

Chapter 20: Terrestrial Mandibulates

Phylum: Arthropoda
 Subphylum: Uniramia
 Class: Chilopoda
 Class: Diplopoda
 Class: Hexapoda (Insecta)

Subphylum: Myriapoda
 Class: Chilopoda
 Class: Diplopoda
 Subphylum: Hexapoda

Class: **Chilopoda** (Gr. margin/lip/jaw foot) centipedes 3000 spp.

carnivores, fast moving- prey on insects, cockroaches, earthworms

prefer moist places, under logs, bark, stones

spiracles cannot close

cuticle unwaxed

head and trunk segments → dorsoventrally flattened

pair of jointed legs on each segment except
 segment behind head & last two in the body

1st pair trunk appendage modified into pair of poison fangs **maxillipeds**

pair of long antennae

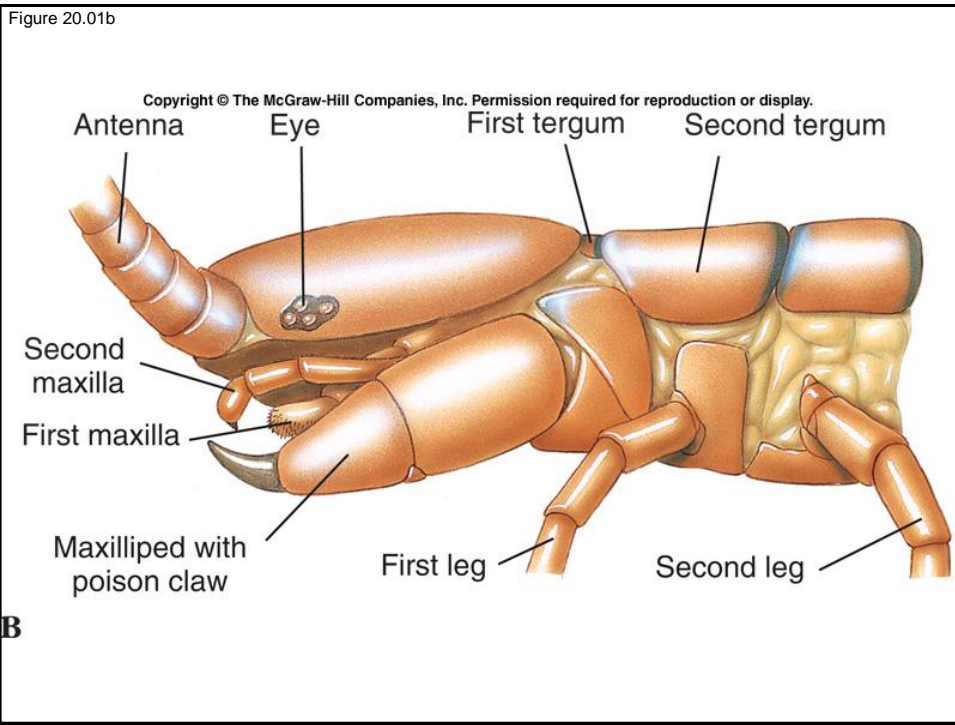
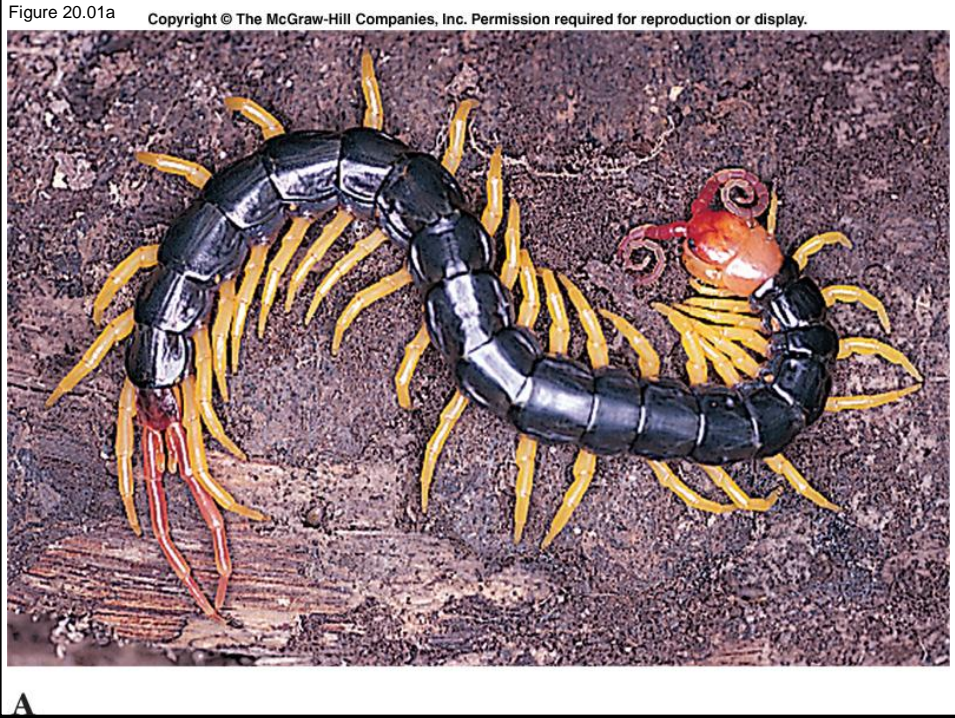
pair of mandibles (chewing)

pair of first & 2nd maxillae

pair of eyes (groups of ocelli)

repugnatorial glands → ventral surfaces

oviparous



Class: **Diplopoda** (Gr. double/two foot)

millipedes (thousand feet) 10,000 spp.

herbivores, deposit feeders, slow moving very few carnivores

integument impregnated with calcium salts/unwaxed cuticle

head with short antennae & simple eyes

body almost cylindrical

head and trunk segments

2 pairs of jointed legs on each segment except the segment behind the head and last two in the body

pair of short antennae

pair of mandibles

pair of maxillae (no distinct second maxillae)

repugnatorial glands

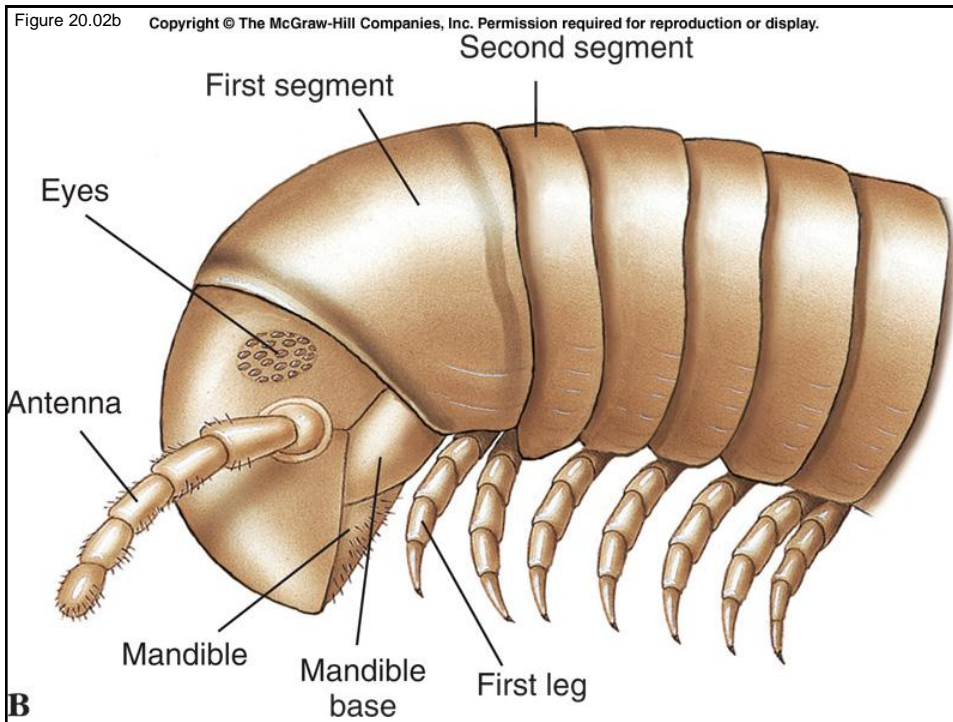
oviparous

Figure 20.02a

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A



Class: **Hexapoda** (Gr. six foot) **Insecta** (L. cut into)

@1,100,000 spp.

I. three tagmatas

head

thorax

abdomen

II. insects importance to human society

pests

destruction to plants/structures

disease vectors

friends

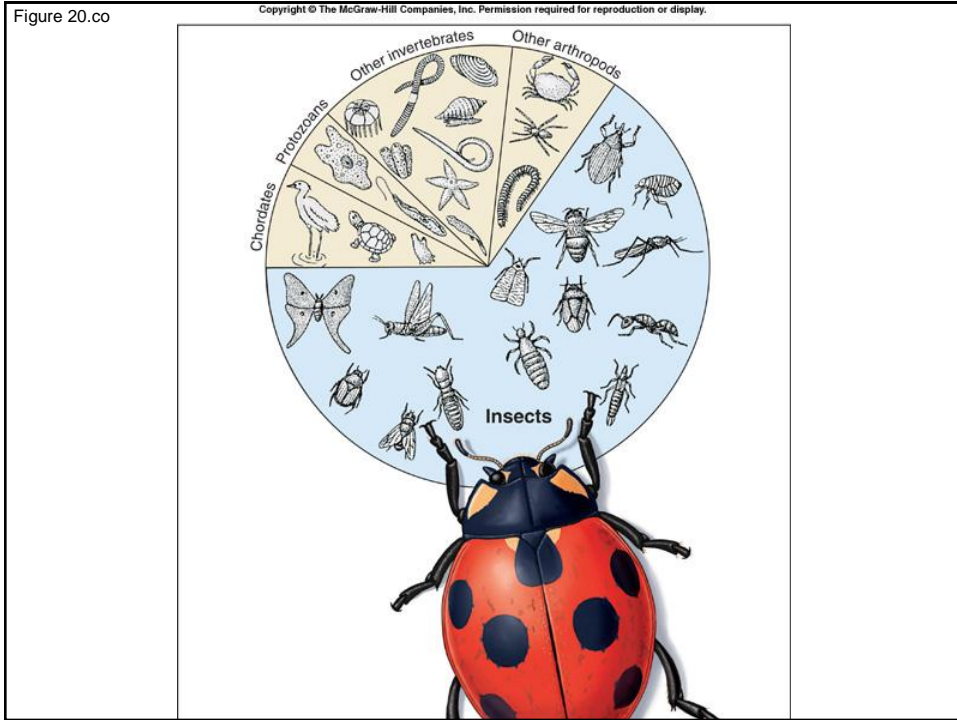
pollinators co-evolution with plants

decomposers-leaf cutter ants/dung beetles

biological control-parasitoids

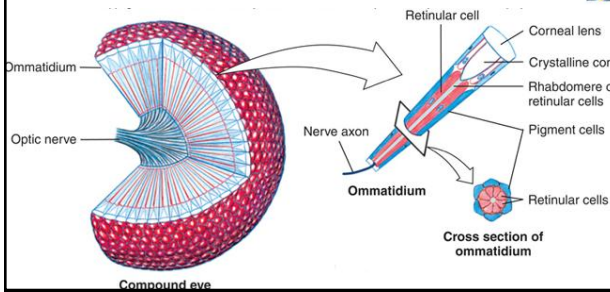
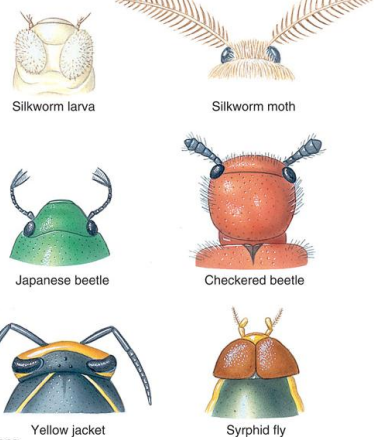
Figure 20.co

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Head

- A. pair of antennae
- B. pair of compound eyes
- C. 3 ocelli



D. mouthparts

- 1) labrum: pr of mandibles
- 2) labium
- 3) tongue-like hypopharynx

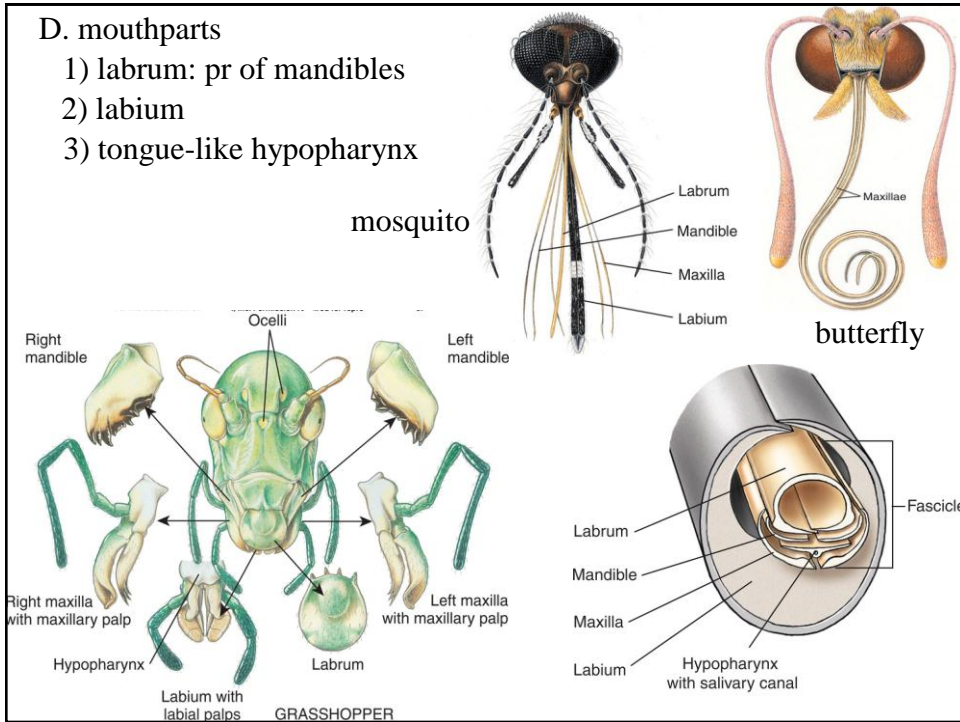


Figure 20.19c

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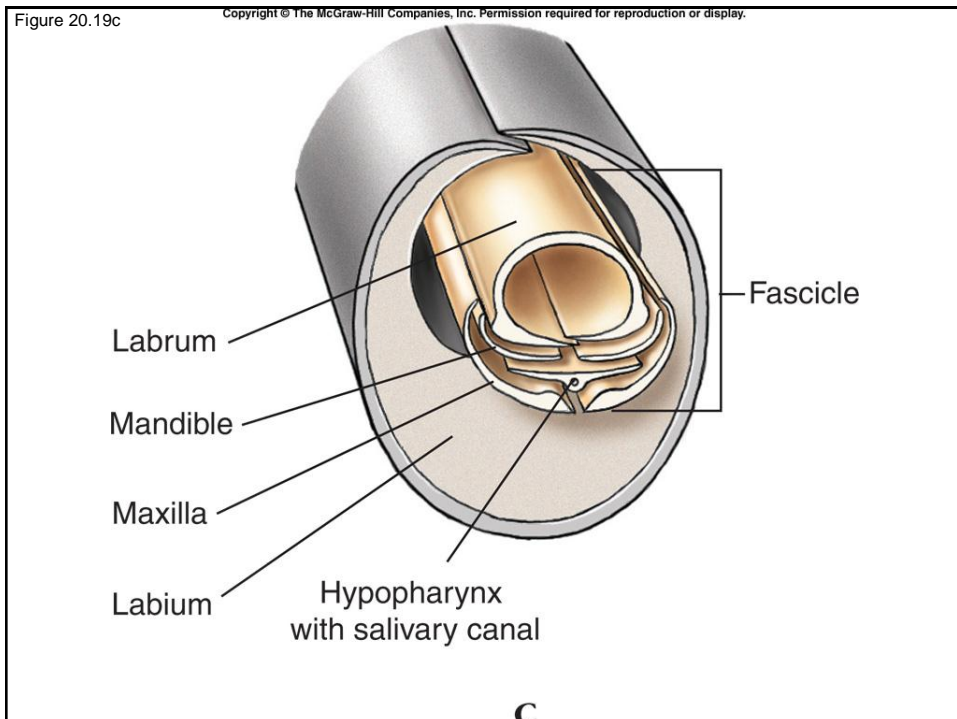
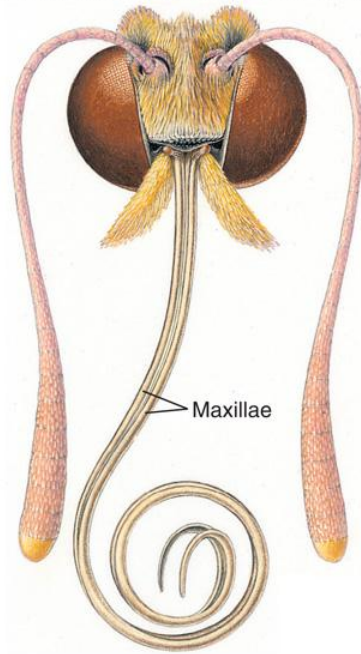


Figure 20.19d

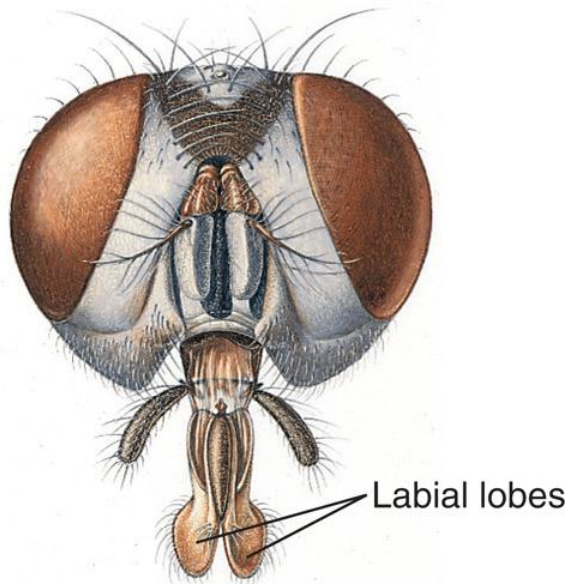
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D. BUTTERFLY

Figure 20.19e

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E. HOUSE FLY

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Chestnut weevil, *Curculio proboscideus*



D

Figure 20.09a

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A

Giant horned beetle

Thorax

prothorax

pair of legs (burrowing/grasping)

mesothorax

pair of legs

pair of wings

metathorax

pair of legs (jumping)

pair of wings

legs-terminal pads, claws, paddle-shaped
wings-cuticular extensions of epidermis

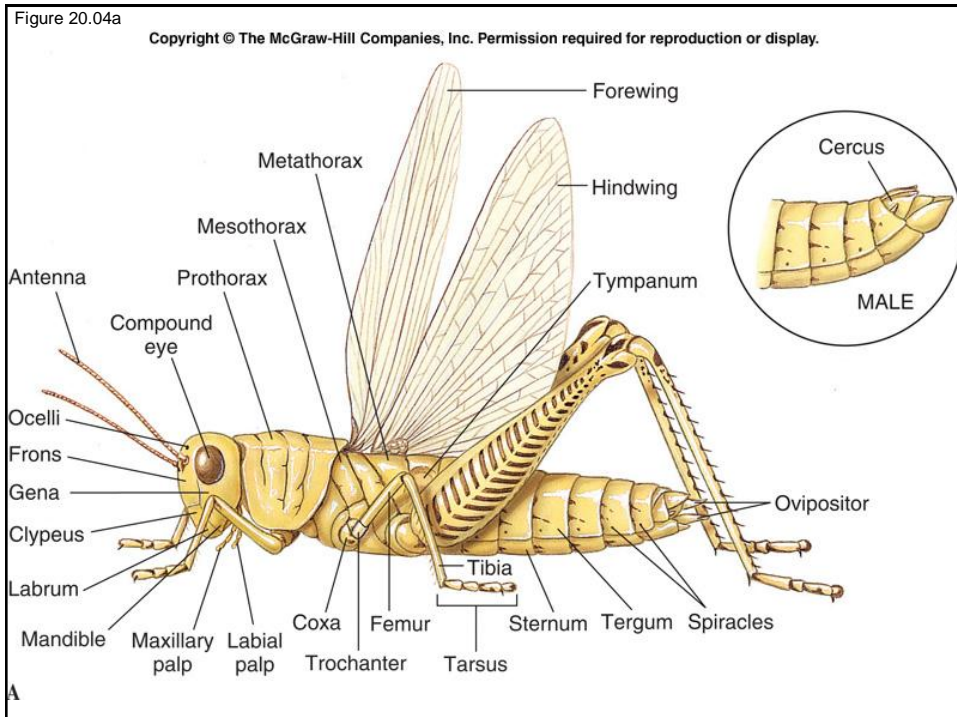
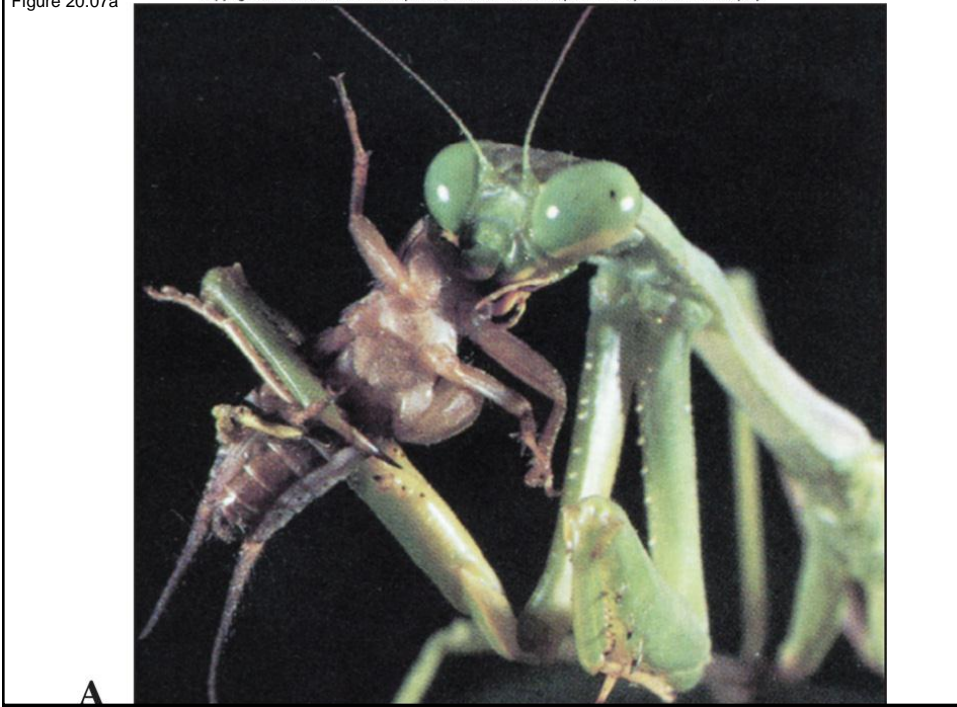


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A

Figure 20.06

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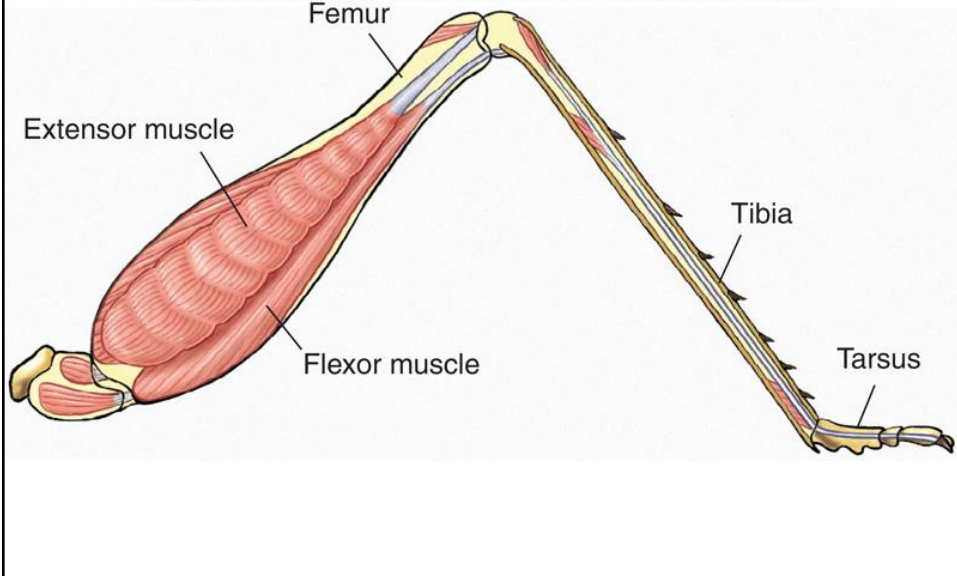


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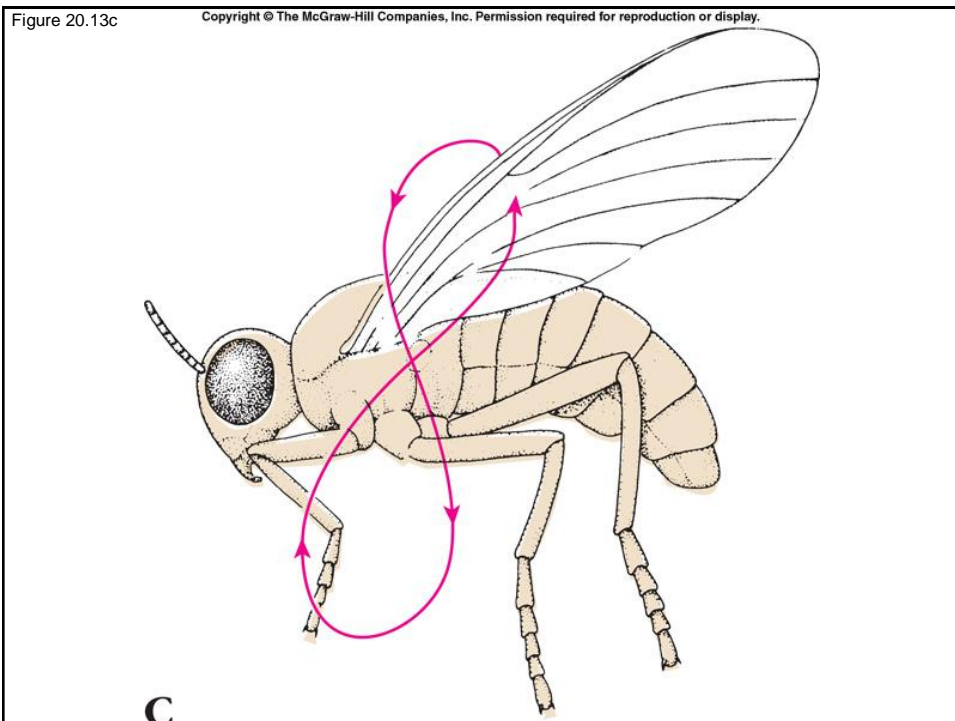
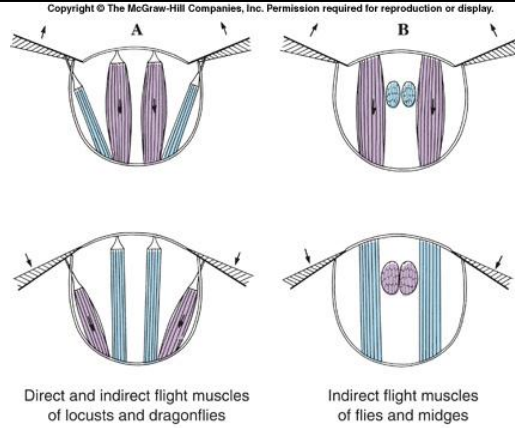


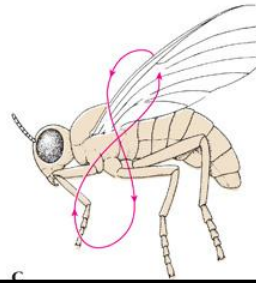
Figure 20.13



Flight

Direct muscles attached to wings

Indirect muscles attached to dorsal tergum



Abdomen

9-11 segments

11th segment → pair of cerci

larval/nymphal forms → appendages

adults → lack appendages

end of abdomen → external genitalia

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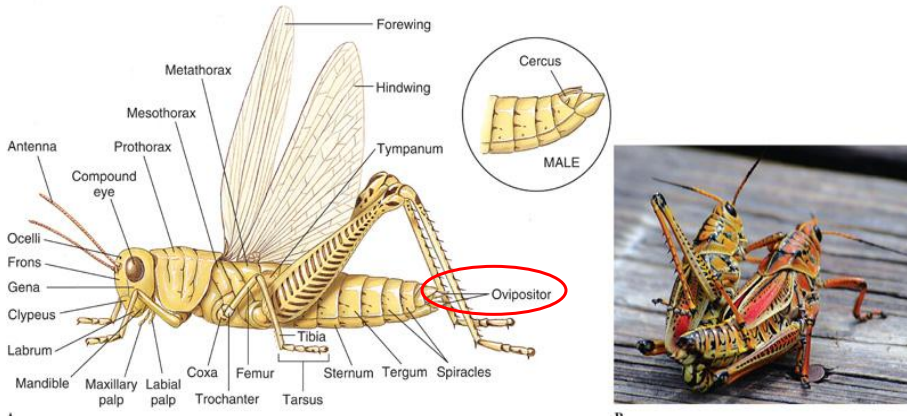


Figure 20.08

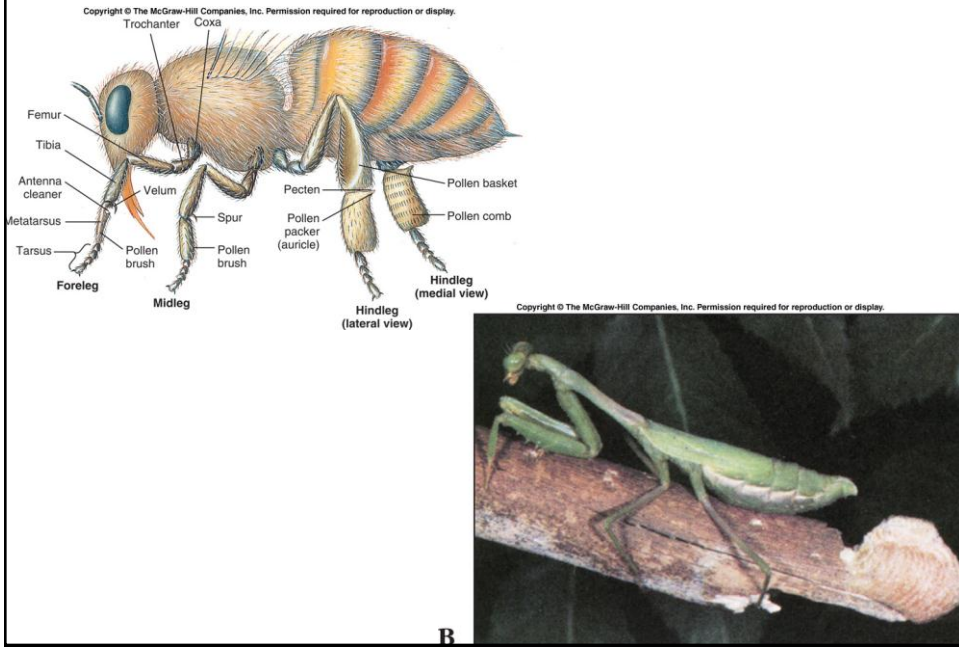


Figure 20.10

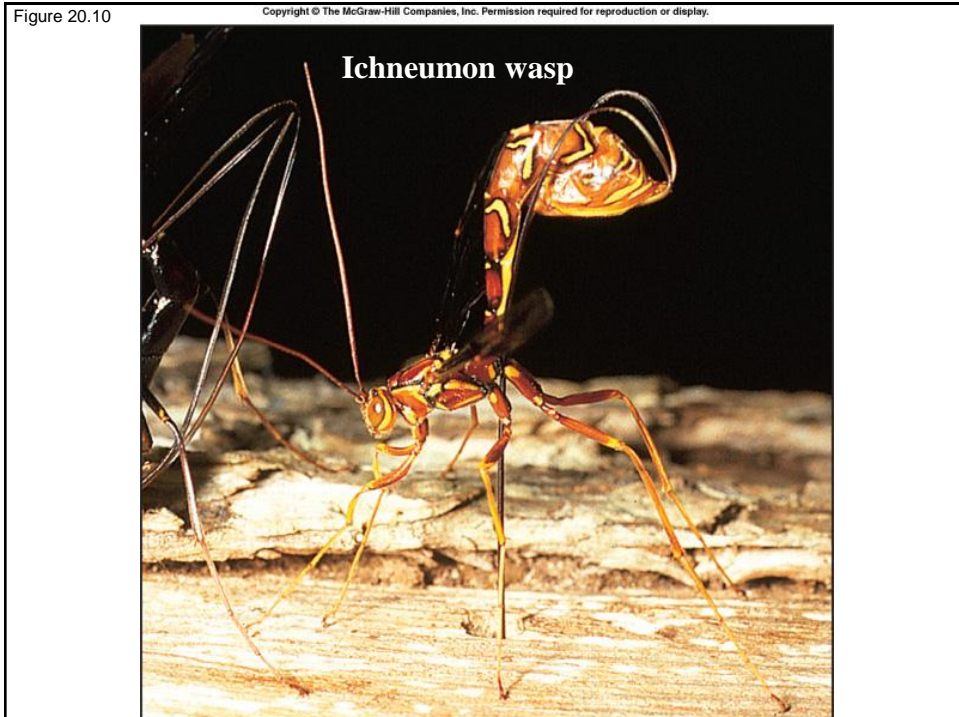


Figure 20.20

Respiration

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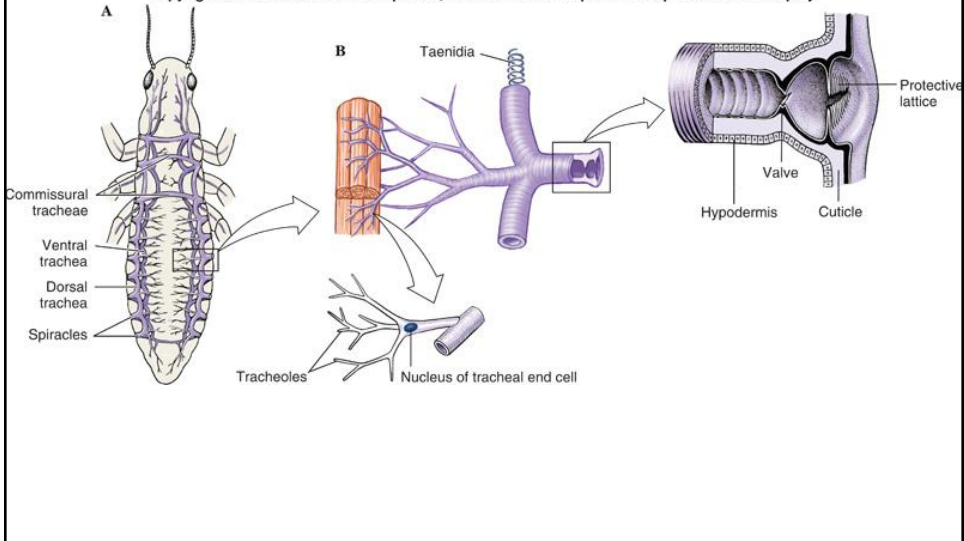
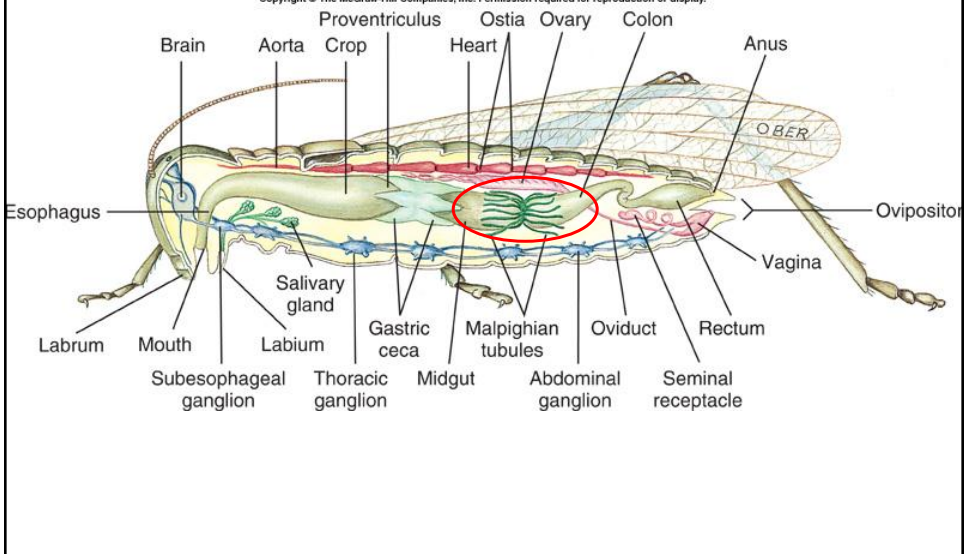
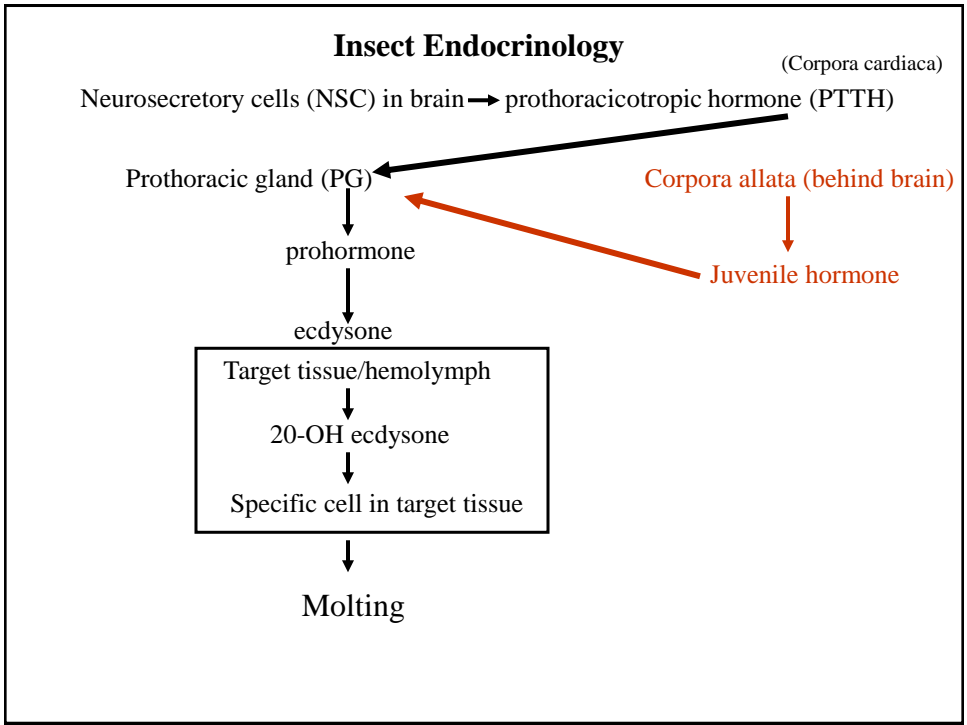
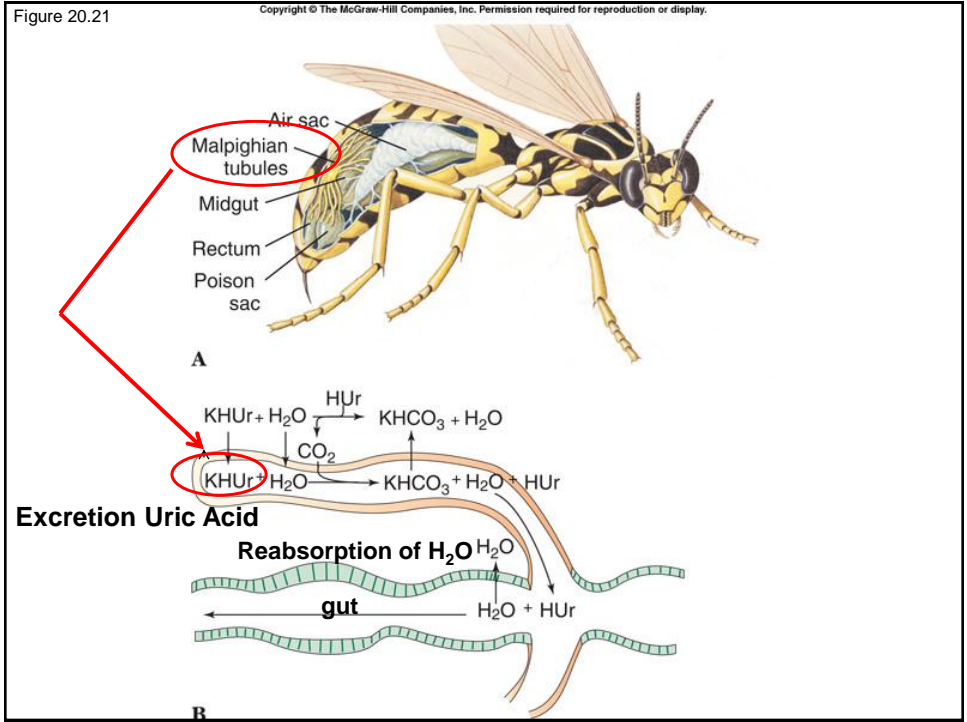


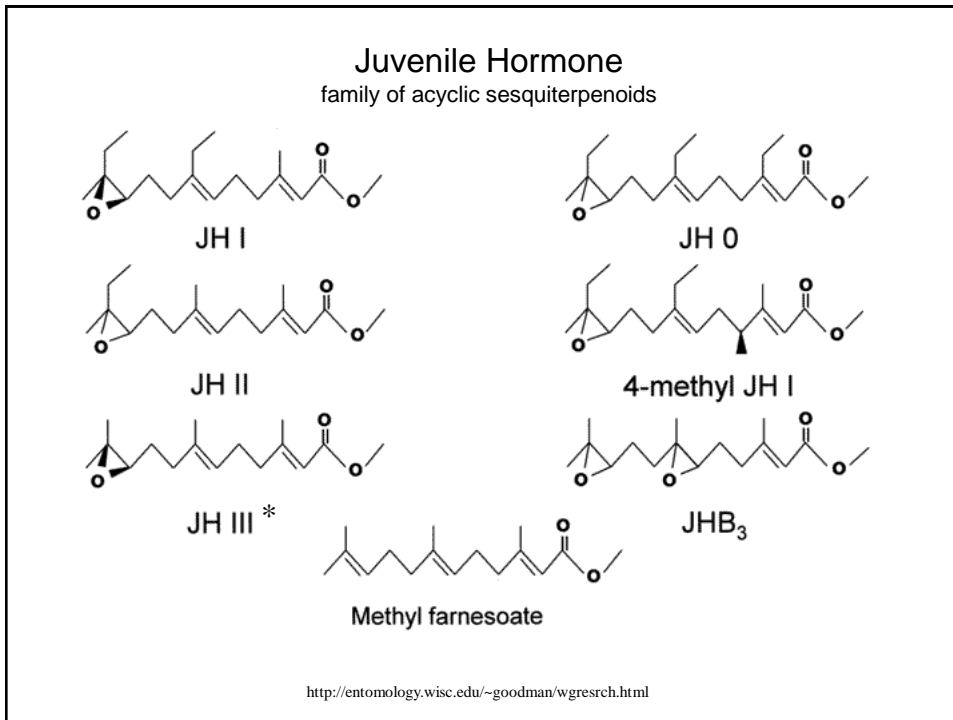
Figure 20.14

Malpighian Tubules

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Responses to Environmental Conditions

Dormancy

= period of arrested metabolism in response to unfavorable environmental conditions

winter sleep:	bears
hibernation	Canadian ground squirrels
summer: estivation	<i>Oreohelix</i> (Utah land snail)
daily: torpor	hummingbirds

Diapause

= prolonged arrested growth regardless of environmental conditions

- extreme adverse condition
- genetically determined
- initiated by particular cue(s) (e.g. photoperiod)
- ended by particular cue(s) (e.g. warmer temperature)

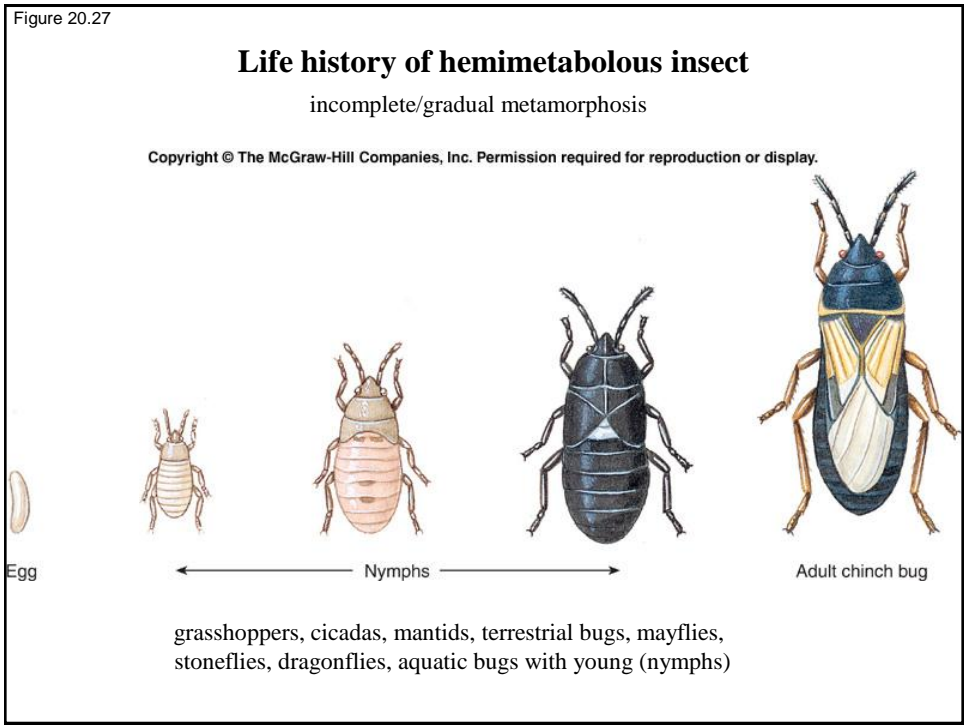
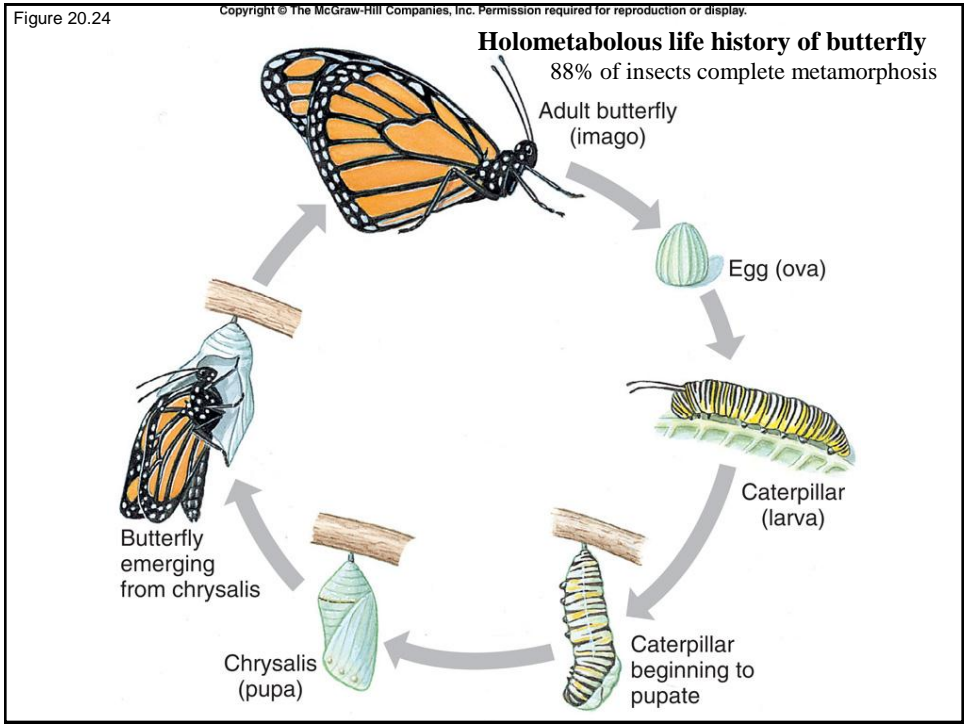
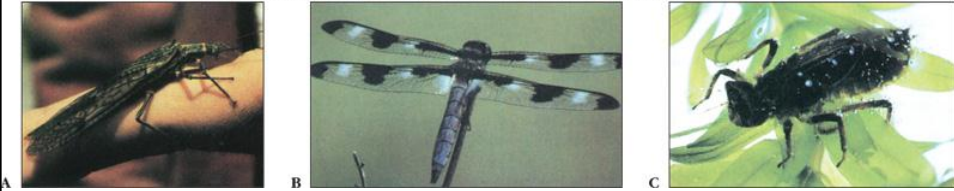


Figure 20.28

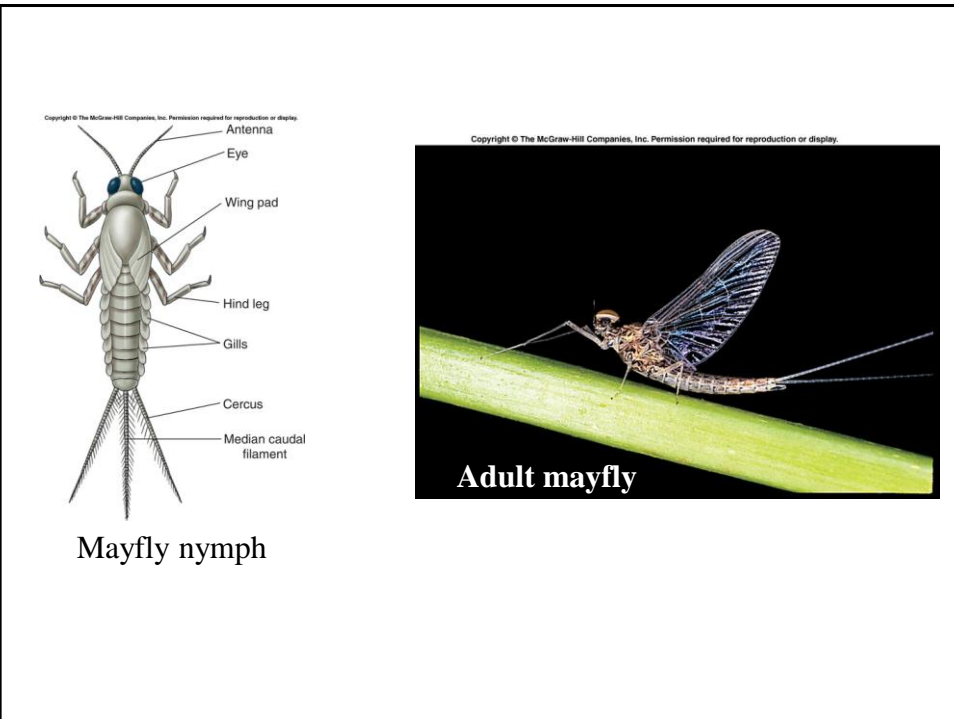
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Stonefly

Ten-spot dragonfly

Dragonfly nymph



Mayfly nymph

Adult mayfly

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Life history of ametabolous (without change) wingless insects

Silverfish, *Lepisma* sp.

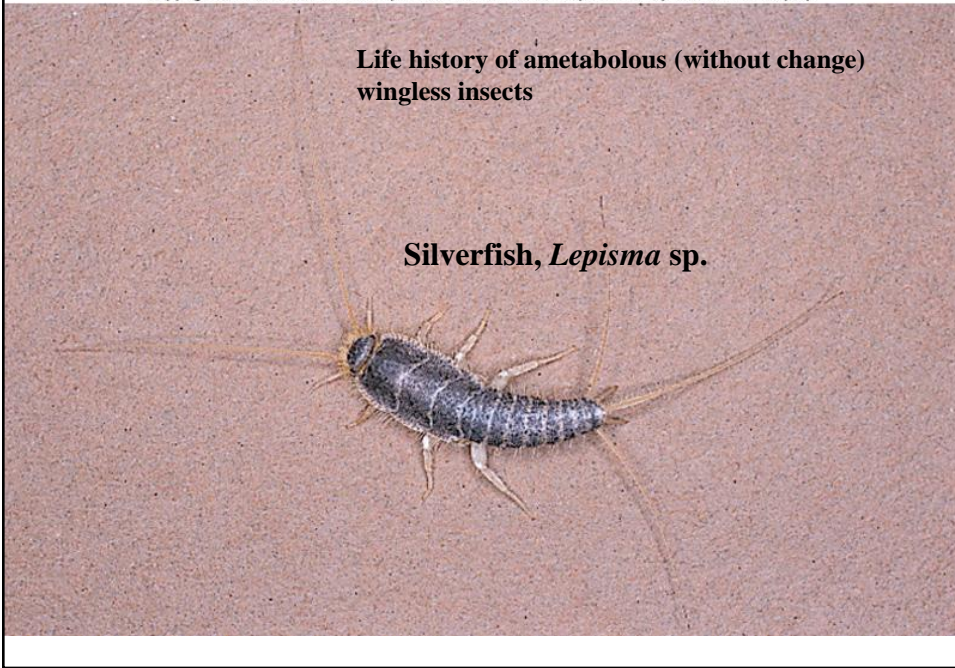
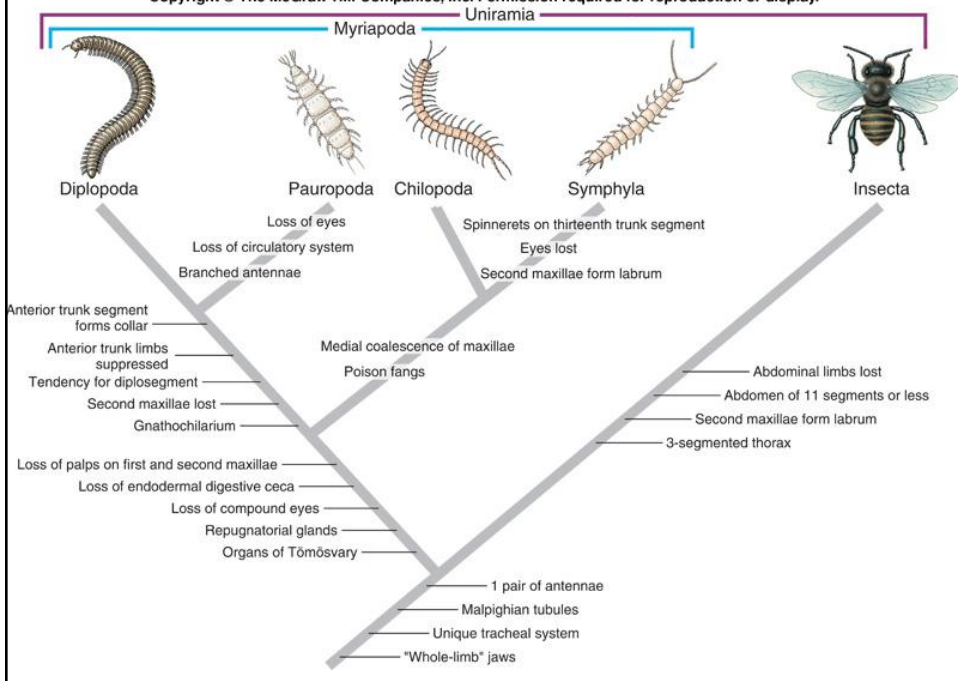
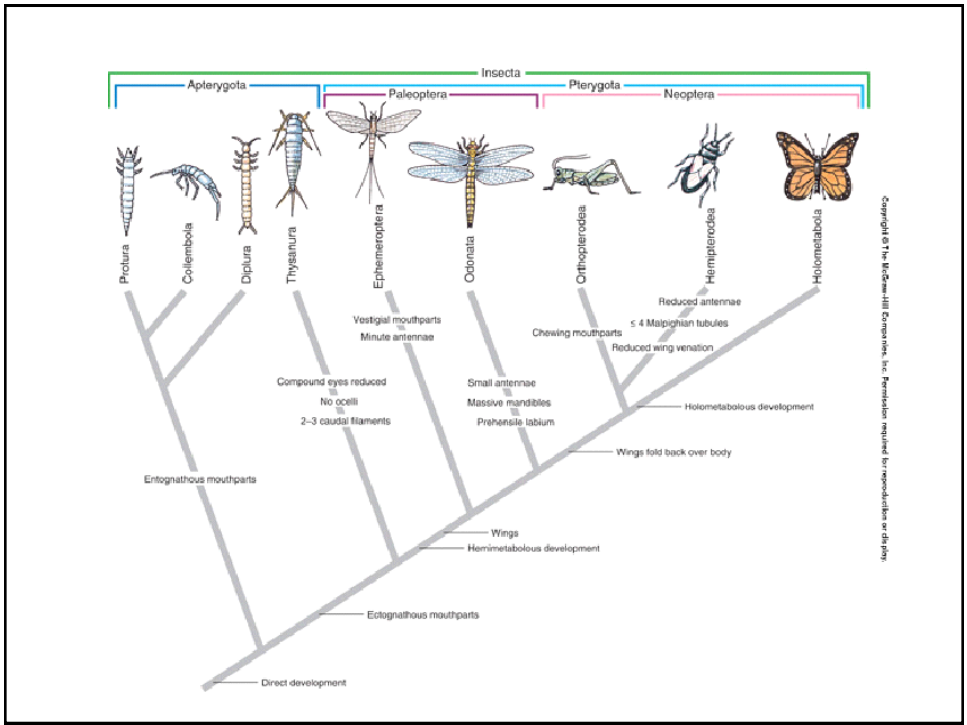
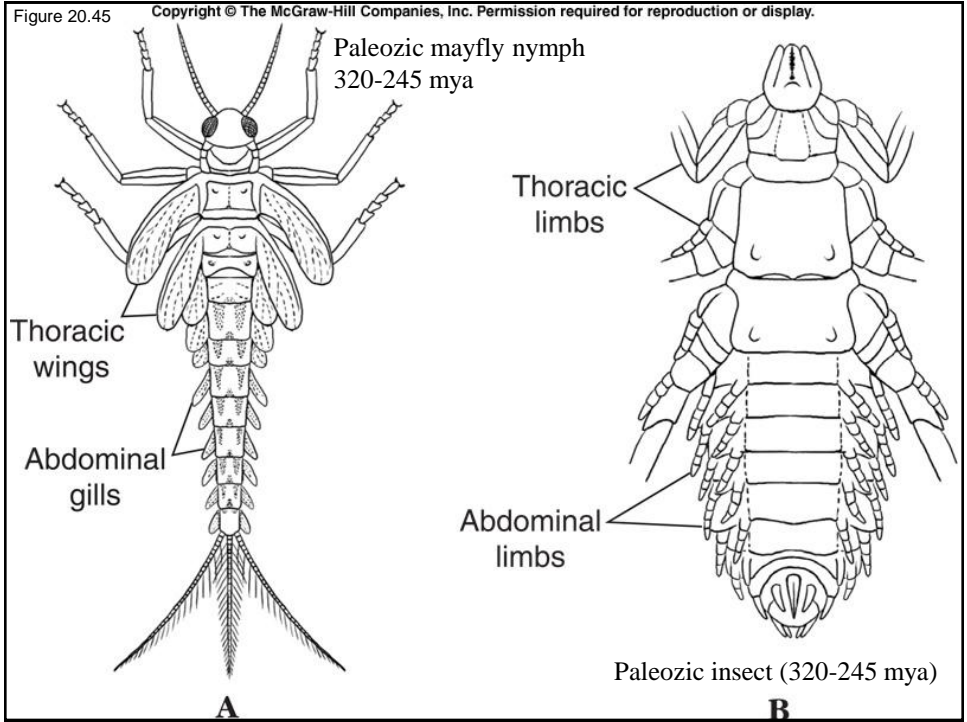
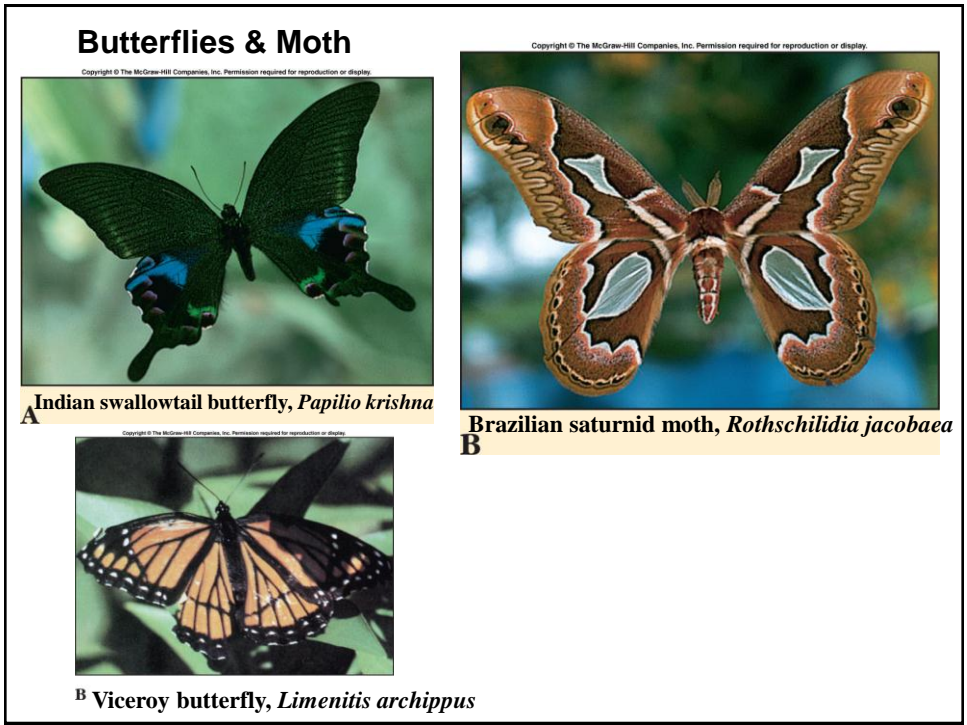
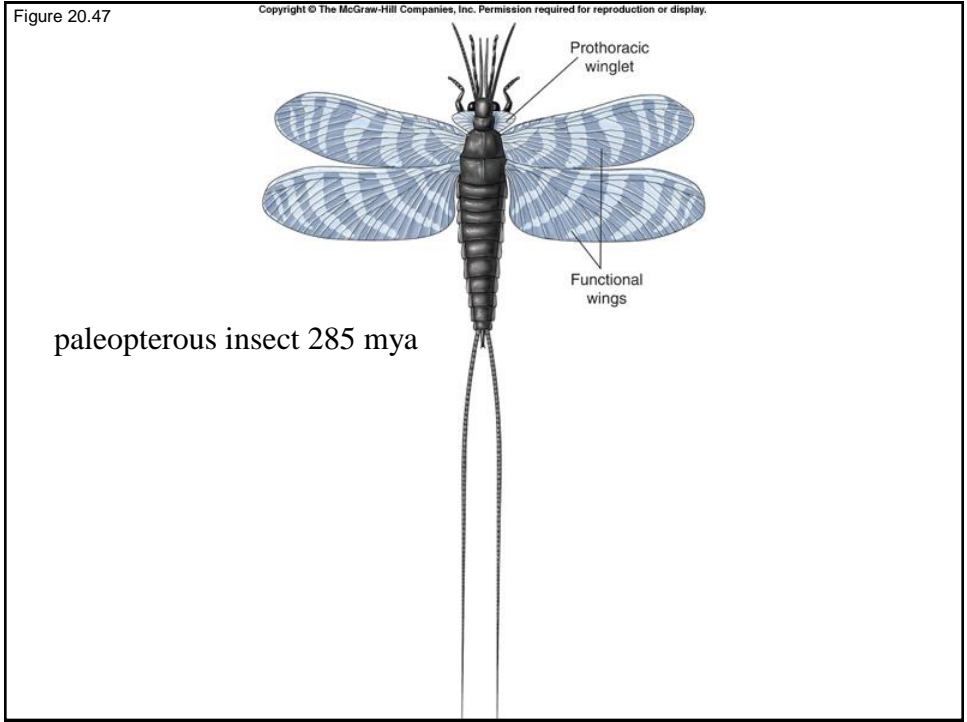


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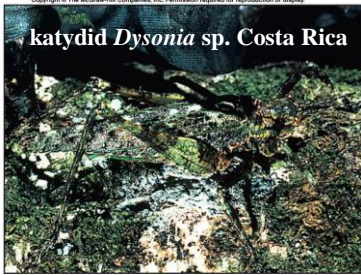
Crypsis = camouflage in shape/coloration to escape predators



A



B



C

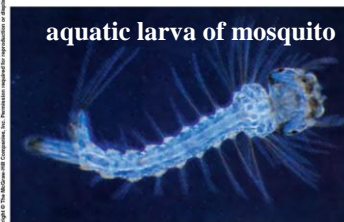


Oak treehoppers, *Platycotis vittata*

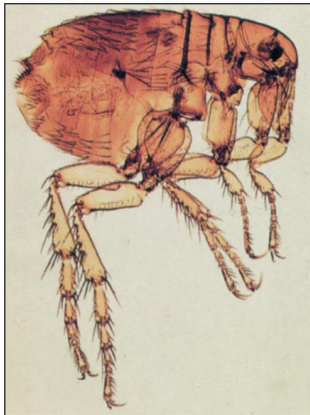
Disease Carrying Insects



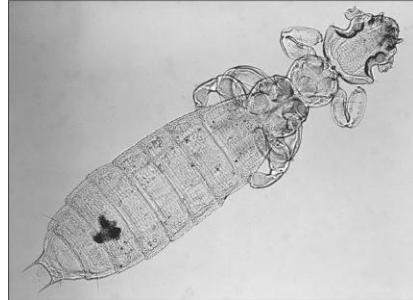
A



B



flea



Chewing louse, *Gliricola porcelli* of guinea pigs

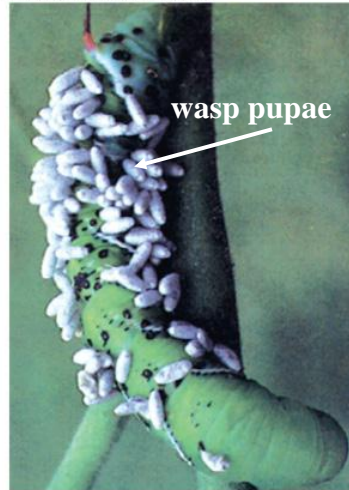


Human head/body louse, *Pediculus humanus*

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A Tomato hornworm, *Manduca sexta*: sphinx moth



B Hornworm parasitized by tiny wasp, *Apanteles*

Pheromones

Released by an organism, a chemical substance that influences behavior or physiology of another organism

- 1) Sexual attraction for mating
- 2) Bark beetles: enable mass attack on tree
- 3) Ladybird beetles: signaling overwintering
- 4) Fend off aggression
- 5) Mark trails
- 6) Signal alarms

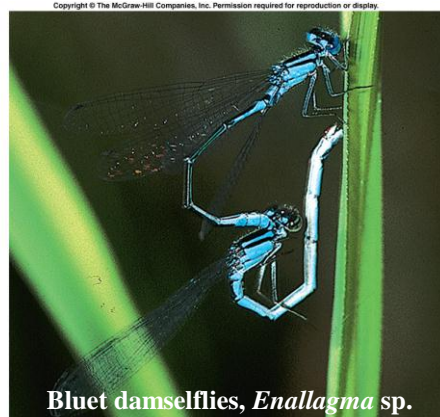
Insect Copulation



A Brazilian kind grasshopper, *Omura congruaria*



B Lubber grasshoppers, *Romalea guttata*



B Bluet damselflies, *Enallagma* sp.

Mimicry = imitation of noxious species

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A

Monarch



B

Viceroy non noxious

Aposematism = warning coloration

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A

Ecdysis in cicada



B

Adult cicada

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Dung beetle → ummmm good!!

F

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Female firefly eating a male firefly



Adult ant lion

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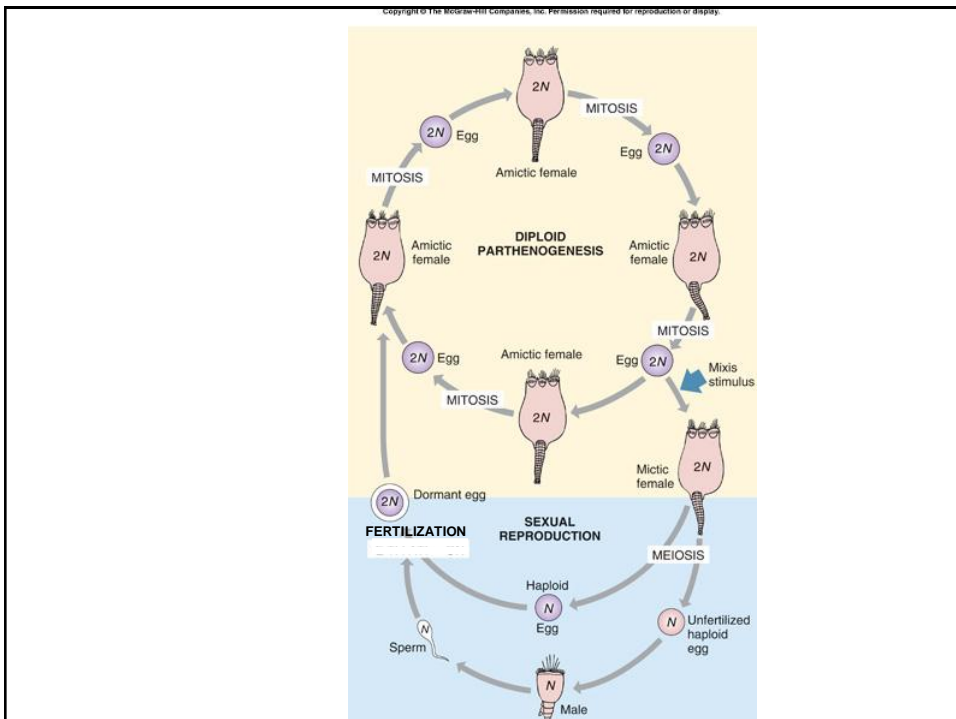
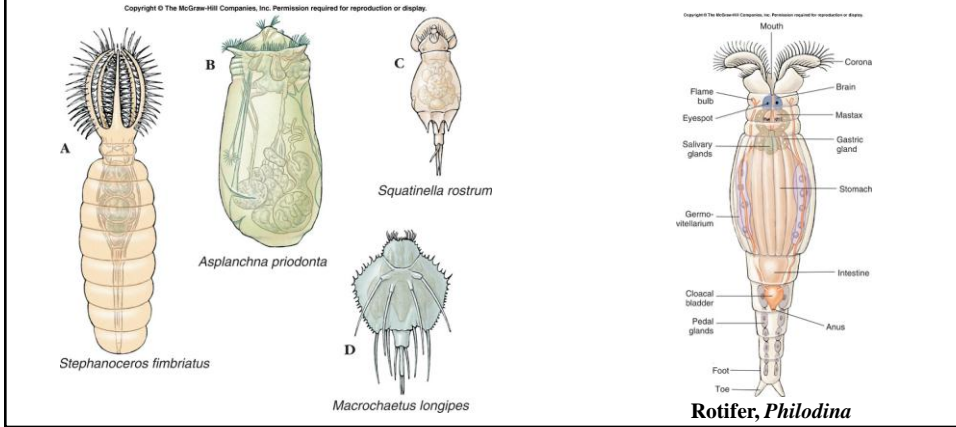
Parthenogenesis = virgin birth

development of an individual from an unfertilized egg no sperm contribution

aphids, ants, wasps & bees

(queen & female bee diploid; male drones haploid) parthenogenetically)

certain flatworms, rotifers, roundworms



Trophallaxis

Exchange of food/fluid between young & adults
common in social insects: ants, bees, wasps & termites

Important in colonial communication

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Paper wasps attending their pupae and larvae

C

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A Sterile wingless termite workers



B Queen termite with workers & soldiers

Termites

fertile individuals: ♀/♂ → mate/lose wings → king & queen

fertile individuals/soldiers feed inhibiting pheromones to nymphs → sterile workers

Figure 20.35

Insect as Pests

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A



B

Figure 20.37

Insect as Pests

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A

Japanese beetle



B

Longtailed mealybug



C

Corn ear worms

Insect as Friends



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Stink bug preying on caterpillar



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Aposematic coloration

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Parasitic wasp, *Larra bicolor* attacking mole cricket & laying eggs



C