

The re-cycle of life and its cast of characters.

Which came first the butterfly or the caterpillar? The frog or the tadpole? The mystery of metamorphosis, the remarkable transformation of a larva into a juvenile has long fascinated humankind. How can one animal evolve such different forms in the same life cycle? How are transitions between these sometimes very different forms orchestrated? How did these different forms evolve from simpler ancestors?

In an attempt to address such fundamental and frequently-asked questions, an international contingent of scientists will be gathering next January at a symposium called "Metamorphosis: A multi-kingdom approach." Part of this year's annual meeting of the Society of Integrative and Comparative Biology, this symposium will feature presentations from biologists representing a wide variety of disciplines to compare life cycle characteristics among a correspondingly wide diversity of life forms. Andreas Heyland (Whitney Laboratories), Jason Hodin (Hopkins Marine Station) and Cory Bishop (Kewalo Marine Laboratories), the symposium organizers, assert that discoveries of new and exciting similarities among life cycles of organisms as different as slime molds and sea squirts warrant a fundamental rethinking of our views on these subjects. The diversity of organisms that are to be discussed in this symposium and associated presentations is unprecedented. Nevertheless, the organizers are confident that the broad fascinating similarities among these organisms will help to create focused evolutionary hypotheses and lead to productive collaborations in the future.

Such similarities also suggest the following question: Why does the history of life involve so much repetition? For example, a simple gas called nitric oxide controls when the mustard plant *Arabidopsis thaliana* begins to make flowers. Surprisingly, this same molecule has been found to exert similar control over the metamorphoses of several marine creatures, as well as fungi and other simple life forms. Why is the same molecule used in a similar way in vastly different organisms? Such topics will be on the discussion table at the symposium.

Other questions about life cycles are not strictly academic. Hormones are universal and important molecules that regulate growth and normal functioning of animals, plants and even fungi. Animals as distantly related as frogs and sea urchins depend upon the same hormonal signals to control the timing of their metamorphoses. Amazingly, larvae of sea urchins and their evolutionary cousins, sand dollars, get these hormones from their diet. This is an example of the direct and profound connection between the environment and the proper progression of the life cycles of all organisms. It is well known that many chemicals, including industrial pollutants and insecticides can mimic naturally occurring hormones. Such pollutants can actually change the timing of metamorphosis, with potentially drastic consequences. A greater understanding of the diversity of organisms whose life cycle transitions depend upon known hormones and other important internal signals is critical to assessing such concerns. The long term outcome of these types of studies could contribute to a scientifically based policy for controlling the release of such pollutants.

For now, however, Heyland, Hodin and Bishop (from Switzerland, USA and Canada, respectively) will have their hands full trying to coordinate a productive gathering of scientists from different backgrounds and perspectives. This ambitious symposium and associated presentations may help to unravel answers to some long held mysteries about the evolution of life on earth.