



January, 2017:

Master Thesis: Functional aspects of protein evolution

We are looking for highly motivated master students who are interested to study **molecular mechanisms of evolution**. We offer an interdisciplinary project that connects sequence evolution und structural biology and is performed in close cooperation with the group of **Prof. Scheidig (Structural Bioglogy)** in the lab of **Prof. Ober (Biochemical Ecology and Molecular Evolution)**. The candidate will work on the evolution of the enzyme homospermidine synthase (HSS). HSS is involved in the biosynthesis of secondary metabolites in plants and HSS originated by **gene duplication** from deoxyhypusine synthase (DHS). At the moment we focus on the evolution of HSS in the Morning glory family.

Background:

Gene duplication is besides *de novo* gene birth an important source for the evolution of novelty. Duplicated genes can basically experience three fates: neofunctionalization, subfunctionalization, and nonfunctionalization. Various models have been developed to predict the probabilities of these three fates. The following two reviews give a clear and comprehensive introduction into these models and ideas: Innan et al. (2010) and Andersson et al. (2015). However, we propose a strong link between the fate of a duplicated gene and the quaternary structure of the encoded proteins. This concept is known as **paralogue interference**, which nicely can explain the evolution of HSS (Kaltenegger et al. 2013, Kaltenegger et al. 2015). We now want to test this new idea in more detail and this is where you will come into action.

Objective of the master thesis

Functional analyses of protein interactions between HSS and DHS. You will use methods like **cloning, heterologous expression of proteins in *Escherichia coli*, protein purification, and western blot**. In addition to the lab work you will also have the opportunity to **generate, analyse and interpret homology models of HSS and DHS *in silico*** to support your experimental findings theoretically.

If you are interested, please contact Elisabeth Kaltenegger ekaltenegger@bot.uni-kiel.de or Christina Hopf chopf@strubio.uni-kiel.de.

Literature:

The evolution of gene duplications: classifying and distinguishing between models. Innan et al., 2010. Evolution of New Functions De Novo and from Preexisting Genes. Andersson et al. 2015. Evolution of homospermidine synthase in the Convolvulaceae: a story of gene duplication, gene loss, and periods of various selection pressures. Paralogue interference affects the dynamics after gene duplication. Kaltenegger et al. 2015.