The neural circuitry contributing to male courtship behavior of *Drosophila*

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Tinbergen defined that fixed-action patterns of animal behavior are generated by the innate releasing mechanism (IRM), although the cellular components of this mechanism remain poorly understood. Male courtship behavior of *Drosophila melanogaster* is composed of several distinct steps. The pattern of each motor act is invariable across individuals, and hardly affected by experience. Therefore, the neural system that generates the courtship behavior in *Drosophila* has been regarded as a prototype of the IRM. The major part of the circuitry for male courtship is composed of neurons expressing *fruitless* (*fru*), a gene encoding a putative transcription factor prerequisites to sexual differentiation of the neural circuitry. Using heat-activatable TRP channel (dTrpA1), we found that artificial activation of entire sets of *fru*-expressing neurons is sufficient for triggering a complete series of courtship behavior even when they were placed singly in a chamber. By reducing the number of neurons expressing dTrpA1 channels by mosaic analysis, we found that the initiation of courtship behavior is significantly correlated with the activation of a subset of *fru*-expressing neurons, i.e., the trans-midline P1 interneurons or descending P2b interneurons. These observations suggest that these neurons are the prime components of IRM that initiate courtship in *Drosophila* males.