

15. Ph. ARTHROPODA: Subph. Tracheata & Chelicerata, & the colonization of land

"The young spider...let loose a cloud of fine silk. As Wilbur watched, the spider let go of the fence and rose into the air. This came as a great surprise to Wilbur." --*Charlotte's Web*, E.B. White

MAJOR TAXA

Ph. Arthropoda

Subph. *Trilobita* (*extinct*)

Subph. Crustacea

Subph. Chelicerata (75,000 spp.)

Cl. Arachnida (spiders, scorpions)

Cl. Merostomata (horseshoe crabs)

Cl. Pycnogonida ("sea spiders")

Subph. Tracheata (750,000 spp. so far)

Cl. Hexapoda (mostly insects)

Cl. Myriapoda (centipedes, millipedes)

Recap: Key innovations in the arthropod body plan (tanned cuticle, jointed appendages, tagmatization), challenges of movement and growth inside an exoskeleton

TOP TEN areas to explore and appreciate about arthropod subphyla

10. Challenges to life in terrestrial habitats
9. Extraordinary diversity among hexapod orders
8. Serial homology and diversification of tagmata, jointed appendages and mouthparts
7. Desiccation resistance by a waxy epicuticle
6. Respiration on land: insect spiracles and tracheal systems, spider book lungs
5. Reproduction on land: protective cocoons, spermatophores, direct insemination
4. How insects created an ecological niche for spiders: prey capture and external digestion
3. Diverse uses of spider silk for locomotion and reproduction
2. Excretion on land: uric acid, malpighian tubules, and coordination with the digestive system
1. Use of different sensory modalities on land

GOALS

After studying from lecture notes and the associated reading, you should be able to:

- List several of the major challenges to living in terrestrial habitats, and describe solutions that characterize the evolution of two arthropod subphyla
- Explain why the arthropod exoskeleton may have "preadapted" them for life on land
- Name animals belonging to each of three classes in the subphylum Chelicerata, and be able to recognize homology among their appendages
- Describe the structure of arachnid book lungs and their function in respiration
- Describe the various uses of silk by spiders for feeding, locomotion, and reproduction
- Explain the importance of direct and indirect insemination among arachnids
- Name animals belonging to different classes within the subphylum Tracheata, as well as to the orders that comprise most of the diversity in the class Insecta
- Explain the significance of the alternate subphylum name "Uniramia"
- Describe the insect tracheal system and its function in respiration, including the role of spiracles and how the method of oxygen delivery to tissues differs from book lungs and gills
- Explain the importance of Malpighian tubules and uric acid for excretion in terrestrial habitats
- Describe the function of the superposition eye for light regulation in terrestrial habitats