SFB 680

MOLECULAR BASIS OF
EVOLUTIONARY INNOVATIONS

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The Virus World: Evolution of viruses and antivirus defense

Emergence of genetic parasites is germane to evolving systems of replicators, and accordingly, virus-like selfish agents most likely antedate full-fledged cells in the evolution of life. Viruses have comprised one of the two fundamental types of organisms throughout the course of evolution, and so the entire history of life is a story of virus-host arms race and cooperation. The genomic and biological diversity of viruses is still under-appreciated as illustrated by the recent discovery of giant viruses and their own distinct mobilomes. All cellular life forms have evolved complex, multilayer systems of antivirus defense that account for a substantial portion of the genome even in simple prokaryotes. These diverse defense systems function on one of the three general principles: i) innate, non-specific immunity; ii) adaptive, specific immunity; iii) programmed cell suicide or dormancy induced by infection. Comparative genomic analysis shows that in bacterial and archaeal genomes, genes encoding innate and adaptive immune systems are invariably associated with genes encoding toxin-antitoxin systems that induce dormancy or suicide. Hence the immunity-dormancy/suicide coupling hypothesis according to which antivirus response in prokaryotes involves key decision-making steps when the cell chooses the path to follow by sensing the course of virus infection. The recently discovered CRISPR-Cas system of adaptive immunity presents a clear-cut case of an environmental sensor that evolves under the Lamarckian evolutionary paradigm. I will present results of mathematical modeling that identify the conditions under which Lamarckian evolution is feasible.

April 30, 12:00

Institute for Genetics, Zülpicher Str. 47a, Lecture Hall, 4th Floor

Host: Michael Lässig

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