Phylum ARTHROPODA

Subphylum TRILOBITA (= Trilobitomorpha)

- 4000 extinct species
- entirely marine, bottom feeders
- dominant in seas
- disappeared by end of Permian
- antennae present
- appendages uniramous (superficially appear to be biramous*)
- authorities are still uncertain to which extant group trilobites are most closely related

Subphylum CHELICERATA (=Cheliceriformes)

Main characteristics:
- no antennae
- six pairs of appendages
  - 1st pair – chelicerae (pincerlike appendages); not homologous with mandibles
  - 2nd pair – pedipalps (derived from legs) – function as jaws
  - 3rd – 6th – leglike
- patella present (extra leg segment between femur and tibia)
- two tagmata: prosoma (=cephalothorax) and metasoma (or opisthosaoma)
- mostly predatory, some mites herbivorous
- importance to humans: stings, bites, plant pests, human skin mite, ticks, chiggers, etc.

Class EURYPTERIDA

- extinct
- cephalothorax narrow
- giant water scorpions (some 3 m long!)

* A biramous appendage bears a process (from the second segment of the appendage) which is more or less leglike, giving the appendage a two-branched appearance. There may be an exit lobe on the basal segment, as in trilobites, and in some cases this functions as a gill.
Class XIPHOSURA
- king or "horseshoe" crabs (*Limulus*)
- cephalothorax wide, arched
- marine – common along the Atlantic Coast
- occur in shallow water and along sandy or muddy shores where they spawn; they feed chiefly on marine worms
- 5 species

The horseshoe crab (*Limulus polyphemus*). A. dorsal view, B. ventral view.

Class PYCNOGONIDA
- sea spiders
- cephalothorax greatly dwarfs abdomen
- gills present
- 1,000 species
Class ARACHNIDA
- abdomen without gills
- four pairs of walking legs
- 75,000 species (but probably at least another 100,000 undescribed!)

Order Palpigradi. Palpigrades. Minute, primitive arachnids. 60 species.

Order Uropygi. Whip scorpions and vinegaroons. 100 species.

Order Amblypygi. Rare. Tailless whip scorpions and whip spiders. 70 species.

Order Ricinulei. Rare. Ricinuleids. 35 species.

Order Schizomida. Rare. Schizomids. Tropical, ca. 80 species.

*Order Scorpiones. True scorpions. Cephalothorax and abdomen broadly joined, abdomen segmented. Chelicerae three-segmented. 1,200 species. (see detail below)

*Order Pseudoscorpionida. Pseudo- or false scorpions. Chelicerae with silk glands and pedipalps with poison glands. 2,000 species. (see detail below)

Order Solpugida (Solifugae). Sun spiders, sun scorpions, wind scorpions. 900 species.

*Order Araneae. Spiders. Cephalothorax and abdomen narrowly joined, not fused; abdomen unsegmented; chelicerae 2-segmented. 35,000 species. (see detail below)

*Order Opiliones (=Phalangida). Daddy-longlegs or harvestmen. Cephalothorax and abdomen broadly joined, fused; abdomen faintly segmented. 5,000 species. (see detail below)

*Order Acari. Ticks and mites. Cephalothorax and abdomen broadly joined, fused; abdomen unsegmented. 30,000 species. (see detail below)

Arachnid phylogeny from the Tree of Life website [http://tolweb.org/Arachnida/2536]
Order: Scorpiones – scorpions
- largest arachnids, ranging in length to about 125 mm
- opisthosoma broadly joined to prosoma, differentiated into two portions, a broad seven-segmented mesosoma and a much narrower five-segmented posterior metasoma that terminates in a sting
- pedipalps long and chelate
- largely nocturnal
- young born alive and carried about on the back of the mother
- sting of most species is painful and usually accompanied by local swelling; only one of the 40-odd species of scorpions in the US has a sting that can be fatal – it occurs in Arizona

Order: Pseudoscorpiones – pseudoscorpions
- small arachnids, seldom more than 5 mm in length
- resemble true scorpions in having large chelate pedipalps, but opisthosoma short and oval, no sting, and body quite fat
- eyes may be present or absent; if present, there are two or four, located at anterior end of prosoma.
- about 200 species in North America
- they are found under bark and stones, in leaf litter and moss, between the boards of buildings, and in similar situations; they sometimes cling to and are carried about by large insects
- they feed chiefly on small insects which are caught with pedipalps
- most species have venom glands that open on the pedipalps
- they have silk glands whose ducts open on the chelicerae
- silk used in making a cocoon for overwintering

Order: Araneae – spiders
- about 2,500 North American species
- distinct and widespread group
- occur in various habitats; often abundant
- although nearly all have venom glands, most not dangerous to humans
- body divided into two regions – cephalothorax and abdomen
- abdomen unsegmented in North American species; attached to cephalothorax by slender pedicel
- cephalothorax bears eyes, mouthparts, and legs
- abdomen bears genital structures, spiracles, anus, and spinnerets
- eyes simple, located on anterior end of carapace; most spiders have eight, but some have fewer
- poison glands with ducts opening near tips of chelicerae
- fangs move laterally in most spiders (suborder Labidognatha), but vertically in tarantulas and trapdoor spiders (suborder Orthognatha)
- pedipalps leglike, clubbed in males with terminal segment modified into copulatory organ
- seven-segmented legs: coxa, trochanter, femur, patella, tibia, metatarsus, and tarsus
- spinnerets – fingerlike silk-spinning structures are at end of abdomen
Order: Opiliones – Harvestmen
- ubiquitous arachnids, often mistaken for spiders
- body rounded or oval with prosoma and opisthosoma broadly joined
- usually two eyes
- most species predaceous or scavengers, feeding on dead animals or plant juices
- they have scent glands that produce defensive secretions

Order: Acari – Mites and Ticks
- very large group of small to minute animals
- more than 30,000 have been described; perhaps half a million more still undescribed
- body usually oval with little or no differentiation of two body regions
- newly hatched young, called larvae, have only three pairs of legs and acquire fourth pair after first molt
- 3 instars between larva and adult called nymphs
- occur in practically all habitats and rival insects in their variations in habits and life histories
- both aquatic (in fresh and salt water) and terrestrial forms
- abundant in soil and organic debris
- many parasitic, at least during part of their life cycle, and both vertebrates and invertebrates (including insects) serve as hosts
- many of free-living forms predaceous
- some scavengers
- many plant feeders
- of considerable medical, biological, and economic importance
Subphylum MYRIAPODA

Main characteristics:
- two tagmata: head and trunk
- multi-legged, many segments
- anamorphic development [adding segments at each molt; continue to molt after reaching adulthood]

Four classes (but only first two common):

Class: Chilopoda – Centipedes
- 2500 species
- each body segment bearing single pair of legs
- elongate flattened animals with 15 or more pairs of legs
- last two pairs of legs directed backward and often different in form from other pairs
- eyes may be present or absent; if present, they usually consist of numerous ommatidia
- head bears pair of mandibles and two pairs of maxillae
- appendages of first body segment behind head clawlike and function as poison jaws – used for paralyzing prey
- found in variety of places, but usually occur in protected situation such as in soil, under bark, or in rotten logs
- fast-running, predaceous animals feeding on insects, spiders, and other small animals
- smaller centipedes of northern states harmless to people, but larger ones of South and in tropics able to inflict painful bite

Class: Diplopoda – Millipedes
- elongate with many legs (most have 30 or more)
- most segments bear 2 pairs
- body cylindrical or slightly flattened
- antennae short and usually seven-segmented
- compound eyes usually present
- usually found in damp places: under leaves, in moss, under stones or boards, in rottng wood, or soil
- do not bite people, most scavengers and feed on decaying plant material, but some attack living plants and sometimes do serious damage in greenhouses and gardens; a few predaceous
Subphylum CRUSTACEA
- large and varied group of arthropods
- more than 44,000 known species
- mostly marine, but many occur in freshwater, and a few terrestrial
- two pairs of antennae
- mandibles
- mostly gill-breathing aquatic taxa
- many appendages biramous

Literature: