Experimental Precision Medicine:

Current Status of Resources and Tools, and Near-term Prospects

Abstract: Mendelian genetics is the study of single gene variants associated with specific traits. Systems genetics is the analysis of many gene variants, networks of interacting traits, and multiple environments. And **experimental precision medicine (EPM)** is the application of systems genetics to human health and disease. The rate limiting step in EPM is acquiring massive phenotype data sets (phenomes) that can be used to systematically study genome-to-phenome (G2P) mechanisms and gene-by-environmental interactions. (GXE) This is particularly hard to do in human cohorts because individual humans cannot be replicated in an experimentally controlled setting (e.g., gene expression in hippocampus following stress). In the case of mice and rats, this is now practical and we can begin a program in EPM. We have acquired and curated thousands of clinically relevant traits for large families of rodents. Many teams of investigators have also generated massive omics data for families of hundreds of strains of highly diverse lines of mice and rats that model some of the complexity of human populations. These animal resources and related data sets promise to revolutionize our ability to deliver personalized and predictive health care to humans. In this talk I will review how exciting new resources are being used to study brain function, aging, diet effects, and disease risk. I will also introduce a powerful on-line resource called GeneNetwork (gn2.genenetwork.org) that is used for EPM and systems genetics research.