CDB SEMINAR

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16:00~17:00 A7F Seminar Room

Shielding up!
Molecular basis of beetle wing evolution

Summary

Morphological innovation is a fundamental process in evolution, yet its molecular basis remains elusive. Coleoptera (beetles) is one of the most successful animal groups on the planet, accounting for over 20 percent of extant animals. Acquisition of elytra, highly sclerotized and modified forewings, is an important innovation that has driven the successful radiation of this insect order.

Our previous analyses using the red flour beetle (*Tribolium castaneum*) have revealed that (i) Hox genes, chief identity selector genes, are not involved in the modification of the elytron, hence the elytron represents a Hox-free "default" state in beetles, (ii) a Hox gene, *Ultrabithorax* (*Ubx*) instead cancels the modification in the hindwing, maintaining a rather typical insect wing morphology.

To gain further insight into the molecular basis of elytron evolution, we have analyzed elytron development in detail in *Tribolium*, with a significant focus on two prominent features of the elytron, its exoskeletalized surface and its unique shape. In regard to the exoskeletalization, we found that the heavy exoskeletalization of the elytron has been achieved by multiple co-options of the exoskeletalization pathways into the conserved wing gene network. These co-options occurred at least three times, under the regulation of *apterous* (*ap*, the dorsal selector gene), the sensory pathway, and the vein pathway. These sequential and repeated co-options appear to have strengthened an advantageous trait in the beetle lineage. In regard to the unique elytron shape, we recently identified *abrupt* (*ab* a BTB Zn finger transcription factor) as a critical component in determining the unique shape of beetle elytra. *ab* appears to have gained a new shape-related function during elytron evolution. In both cases, these wing genes have gained novel functions without compromising the conserved wing-related functions. Gaining a new function while maintaining evolutionarily conserved functions appears to be a key theme in the evolution of morphologically novel structures.

In this talk, I will discuss our current model for the evolution of beetle elytra. In addition, in the course of analyzing genes important for elytron evolution, we have obtained several interesting insights into the evolution of insect wings and wing veins. If time permits, I will also discuss these findings.

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