# Genes, Neurons, and Circuits Underlying the Reproductive Behavior in Drosophila (Advanced Studies on Sustainable Animal Production: Interrelationships among Human, Animal and Environment, 8th International Symposium of Integrated Field Science)

# 1-4. Genes, Neurons, and Circuits Underlying the Reproductive Behavior in *Drosophila*

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Instinct is organized by genetic programs that preconfigure the appropriate neural circuitry. Genetic dissection in model organisms thus has the potential to reveal the genes, neurons, and circuits underlying such behaviors, allowing us to determine the principle for instinct. With this goal in mind, we are studying the male courtship ritual of *Drosophila melanogaster*. This instinctive behavior is specified by the male-specific products of the *fruitless* (*fru*) gene, Fru, which are expressed in ~ 2000 cells in the male central nervous system. The *fru* mutant males show enhanced intermale courtship, with a concomitant decline in the activity to court to and copulate with females. The enhanced homosexual courtship in *fru* mutant males is considered to result from de-masculinization of a part of the brain due to loss-of-function of the *fru* gene. In fact, some *fru*-expressing neurons are sexually dimorphic in their numbers and projections. These neurons are completely feminized in males who are loss-of-function *fru* mutants. To understand molecular and cellular bases of Fru functions, we performed genetic screening for modifiers of *fru*, with the aim at determining their cofactors and targets. We show evidence that the *longitudinal lacking* (*lola*) gene genetically interacts with *fru* to generate neural sexual dimorphism and therefore contributes to gender specificity of behavior. This gene produces an enormous numbers of different BTB-Zn finger transcription factors through alternative splicing of its primary mRNA, and likely to function as a major regulator of axon patterning by controlling expression of multiple guidance molecules such as Slit and Robo.