Concurrent session 6: Evolution of complex body plan

Program/Abstract # 43
Petal development: Variations on a theme
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Most angiosperm flowers possess a perianth surrounding the reproductive structures. The perianth may be ‘undifferentiated’ and consist of tepals, or may be ‘differentiated’ into sepals and petals. Transitions between an undifferentiated and a differentiated, or bipartite, perianth appear to have occurred multiple times during angiosperm evolution. Arabidopsis flowers possess a bipartite perianth, with specification of petal identity being dependent on two MADS-box transcription factors, APETALA3 (AP3) and PISTILLATA (PI). We are characterizing the regulatory network controlled by AP3/PI in Arabidopsis to define the steps involved in specifying petal identity. To determine how this network has diversified across flowering plants, we have carried out studies in other core eudicot species, including members of the Solanaceae, as well as the basal eudicot species Papaver somniferum. These functional analyses highlight several important conclusions about the changing roles of these genes in petal specification. The AP3/PI network appears to have been recruited multiple times, albeit in different ways, in different angiosperm lineages. These changes have occurred through gene duplication and diversification, through changes in expression patterns, and through changes in cofactor interactions. Based on these observations, I will discuss a model for how the petal developmental program has evolved.

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Program/Abstract # 44
Yolk utilization depends on thyroid hormone in a direct developing frog
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Nutritional endoderm, consisting of large yolky cells, provides nutrients during embryogenesis of the direct developing frog, Eleutherodactylus coqui (Buchholz et al., 2007). Methimazole, a drug for hyperthyroidism, inhibits thyroid hormone (TH) synthesis. When treated with methimazole, the embryos retained a large amount of yolk in the nutritional endoderm. Histologically, the yolky cells in the TH inhibited embryos had many yolk platelets while control embryos at hatching had vacuolated cells with few yolk platelets. In Xenopus laevis, acidification of yolk platelets is an initial step in the breakdown of yolk platelets (Fagotto and Maxfield, 1994). E. coqui embryos in methimazole failed to acidify their yolk platelets, but acidification was stimulated by TH. In X. laevis, yolk is completely utilized long before TH is expressed and its thyroid hormone receptor, TRb, is upregulated in response to TH and induces differentiation of the adult gut. EcTRb, the E. coqui orthologue, is highly expressed in the gut at hatching. The large nutritional endodermal cells in E. coqui were dissociated and assayed for their gene expression relative to the definitive gut endoderm. Quantitative PCR indicated high EcSox17 expression in the nutritional endoderm indicating a direct role for TH in yolk metabolism. The low level of EcSox17, an endodermal transcription factor, in these nutritional endodermal cells was consistent with the fact that these cells did not contribute to the definitive gut. In conclusion, the utilization of yolk has come under TH control in the evolution of these direct developing frogs.

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