

Title: O fly where are thou?

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Abstract: Genomic technologies such as microarrays and short-read sequencing have revolutionized our understanding of the structure of genetic variation in natural populations, and have led to the identification of many interesting associations between genomic regions and common human diseases. Understanding the map from genotype to phenotype more generally remains a difficult problem, and intermediate phenotypes such as expression, methylation, transcription factor binding site occupancy and histone marks are now routinely measured to help elucidate the map. Many interesting statistical and computational questions are raised by large-scale data such as these.

In this talk I will focus on the phenotype end of the problem, with particular reference to behavioural studies of the model organism *Drosophila melanogaster*. We have developed a tracking system that allows us to follow individual flies in a group at real time rates for many days [1]. We can also track tissue- specific fluorescent reporter expression in multiple transgenic flies simultaneously as a measure of their target gene expression using visible light, GFP fluorescence and DsRED fluorescence [2,3]. The movement of multiple flies can be tracked accurately at real time rates, while simultaneously assaying the expression level of two different transgenes marked with GFP and DsRED. The individual flies can be tracked accurately and distinguished even during periods when transgene fluorescence was undetected.

I will give an overview of our approach, describe some of the statistical and bioinformatic aspects of the analysis of tracking data, and illustrate some applications, including circadian behavior of gene expression, courtship and aging. Time permitting, I will outline some of the future developments of this system and its use for behavioral genetics studies.

References:

- [1] Grover D, Tower J, Tavaré S: O fly, where art thou? *J R Soc Interface* 2008, 5:1181-1191.
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- [3] Grover D, Yang J, Ford D, Tavaré S, Tower J: Simultaneous tracking of movement and gene expression in multiple *Drosophila melanogaster* flies using GFP and DsRED fluorescent reporter transgenes. *BMC Research Notes* 2009, 2:58.