive populations. This depends on the proper collection, handling, storage and transportation of gametes, especially sperm, and these technologies are only in their infancy in Dama gazelles. The first Dama gazelle calf from an artificial insemination was a Mohor gazelle born in 2005, so ARTs have promise but have a long way to go to be viable (Roldan et al., 2006). Most of these ARTs have only been tested on Mohor gazelles, so while they likely will have the same results on addra gazelles, we cannot be positive. Dama gazelles have been shown to have different numbers of chromosomes, ranging from 2n=38 to 2n=40, which means that the subspecies of *Nanger dama* should be classified as species instead (Benirschke, 2004). Therefore, findings regarding sperm abnormalities in *N. dama mhorr* do not necessarily apply to *N. dama ruficollis*.

The Smithsonian Institution maintains a total of eleven addra gazelles (*Nanger dama ruficollis*) between its facilities, the National Zoological Park in Washington, D.C. and the Smithsonian Conservation Biology Institute in Front Royal, Virginia (Anonymous, 2010c). Because of the need for data on the sperm morphology and abnormalities for this subspecies, I propose to study the sperm characteristics of the
Smithsonian’s addra gazelles. I will be conducting morphology assessments on Dama gazelle electroejaculates in order to generate baseline data on ejaculate traits and sperm morphology for this subspecies.

In order to complete this assessment, I will be working under Dr. Budhan Pukazhenthi, Ungulate Scientist at the Smithsonian Conservation Biology Institute. I will be learning how to handle, prepare, and evaluate sperm and how to search for defects in individual sperm that lead to reduced fertility and conception rates. These skills will help me to conduct an assessment that can be used by future researchers to solve the problems with captive propagation of the Dama gazelle.

**Question to Test**

Does the sperm of the addra gazelle (*Nanger dama ruficollis*) exhibit similar types and frequencies of abnormalities as the sperm of the Mohor gazelle (*N. dama mhorr*)?

**Tentative Protocol**

In order to conduct sperm morphology assessments, I will be using raw sperm that has been collected using electroejaculation, treated with a fixative, diluted, and stored in a refrigerator. Using a micropipette, I will collect two 20 microliter samples and place them on a clean slide. Then I will use a phase-contrast microscope at 100x magnification to evaluate 200 individual sperm from each sample using the following categories:

- Normal sperm
- Macrocephalic
- Microcephalic
- Bicephalic
- Abnormal acrosome
- Abnormal midpiece
- No midpiece
- Tightly coiled tail
- Biflagellate
- Bent midpiece with cytoplasmic droplet
- Bent midpiece without cytoplasmic droplet
- Bent tail with cytoplasmic droplet
- Bent tail without cytoplasmic droplet
- Proximal cytoplasmic droplet
- Distal cytoplasmic droplet
- Bent neck
- Spermatid
- Cells
- Other
  - Detached head
  - Detached tail
  - Abnormal head
I will then record the percentage of normal sperm and the major abnormalities present in each sample.

**Tentative Timetable**

*Fall 2010: Laboratory Work at SCBI*
Approximately eight to ten hours per week in the laboratory, with more depending on when collections are scheduled.

- Week of 20 September: Introduction to techniques and protocols, begin sperm assessments
- Week of 27 September: Staining protocols, continue sperm assessments
- Week of 4 October: Staining protocols, continue sperm assessments
- Week of 11 October: Cryopreservation protocols, continue sperm assessments
- Week of 18 October: Continue sperm assessments
- Week of 25 October: Continue sperm assessments
- Week of 1 November: Continue sperm assessments
- Week of 8 November: Continue sperm assessments
- Week of 15 November: Continue sperm assessments
- Week of 22 November: Continue sperm assessments
- Week of 29 November: Continue sperm assessments
- Week of 6 December: Continue sperm assessments
- Week of 13 December: Continue sperm assessments, conclude and collect all data

*Winter 2010: Data Analysis and Conclusions at UCD*
Take ABI 189 and 189D.
Analyze data and see if conclusions can be drawn.
Write report of results and submit.

**References**


Importance to self, society, and biology

This practicum project is very exciting for me because during my time at UC Davis, I have developed a fascination with reproductive technologies. In addition, I have always wanted a career in conservation, so working directly with the sperm of a critically endangered ungulate is not only great experience, but also uniquely synthesizes my interests. Currently I am participating in the Smithsonian-Mason Semester Program, a program through George Mason University and the Smithsonian Institution, in which undergraduates live at the Smithsonian Conservation Biology Institute in Front Royal, Virginia and take classes in applied conservation. I am literally living with some of the most endangered animals in the world as well as some of the most respected scientists. This project gives me the opportunity to take advantage of both, while doing something I am interested in, so I am extremely enthusiastic about it. In addition, I will get to learn techniques of collecting, manipulating, cryopreserving, and evaluating sperm, which will be marketable skills for a future career as a conservationist or reproductive scientist.

While captive breeding will not solve all the conservation problems on the planet, for the Dama gazelle in particular it is one of their only hopes for survival, and I feel privileged to be able to help solve this problem. The more scientists learn about the reproductive biology of endangered animals, the more efficient conservation efforts can become and hopefully we can reverse the rapid increase in extinction rates worldwide. The issue of extinction affects individuals and societies across the globe, so any small step, such as assessing the sperm morphology of a subspecies of gazelle, in the direction of solving the problem is a step that can have a lasting, positive impact.
ACADEMIC PLAN

Academic Interests Statement

My academic interests center on animal and habitat conservation. While I am interested in all animals, I am specifically fascinated by birds and mammals. Because I plan to work with these animals in captivity, I am interested in learning about their behavior and physiology. Additionally, I am fascinated by reproductive biology and would like to augment my laboratory skills in order to solve the problems faced when rare animals have difficulty breeding.

Therefore, I plan to take several classes in the areas of conservation biology, reproductive physiology, and behavior.

Restricted Elective Course List and Justifications

Neurology, Physiology and Behavior 102: Animal Behavior

This class would be helpful for me because I plan to work with captive animals, and to understand their behavior is vital for a successful relationship with them. In addition, knowing an animal's behavioral patterns will aid conservation efforts.

Wildlife, Fish and Conservation Biology 111: Biology and Conservation of Wild Birds

Since I am most interested in the conservation of both birds and mammals, this class would prepare me to understand the challenges facing conservationists working with birds. This is also something I am interested in as a career so it would be a valuable class for me to take.

Animal Genetics 107: Genetics and Animal Breeding

My proposed practicum is about how to improve the reproductive success of endangered, captive animals. Understanding how to make good breeding decisions is essential for anyone working in the conservation breeding field, like I would like to do.

Wildlife, Fish and Conservation Biology 154: Conservation Biology

Since conservation biology is the broad field in which I am interested in, this class will be vital for me. It seems a decent introductory course to the field, which is ideal for my proposed specialization.
Animal Science 129: Environmental Stewardship in Animal Production Systems

Conservation depends on the public doing the right thing, and all too often food animal producers are vilified and blamed for ruining the environment. Therefore I think this class would be an interesting perspective on how producers can be, should be, and are environmentally friendly to help conservation efforts.

Animal Science 123: Animal Growth and Development

This class would be an appealing supplement to my basic biology courses that never seem to go very deep into this topic. I would add to my understanding of reproduction by studying development patterns of animals in this class.

Wildlife, Fish and Conservation Biology 110: Biology and Conservation of Wild Mammals

This class would teach me about the broad topics and challenges facing conservationists working with mammals. Since this is a group I am interested in working with, this class would be very instructive for me.

Neurology, Physiology and Behavior 121: Physiology of Reproduction

My proposed practicum project is about the reproductive biology of male Dama Gazelles so this class directly applies. It would afford me the opportunity to study reproductive physiology more in-depth.
Proposed Course Schedule

Winter 2011
- General Physics 7B – 4 units
- Biological Sciences 2C: Biodiversity and the Tree of Life – 5 units
- Biological Sciences 101: Genes and Gene Expression – 5 units
- Animal Biology 189D: Senior Practicum Discussion – 1 unit

Total units: 15

Spring 2011
- General Physics 7C – 4 units
- Neurology, Physiology and Behavior 101: Systemic Physiology – 5 units
- *Neurology, Physiology and Behavior 102: Animal Behavior – 3 units
- Evolution and Ecology 101: Introduction to Ecology – 4 units

Total units: 16

Fall 2011
- Animal Biology 102: Animal Biochemistry and Metabolism – 5 units
- *Wildlife, Fish and Conservation Biology 111: Biology and Conservation of Wild Birds – 3 units
- *Animal Genetics 107: Genetics and Animal Breeding – 5 units
- *Wildlife, Fish and Conservation Biology 154: Conservation Biology – 4 units

Total units: 17

Winter 2012
- *Animal Science 129: Environmental Stewardship in Animal Production Systems – 3 units
- Evolution and Ecology 100: Introduction to Evolution – 4 units
- Neurology, Physiology and Behavior 123: Comparative Vertebrate Organology – 4 units
- Animal Biology 103: Animal Biochemistry and Metabolism – 5 units

Total units: 16 units

Spring 2012
- *Animal Science 123: Animal Growth and Development – 4 units
- *Wildlife, Fish and Conservation Biology 110: Biology and Conservation of Wild Mammals – 3 units
- *Neurology, Physiology and Behavior 121: Physiology of Reproduction – 5 units
- Viticulture and Enology 3: Introduction to Winemaking – 3 units (elective)

Total units: 15

*Total restricted elective units: 30

Total units for last 5 quarters: 79

Total units from first 6 quarters: 130

Transfer units: 29

TOTAL EXPECTED UNITS: 238 (would have to petition)
Bela Lugosi  
blugosi@ucdavis.edu  
(765) 198-7654

Permanent Address  
1828 76th Avenue SW  
Seattle, WA 98146

Birth Date: 10/20/1882

Campus Address  
609 Drake Drive #429  
Davis, CA 95616

Citizenship: United States Citizen

Statement of Purpose

My ultimate goal is to work in the field of conservation. I would like to be educated in the sciences of zoology and conservation and then use my knowledge to organize conservation efforts and to teach the public about them. I plan to accomplish this in a zoo or aquarium setting. Alternatively, I am interested in solving the problems of conservation through laboratory or field work, especially regarding reproduction and behavior. I believe that creating that personal connection between the public and a species is the best form of conservation education and my goal is to find a job in which I can help forge such a connection.

Education

University of California, Davis – Davis, CA  
2008 - present
  Major: Animal Biology  |  GPA: 3.25
  Expected graduation: Spring 2012
  Relevant Classes: Animal Biology 50A, B, C; Biological Sciences 2A, B, C; Statistics 13

Smithsonian-Mason Semester Program – Front Royal, VA  
Fall 2010
  Applied Conservation Studies at the Smithsonian Conservation Biology Institute

South Seattle Community College – Seattle, WA  
2006 - 2007

Work and Volunteer Experience

Birds Intern, Little Rock Zoo – Little Rock, AR  
2010
  • Maintained a variety of birds and hoofstock, including training and enrichment
  • Supervisor: Joseph Darcangelo, Hoofstock Curator

Student Assistant, UC Davis Animal Science Department – Davis, CA  
2010 - present
  • Monitored pregnant livestock, assisted with births, fed and cleaned animals, mentored students
  • Supervisor: Lisa Nash Holmes, Animal Science Teaching Coordinator

Wood Duck Intern, UC Davis – Davis, CA  
2010 - present
  • Monitored wood duck (Aix sponsa) nest boxes, collected and recorded data
  • Supervisor: Dr. John Eadie, Associate Professor

Field Day Coordinator and Species Leader, UC Davis Dairy – Davis, CA  
2009 - 2010
  • Taught students to train and show dairy cattle as part of Young Cattlemen’s Association
  • Organized all animals, judges, and volunteers for FFA judging competition
  • Supervisor: Doug Gisi, Dairy Facility Manager
Data Entry Clerk, Sound Community Bank – Seattle, WA 2009
• Digitized sensitive bank files and maintained customer accounts
• Supervisor: Dave Haines, Vice President of Technology and Communications

Volunteer, California Raptor Center, UC Davis – Davis, CA 2009
• Assisted with rehabilitation and release of raptors and maintenance of captive birds
• Supervisor: Brett Stedman, Raptor Center Manager.

Kidding Intern, UC Davis Goat Barn – Davis, CA 2009
• Responsible for care of young dairy goats, milk pasteurization and record-keeping
• Supervisor: Jan Carlson, Goat Barn Facility Manager

Intern, Woodland Park Zoo – Seattle, WA 2005 - 2008
• Assisted with office work, coordinated and scheduled volunteers, assisted visitors
• Handled reptiles, arthropods and raptors and presented educational programs
• Raptor care and presentation – one of two interns selected for assignment
• Husbandry, training, and enrichment of Lowland Anoa (Bubalus depressicornis)
• Bird banding – participated in mist net study of passerines
• Supervisor: Leathia Krasucki, Zoo Corps Coordinator

Skills
• Strong customer service skills
• Experience using Microsoft Office Suite
• Competent in Spanish
• Observant and responsible
• Experience with Artificial Insemination, semen handling and liquid nitrogen protocols

Awards and Accomplishments
• Recipient, Henry A. Jastro Scholarship at UC Davis
• Enrolled in Integrated Studies Honors Program – top 3% of admitted freshmen
• Certified Bovine Artificial Insemination Technician

References
Leathia Krasucki
Zoo Corps Coordinator, Woodland Park Zoo
601 N. 59th Street
Seattle, WA 98103
Mrs. Krasucki can attest to my skills with customer service, public speaking, responsibility and initiative.

Margaret France
Associate Instructor, University of California, Davis
180 Montecitio #306
Oakland, CA 94610
Ms. France can recommend me based on my academic achievement, work ethic, and intellect.

Gretchen Albrecht
Zookeeper, Woodland Park Zoo
601 N. 59th St.
Seattle, WA 98103
Ms. Albrecht is familiar with my work with animals and can provide a recommendation about my animal and observational skills, as well as my eagerness to take on extra projects.