

Evolution of social gene complexes

Supervisory team:

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Project description:

Social interactions can have profound impacts on the success of an organism. In many systems, the genes governing these interactions appear in clusters within the genome. This pattern is seen for imprinted genes (where individuals all use only the copy of the gene received from either their mothers or fathers) in mammalian genomes, which are known to govern a range of social traits such as parental care and social dominance.

Clustering of genes also appears to be a primary feature of 'greenbeard' loci, which are regions of the genome that allow individuals to direct benefits from social interactions towards other individuals who carry copies of the greenbeard (or direct harm to those who do not). For example, our work on the social amoeba *Dictyostelium discoideum* has demonstrated that the multigenic Tgr locus acts as a greenbeard that governs which genotypes a given genotype will cooperate with.

The goal of this project is, therefore, to understand the evolutionary processes that build and shape these gene clusters. It is likely that the evolutionary processes that produced these genomic patterns are driven by the interplay between conflict and cooperation between genes in relatives, along with interactions between genes within individual genomes. We will address this problem by developing theoretical models that will be tested using genome sequence data. From the modelling side, we will build on models of social evolution and evolution of gene networks, the latter of which allows us to also consider the potential roles of 'non-social' molecular and mechanistic phenomena that provide alternative explanations.

This novel theory will be tested by developing predictions that can be assessed using genomic datasets (including both publicly available and sets generated in our Lab). We will use both analytical (mathematical) and computer-based approaches for the modelling, but do not expect prospective students to necessarily have a background in maths or computer science.

The training plan integrates the necessary computational and mathematical skills to prepare students with a wide range of backgrounds for successful completion of this project.