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**University of Scranton
Faculty Research Committee
INTERNAL RESEARCH PROGRAM**

APPLICATION FORM/COVER SHEET

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<http://academic.scranton.edu/departments/ors/intres.pdf>*

NAME Gary Kwiecinski **DEPT.** Biology

Title of Proposal: The Bats of St. Vincent and the Grenadines: Biodiversity,
Biogeography, and Relationships to Bats of the Lesser Antilles.

Total amount requested: \$1,500.00 **Start date:** Apr. 15, 2005 **End date:** Aug. 26, 2005

Co-Investigator Names and Depts:

PROPOSAL CHECKLIST (*Please read attached Guidelines and Instructions before preparing your proposal.*)

- Abstract (1 page)
- Narrative (4 pages)
 - Objectives
 - Methodology
 - Relevance/Significance
 - Dissemination Plans
 - References
- Biographical Information (1 page)
- Budget and Budget Justification (*use attached budget form*)
- Plans for Continuation Funding/Additional Funding Sources
- Previous Internal Research Funding/Results
- Attachments
- Approvals (if necessary)
 - IACUC - date of approval _____
 - IRB - date of approval _____
- Original signed proposal and 4 copies

Signature of Principal Investigator (PI) 23 Feb 2005
Signature on File (mcl) *Date*

Submit original proposal and 4 copies to the Office of Research Services, Estate Room 221.

BUDGET FORM

PI name Gary Kwiecinski

	Amount
A. Salaries and Wages (<i>students and other personnel paid through University payroll</i>) – specify no. of hours and hourly wage	
A. Total Salaries and Wages	
B. FICA (<i>0.0765 x total salaries and wages</i>)	
C. Consultants and other Fee-for-Service Personnel (<i>personnel paid via check voucher</i>) - specify no. of hours and hourly wage	
C. Total Consultants	
D. Equipment Mist nets, Avinet (4 x \$70/net) Ringing Poles for mist net support (8 x \$30/pole)	\$280.00 240.00
D. Total Equipment	\$520.00
E. Supplies Head lights, fixatives, batteries, tapes, ropes, gloves, bags, etc.	300.00
E. Total Supplies	\$820.00
F. Travel (<i>itemize mileage, per diem, hotel, airfare</i>) Travel to St. Vincent for 2 @ \$900/ticket Lodging (@40/day/person x 14 days x 2 people) Meals (14 days, per diem @ \$42.00 x 2 people) Transportation on St. Vincent & to the Grenadines	\$1,800.00 1,200.00 1,176.00 800.00
F. Total Travel	\$4,896.00
G. Other	
Total Other	
H. TOTAL PROJECT COST	\$5,616.00
I. AMOUNT REQUESTED (<i>Max. \$1500 individual; \$2500 collaborative</i>)	\$1,500.00
J. Subtract I from H - If H is greater than I, explain how the additional expense will be covered.	\$4,216.00

Budget Justification – details and information about items included above. (Use additional page if necessary.)

The amount requested for equipment, supplies, and travel is reasonable considering total expenses for such travel. An associate (student) is physically necessary and the safe way to travel and work in unfamiliar settings. Additional expenses (travel) will be personally absorbed by the PI and student.

ABSTRACT

St. Vincent and the Grenadines, located in the southern Lesser Antilles, occupies an interesting zoogeographic position. It is positioned to receive species invading the Antilles from the south via Grenada, Trinidad and Tobago and the South American mainland and from Antillean endemic species to arrive from the north via St. Lucia. The endemic mammals (bats) of St. Vincent and the Grenadines are not well characterized and poorly understood. The literature of the bats of St. Vincent and the Grenadines is sparse and scattered, as is usual for most Caribbean islands. The purpose of this proposal is to seek funding, in part, for myself and a student, to participate in a survey of the bats of St. Vincent and the Grenadines during summer 2005. We wish to 1) Determine precisely which bat species presently inhabit St. Vincent and the Grenadines (a population and genetic survey to determine biodiversity and biogeography); 2) Determine which habitats bats are utilizing and to determine the health of captured bats on St. Vincent and the Grenadines; 3) Compare the anatomy and appearance of bats of St. Vincent and the Grenadines to bats from other islands of the Lesser Antilles; and 4) Determine relationships and origins of the bats from St. Vincent and the Grenadines using genetic data. Outcomes from this study will allow us to produce manuscripts on the bats of St. Vincent and the Grenadines, their relationships to other bats in the Antilles, and determine the extent of endemic species in the southern Caribbean. We will also be able to bring materials back to our respective institutions for further studies (e.g., undergraduate research). We will provide useful information to the government of St. Vincent and the Grenadines and provide for cultural and scientific exchange between participants.

NARRATIVE

Background

St. Vincent and the Grenadines, situated at the southern end of the Lesser Antilles in the Caribbean Sea (300 km from the northern coast of Venezuela), are volcanic islands, and have been affected by the activity of hurricanes, the volcano La Soufrière, and clearance of lands for agriculture. St. Vincent and the Grenadines occupies an interesting zoogeographic position. It is positioned to receive bat species invading the Antilles from the south via Grenada, Trinidad and Tobago and the South American mainland and from Antillean endemic species to arrive from the north via St. Lucia. The literature of the bats of St. Vincent and the Grenadines is sparse and scattered, but there are 12 known species (Vaughan and Hill 1996) and we (my colleagues and I) suspect four other potential species.

I believe that all of the species of bats currently on islands in the Caribbean region have arrived via over water migration rather than being the result of vicariance (the separation or division of a group of organisms by a geographic barrier, such as a mountain or a body of water, resulting in differentiation of the original group into new varieties or species). There has been a veritable plethora of recent investigations of mammalian fauna (bats) of the West Indies to the point that it is believed that the zoogeographic boundary of the West Indian subregion can now be defined with relative certainty. The boundary demarcating the West Indian Faunal subregion has been termed “Koopman’s Line”, in honor of the late bat biologist Dr. Karl F. Koopman (Genoways et al. 1998). Koopman’s Line limits the southern boundary for West Indian endemic bat species at St. Vincent. The Grenadines were excluded primarily because the bat fauna of these islands are poorly understood.

The purpose of this proposal is to seek funding, in part, for myself and a student, to participate in a survey of the bats of St. Vincent and the Grenadines during summer 2005. The survey to be completed will search for day-time roosts, survey foraging activity, and collect specimens for tissue, morphological and species (genetic) data. The data to be collected this summer, although a new and distinct study and data set, will also contribute to other ongoing studies related to the bat fauna of the Lesser Antilles (e.g., Pedersen et al. 2002). This project has participants worth noting: I am part of a “Team” that has been investigating bats in the Caribbean for decades and has recently been invigorated by new opportunities. The team includes Hugh Genoways, State Museum and the University of Nebraska; Scott Pedersen, South Dakota State University; and Robert Baker and Peter Larsen, The Museum, Texas Tech University. This year I am “on lead” for establishing a relationship with the Ministry of Agriculture, Forestry and Fisheries,

St. Vincent and the Grenadines, in order to acquire permits, and to make logistic arrangements for equipment, supplies, and an exchange of culture, ideas, and data.

Objectives

The proposed study of the bats of St. Vincent, Summer 2005, has the following objectives:

1. To determine precisely which bat species presently inhabit St. Vincent and the Grenadines (a population and genetic survey to determine biodiversity and biogeography).
2. To determine which habitats bats are utilizing and to determine the health of captured bats on St. Vincent and the Grenadines.
3. We wish to compare the anatomy and appearance of bats of St. Vincent and the Grenadines to bats from other islands of the Lesser Antilles.
4. To precisely determine relationships and origins of the bats from St. Vincent and the Grenadines using genetic data.

This last goal is important and deserves clarification. Two very interesting bats are common on St. Vincent: *Pteronotus* and *Artibeus*. But how did they get to the island and whom are they related to?

For *Pteronotus*, there are two possibilities: *Pteronotus* on St. Vincent may be a recent invasion from South America and we need to evaluate how they are related to other South American species.

Alternately, *Pteronotus* in the Greater Antilles may have expanded to the south, leaving a unique pattern of presence/absence along the various islands in the Lesser Antilles. The situation in *Artibeus* is very complicated as well. Presently, there are at least two species of *Artibeus* on the island but some unique genetic data collected in the 1990's (Phillips et al., 1991; Vaughan 1996) suggests there may be 4 species of *Artibeus* on St. Vincent: *planirostris*, *jamaicensis*, *schwartzi*, and *literatus*. If we can confirm this, it would mean a significant increase in Biodiversity on this island!

Methodology:

- 1) Identification of cave roosts and maternity colonies for the purposes of management. Collect bats (by hand or hand-held nets) and collect data from roost sites.
- 2) Capture bats (with mist nets) as they forage and commute through differing habitats.
- 3) All captured bats will be held until all nets are closed to prevent recapture and reduce stress. Data will be collected regarding body weight, forearm length, sex and reproductive condition, general health, and parasites. Some representatives will be held to be sacrificed humanely and data collected. Tissue samples will be prepared for genetic studies and DNA analyses (liver, blood, and muscle tissue fixed in lysis buffer) and the body will be fixed in formalin for further morphological characterization after museum preparation.

Relevance/Significance/Uses of Data:

- 1) Produce a scientific article "Bats of St. Vincent and the Grenadines" as we have done or are currently doing for The United States Virgin Islands, St. Kitts, Montserrat, Grenada, and Nevis.
- 2) Produce a second scientific article "Bats of the Grenadines and the Location of Koopman's Line" (Koopman excluded the Grenadines and Grenada as part of the West Indies fauna, claiming they are peripheral islands that lack endemic species of bats).
- 3) Once these data have been published, we can produce a full report to the Ministry of Agriculture, Forestry and Fisheries, St. Vincent and the Grenadines including all tables, figures and raw data, e.g., for management purposes.
- 4) In the future, materials and data will be incorporated with specimens from other islands to review the systematic relationship of several groups of bats including *Molossus molossus*, *Tadarida brasiliensis*, *Ardops nichollsi*, *Monophyllus plethodon*, *Pteronotus parnellii* and *Artibeus jamaicensis*.

References

- Genoways, H. H., C. J. Phillips, and R. J. Baker. 1998. Bats of the Antillean island of Grenada: A new zoogeographic perspective. Occasional Papers, Museum of Texas Tech University 177:1-28.
- Koopman, K. F. 1989. A review and analysis of the bats of the West Indies. Pp. 635-643, in Biogeography of the West Indies: Past, Present, and Future (C.A. Woods, ed.) Sandhill Crane Press Inc., Gainesville, FL. xvii + 878 pp.
- Pedersen, S. C., H. H. Genoways, Morton, M. Kwiecinski, G. G., Hadley, K., and R. Adams. 2002. Biogeography of the bats in the Northern Lesser Antilles: Recent census activity on Montserrat, Antigua, Nevis, and St. Kitts:1993-2001. Bat Research News 42:173.
- Phillips, C. J., D. E. Pumo, H. H. Genoways, P. E. Ray, and C. A. Biskey. 1991. Mitochondrial DNA evolution and phylogeography in two Neotropical fruit bats, *Artibeus jamaicensis* and *Artibeus literatus*. Pp. 97-123, in Latin American Mammalogy: History, Biodiversity, and Conservation (M. A. Mares and D. J. Schmidley, eds.), University of Oklahoma Press, Norman, xviii + 468 pp.
- Vaughan, N., and J. E. Hill. 1996. Bat (chiroptera) diversity in banana plantations and rain forest, and three new records for St. Vincent, Lesser Antilles. Mammalia 60:441-447.

Dissemination Plans

Manuscripts for submission to peer-reviewed journals will be prepared by the PI of this proposal and by his collaborators. The results will be presented at meetings, such as the annual meetings of the American Society of Mammalogists, North American Symposium on Bat Research, and the International Bat Research Conference.

Biographical Information: See attached ABBREVIATED CURRICULM VITAE

Budget and Justification: See attached BUDGET FORM

Funding plans

We have outlined an NSF proposal. We consulted with Dr. Susan J. Mazer, Director, Ecological Studies Cluster (BIO/DEB), NSF, who recommended we get permits/permission from international governments before submitting our proposal. We are currently requesting permission from the governments of Montserrat and St. Kitts and Nevis for experiments on their islands. We will apply to evaluate the extent to which bats migrate amongst islands and to determine if the process of immigration/emigration is primarily a function of stochastic (natural disasters) or deterministic (behavioral) events.

Previous Internal Research Funding/Results

Title: Endemic mammals and volcanic activity: Immediate effects on animal health, biodiversity, and dependent habitats..

DATE: *ACADEMIC YEAR 2003-2004, FUNDED APRIL, 2004.*

Amount: Funded \$1,500.

RESULTS: *1) KWIECINSKI, G. G., P. J. KELLY, AND W. COLES. STENODERMA RUFUM FOUND ON ST. CROIX: A NEW RECORD AND IMPLICATIONS FOR ZOOGEOGRAPHY OF THE VIRGIN ISLANDS. (IN PREPARATION)*

2) An honors student, Patrick J. Kelly (2007), is currently helping to process tissues for determination of effects of volcanic ash on soft tissues by applying histological techniques.

Approvals: N.A.

ABBREVIATED CURRICULUM VITAE for GARY G. KWIECINSKI

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EDUCATION:

1975 B.S., Biology, Cornell University, NY
1976 M.S., Physiology, Rutgers University, NJ
1984 Ph.D., Zoology, Cornell University

SELECTED PEER REVIEWED PUBLICATIONS:

1. Kwiecinski, G.G., D.A. Damassa and A.W. Gustafson. (1986) Control of Sex Steroid-Binding Protein (SBP) in the Male Little Brown Bat: Relationship of Plasma Thyroxine Levels to the Induction of Plasma SBP in Immature Males. *J. Endocrinol.* 110:271-278.
2. Kwiecinski, G.G., L. Krook and W.A. Wimsatt. (1987) Annual Skeletal Changes in the Little Brown Bat, *Myotis lucifugus lucifugus*, With Particular Reference to Pregnancy and Lactation. *Amer. J. Anat.* 178:410-420.
3. Kwiecinski, G.G., W.A. Wimsatt and L. Krook. (1987) Comparative Morphology of Thyroid C-Cells and Parathyroid Glands in Summer-Active Little Brown Bat, *Myotis lucifugus*, With Particular Reference to Pregnancy and Lactation. *Amer. J. Anat.* 178:421-427.
4. Kwiecinski, G.G., D.A. Damassa and A.W. Gustafson. (1987) Plasma Sex Steroid-Binding in Chiroptera. *Biol. Reprod.* 36:628-635.
5. Kwiecinski, G.G., D.A. Damassa and A.W. Gustafson. (1991) Patterns of Plasma Sex Hormone-Binding Globulin, Thyroxine and Thyroxine-Binding Globulin in Relation to Reproductive State and Hibernation in Female Little Brown Bats. *J. Endocrinol.* 128:63-70.
6. Steele, M. and G.G. Kwiecinski. (1994) Mammals of Pennsylvania: A Checklist with Notes on Status, Habitat, and Behavior. Pennsylvania Game Commission, Harrisburg.
7. Damassa, D.A., A.W. Gustafson, G.G. Kwiecinski and G.A. Amico. (1995) Seasonal Influences on the Control of Plasma Sex Hormone-Binding Globulin by T₄ in Male Little Brown Bats. *Amer. J. Physiol.* 268:R1303-R1309.
8. Kwiecinski, G.G. (1998) *Marmota monax*. *Mammalian Species*. 591:1-8.
9. Kwiecinski, G.G. and T. Griffiths. (1999) *Rousettus aegyptiacus*. *Mammalian Species*. 611:1-8.
10. Kwiecinski, G.G. and D.A. Damassa. (2000) Peripheral Control of Reproduction. Pp. 65-89, In: Reproductive Biology of Bats. Crichton, E. & P. Krutzsch, Eds. Academic Press, London. pp. 510.
11. Kwiecinski, G.G., L. Zhiren, T.C. Chen, and M.F. Holick. (2001) Observations on Serum 25-hydroxyvitamin D₃ and Calcium Concentrations in Wild-Caught and Captive Neotropical Bats, *Artibeus jamaicensis*. *Gen. Comp. Endocrinol.* 122:225-231.
12. Kwiecinski, G.G., M. Falzone, and E.H. Studier. (2003) Milk Concentrations and Postnatal Accretion of Minerals and Nitrogen in Two Phyllostomid Bats. *J. Mammal.* 84:926-936.
13. Kwiecinski, G. G. *Phyllostomus discolor*. Submitted to *Mammalian Species*.
14. Pedersen, S. C., H. H. Genoways, M. N. Morton, G. G. Kwiecinski, and S. E. Courts. Bats of St. Kitts (St. Christopher), Northern Lesser Antilles, with Comments Regarding Capture Rates of Neotropical Bats (Submitted to *Caribbean Journal of Science*).
15. Kwiecinski, G. G., P. J. Kelly, and W. Coles. *Stenoderma rufum* found on St. Croix: A New Record and Implications for Zoogeography of Bats from the United States Virgin Islands. (In preparation)

