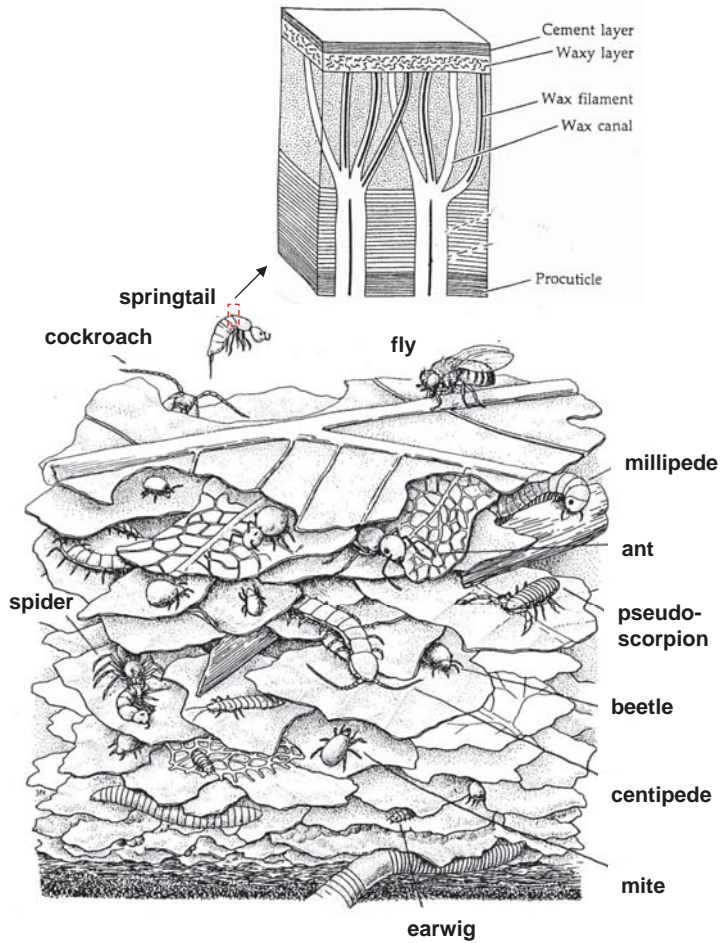
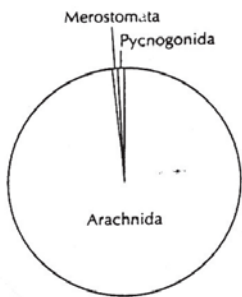


What are the challenges of moving from water to land?

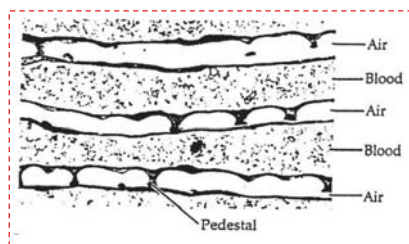
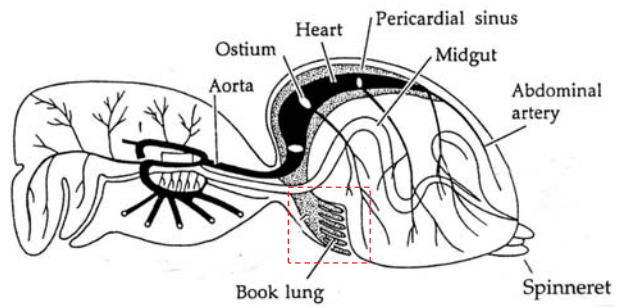
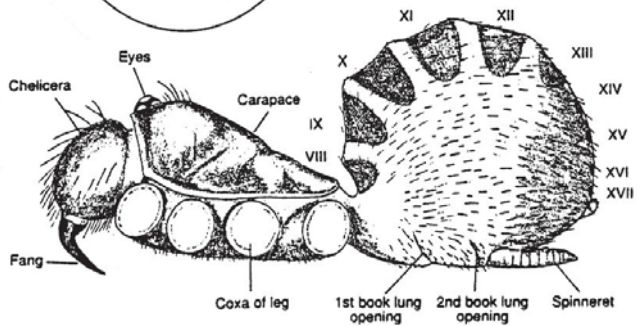
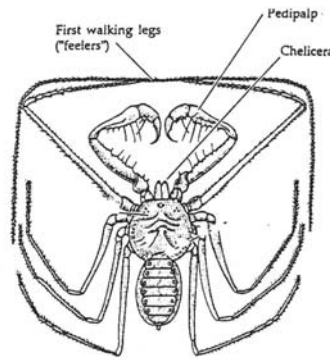
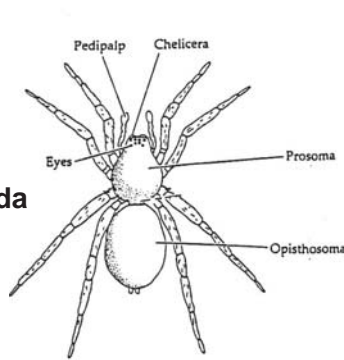


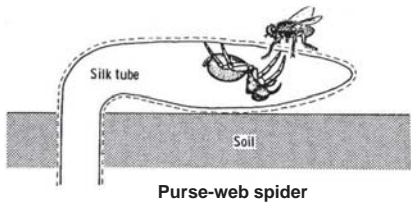
Problem	Solution
desiccation	waxy cuticle
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Subph. Chelicerata (approx. 75,000 species)



Cl. Arachnida





Purse-web spider

Life on land: feeding Evolution of spider web design

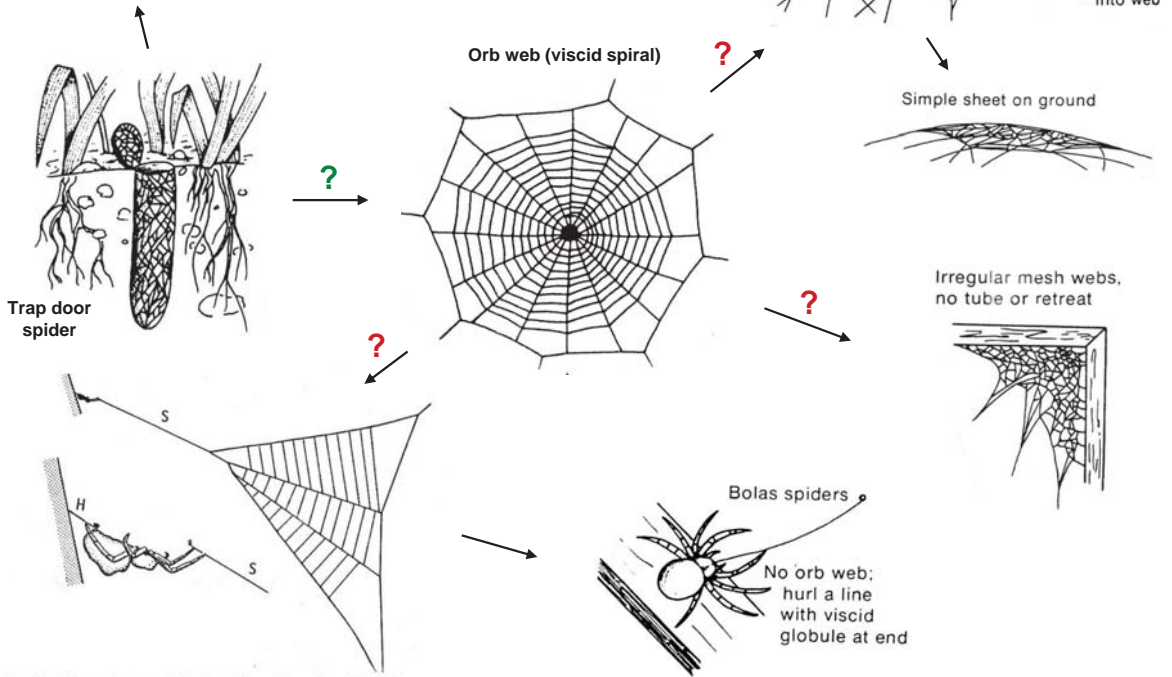


Fig. 100. The spring trap of *Hyptiotes*. The web consists of only three sectors of an orb. The spider itself forms a living bridge between a tension thread (S) and an attachment thread (H).

Life on land: reproduction ...and some other creative uses of silk

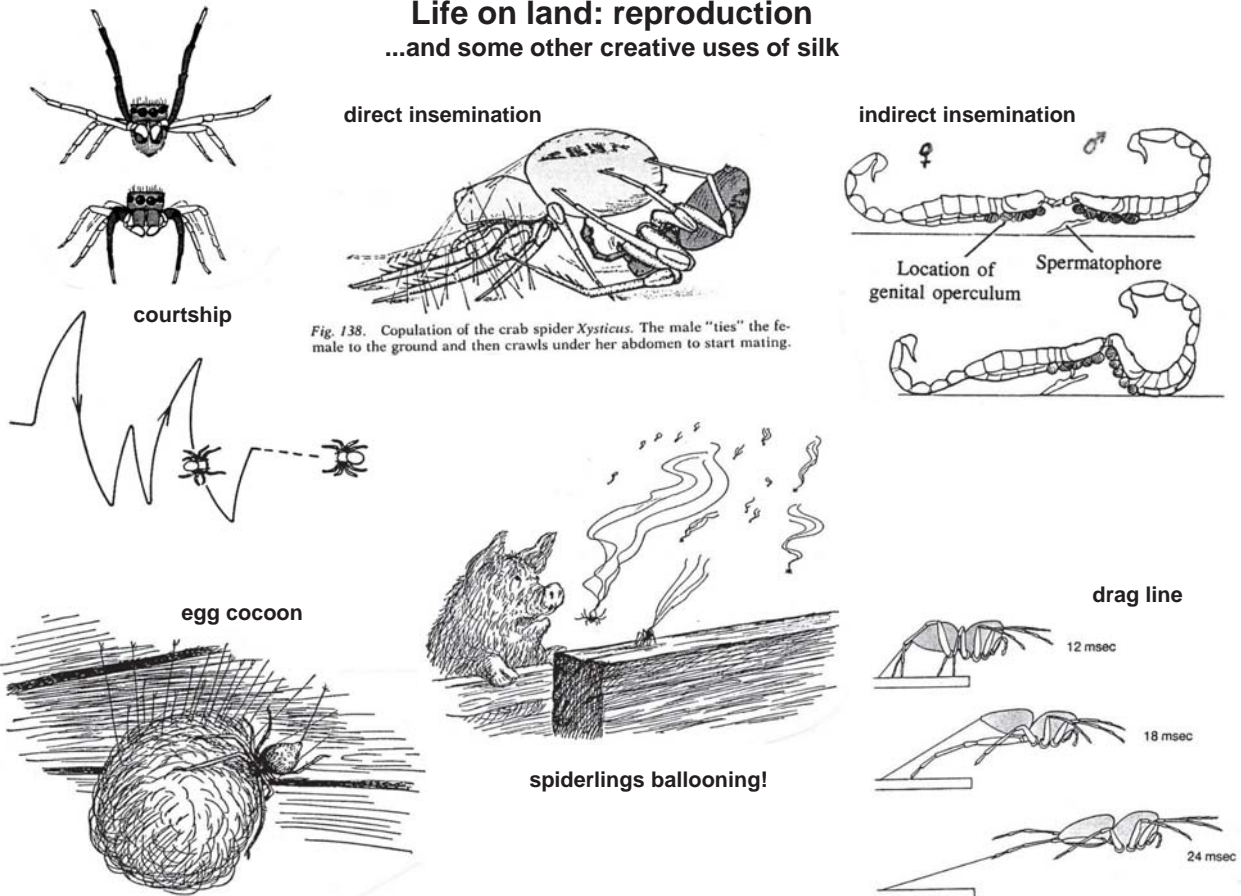
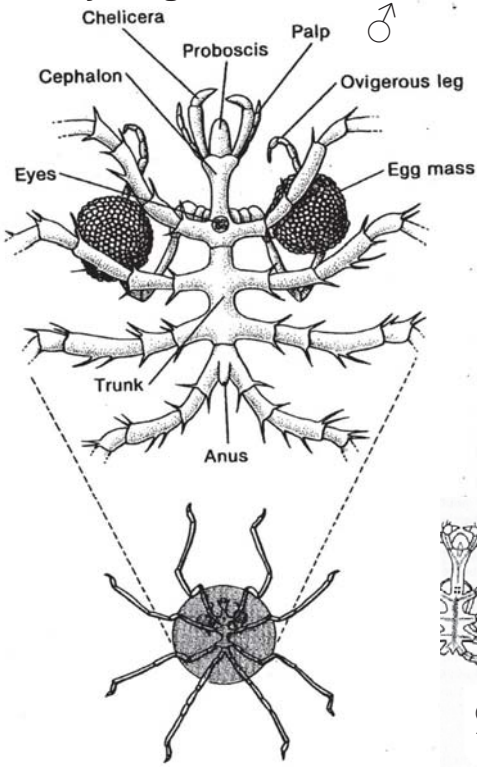


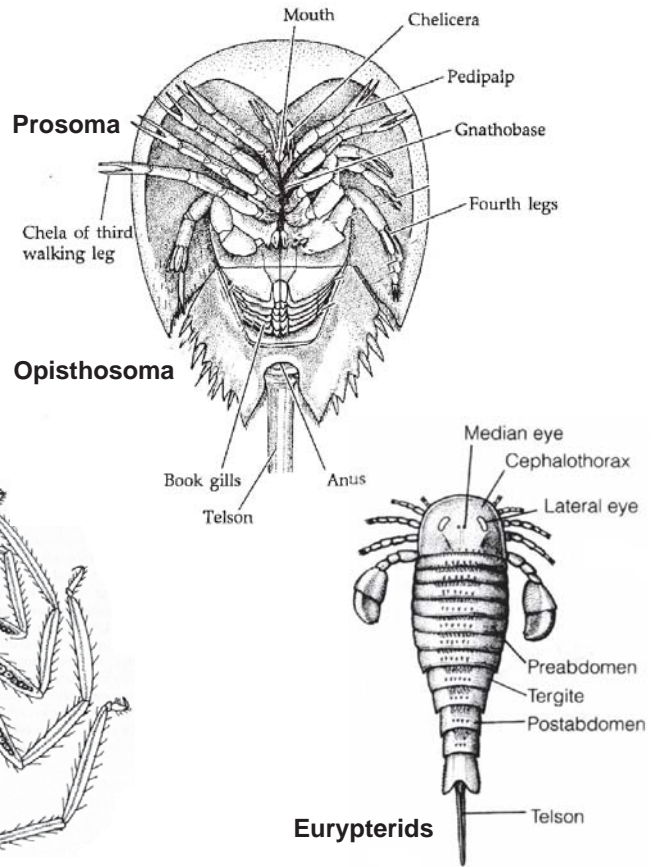
Fig. 138. Copulation of the crab spider *Xysticus*. The male "ties" the female to the ground and then crawls under her abdomen to start mating.

Subph. Chelicerata

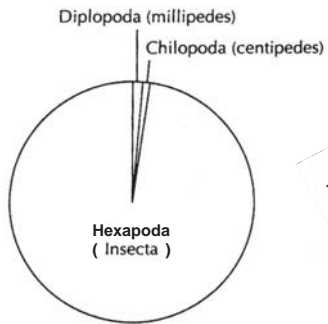
Cl. Pycnogonida



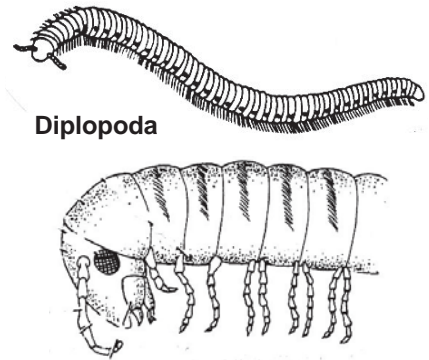
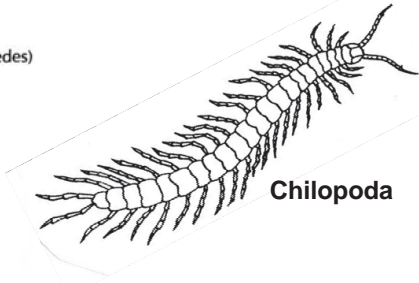
Cl. Merostomata



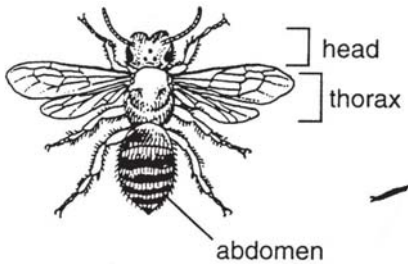
Subph. Tracheata (= Uniramia) (approx. 750,000 species)



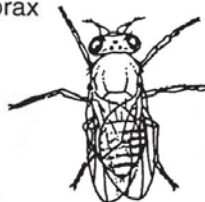
Cl. Myriapoda



Cl. Hexapoda (= Insecta)



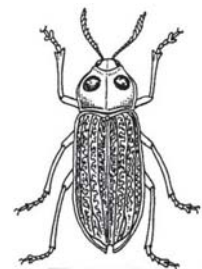
Bees, wasps, ants
(O. Hymenoptera)
130,000!



Flies
(O. Diptera)
150,000!



Butterflies and moths
(O. Lepidoptera)
160,000!



Beetles
(O. Coleoptera)
360,000!

Arthropods are mind-blowingly species rich

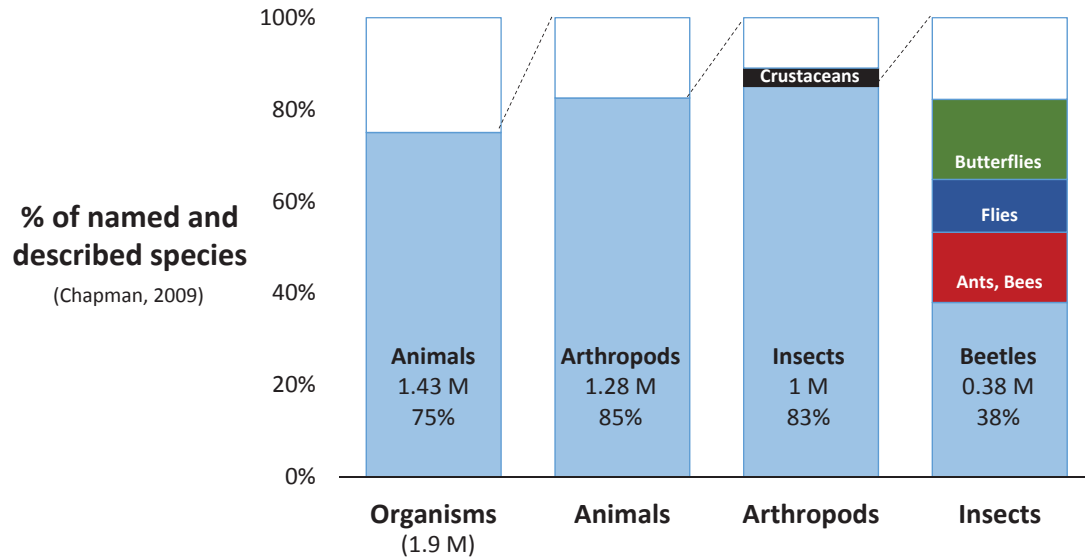
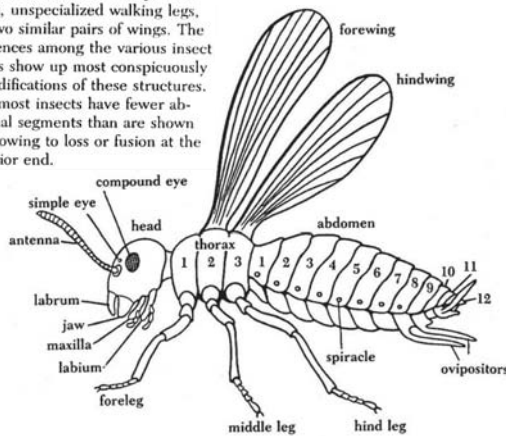
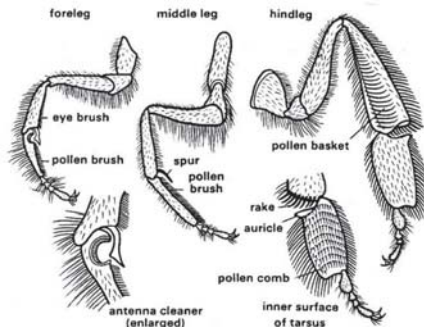


Diagram of a generalized insect, with antennas that are simple filaments, unspecialized walking legs, and two similar pairs of wings. The differences among the various insect groups show up most conspicuously in modifications of these structures. Also, most insects have fewer abdominal segments than are shown here, owing to loss or fusion at the posterior end.



legs

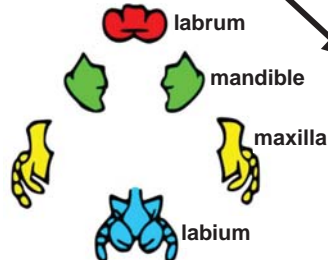
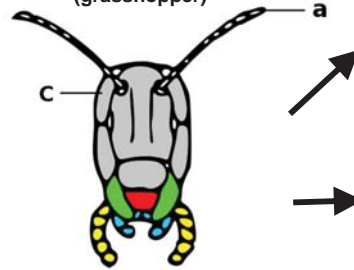


The legs of a honey bee are modified for collecting pollen. Each pair is different from the others, so that, together, they constitute a complete set of tools for manipulating the pollen upon which the bee feeds.

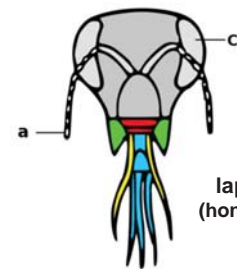
Life on land: feeding specialization of appendages

mouthparts

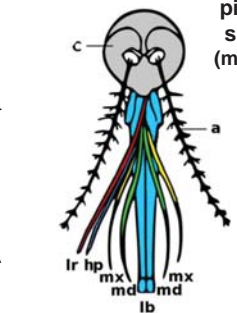
biting-chewing (grasshopper)



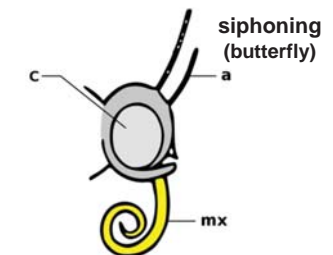
Credit: Xavier Vázquez



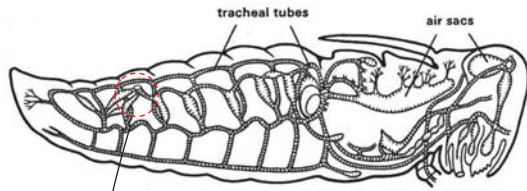
lapping (honey bee)



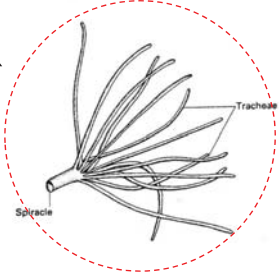
piercing-sucking (mosquito)



siphoning (butterfly)



Tracheal system of a grasshopper. Only the main tracheas and air sacs are shown.



Life on land: respiration insect spiracle-tracheal system

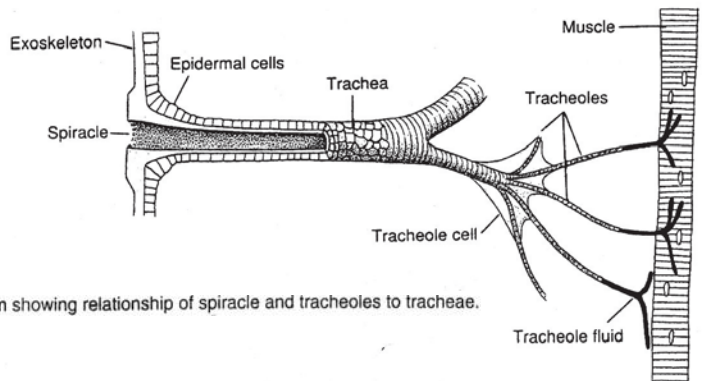


Diagram showing relationship of spiracle and tracheoles to tracheae.

comparison of subphyla

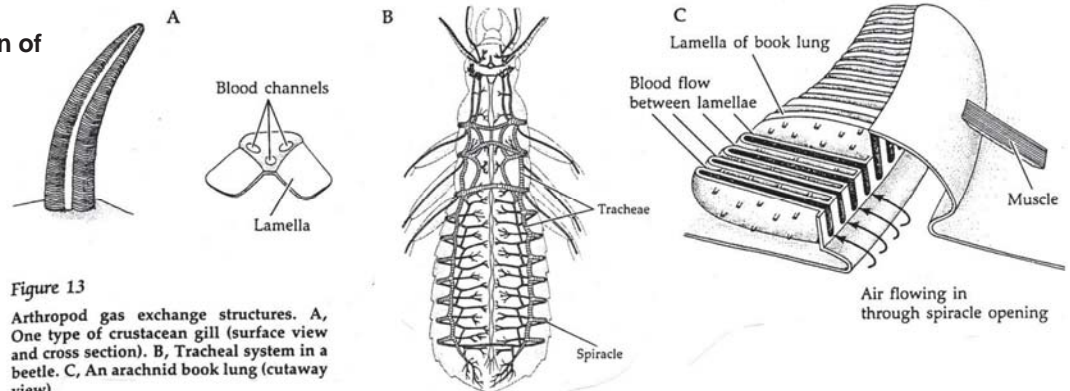
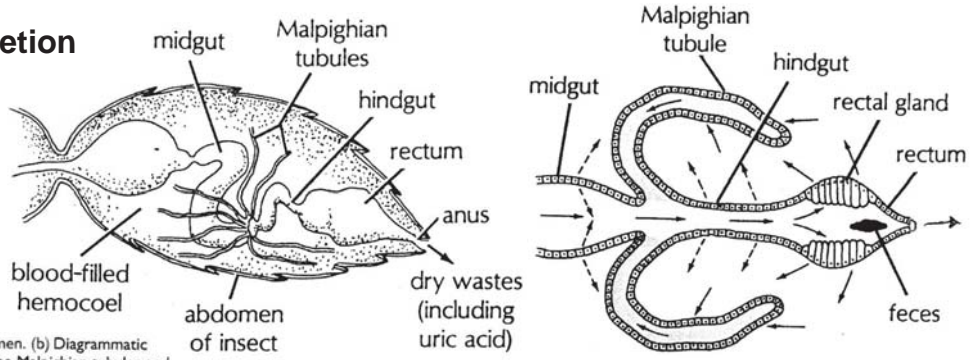


Figure 13
Arthropod gas exchange structures. A, One type of crustacean gill (surface view and cross section). B, Tracheal system in a beetle. C, An arachnid book lung (cutaway view).

Life on land: excretion



(a) Malpighian tubules in the insect abdomen. (b) Diagrammatic illustration of the relationship between the Malpighian tubules and the posterior portion of the digestive tract. Fluid moves from the hemocoel into the tubules, where it joins wastes moving toward the anus. The arrows indicate the extensive reclamation of water that occurs in the hindgut and rectum.

Life on land: vision (compound superposition eyes)

