

Center for Biocomplexity Colloquium

Johannes Knabe

**Adaptive Systems Research Group
University of Hertfordshire, UK**

***“Evolution and Morphogenesis of Differentiated
Multicellular Organisms: Autonomously Generated
Diffusion Gradients for Positional Information”***

Wednesday October 8, 2008

4:00pm

229 Hayes-Healy Center

****Tea at 3:30pm****

Development is the powerful process involving a genome in the transformation from one egg cell to a multicellular organism with many cell types. The dividing cells manage to organize and assign themselves special, differentiated roles in a reliable manner, creating a spatio-temporal pattern and division of labor. This despite the fact that little positional information may be available to them initially to guide this patterning.

Inspired by a model of developmental biologist L. Wolpert, we simulate this situation in an evolutionary setting where individuals have to grow into "French flag" patterns. The cells in our model exist in a 2-layer Potts Model physical environment (using CompuCell3D, developed at Indiana University and Notre Dame).

Controlled by continuous genetic regulatory networks, identical for all cells of one individual, the cells can individually differ in parameters including target volume, shape, orientation, and diffusion. Intercellular communication is possible via secretion and sensing of diffusing morphogens.

Evolved individuals growing from a single cell can develop the French flag pattern by setting up and maintaining asymmetric morphogen gradients - a behavior predicted by several theoretical models.