



Aurora M. Nedelcu
Professor
Biology Department
University of New Brunswick
Fredericton, Canada

What does not kill you makes you more complex: The role of stress in the evolution of multicellularity, altruism and cancer

Part of our current research program is focused on developing and testing the hypothesis that the potential to increase in complexity is related to the ability to adaptively respond to various environmental challenges. This hypothesis predicts that mechanisms underlying cellular responses to stress have been co-opted into new traits instrumental to the evolution of more complex biological systems. This idea is imported from cybernetics and is in accordance with Ashby's Law of Requisite Variety, which states that in order to achieve complete control, the variety (i.e., diversity) of actions a control system should be able to execute must be at least as great as the array of environmental perturbations that need to be compensated. However, the same hypothesis also predicts that the loss of complex traits (such as during the de-differentiation processes associated with cancer initiation) can result in decreased ability to withstand stressful environments. I will discuss our work on the evolution of multicellularity and somatic cell differentiation (i.e., a form of reproductive altruism) in the volvocine green algal lineage, from the point of view of the mechanistic basis for the co-option of stress responses present in their unicellular ancestors as well as the "internalization" of external/environmental stress into new developmental pathways.