**Trans-generational epigenetic inheritance in living and digital hyenas**

A Progress Report submitted by Kay Holekamp & Risto Miikkulainen

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During the past decade, epigenetically-mediated developmental plasticity has come to represent a critical aspect of evolutionary developmental biology, and computer scientists have also recently started to appreciate the implications of epigenetics for machine learning and robotics. In both biological and computational systems, epigenetically-mediated developmental plasticity can bias evolution and enhance evolvability. In fluctuating environments, epigenetic modification can theoretically permit young mammals to enhance their fitness by adjusting their phenotypes to match the environment they will experience at independence. Here we are combining field and lab-based study of wild spotted hyenas with evolution *in silico* of digital hyenas to test a hypothesis suggesting that epigenetic mechanisms match offspring phenotypes to current environmental conditions, and thereby permit crossing of fitness valleys imposed by fluctuating environments

Although our funding for this project has now been in force for only a few weeks, we have nevertheless made considerable progress. Holekamp is currently teaching a graduate class entitled “Epigenetic mediation of complex phenotypes” (IBIO822); the enrollment is 16, including several BEACON students in both biology and computer science. In the Holekamp lab, both Zach Laubach and Kevin McCormick are working on epigenetic mediation of various aspects of the behavioral phenotype in spotted hyenas. Both are making excellent progress, and in fact both Zach & Kevin recently gave talks at the 2015 BEACON Congress (references appear below). In addition Kevin also recently (Fall 2015) gave a lecture in IBIO415 (Behavioral Ecology) entitled "Plasticity, Epigenetics and Personality.” Instead of Elliot Meyerson, who had been specified in our original proposal as the grad student at Texas who would be supported by these BEACON funds, Miikkulainen has recruited Jason Liang to participate in the epigenetics project. Zach Laubach is currently being supported at MSU by BEACON funds so he can divide his time between MSU and the epigenetics lab at the University of Michigan. Zach is also currently preparing a F31 proposal for submission to NIH this fall entitled “Early-life social environment determinants of adult physiological and behavioral stress response and the mediating role of DNA methylation.” Three different NIH program officers have been very encouraging when Zach asked them about the appropriateness of submitting his proposal to their study sections. On the other hand, Holekamp submitted a NSF preproposal on epigenetic mediation of hyena phenotypes, but that was promptly declined, saying we should be studying such phenomena in lab rats rather than wild hyenas.

Laubach, Z. M. Laubach, Faulk, C., Dolinoy, D & Holekamp, K.E. (2015) Measuring glucocorticoid receptor DNA methylation in spotted hyenas. Platform presentation given at 2015 BEACON Congress.

McCormick, S.K. & Holekamp, K.E (2015). Social Development of Personality Traits in a Gregarious Mammal. Platform presentation given at 2015 BEACON Congress.