80.1 VAN WASSENBERGH, S*; AERTS, P; Univ. Antwerpen; *sam.vanwassenbergh@ua.ac.be*

A computational modelling perspective on buccal expansion dynamics and water flow patterns in suction feeding fish

By performing a sudden expansion of the mouth cavity while approaching a prey, suction feeders generate a flow of water that draws the prey into the mouth. This process involves extremely unsteady flow, externally as well as internally of the expanding mouth cavity. Especially for flow patterns inside the mouth cavity and related dynamics (e.g. the forces, muscle power requirements and energetics for expanding the buccopharyngeal cavity) our current knowledge is largely based on modelling studies. An overview is given of our recent insights based on models of fish using the computational fluid dynamics (CFD) method. CFD shows a gradually developing boundary layer, which causes the highest velocity stream to be central in the expanding cavity, with peak velocities slightly posterior of the mouth aperture. Consequently, although related to size, the effects of viscous forces in the flow can generally not be neglected. The displacement of freely-suspended, non-reacting prey items by suction is entirely independent of the shape of the prey. Finally, the (hydro)dynamical consequences of opening of the opercular and branchiostegal valves are explored, since this distinguishes the unidirectional nature of suction feeding in fish from bidirectional suction feeding as observed in amphibians or turtles.

31.1 VANDENBROOKS, John M.*; MUNOZ, Elyse E.; WEED, Michael D.; HARRISON, Jon F.; Arizona State University; *jvandenb@asu.edu*

The Role of Atmospheric Oxygen in the Evolution of Insect Body Size

While not all models agree, most estimate that over the last 500 million years atmospheric oxygen has varied from 12% to 31%. The giant insects of the late Paleozoic occurred when atmospheric PO2 (aPO2) was hyperoxic, hinting at a role of oxygen in the evolution of insect body size. However, the paucity of the insect fossil record and the complex interactions between oxygen levels, organisms and communities have made it difficult to definitively accept or reject a historical oxygen-size link. We've carried out a unique combination of modern rearing and fossil studies to test this link. The results of our rearing studies support a link between oxygen and size: 1) most insects develop smaller body sizes in hypoxia, and some develop and evolve larger sizes in hyperoxia; 2) insects developmentally and evolutionarily reduce their proportional investment in the tracheal system when living in higher aPO2; and 3) larger insects invest more of their body in the tracheal system, potentially leading to greater effects of aPO2 on large insects. These provide mechanisms by which tracheal oxygen delivery may be involved in the small size of modern insects and hyperoxia-enabled Paleozoic gigantism. The results of our fossil studies also support the oxygen-size link: 1) the maximal and average size of *Protodonata* and *Paleodictyoptera* fossils correlate positively with modeled atmospheric oxygen, 2) *Blattodea* fossils showed little variation in maximum size, but average size was correlated with atmospheric oxygen, and 3) the giant arthropods, such as *Arthropleura* , are outliers to an overall pattern of oxygen-mediated body size change. These results strengthen the argument that atmospheric oxygen has played a role in the evolution of insect body size. Supported by NSF EAR 0746352.

7.4 VARNER, Johanna M*; DEARING, M. Denise; University of Utah; *johanna.varner@utah.edu*

Estimating Duration of Infection Using Antibody Avidity Assays: A Potential Limitation

The number of recent infections in a host-pathogen system is often reflective of the rate of transmission, or force of infection. Traditionally, laborious mark-recapture studies have been necessary to estimate duration of infection in wildlife. Recently, avidity assays have been used to infer age of infection at individual and population levels; however, these assays may be confounded by antibody concentration. We examined the effect of titer on an enzyme-linked immunosorbent avidity assay for Sin Nombre virus (SNV), a *Hantavirus* primarily carried by the deer mouse (*Peromyscus maniculatus*). Avidity indices were positively correlated with anti-SNV serum antibody titers in infected animals; experimental dilution of titer in the avidity assay significantly decreased avidity scores. Furthermore, 20% of samples, mostly older infections with low titers, were misclassified as recent infections. These results suggest that the avidity assay classifies samples with low titers (including some older infections and uninfected juveniles with dilute maternal antibodies) as recent infections regardless of actual infection history. As a result, the assay tends to overestimate the number of recent infections in a population, which may lead to falsely high estimates of public health risk.

S10.7 VÉZINA, F.; UniversitÃ© du QuÃ©bec Ã Rimouski; *francois_vezina@uqar.ca*

Cold acclimation, migration, and phenotypic compromises in a long distance migratory shorebird

Although there is considerable knowledge on wintering ecology of migratory shorebirds, little is known on phenotypic adjustments to cold and how this may interact with other constraints in species spending their winters at northern latitudes. In this talk, I will review our recent work on physiological adjustments in relation to winter and migratory constraints in a species well known for its phenotypic flexibility: the red knot (*Calidris canutus islandica*). *Islandica* are the northernmost wintering subspecies of knots, spending their winters on cold and windy mudflats of Western Europe and breeding in the Canadian and Greenlandic High Arctic. I will show how these birds improve their winter thermogenic capacity and cold endurance by simple body mass adjustments and how this may be compromised when conflicting wintering constrains are co-occurring. I will also discuss energy management strategies in these molluscivore birds during extended periods of winter fasting such as those associated with high tide and stormy winter weather. Finally I will present our recent work on gut reconstruction following migration to the Arctic breeding ground, asking whether this may constrain digestive capacity and explain an observed steady increase in basal metabolic rate over time.