

A microscopic image showing several arthropod embryos or larvae. They are light-colored, elongated, and have a segmented appearance. The background is dark, making the specimens stand out. The text is overlaid on the image.

# Phylum Arthropoda

Blueprint for Success

# Success

- How do you define success?
- How is a phylum's success determined?
- Arthropods are very successful!

# Classification

- Members of Ecdysozoa: Arthropoda, Nematoda, Nematomorpha, Kinorhyncha, etc...
  - Cuticle
  - Loss of epidermal cilia
  - Shed cuticle through ecdysis

# Classification cont'd

- 4 subphyla of living arthropods
  - Chelicerata
  - Crustacea
  - Hexapoda
  - Myriapoda
- 1 extinct subphylum
  - Trilobita

# The Exoskeleton

- External, jointed skeleton
  - Support
  - Protection
  - Prevents water loss
  - Aids in movement

# Armor is good, but...

- Invaginations – for muscle attachment
- Joints – thinner, less hardened regions
- Sensilla
- Gas exchange

# How do they grow?

- Ecdysis
  - Old procuticle digested
  - New procuticle and epicuticle
  - Old exoskeleton splits
  - Hardening (Hide away!)

# The hemocoel

- Internal cavity for open circulation
- Exchange of nutrients, wastes, and sometimes gases
- Coelom is reduced



# Metamorphosis

- Reduces competition between adult and immature stages
  - Ex: butterfly and caterpillar
- Why is this good?

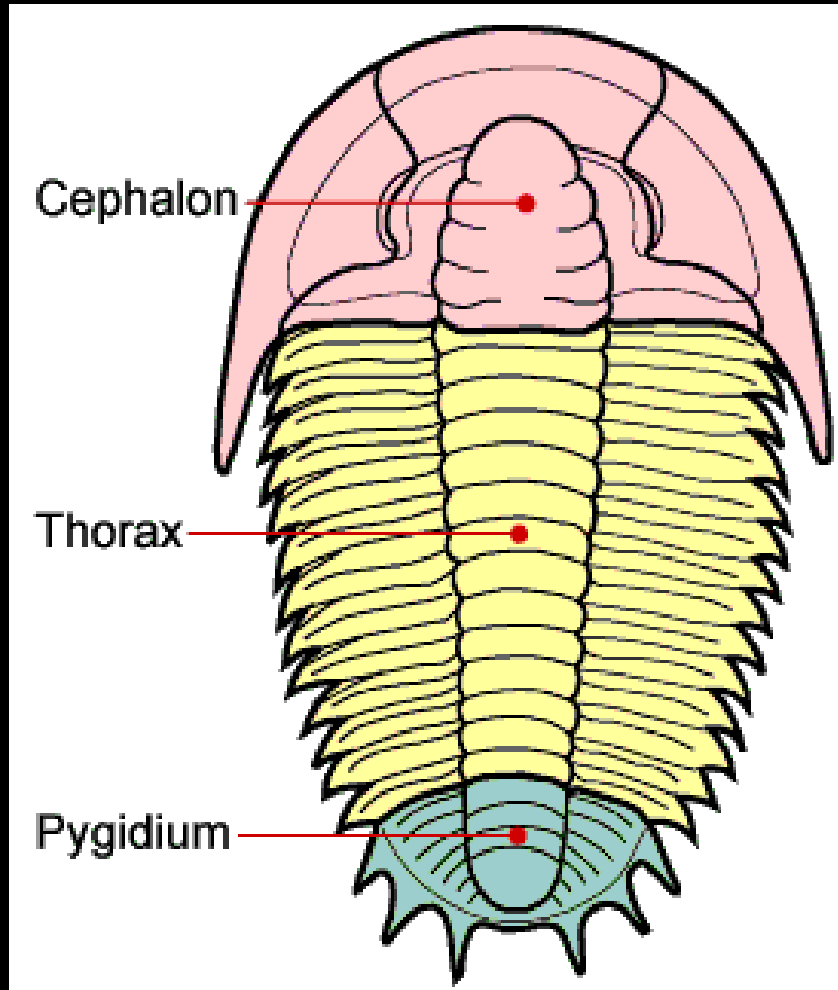
# Subphylum Trilobitomorpha

- Now extinct
- Dominated oceans from Cambrian period to Carboniferous period
- Crawled, eating annelids, mollusks, decaying org matter



**1.0 cm**

# Trilobite body plan



- 3 segments
- Could roll up when threatened
- Appendages – 2 lobed or biramous
  - Walking segment
  - Spiked segment

# Subphylum Chelicerata

- Spiders, mites, and ticks Oh My!
- Horseshoe crabs and sea spiders

# Two segments

## 1. Prosoma

- sensory, feeding, locomotor
- Eyes, but never antennae
- Paired appendages
  - 1<sup>st</sup> pair chelicerae – pincers or fangs for feeding
  - 2<sup>nd</sup> pair pedipalps – sensory, feeding, locomotion or reproduction
  - After pedipalps, paired walking legs

# Two segments

## 2. Opisthosoma - organs

- Digestive
- Reproductive
- Excretory
- Respiratory

# Class Merostomata

- 2 subclasses
  - Eurypterida – water scorpions (extinct)
  - Xiphosura – horseshoe crabs
    - 4 species
    - Eat annelids, small mollusks, other inverts
    - Unchanged for 200 million years!



# Horseshoe crabs

- Prosoma
  - Chelicerae, pedipalps, and 1<sup>st</sup> 3 pairs of walking legs
    - walking
    - food handling
  - Last pair used for locomotion and digging





# Horseshoe crabs

- Opisthosoma
  - Long unsegmented telson
  - If flipped, arch opisthosoma dorsally
    - [https://www.youtube.com/watch?v=V\\_rtiQ\\_QUkE](https://www.youtube.com/watch?v=V_rtiQ_QUkE)
  - 1<sup>st</sup> pair of appendages cover genital pores – genital opercula
  - Other 5 pairs – book gills



# Horseshoe Crabs

- Dioecious
- Male grasps female w/pedipalps
- Female digs hole and deposits eggs
- Male fertilizes eggs
- Eggs covered with sand and left



# Class Arachnida

- Most spiders, ticks, mites, and scorpions are harmless or helpful to humans
- Watch out for



# Feeding

- Hold prey and either
  - Pour digestive juices over it
  - OR
  - Inject digestive juices
- Then consume partially digested food

# Excretion

- Mainly excrete uric acid
  - Semi-solid
  - Important for water conservation

# Gas exchange

- Very little exposed
- Book lungs
  - Gas exchange in lung chamber
  - OR
  - Delivered to body systems through tracheae

# Order Scorpionada

- Tropical and warm climates
- Secretive and nocturnal

# Scorpion Body Plan

- Prosoma
  - Shield-like covering
  - Small chelicerae
  - Enlarged (pincer-like) pedipalps



# Scorpion Body Plan

- Opisthosoma
  - Preabdomen
    - Openings to book lungs
    - Chemical receptors
    - Genital openings
  - Postabdomen (tail)
    - Narrow, curved dorsally
    - Stinger at tip

# Beware

- *Androctonus*
- *Centruroides* below



# Reproduction

- Courtship period
- Male
  - grabs female (mating dance)
  - deposits spermatophore on ground
  - positions female over spermatophore
  - Trigger releases sperm into female

# Reproduction (cont.)

- Oviparous (most arthropods) – eggs develop outside body
- Ovoviviparous – eggs develop inside body
- Viviparous – embryos develop inside body
  - Development can take 1.5 year
  - 20 to 40 brooded
  - Young live on mother for a month

A close-up photograph of a spider on its web. The spider is dark-colored with long, thin legs. It is positioned in the center of the frame, surrounded by a dense, intricate web of white silk. A small, brown, segmented insect, possibly a fly or a larva, is visible in the upper left corner of the image. The background consists of green, leafy plants, likely ferns, which are slightly out of focus. The overall lighting is natural, highlighting the texture of the spider's body and the delicate structure of the web.

# Order Araneae

- Prosoma
  - Chelicerae w/poison glands & fangs
  - Leg-like pedipalps (sperm transfer in males)
  - 6 to 8 eyes
- Opisthosoma
  - Openings to rep. tract, book lungs, tracheae
  - 2 to 8 spinnerets & silk glands

# Spider Silk

- Several kinds
  - Web
  - Safety line
  - Wrap eggs
  - Ballooning
- Very resilient

# Spider feeding

- Feed on insects (or small vertebrates)
  - Bite to paralyze prey
  - Inject prey w/digestive enzymes
  - Pumping stomach moves food inside

# Mating

- Female deposits pheromones
- Male plucks web
- Male pedipalps deliver sperm
- Female puts up to 3,000 eggs in silken egg case
  - Hides
  - Carries with her



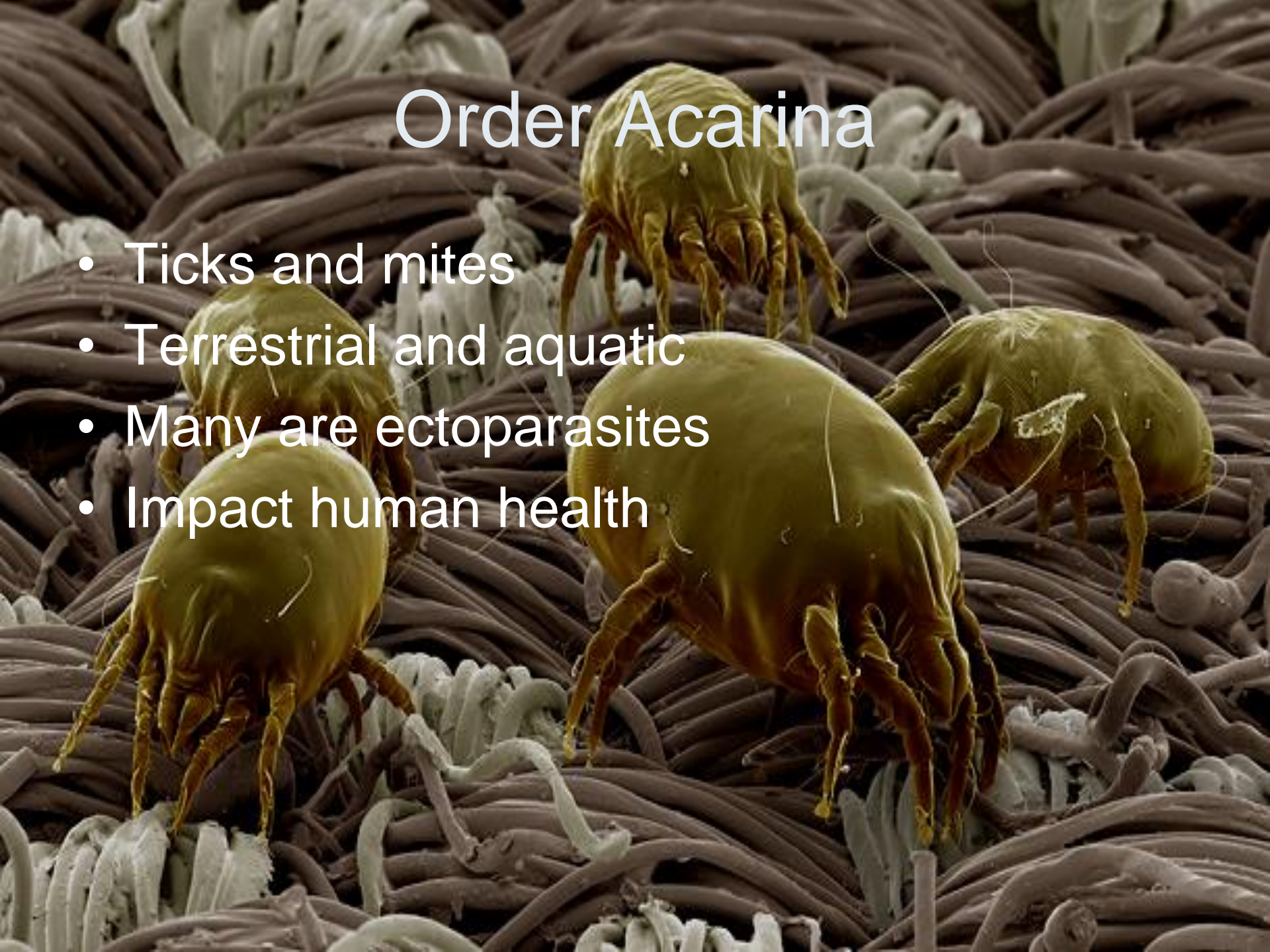
# Order Opiliones



- Harvestmen or daddy long legs
- Prosoma broadly joins opisthosoma (appears ovoid)
- Many are omnivores
- Some predators
- Sperm transfer is direct
- Eggs laid on damp ground

# Order Acarina

- Ticks and mites
- Terrestrial and aquatic
- Many are ectoparasites
- Impact human health





# Mites

- 1 mm or less
- Prosoma and Opisthosoma under single cover
- Herbivores, scavengers, parasites



# Ticks

- Up to 3 mm in length
- Feed on blood
- Females less sclerotized than males and engorge with blood
- Vector for Lyme disease, Rocky Mountain spotted fever, and tularemia

