E109 Scaling of hindlimb morphology and take-off performance in anuran amphibians

Jae Seung Shin*, Mi Hyun Kim, Jae Han Shim, and In-Ho Choi
Department of Life Science, Yonsei University

Anuran amphibians show geometric similarity over body mass (m), demonstrating smaller animals are miniatures of larger ones in body shape. Do they function similarly too? To answer the question, we examined hindlimb morphology and take-off capacity of four anuran species, *Rana nigromaculata, Bombina orientalis, Eleutherodactylus fitzingeri* and *Bufo typhonius*. The first two species were studied in Wonju, Kangwon-Do and the last two species were examined in the central Panama. *R. nigromaculata* and *E. fitzingeri* are powerful jumpers whereas the other two are slower hoppers. Morphological measurements included thigh muscle mass (TM, indicative of total muscle force) and hindlimb length (HL, determining acceleration distance). To gauge take-off capacity, take-off speed (v) and take-off angle (θ) were measured from video analysis, and jump distance (R) was calculated with an equation $R = v^2\sin2\theta/g$ (where g is the gravitational constant). The morphometric variables changed isometrically with m to the power of 1.05 – 1.09 for TM and 0.33 – 0.36 for HL, as reported previously. However, take-off response changed allometrically with m to the power of 0.11 – 0.14 for v and 0.24 – 0.31 for R, and 0.03 - 0.05 for $\sin2\theta$. Scaling exponents in each variable were amazingly similar among species despite 2.1 – 4.9 times difference in take-off capacity. Such allometric locomotory relations could be explained with a muscle power output model, in which v scales with $m^{0.11}$ and R with $m^{0.22}$. The empirical scaling exponents of R were a little greater than those predicted by the theory due to some factors additional to the morphological variables (e.g., take-off angle, subcellular attributes).

E110 Seasonal Biochemical Plasticity of Bats, *Murina leucogaster ognevi*

Mi Hyun Kim*, Yung Keun Oh, Noh-Pal Jung, Byoung Joo Gwag, Hyung-Cheul Shin, and In-Ho Choi
Department of Life Science, Yonsei University

Seasonal fluctuation of temperature and foods effects an annual cycle of activity to bats. Due to relatively high metabolic rates, flight and thermogenic activities are kept minimally during hibernation, but are restored in summer mostly for some portion of a day (dusk, dawn). To test a hypothesis that cellular and subcellular properties of muscles follow functional demands imposed on them which would vary seasonally, we examined myofiber size, glycolytic and oxidative catalytic capacities, and total protein content of the pectoral muscle in a bat species *Murina leucogaster ognevi*. We collected the bats in mid-hibernation (MH, February), end-hibernation (EH, April), and mid-summer (MS, August) to keep track the seasonal activity properties. Fiber cross-sectional area (mean $\pm$ 1SEM) was (579.5$\pm$ 70.1) in MH, (425.7$\pm$106.8) in EH, and (484.6$\pm$66.0) in MS. Total protein content decreased by 18.3% between MH and EH, but increased by 6.7% between EH and MS. Oxidative capacity (gauged by citrate synthase activity) and glycolytic capacity (lactate dehydrogenase activity) increased 100-200% as the season shifted from MH thorough EH to MS. Our results seem to demonstrate that the bats have there flied muscle weakened due to about 5 month disuse for hibernation but have the catalytic system functioning highly at the time of arousal.