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Adaptation, constraint, and development

Thursday 29 November 2012 1pm

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Gould Seminar Room (Room 235) Gould building, 116 Daley Road, ANU



The footprint of adaptation, in the fit between organismal form and function, is one of the most striking and obvious patterns in nature. Practically any part of an organism has features that can be explained as reflecting adaptation. Criticising this practice, in 1979 Gould and Lewontin published their famous essay on the “Spandrels of San Marco.” Following this paper, biologists became more circumspect in devising their explanations of organismal features and became more sensitive to the possibility that a feature might not be adaptive. The most common non-adaptive explanation is “constraint.” However, though Gould and Lewontin emphasized the importance of constraint, they didn’t explain how it should be studied. I will discuss the various practices that have sprung up in the last 30 years to fill this gap and provide the missing framework for testing hypotheses of adaptation and constraint. I will show how, as part of this framework, more and more biologists are turning to studies of developmental potential in testing hypotheses of adaptation and constraint. They come from all perspectives in the study of adaptation, including quantitative genetics, comparative biology, ecology, and embryology, but all converge on similar reasoning. To show how this development-based reasoning works, I briefly outline how

inferences of adaptation and constraint are constructed, and illustrate my points from my work on the (adaptive) scaling between the cells that conduct water in flowering plants and overall plant size. I finish by suggesting that this perspective shows that no one orientation in the study of adaptation or constraint (e.g. quantitative genetics, comparative studies, optimality studies) is the definitive one, but that all provide necessary and complementary information.

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