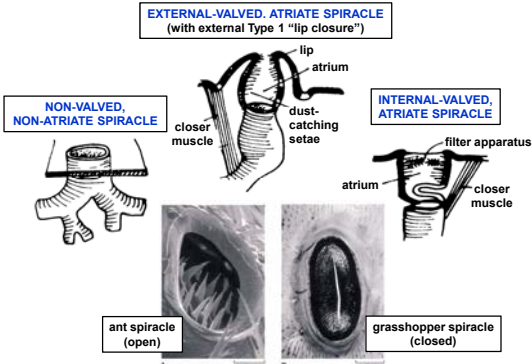
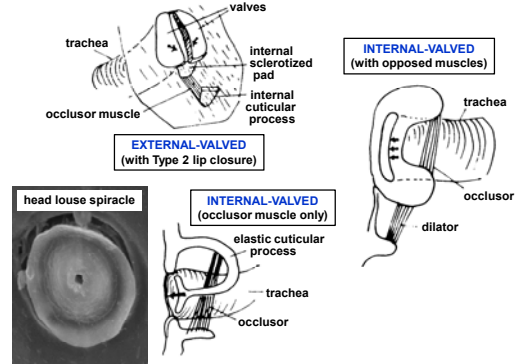


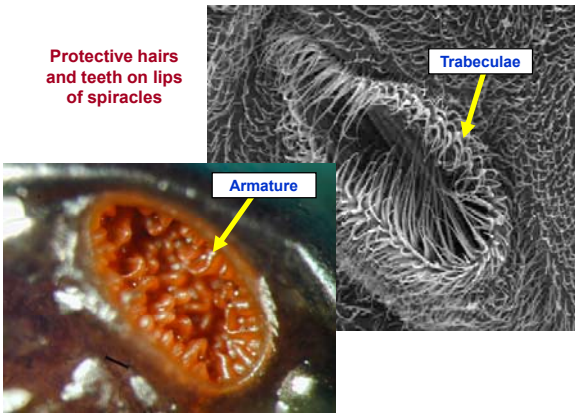
**Spiracle types and closure mechanisms**



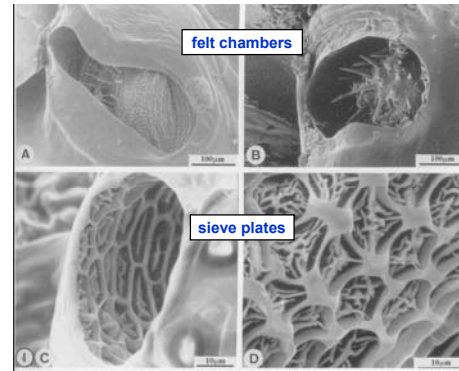
**Spiracle types and closure, continued**



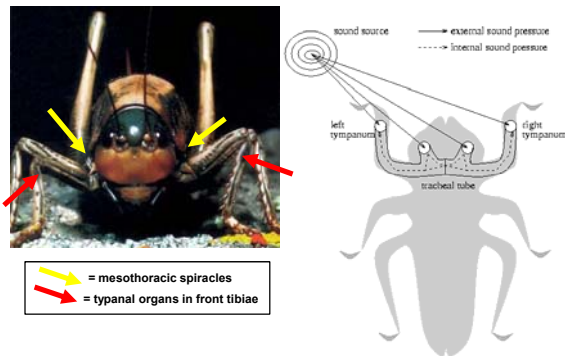
Protective hairs and teeth on lips of spiracles



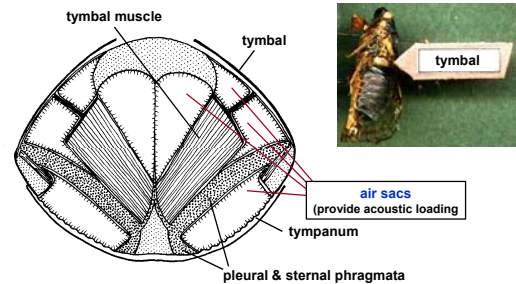
**Spiracular filtering devices (various Orthoptera)**



**Directional hearing in crickets (Orthoptera)**



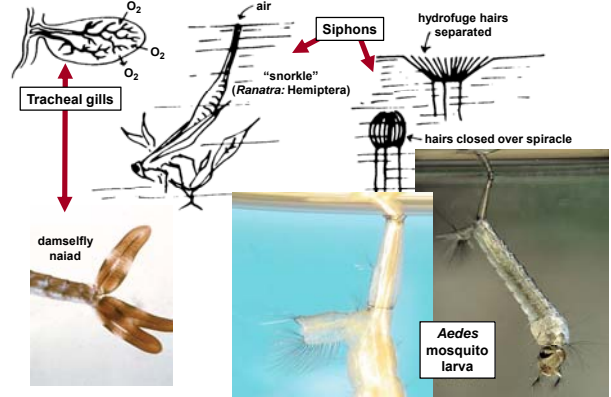
**Capacitive loading of tymbals & ears in cicadas (Hemiptera)**



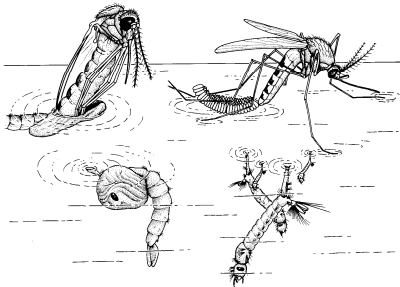
**Aquatic respiratory non-adaptation:  
Cutaneous diffusion in spongillafly larva (Neuroptera: Sisyridae)**



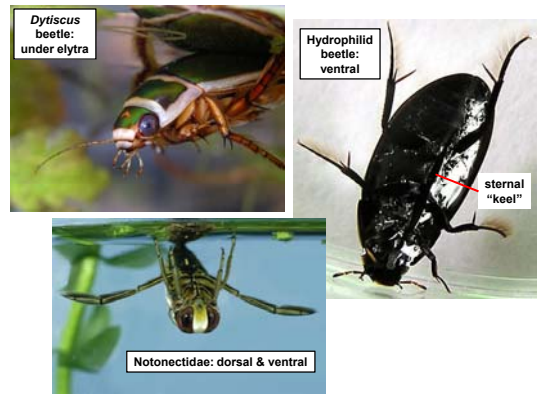
**Aquatic respiratory adaptations: gills & siphons**



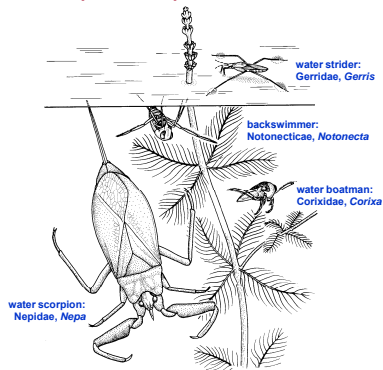
**Culex pipiens life cycle (Diptera: Culicidae)**



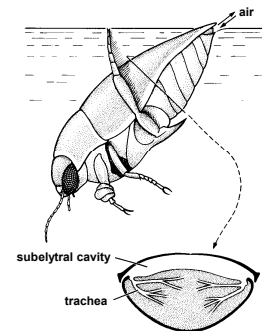
**Aquatic respiratory adaptations: bubbles in beetles & bugs**



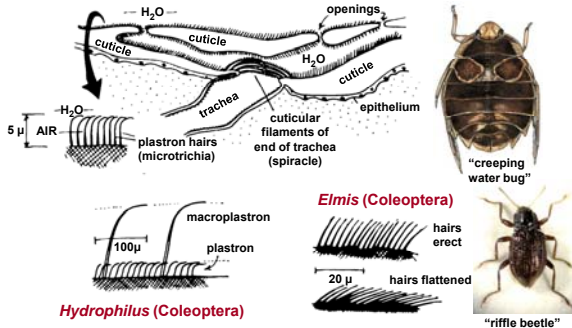
**Aquatic Hemiptera: four families**



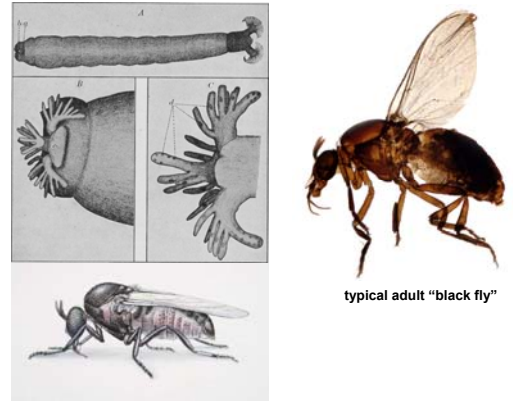
**Aquatic respiration by an air bubble:  
Dytiscus (Coleoptera: Dytiscidae)**



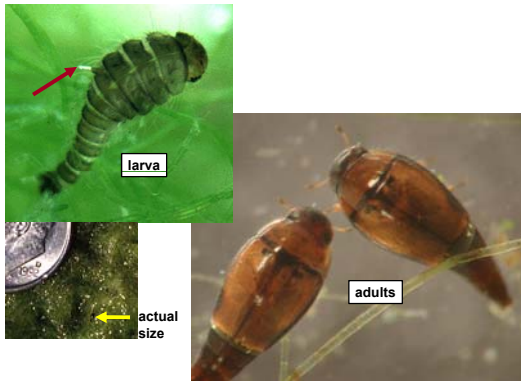
**Gaseous plastron – *Aphelocheirus* (Hemiptera)**



**Blood gills (Ex = anus of *Simulium pictipes* larva – Diptera)**



**Spiracular gills (Ex = *Hydrosapha natans* – Coleoptera)**



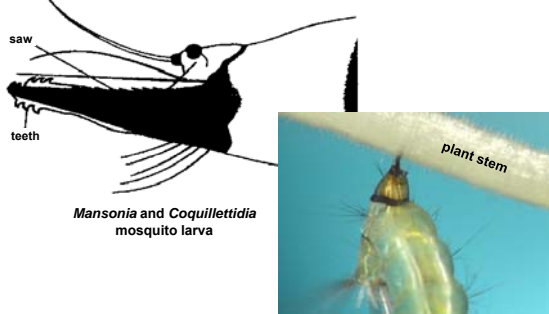
**Hemoglobin for respiration (Ex = *Chironomus* spp. – Diptera)**



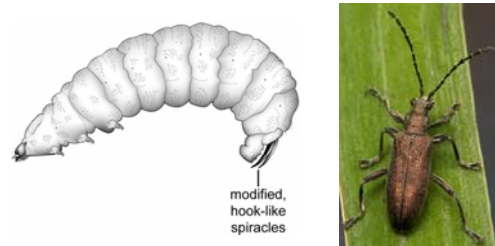
**Hemoglobin for buoyancy and respiration (Ex = *Anisops* sp. – Hemiptera)**



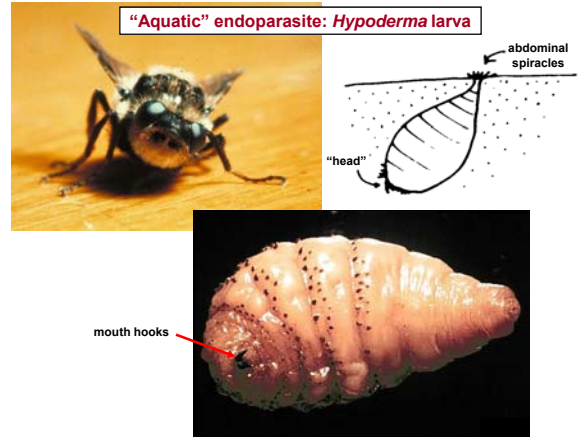
**Respiratory siphon for puncturing plant stems**



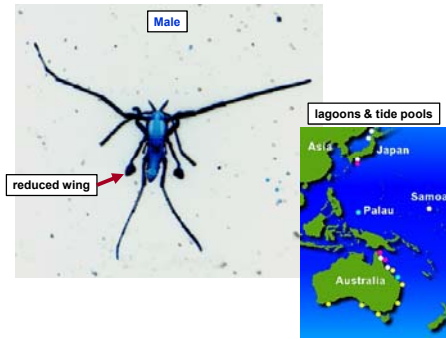
**Tapping underwater plant stems for air in *Donacia* (a "long-horned" leaf beetle – Coleoptera: Chrysomelidae)**



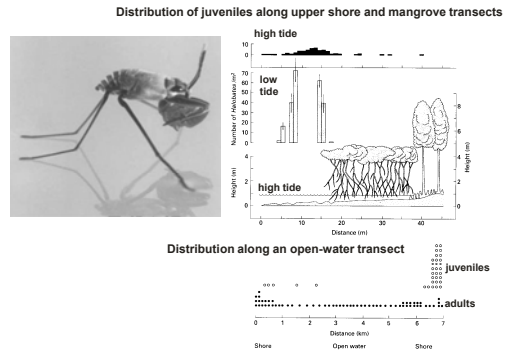
**Tapping underwater plant stems for air in *Chysogaster***  
(Syrphidae: Diptera)



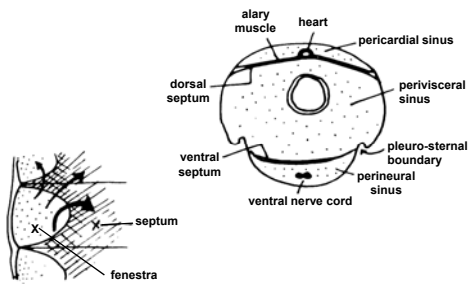
***Pontomyia* sp. (Diptera: Chironomidae) – a marine insect**



***Halobates fijiensis*, a truly marine insect (Hemiptera: Gerridae)**



**The insect circulatory system**



**Pattern of circulation**

