

PHYLUM ARTHROPODA (15-30 million spp??)

The "jointed leg" invertebrates: spiders, mites, scorpions, shrimp, crabs, barnacles,
centipedes, millipedes, insects, etc.

Protostomes

Eucoelous

Complete Digestive Tract

All Organ systems present & well developed

Advanced Metamerism

A. Exoskeleton of chitin & protein (glycoprotein)

Epicuticle

Exocuticle ("tanned" - cross links of phenols)

Endocuticle

"Sclerotized" when exocuticle particularly thick, but joints and molt lines
remain thin

B. Muscles attached inside exoskeleton

C. Metamerism shows: specialization, reduction, and/or fusion; arose from the annelid
condition

- D. Jointed appendages (possibly homologous with the annelid parapodium)
- E. Anterior & posterior internal structures derived from ectoderm. Midgut structures from endoderm
- F. Open circulatory system (Hemocoel), mostly hemocyanin, tubular heart possibly homologous with the annelid dorsal contractile vessel
- G. Nervous system - anterior pair of ganglia ("brain") & paired ventral longitudinal nerve cords - possible homologous with the annelid condition.
- Sensory organs - Antennae & Compound Eyes
- H. Coelome much reduced from annelid condition
- I. Malpighian Tubules (no nephridia) - blind sacs bathed in blood of hemocoel (no closed circulatory system)
- J. Respiratory system - gills, book lungs, or tracheae
- K. Gonads & ducts distinct; most spp. dioecious

Exoskeleton large evolutionary advancement

Arthropods move away from a hydrostatic skeletal support of annelids.

Chitin covering provides: strong body support, manipulative appendages for altering the environment, protection from desiccation, & protection against knocks.

However, the downside is that arthropods now must molt - advantages temporarily disappear during Ecdysis

Characteristics of general body plan basis for major taxonomic divisions:

1. Cephalon, Thorax, Abdomen (3 body divisions)
2. # of antennae
3. # and kinds of mouth parts
4. # and structure of appendages (Biramous/Uniramous)

4 subphyla & ~13 classes

List of taxonomic groups to be examined:

Subphylum TRILOBITOMORPHA (trilobites, Paleozoic, extinct)

Cephalon, thorax, pygidium; pair of compound eyes; one pair of antennae

Subphylum CHELICERATA

Usually a Cephalothorax + Abdomen; no antennae; Chelicera + Pedipalps;

4 pairs of legs

Class MEROSTOMATA (horseshoe crabs & extinct euryperids)

Class ARACHNIDA (whipscorpions, pseudoscorpions, scorpions, spiders, mites,
ticks)

Class PYCNOGONIDA (sea spiders - ignore)

Subphylum CRUSTACEA

Two pairs of antennae; Mandibles

Class MALACOSTRACA (shimps, crabs)

Class BRANCHIOPODA

Class MAXILLOPODA

Subclass COPEPODA micro-crustaceans

Subclass OSTRACODA

Subclass CIRRIPEDIA (barnacles)

Subphylum UNIRAMIA

One pair of antennae; Mandibles

Class CHILOPODA (centipedes)

Class DIPLOPODA (millipedes)

Class INSECTA (insects)

Subphylum Trilobitomorpha (3,900 spp) ≤ 1 m

Most primitive of arthropods (Cambrium & Ordovician)

Cephalon = fusion of first 5 segments, pair of antennae & compound eyes

Biramous appeandages

Segmented thorax

Subphylum Chelicerata (chelicera, pedipalps)

Class Merostomata

Old group (Ordovician), two divisions (horseshoe crabs, 5 living spp & extinct eurypterids)

Horseshoe crabs bottom feeders, book gills, telson, dioecious (\varnothing 30,000 eggs \rightarrow

"trilobite" larvae, at full & new moons in spring & summer)

Eurypterids (Cambrium - Permian), 3-4 m, top predator of early life, perhaps
ancestor of terrestrial arachnids

Class Arachnida (60,000 spp)

First fossils by the Silurian (>400 mya)

13 orders - we will look at only a few:

Class Arachnida

Order SCORPIONIDA (800 spp)

Oldest terrestrial arthropod

Pedipalps enlarged

Chelicera small and delicate

Sting in tail (neurotoxin)

Elaborate courtship (spermatophore)

♀ gives parental care

Order PSUEDOSCORPIONIDA (2,000 spp)

Chelicera small

Pedipalps enlarged & armed w/ poison glands

No tail or sting

Elaborate courtship (spermatophore)

♀ provides parental care

Order OPILIONES (3,200 spp) daddy longlegs

Short segmented abdomen

No Pedicel

Order ACARI 30,000+ spp [ACARINA in some taxonomies]

Specialized ectoparasites in this group - much reduced metamerism

Unsegmented abdomen, fused cephalothorax

Most <1 mm

Terrestrial, F.W., & marine

Chelicera → teeth; Pedipalps → barbs

Ticks: egg → 6-legged lava → 8-legged nymph → 8-legged adult (30 days to death)

Mites: "chigger" is larva of harvest mites - on skin - proteolytic enzyme breaks down skin (what itches) - feeds for 10 days - drops off - molts to nymph (predaceous) - molts to adult (predaceous, insect eggs) → eggs → chigger (you walk by).

Food habits: nematodes, small arthropods, invertebrate eggs, larvae, plant juices, organic matter (flour, dried fruits, upholstery, cheese, hay, dead skin, feathers, etc.)

Vectors: Rocky Mountain spotted fever, limes disease, tularemia, Texas

Cattle fever, relapsing fever (scabies, mange)

Order ARANEAE (spider, 33,000 spp)

Chelicera - like hollow fangs, armed w/ poison

Pedipalps modified in ♂♂ as copulatory organs

Pedicel between cephalothorax * abdomen

Silk - hardens as drawn out (dry, sticky, wooly)

Uses: drag line, prey capture, mating, egg protection, transportation, communication

Web design stereotyped and used for taxonomy

Reproduction: solution for terrestrial restrictions

Paired gonads in abdomen - Gonopore

Spermatophore in scorpions, but in spiders -

♂ pedipalp modified (lock & key) to fit

♀ gonopore (Epigynum) - ♂ spins small silk pad, semen deposited on
it, then sucks up semen into pedipalps.

Sensory - hairs act as tactile and chemo receptors, especially web spinners.

Silk used < by cursorial species, and eyes better developed (e.g., jumping
spiders, wolf spiders)