

# Cologne Evolution Colloquium

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Molecular Basis of  
Evolutionary Innovations

SFB 680

## Gene Duplication and Metabolic Pathways: Learning the Rules of Evolution

My research group has a fundamental interest in understanding the processes driving the lineage-specific functional divergence of genomes, which becomes possible when mechanistic models rooted in biochemistry and evolutionary/population genetic processes are developed. Studies on two sub-problems will be described. Gene duplication is a fundamental process that enables rapid molecular diversification of protein sequences. Following a discussion of analyses of mammalian genomes together with the recently sequenced Atlantic salmon genome, new mechanistic models for duplicate gene retention will be presented. Recent improvements in our models include explicit treatment of non-fixed duplicates differently from fixed duplicates and characterization of probabilities of retention under six processes: non-functionalization, and then non-functionalization plus neo-functionalization, sub-functionalization, dosage balance, and lastly, with dosage balance as a transition state to subsequent sub-functionalization and dosage balance to neo-functionalization.

A second problem we will examine is the co-evolution of enzymes in metabolic pathways, where selection acts on pathway function. We describe the important role of mutation-selection balance in describing the evolutionary dynamics and present some statistical approaches that may enable differentiation between inter-molecular compensatory evolution and directional change in pathway function. Lastly, new results show how such dynamics are influenced by the gene duplication process, introducing new enzymes to pathways according to both the patchwork and retrograde models for pathway evolution.

Thursday, January 21, 2016, 17:00  
University of Cologne, Institute for Genetics  
Seminar Room 0.46

Hosted by Michael Lässig