The *Drosophila FoxP* gene is required for operant self-learning: Implications for the evolution of language acquisition

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1. **Summary**

   - FoxP proteins regulate operant self-learning, a behavioral strategy in development that allows an organism to improve behavior through repeated practice. In operant self-learning, the organism learns to associate a specific outcome (e.g., reward) with a particular behavior (e.g., key pressing). This process involves the formation of a habit, which is a learned, automatic response to a stimulus.
   - The present study investigates the role of the *Drosophila FoxP* gene in operant self-learning. The authors found that mutations in the *FoxP* gene affect operant self-learning, and that these effects are specific to the *FoxP* isoform B.

2. **Conceptual language learning**

   - Preferred outcome → Comparator → Outcome perceived → Behavior produced → Error signal → Motor system

3. **The FoxP gene family tree**

4. **The Drosophila FoxP gene locus**

5. **Characterizing three insertion lines**

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**Figure 1:** Conceptual architecture of operant feedback loops. The motor system generates a behavior, which is associated with an outcome. If the outcome is rewarding, the behavior is reinforced and becomes more likely to be repeated in the future. If the outcome is not rewarding, the behavior is less likely to be repeated. This process allows the organism to learn and adapt to its environment through repeated practice.

**Figure 2:** The insect FoxP orthologues suggest the ancestral form of the FoxP gene is conserved among different species. The figure shows the genomic structure of the *Drosophila* FoxP gene locus and the expression patterns of the three isoforms. B - Flight performance tests show that only line 3955 is capable of normal flight performance. A - RT-PCR results using the primers as described in Fig. 3. The three lines show marked differences in the expression of the FoxP isoforms B and C.