

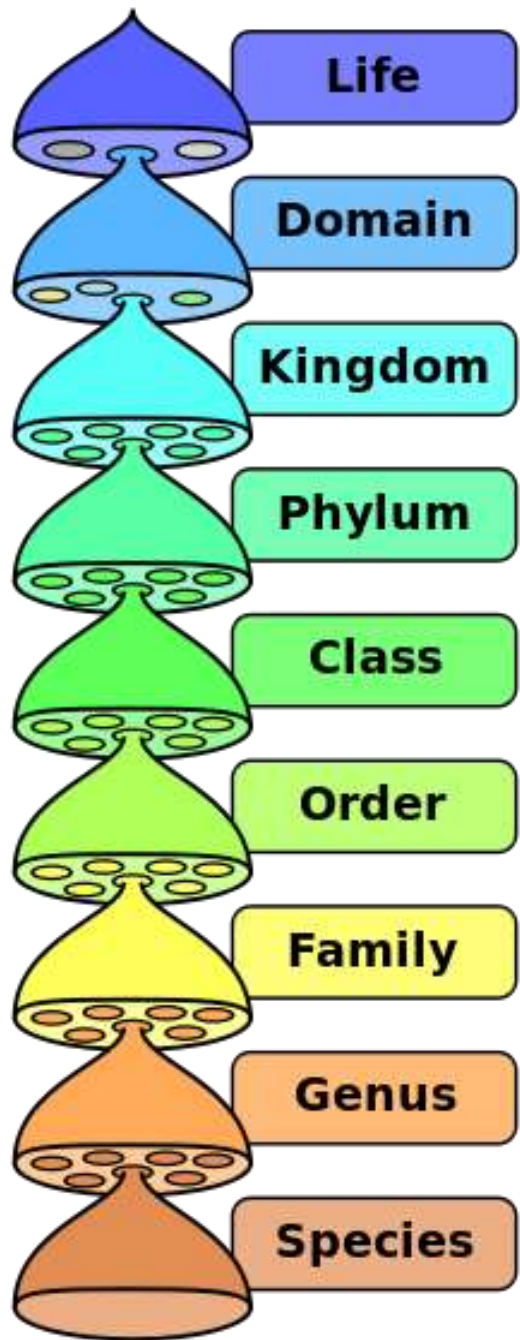


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**Position of insects in animal kingdom and their  
relationship with other Arthropods**



# **33 categories in Hierarchic Classification**

**Kingdom – Subkingdom – Infrakingdom –  
Superphylum – Phylum – Subphylum – Infraphylum –  
Superclass – Class – Subclass – Infraclass – Supercohort  
– Cohort – Subcohort – Infracohort – Superorder –  
Order – Suborder – Infraorder – Superfamily – Family –  
Subfamily – Infraclass – Supertribe – Tribe – Subtribe  
– Infratribe – Supergenous – Genus – Subgenus –  
Superspecies – Species – Subspecies.**

- The standardized endings are
- Superfamily - **oidea** (Ichneumonoidea)
- Family - **idae** (Ichneumonidae)
- Subfamily - **inae** (Pimplinae)
- Tribe - **ini** (Poemeniini)
- Subtribe - **ina** (Poemeniina)



**CLASSIFICATION OF PHYLUM ARTHROPODA UPTO CLASSES & POSITION OF INSECTS IN ANIMAL KINGDOM AND ITS RELATIONSHIP WITH OTHER ARTHROPODA**

Scientific classification

Kingdom:

Animalia

Phylum:

Arthropoda

*Clade:*

Pancrustacea

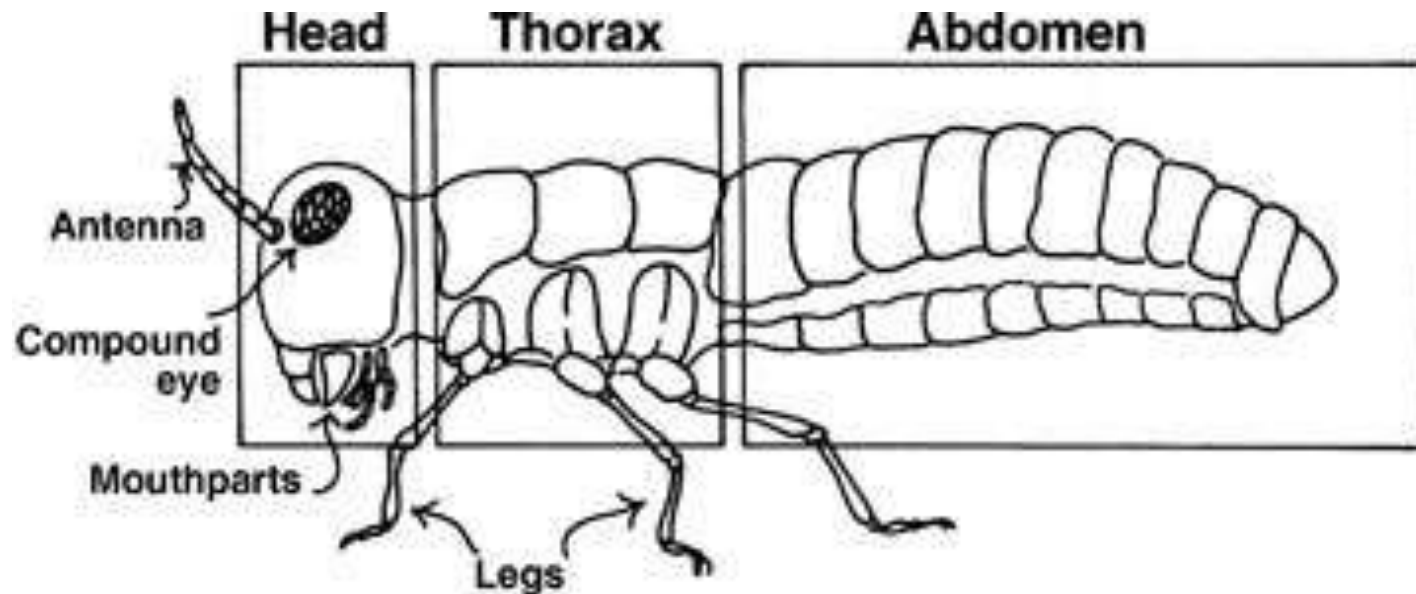
Subphylum:

Hexapoda

Class:

**Insecta** Linnaeus, 1758

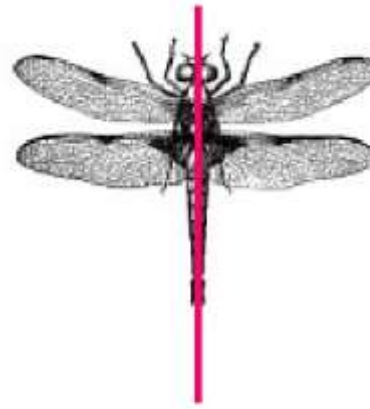
- Insects are invertebrates grouped in the phylum Arthropoda (**Subphylum : Uniramia**)
- Characters of the Phylum Arthropoda: (**Arthro-joint, poda-foot**)
- i. Segmented body
- ii. Segments grouped into 2 or 3 regions known as Tagmosis



iii. Renewable chitinous exoskeleton

iv. Grow by moulting

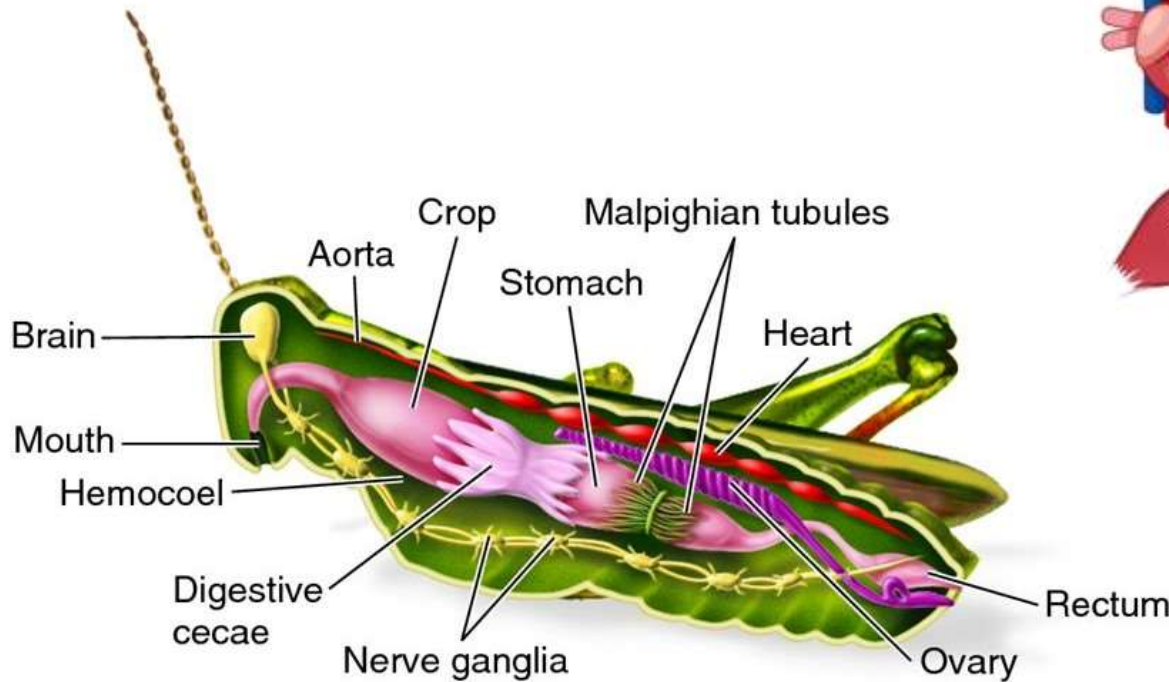
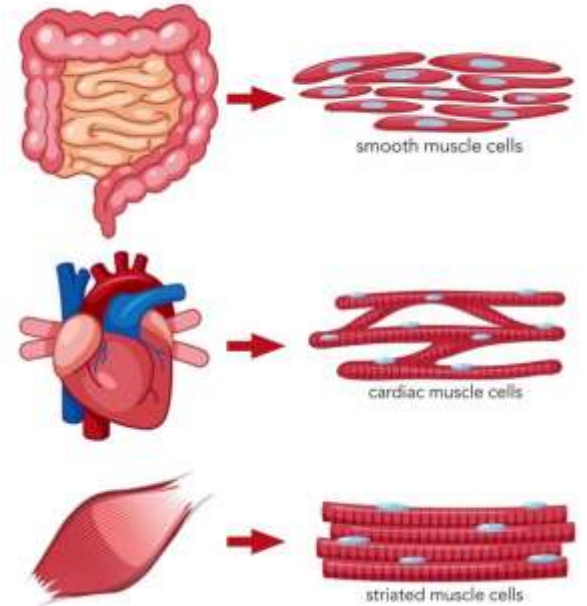
v. Bilateral symmetry



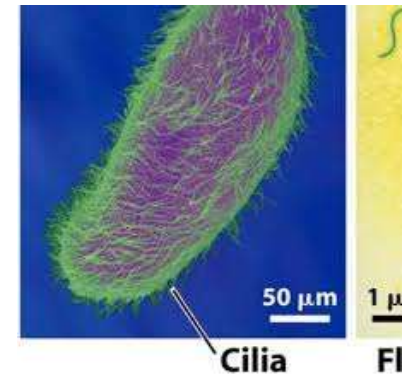
**This example bugs me!**

- vi. Body cavity filled with blood-Haemocoel
- vii. Tubular alimentary canal with mouth and anus
- viii. Dorsal heart with ostia
- ix. Dorsal brain with ventral nerve cord
- x. Striated muscles, xi. No cilia
- xii. Paired segmented appendages

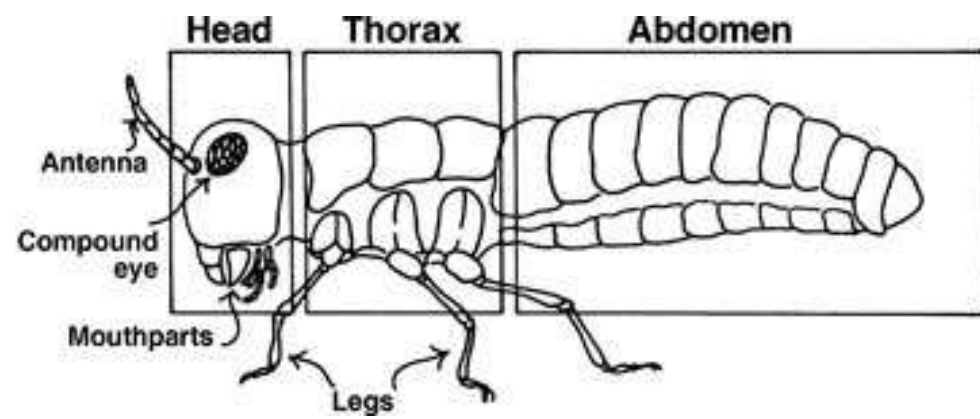
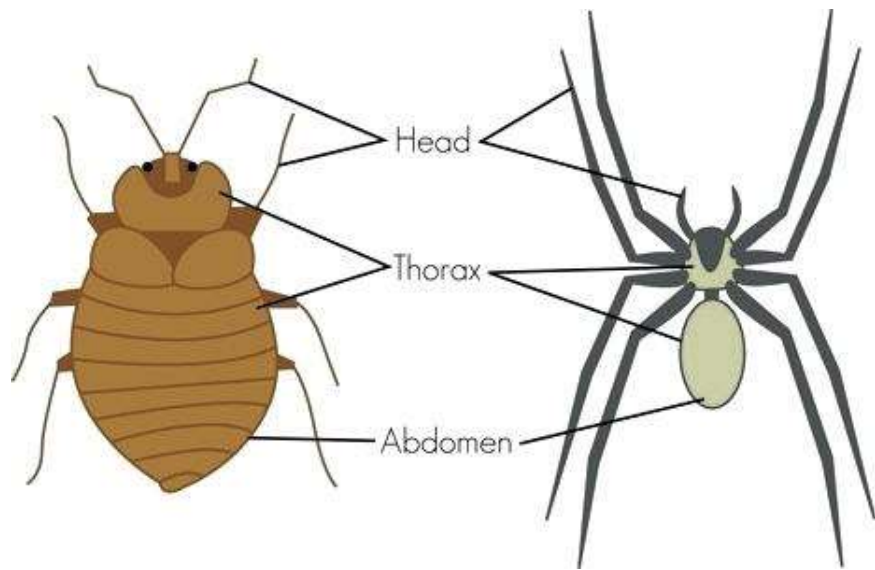
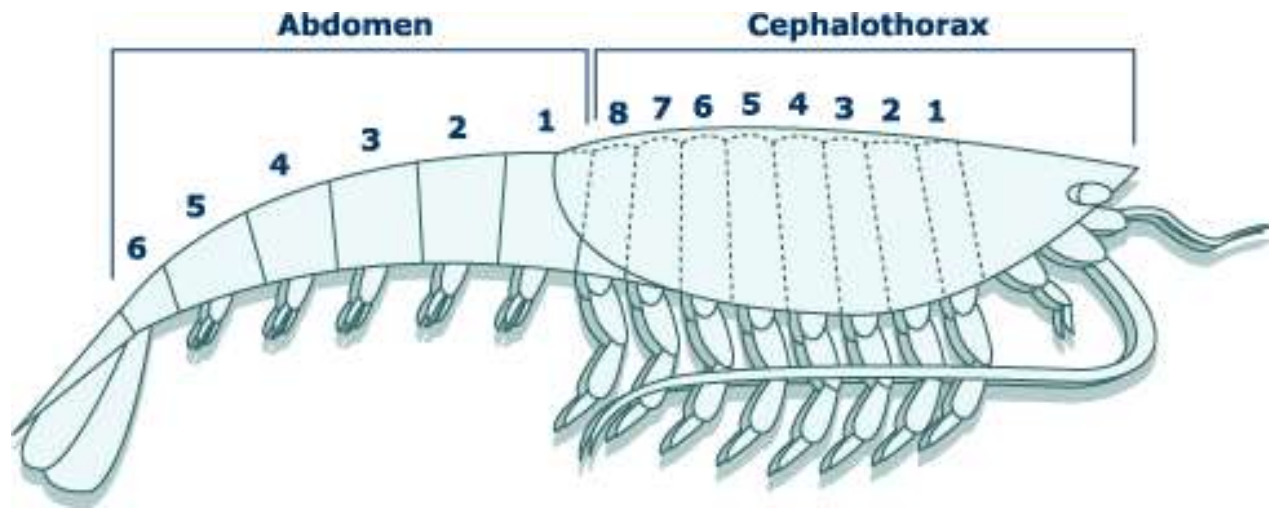
### Types of Muscle Tissue



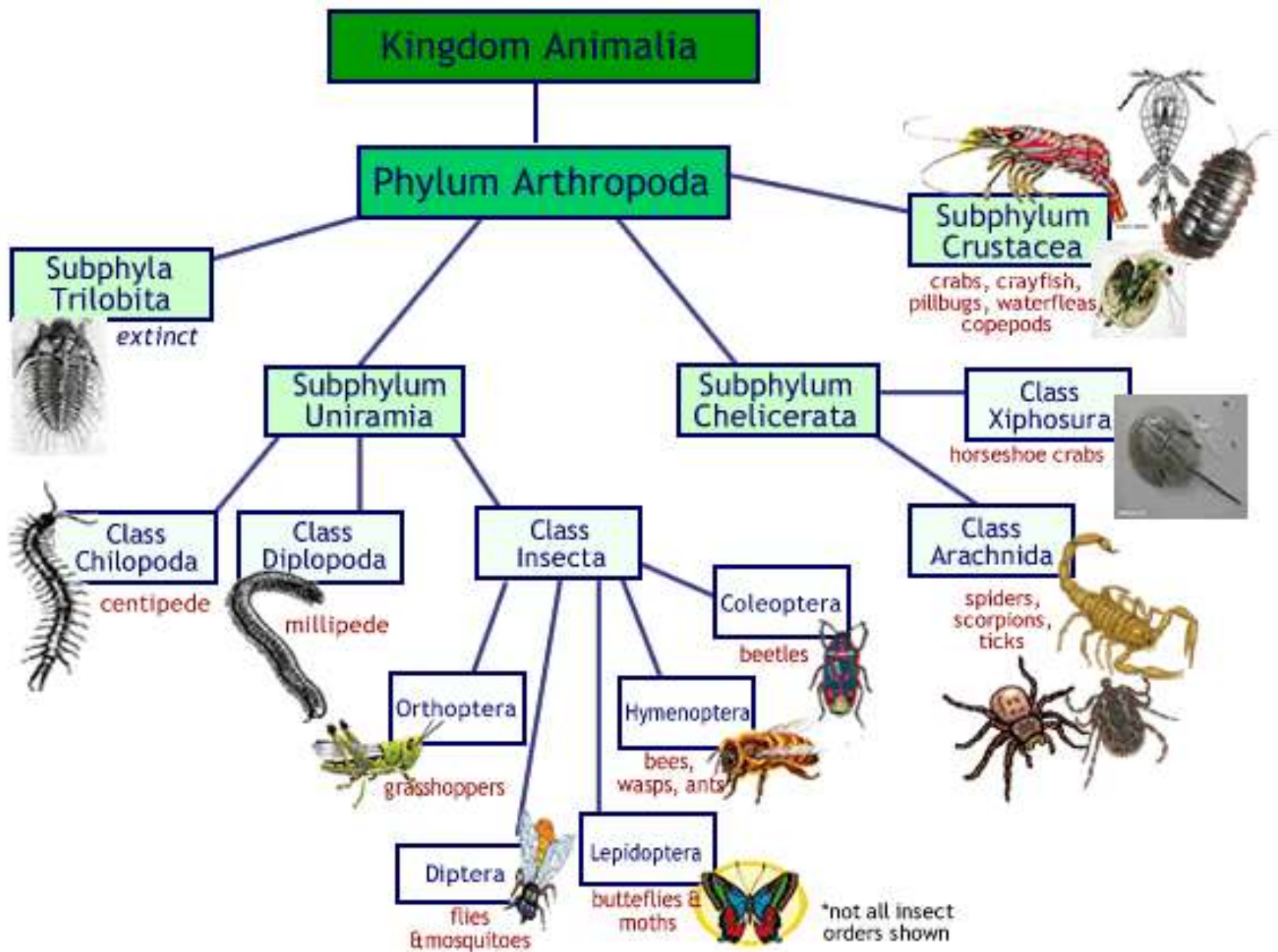
(b) Internal anatomy



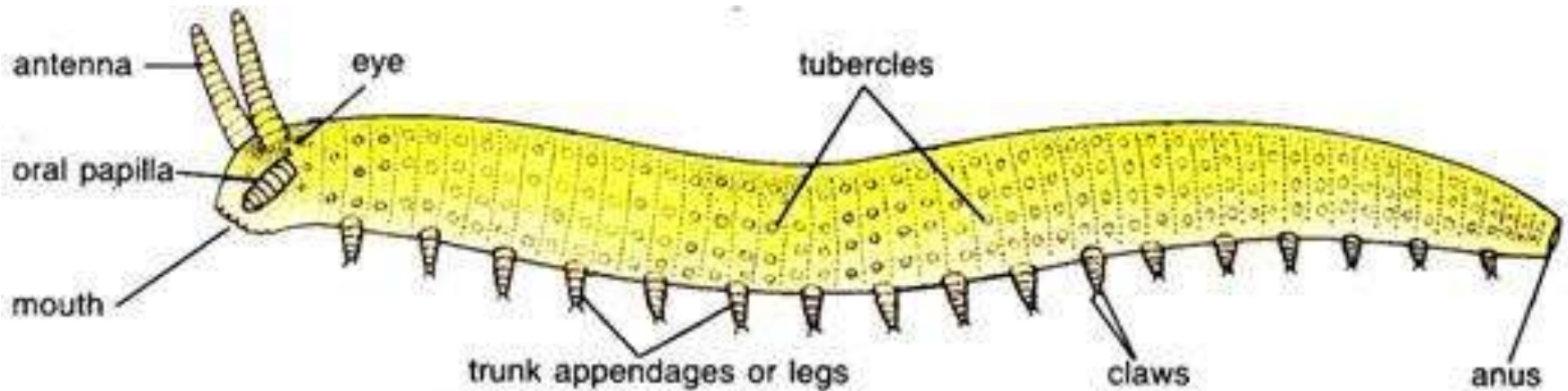




- **Classification: 7 classes.**
- **Phylum : Arthropoda**
- **Classes :** 1. **Onychophora** (claw bearing) e.g. Peripatus
- 2. **Crustacea (Crusta - shell)** e.g. Prawn, crab, wood louse
- 3. **Arachnida (Arachne - spider)** e.g. Scorpion, spider, tick, mite
- 4. **Chilopoda (Chilo - lip; poda - appendage)** e.g. Centipedes
- 5. **Diplopoda (Diplo - two; poda- - appendage)** e.g. Millipede
- 6. **Trilobita** (an extinct group)
- 7. **Hexapoda or Insecta** e.g. Insects.



- **Onychophora** (claw bearing) e.g. *Peripatus*
- Onychophora: The Velvet Worms
- Approximately 100 species worldwide living among moist leaf litter in forest.
- Species are predatory, spraying a proteinaceous “glue” from the oral papillae that ensure prey such as snails, worms and small arthropods.
- Body segments have a pair of distinct, unjointed lobopods with terminal claws.
- The head segment also has one set of paired appendages which forms sensory structures superficially similar to the antennae of arthropods.
- The phylum unites primitive features of typical “worms” (e.g., Nematoda and Nematomorpha) with those of other panarthropods.

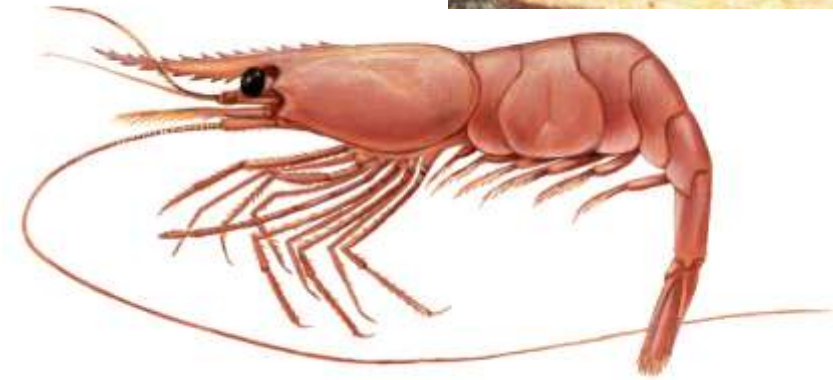


**Fig. 83.1.** *Peripatus*. External features in lateral view.

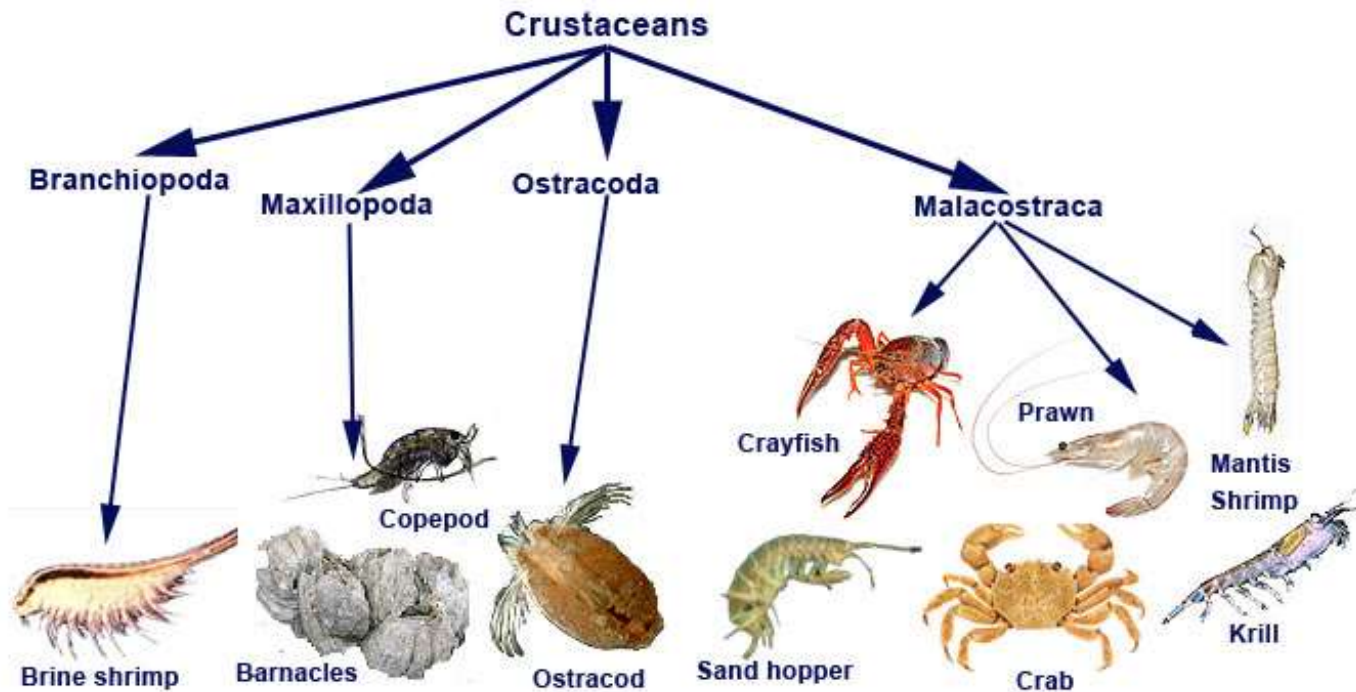
- Onychophorans were present in the Cambrian and several enigmatic fossil forms from the Burgess Shale are placed in the Onychophora, including *Hallucigenia*.
- Unlike the modern members of the phylum, these forms were entirely marine.
- The first terrestrial forms are known from the Upper Carboniferous about 300 mya.



- **Crustacea (Crusta - shell)** e.g. Prawn, crab, wood louse
- hard exoskeleton made of calcium - no internal skeleton.
- The head has two compound eyes,
- two pairs of antennae, and three pairs of mouthparts.
- A pair of green glands excrete wastes near the base of antennae.
- The abdominal segments have swimmerets (swimming legs)
- The sexes are separate. Eggs are attached to the swimmerets (swimming legs) of the female.



- The first pair is enlarged in the male (it is used to pass sperm to the female).
- The tail is fan-shaped, and ends in uropods and a telson.
- The circulatory system is open; there is no heart and the "blood" is pumped by vessels into sinuses, and does not flow in a closed loop).
- The nervous system consists of a primitive ventral nerve cord and ganglia system (similar to those of an earthworm).

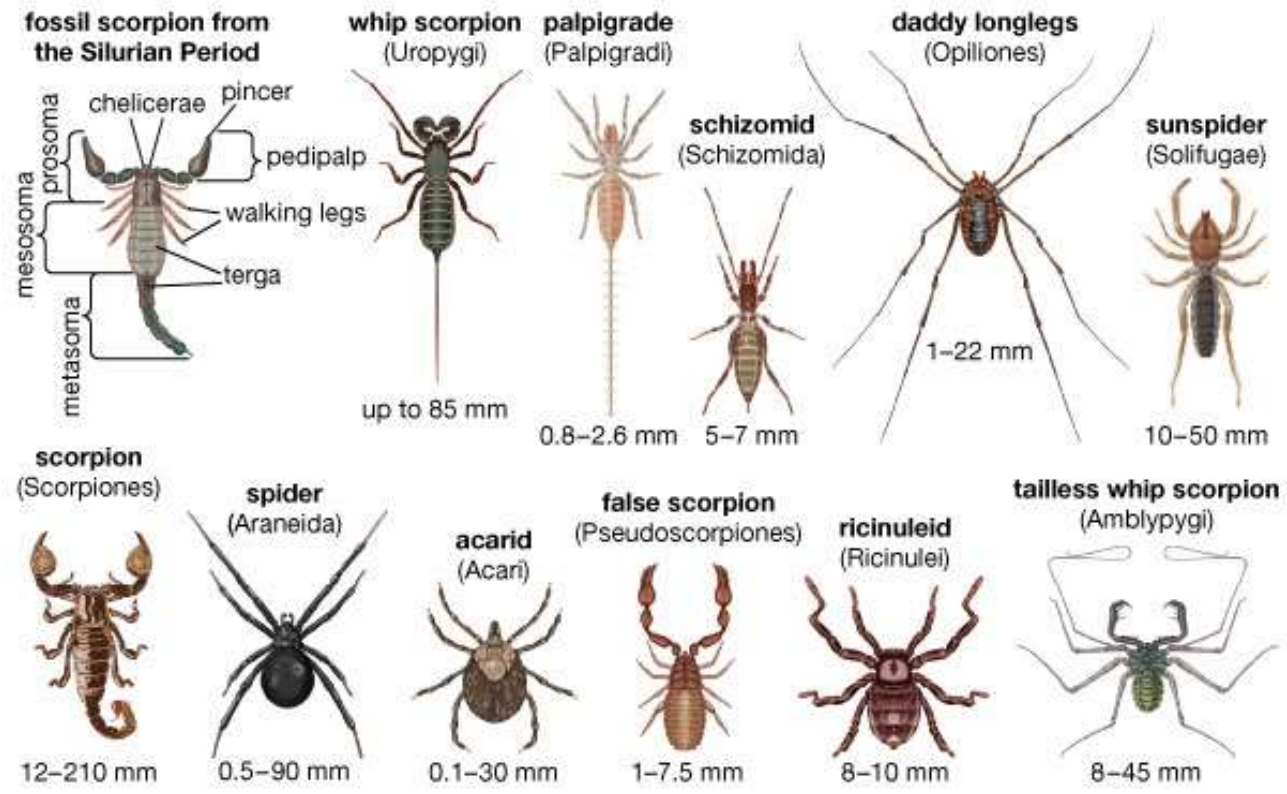


- **Arachnida (Arachne - spider)** e.g. Scorpion, spider, tick, mite
- Body segmentation - usually consisting of a head, thorax, and abdomen
- Jointed appendages
- A firm but flexible exoskeleton
- An open circulatory system - blood is free-flowing in the body, not contained in vessels
- Specialized appendages - including claws (crustaceans) or wings (insects)
- Arthropods are sometimes nicknamed the 'swiss army knives of living things', for their dexterity and array of appendage functions.

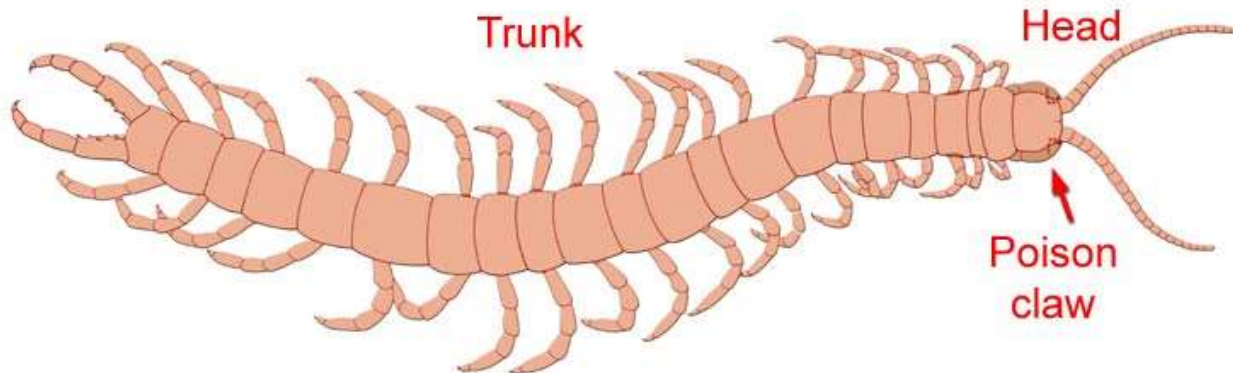




- Arachnids' specific class within Phylum Arthropoda is called Class **Arachnida**.
- Arachnids possess the same general characteristics that define all arthropods, but have a few other unique distinctions:
- No antennae, claws, or wings, but instead have **mandibles** : structures for biting and chewing prey
- Eight appendages
- A fused head and thorax, called a **cephalothorax**



- **Chilopoda (Chilo - lip; poda - appendage)** e.g. Centipedes
- Centipedes have one pair of legs per body segment.
- The first pair of legs is modified into venomous fangs.
- The centipede's body is generally flattened and there is a pair of well developed antennae on the head.
- Centipedes are generally predators that feed on insects and other arthropods.
- They pierce the prey to kill or disable it.
- They are active mostly at night and can move quickly.
- One Texas species in the genus *Scolopendra* is large enough to be a hazard to humans.

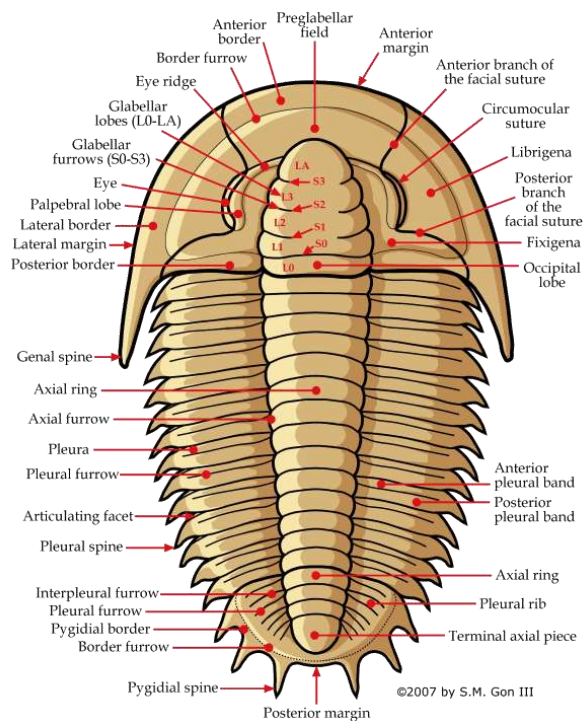


- **Diplopoda (Diplo - two; poda- - appendage)** e.g. Millipede
- First, all millipedes have two pairs of legs attached to each body segment.
- Other similar animals, like centipedes, have one pair of legs on each body segment.
- Millipedes are different because each segment is really made up of two segments fused together.
- These fused body segments are called **diplosegments**, which explains why the class is called Diplopoda.

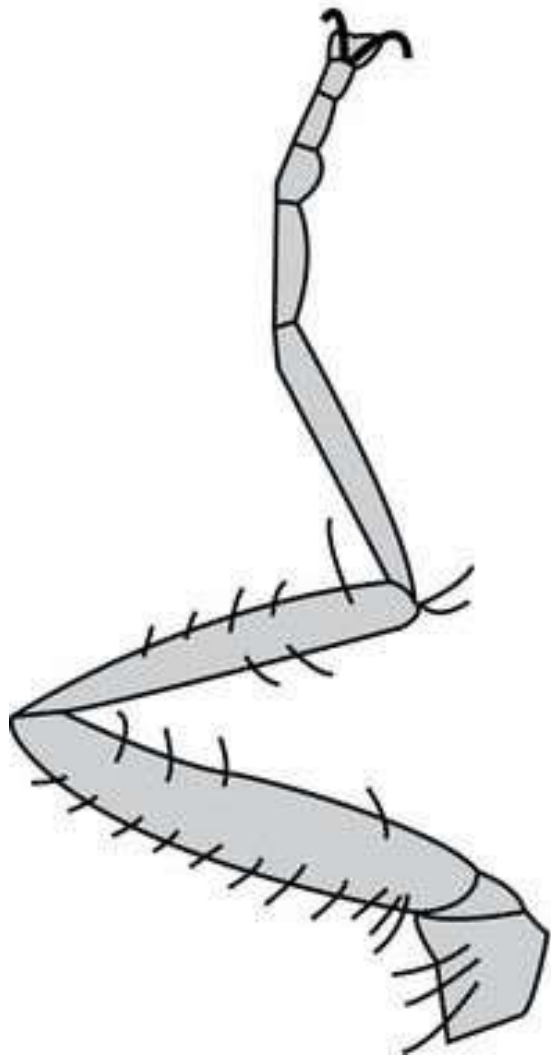


Trait	Millipedes	Centipedes
Legs	Two pairs on most body segments; attached to underside of body	One pair per body segment; attached to sides of body; last pair extends backwards
Locomotion	Generally adapted for burrowing or inhabiting small crevices; slow-moving	Generally adapted for running, except for the burrowing <a href="#">soil centipedes</a>
Feeding	Primarily detritivores, some herbivores, few carnivores; no venom	Primarily carnivores with claws modified into venomous fangs
Spiracles	On underside of body	On the sides or top of body
Reproductive openings	Third body segment	Last body segment
Reproductive behaviour	Male generally inserts spermatophore into female with gonopods	Male produces spermatophore that is usually picked up by female

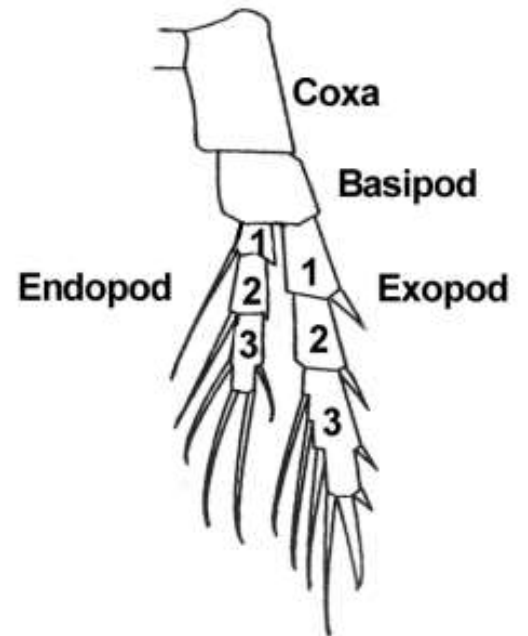
- **Trilobita** (an extinct group)
- 4000 extinct species –
- entirely marine, bottom feeders
- dominant in seas
- disappeared by end of Permian
- antennae present
- appendages uniramous (superficially appear to be biramous\* )
- authorities are still uncertain to which extant group trilobites are most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



uniramous



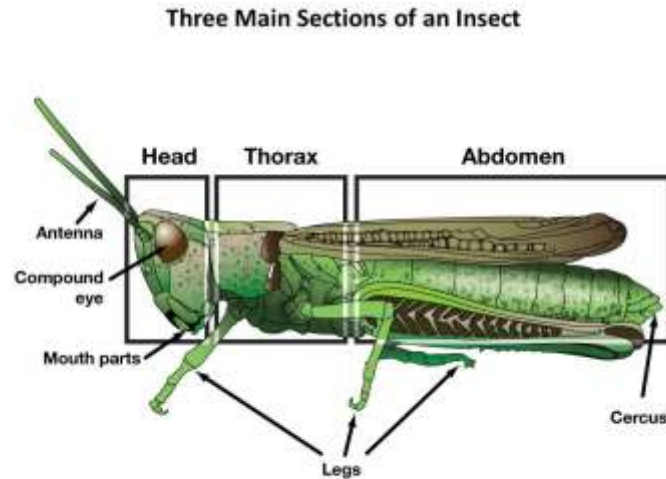
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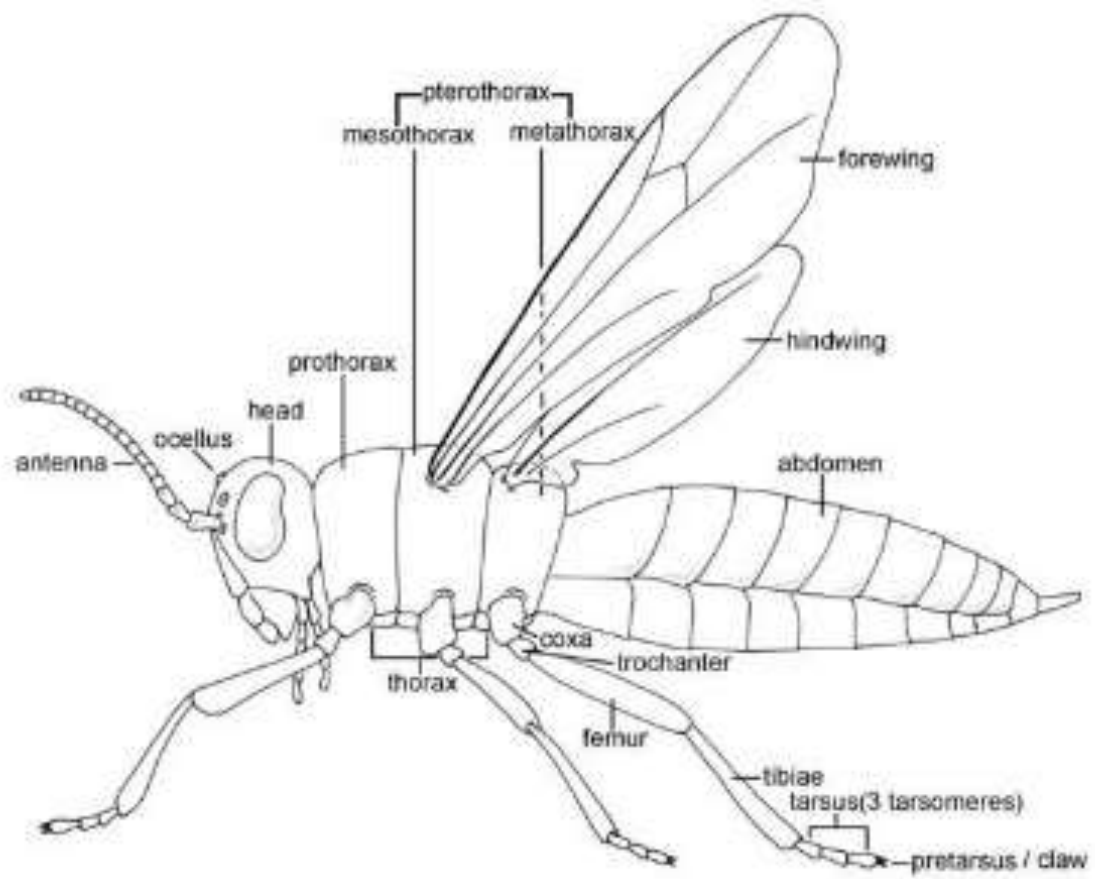
branchpoint



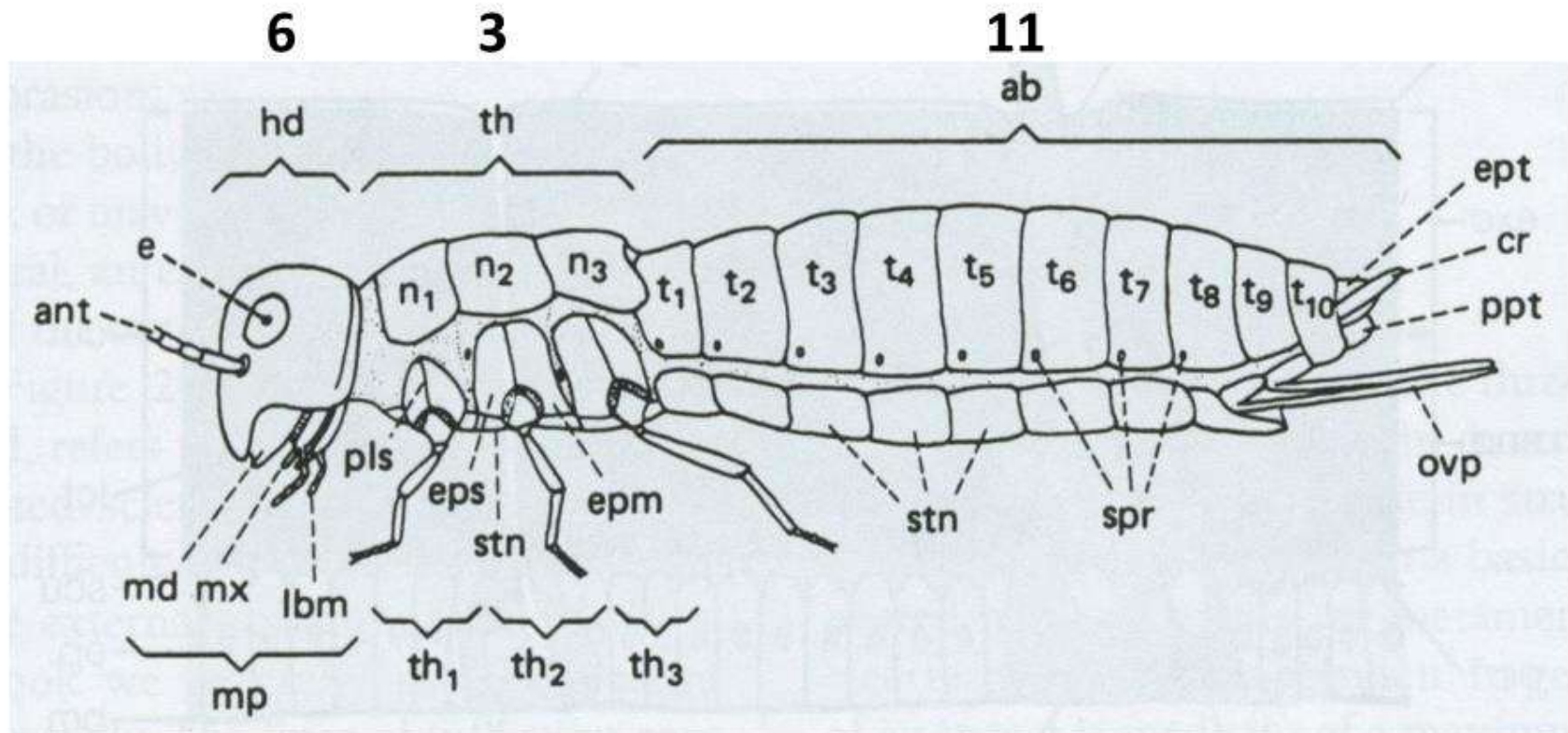
- **Hexapoda or Insecta** e.g. Insects.
- **Insect**, (class Insecta or Hexapoda), any member of the largest class of the phylum [Arthropoda](#), which is itself the largest of the [animal](#) phyla.
- Insects have [segmented](#) bodies, jointed legs, and external skeletons ([exoskeletons](#)).
- Insects are distinguished from other arthropods by their body, which is divided into three major regions:
  - (1) the [head](#), which bears the [mouthparts](#), eyes, and a pair of antennae,
  - (2) the three-segmented [thorax](#), which usually has three pairs of legs (hence “Hexapoda”) in adults and usually one or two pairs of wings.
  - (3) And the many-segmented [abdomen](#), which contains the digestive, excretory and reproductive organs.







# Segmentation and tagmosis



- Insect body is divided into a series of segments, the *metameres*, which are grouped into three distinct regions or **tagmata**: head, thorax, and abdomen.
- **Tagmosis**: amalgamation of segments into functional units

**Table 1. Relationship of Insects with other Arthropods**

Characters	Onychophora	Crustacea	Arachnida	Chilopoda	Diplopoda	Insects (Hexapoda)	
1.	Habit	Terrestrial	Aquatic and few terrestrial	Terrestrial	Terrestrial	Terrestrial	Many terrestrial and very few aquatic
2.	Body regions	Not distinct	Two-Cephalothorax and abdomen	Three-Pro, meso and Metasoma eg. Scorpion Two-Pro and Opisthosoma eg. Spider	Two-Head and multisegmented trunk	Two-Head and multisegmented trunk	Three-Head, thorax and abdomen
3.	Antenna	1 pair	2 pair - Antennule and Antenna	No antenna	One pair	One pair	One pair

Characters		Onychophora	Crustacea	Arachnida	Chilopoda	Diplopoda	Insects (Hexapoda)
4.	Visual	Not distinct	One pair-	One pair-simple	One pair-simple	One pair-simple	Both simple eyes and
	organs		Stalked	eyes	eyes	eyes	compound eyes (one
			compound				pair)
			eyes				
5.	Locomotor	Many pairs of	Minimum five	Four pairs	One pair per	Two pair per	Three pairs of legs on
	organs	unjointed legs	pairs of		segment (First	segment (No	three thoracic
			biramous legs		pair of legs	poison claws)	segments and two
					modified as		pairs of wings on
					poison claws)		meso and metathorax



Characters		Onychophora	Crustacea	Arachnida	Chilopoda	Diplopoda	Insects (Hexapoda)
9.	Circulatory	Heart with	Heart with	Heart with ostia	Heart with ostia	Heart with ostia	Heart with ostia
	system	ostia	ostia				
10.	Developme	Anamorphosis	Anamorphosis	Metamorphosis	Metamorphosis	Metamorphosis	Metamorphosis
	nt			absent-			
				Scorpion;			
				Metamorphosis			
				present- mites			

Characters		Onychophora	Crustacea	Arachnida	Chilopoda	Diplopoda	Insects (Hexapoda)
11.	Habit	Feed on	Herbivorous and	Phytophagous	Carnivorous	Herbivorous	Phytophagous,
		organic matter	Carnivorous	and predators			predators and
							parasitoides
12.	Special	Link between	Calcification	Life cycle; Egg-	Opisthogenital-	Progogenital-	Genital structures on
	features	Annelida and	strengthens	larva-nymph-	gonopore	gonopore in 3rd	8th and 9th
		Arthropoda	exoskeleton	adult larva with	present in the	segment	abdominal segments.
				3 pairs of legs	terminal		Brain with proto,
				and Nymph with	segment		deuto and
				4 pairs of legs			tritocerebrum

# THANK YOU

