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Abstract for an Invited Paper
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Geometry Genetics and Evolution[1]

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Darwin argued that highly perfected organs such as the vertebrate eye could evolve by a series of small changes, each of which conferred a selective advantage. In the context of gene networks, this idea can be recast into a predictive algorithm, namely find networks that can be built by incremental adaptation (gradient search) to perform some task. It embodies a "kinetic" view of evolution where a solution that is quick to evolve is preferred over a global optimum. Examples of biochemical kinetic networks were evolved for temporal adaptation, temperature compensated entrainable clocks, explore-exploit trade off in signal discrimination, will be presented as well as networks that model the spatially periodic somites (vertebrae) and HOX gene expression in the vertebrate embryo. These models appear complex by the criterion of 19th century applied mathematics since there is no separation of time or spatial scales, yet they are all derivable by gradient optimization of simple functions (several in the Pareto evolution) often based on the Shannon entropy of the time or spatial response. Joint work with P. Francois, Physics Dept. McGill University.

[1]With P. Francois, Physics Dept. McGill University