Understanding Basic Biology of Mammalian Reproduction:

Growth, Development and Mother's Milk

by Gary Kwiecinski

University of Scranton

Summer 1999 Faculty Development Grant Proposal

established a breeding colony of these bats at The University of Scranton and, for several years, I have collected data for determining growth rates during neonatal development (Nebzydoski and Kwiecinski, 1997). One benefit of such activities has been the ability to supply the Bronx Zoo (Wildlife Conservation Colony) with animals that serve as "seed" bats for their colony of the same species. Despite their efforts, the Bronx Zoo had not been able to establish a breeding colony of this hardy species. I am now positioned for a unique opportunity to further my studies in this species concerning reproductive and life history characteristics, including maternal investment (milk production and composition) during growth and development of young. The value of such information is of interest to biologists in itself, and moreover, the applications and ramifications are far reaching. For example, in many natural populations of plants and animals, there is a critical need to maintain captive breeding populations as necessary refuges for declining world populations. In some instances, not enough has been known about basic life histories to make appropriate management decisions before it was too late for a particular species, as was the situation surrounding the extinction of Pteropodid bats on the Japanese islands (Kunz and Racey, 1998).

For all mammals, milk composition is physiologically controlled by the mother and its nutrient content may be correlated with the nutritional needs of the growing young. Because growth rates of mammalian young are linked with the ability of the mother to provide nutrients, milk composition and output may well represent the best measure of maternal investment during lactation in many mammals. In general, small mammals have large litter sizes and short lactation periods. Rodents, the most numerous small mammals, typically produce small litters that are weaned quickly at 30-44% of adult size (Millar, 1977); however, bats depart from typical small-mammal lactation

instrumentation and another 4-6 weeks to analyze my samples. With a summer faculty grant from The University of Scranton, I could accomplish training and analyze most, if not all, samples. These preliminary data could then be critical components for publications, grant proposals and to direct future research endeavors.

II. Methodology

Milk will be collected from lactating females in the colony at the University of Scranton after 4-6 hours of separation from pups (72 samples, or one sample each week from 6 - 8 lactating bats over a 12 week period; this is in progress as you read this proposal). Bats are hand-held (and cooperative--no anesthesia required), 100 microliters of oxytocin is given by intraperitoneal injection, and milk is expressed by manual massage into capillary tubes. Collected milk is stored in microcentifuge tubes at -80 C until analyzed. Oxytocin (the natural hormone of milk letdown, bovine source, purchased from Sigma Chem.Corp.) is given to insure a true sample of gland contents. Without oxytocin, milk in deep gland ducts will not be expressed.

Milk samples will be transported to the Nutrition Research Laboratory, National Zoological Park, Smithsonian Institute, Washington D.C., on dry ice. Analysis of milk samples for lipids, carbohydrates, nitrogen, protein, dry matter, and water will be by established standard methods (Oftedal and Iverson, 1995) for samples of adequate size and by testing new technology to miniaturize the assays even further. An inherent problem with the standard methods is the reliance on assays established for larger samples (100 ml – 1 liter) from humans and cows, whereas bat samples are typically much smaller (0.05 – 0.5 ml). Dr. Oftedal's lab recently

IV. Relevance/Utility/Impact

The data proposed to be collected this summer, are relevant in that they provide a large "piece of the puzzle" characterizing growth and development in this species. For years I have been collecting and accumulating physical data on growth and development of neonates. The milk analyses provide a measure of maternal contribution to growth and development, and, with the physical data, I can synthesize a detailed contribution to our understanding of growth, development and maternal investment in these bats, that have unusually large neonates, growth profiles and size at weanling. Also, the data collected will be used for future publication(s) and to prepare a major grant proposal for extramural funding. I have chosen to pursue this project because it offers excellent opportunities towards writing grant proposals with high chances for funding that include undergraduate student participation. In essence, the proposed activities are designed to increase the efficacy of my undergraduate teaching and my professional research programs. My teaching fertilizes my research and vice versa. I believe it is important for students to learn to apply modern analytical techniques to whole animal physiology so they can become aware of the multifaceted approaches to biological investigation.

V. Qualifications of the Applicant

VIII. Previous Grants

I have not received a University of Scranton Faculty Development Grant in the last three years.

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