# BIOL/GNET 645: Quantitative Genetics of Complex Traits (1 credit)

<u>January 19 – February 11, 2014</u>   Instructors: Daniel Pomp and guest lecturers

Students will learn about various topics that form the basis for understanding Quantitative Genetics of Complex Traits with biomedical, agricultural and evolutionary relevance. The ultimate goal of quantitative genetics in this post-genomic era is prediction of phenotype from genotype, namely deducing the molecular and physiological bases for genetic trait variation.

Topics to be covered include:

• Basic principles of population and quantitative genetics
• Selection theory and applications in research, agriculture and evolution
• Partitioning of Genetic Variance: additive, dominance, epistasis, heritability, correlations
• QTL Detection: linkage, association, mouse models, other animal/plant models, human GWAS
• Advanced Partitioning of Quantitative Genetic Variance: eQTL, mQTL, pQTL, Networks, Systems Genetics
• Applications of Quantitative Genetics: detecting selection sweeps, whole genome selection, human risk prediction
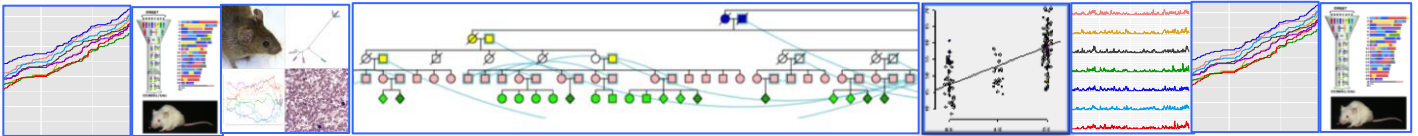

BIOL/GNET 646: Principles & Experimental Approaches of Mammalian Genetics (1 credit)

<u>February 13 – March 20, 2014</u>   Instructors: Scott Bultman & Fernando Pardo Manuel de Villena

This module will focus on the laboratory mouse as a model organism to learn fundamental genetic concepts and understand how experimental approaches are being used to elucidate gene function and genetic architecture of biological traits. For Mendelian traits, the emphasis will be on gene-targeting and genetic screens. For quantitative genetics, there will be an emphasis on the genetic diversity of mouse strains and how this can be exploited to identify the molecular basis of complex traits. A common theme linking both parts of the course will be the development and analysis of mouse models of human disease for understanding basic mechanisms and starting translational studies in pre-clinical settings. There will also be a weekly recitation session where students assigned readings and problem sets with the Teaching Assistant.

Topics to be covered include:

• The laboratory mouse as a model for mammalian genetics   • Knockouts, knock-ins, and conditional knockouts
• Genetic Reference Populations: the Collaborative Cross   •Epigenetics
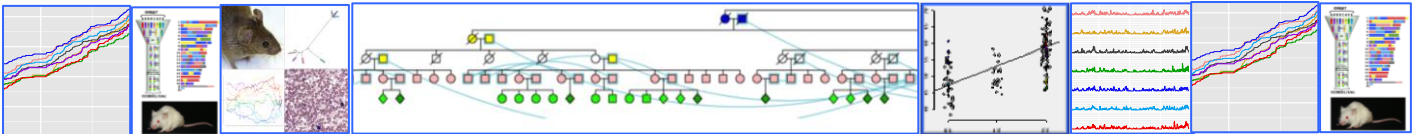
BIOL/GNET 647: Human Genetics and Genomics (1 credit)

<u>March 25 – April 24, 2014</u>   Instructors: Karen Mohlke and guest lecturers

This module will focus on the principles and modern approaches of human genetics and genomics. Analysis of human genetic variation is used to understand the fundamental concepts of genetics. This module covers current research methods for analysis of gene function and genome regulatory elements, focusing on the genetic architecture of complex human traits and diseases. The molecular basis of specific genetic disorders and the identification of specific disease variants will be used to illustrate key points. In a weekly recitation session, students will discuss assigned readings and problem sets with the Teaching Assistant.

Topics to be covered include:

• Human genetic variation in individuals and populations   • Genome-wide linkage and association analyses
• Exome and genome sequencing in monogenic and complex human traits   • The Haplotype Map, 1000 Genomes, ENCODE and RoadMap Epigenomics Projects   • The molecular basis of human complex traits and diseases   • Current research in medical genetics and cancer genomics

There are two lectures per week (Tuesdays and Thursdays, 12:30-1:45 PM); the material covered in lectures is reinforced through readings of research and review articles. A previous course in genetics is helpful, but is not absolutely required.