Orders of Aquatic Macroinvertebrates

Lecture 2

Spring 2018

Review of Linnean Hierarchy (Simplified)

Phylum

Class

Order

Family

Genus

Species

THIS IS WHERE WE STOP!!

TAXONOMIC RESOLUTION – what is it and why is it important!?!

Phylum: Arthropoda

- Synapomorphic characters (shared, derived)
  - Exoskeleton
  - Jointed appendages
  - Segmented bodies
  - Bilateral symmetry
  - Dorsal blood vessel
  - Ventral nerve cord
- Class: Malacostraca
- Class: Insecta

Class: Malacostraca

- Synapomorphic characters
  - 2 body region, thorax and abdomen
  - 5 or more pair of legs
  - 2 pair of antennae

- Order: Isopoda (sowbugs)
- Order: Decapoda (crayfish)
- Order: Amphipoda (scuds)

Order: Isopoda (sowbugs)

- Dorsoventrally flattened
- First pair of legs sometimes enlarged
- Large plates visible from above
- Looks like a flattened pillbug (rolly polly)

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Order: Isopoda (sowbugs)

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Order: Decapoda (crayfish)

- Have 5 pairs of legs; first pair is robust
- Head and entire thorax form large cephalothorax
- Range in size from 10-150mm long

Order: Decapoda (crayfish)

Male? Female?

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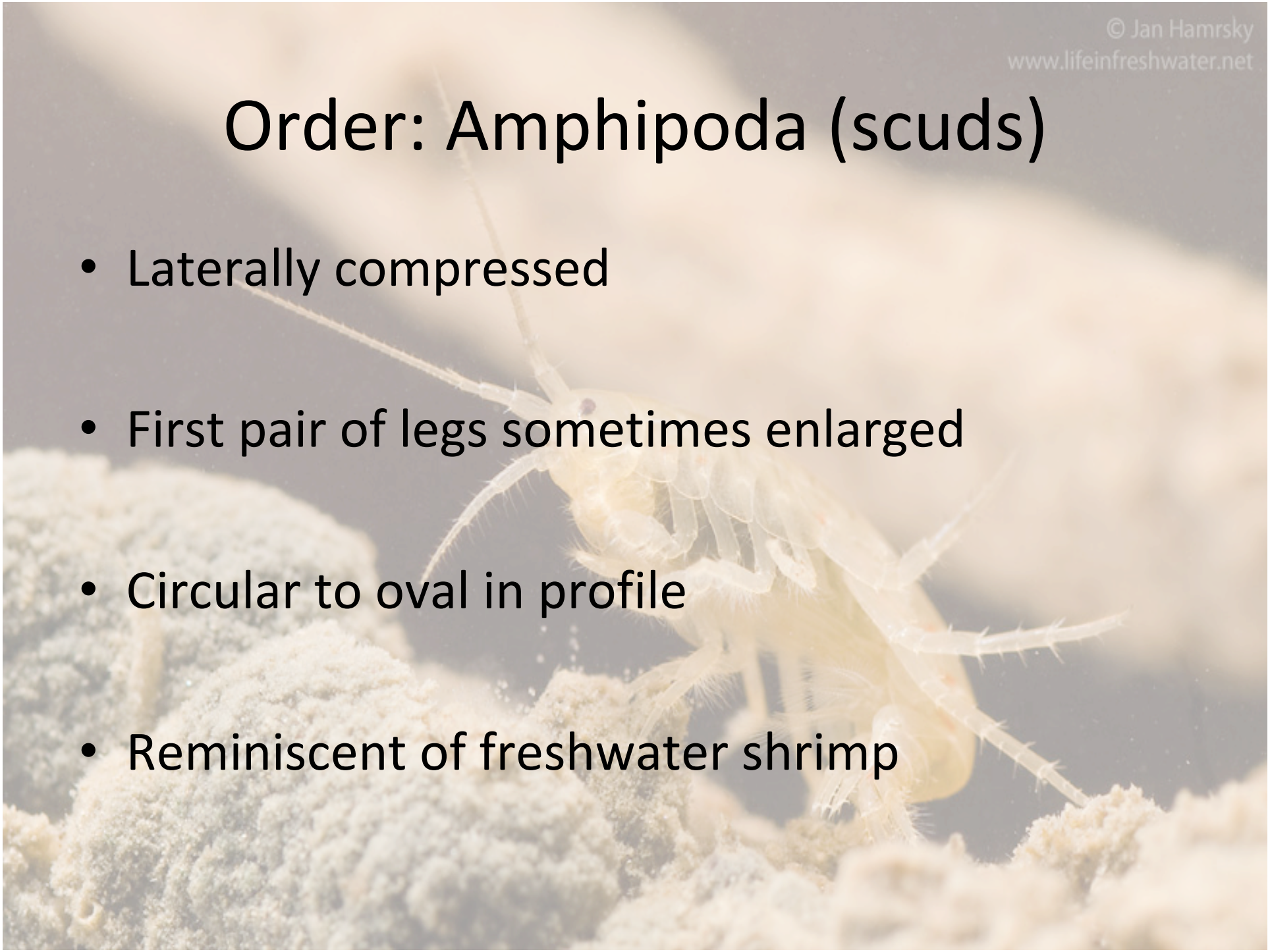

Order: Amphipoda (scuds)

- Laterally compressed
- First pair of legs sometimes enlarged
- Circular to oval in profile
- Reminiscent of freshwater shrimp

Order: Amphipoda (scuds)

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Class: Insecta

- Synapomorphic characters
  - 3 body regions, head, thorax, abdomen
  - 3 pairs of legs
  - 1 pair of antennae
- Order: Ephemeroptera (mayfly)
- Order: Odonata (dragonfly and damselfly)
- Order: Plecoptera (stonefly)
- Order: Hemiptera (true bugs)
- Order: Megaloptera (dobsonfly, alderfly, fishfly)
- Order: Trichoptera (caddisfly)
- Order: Coleoptera (beetles)
- Order: Diptera (midges, mosquitos)

Order: Ephemeroptera (mayfly)

- Larvae
  - Aquatic, with abdominal gills at junction of segments 1-7 (the number varies)
    - Lamellate gills of species in moving water
    - Plumose gills of species in standing water
  - Long-lived as immatures, usually have 1 generation/yr (some 2 gen./yr; some species may take 2-3 years
  - Found in fast-moving streams or still waters of lakes where some species burrow into clay and silt substrate

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Order: Ephemeroptera (mayfly)

- Larvae (continued)
  - Larval mouthparts are mandibulate (chewing)
  - Most are herbivores, scrapers of algae, collectors of detritus; a few are predaceous
  - May molt 10-45 times
  - 3 caudal filaments like adults; some only have 2
  - Have only one tarsal claw

(Google Images)

Order: Ephemeroptera (mayfly)

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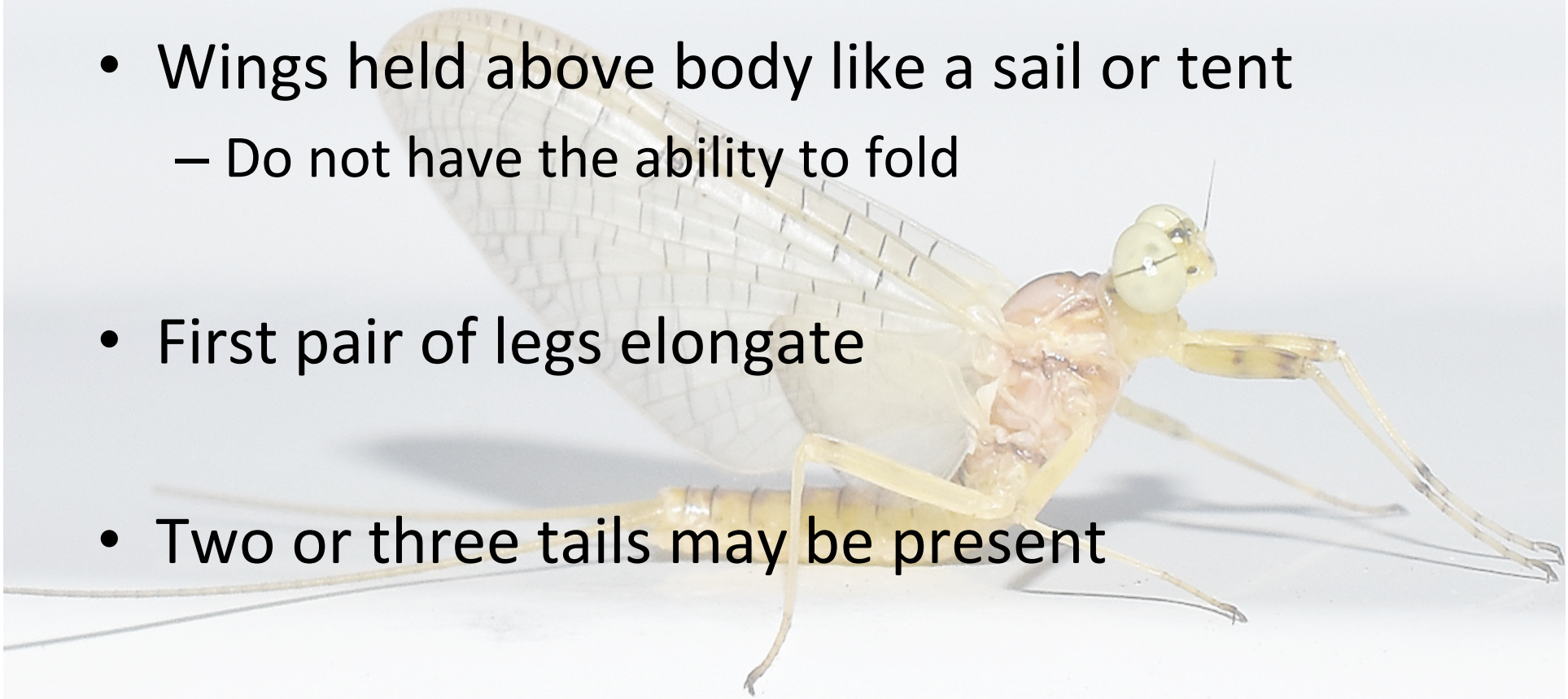
Order: Ephemeroptera (mayfly)

- Wings held above body like a sail or tent
  - Do not have the ability to fold
- First pair of legs elongate
- Two or three tails may be present



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Order: Ephemeroptera (mayfly)

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Order: Odonata (dragonfly and damselfly)

- Larvae:
  - Hatch from eggs inserted into aquatic plants; or on them in some families; or eggs may be laid on the water
  - Larvae are fierce predators w/ good eyesight
  - Specialized extensible mouthparts that can even catch small fish and tadpoles https://www.youtube.com/watch?v=W557aSVdW_g
  - Placement of gills differs between the two suborders
    - Anisoptera with gills inside anus; expel for jet propulsion, body stout and robust
    - Zygoptera with three terminal gills that are leaflike; slender fragile bodies similar to adults

(Google Images)

Order: Odonata (dragonfly and damselfly)

(Google Images)

Order: Odonata (dragonfly and damselfly)

- Adults:
  - Strong biting mouthparts; active and aggressive carnivores preying mostly on other insects
  - Have massive eyes that may contain as many as 30,000 individual units / lenses called ommatidia
    - provides exceptional almost 360 degree eyesight, good depth perception; can detect movement up to 40 feet away

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Order: Odonata (dragonfly and damselfly)

- Adults:
  - Have two pairs of almost equally sized long, thin membranous wings
    - both pairs of wings usually have a dark, colored patch near the tip of leading edge called a stigma
    - mass of crossveins giving the appearance of mesh
  - Unlike most insects, which flap both pairs of wings in unison (bees & butterflies), or only flap the hind pair (beetles), or have only one pair (flies), Odonata can flap their wings independently

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Order: Odonata (dragonfly and damselfly)

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Order: Plecoptera (stonefly)

- Larvae
  - Nymphs have external gills (tufts) usually located at the base of the legs; behind the head; or around the anus
  - Nymphs have each segment of the thorax covered by a large dorsal sclerite
  - Two long cerci (tails) with many segments
  - Two tarsal claws on each leg

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Order: Plecoptera (stonefly)

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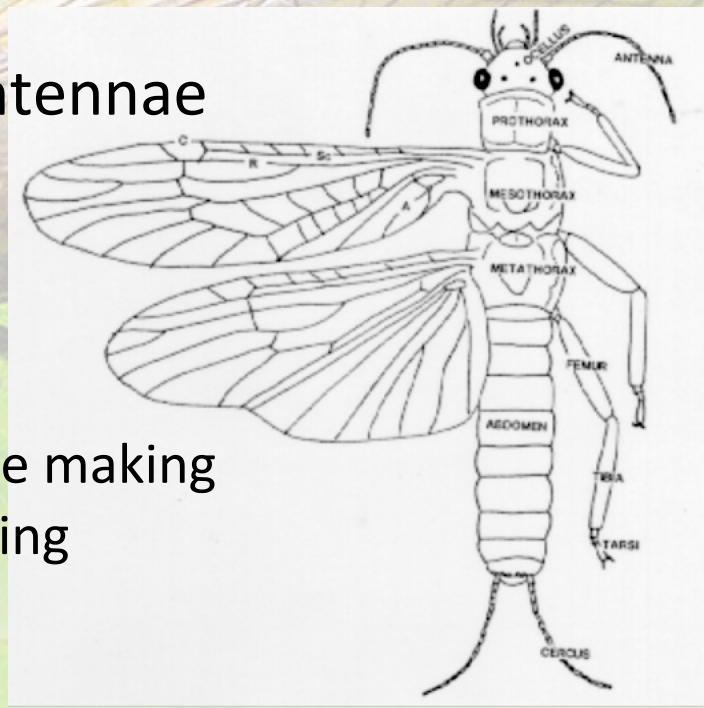
Order: Plecoptera (stonefly)

- Adults
  - Small to medium-sized (4-60 mm), body elongate, flattened, parallel-sided
  - Chewing mouthparts in nymphs; sometimes vestigial in adults
  - Both adults and nymphs with two caudal filaments (tails)
  - Well developed compound eyes w/ 3 ocelli (simple eyes)

Order: Plecoptera (stonefly)

- Adults
  - Long, filamentous, tapering antennae
  - 2 pairs of wings; folded over abdomen at rest
    - Hind wings have a large anal lobe making them far larger than the front wing
    - Some males without wings
  - Females lack an ovipositor



Order: Plecoptera (stonefly)

(Google Images)

Order: Hemiptera (true bugs)

- Wings are folded over body
  - Overlapping
  - Make an X shape dorsally
- Legs often with swimming hairs or modified for swimming
  - May be modified for grasping prey
- Piercing/sucking mouthparts

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Order: Hemiptera (true bugs)

Order: Megaloptera (dobsonfly, alderfly, fishfly)

- Primarily aquatic
- Predaceous
- Possess chewing mouthparts
- Appear similar to beetle larvae, but are distinguished by:
  - Lateral filaments
  - Pair of anal prolegs with double hooks

  OR

  - Single unbranched filament at end of abdomen

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Order: Megaloptera (dobsonfly, alderfly, fishfly)

(Google Images)

Order: Megaloptera (dobsonfly, alderfly, fishfly)

- Medium to large
  - Short-lived and probably don't feed
  - Secretive and often nocturnal; atracted to lights
- Generally poor and clumsy fliers
- Dark wings are similar in size
- Hind wings folded at rest, pleated
- Wings held roof-like over body (Corydalidae not as much)
- Wing veins generally do not branch at margin
- No tails

(Google Images)

Order: Megaloptera (dobsonfly, alderfly, fishfly)

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Order: Neuroptera (spongilla flies)

- Habitat – associated with freshwater sponges
- Live on surface or inside cavities of sponges
- Feed on sponges by piercing them with elongate mouthparts
- Fully developed larvae 4-8 mm
- 3 instars – can have several generations per year

Order: Neuroptera (spongilla flies)

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Order: Trichoptera (caddisfly)

- The larval stage is mostly:
  - Caterpillar-like with a strongly sclerotized head
  - Short antennae with chewing mouthparts
  - Well developed legs with a single tarsal claw
  - Case bearing species often have 3 papillae to hold centrally in case to allow good water flow over gills & last abdominal segment with a pair of “grappling” hooks
  - Mostly omnivores, but some phytophagous on plants and diatoms; a few are predators; scavengers of vertebrate bodies

(Google Images)

Order: Trichoptera (caddisfly)

(Google Images)

Order: Trichoptera (caddisfly)

- Adults are terrestrial and look much like drab, fragile moths with 2 pairs of membranous wings; wings at rest are held rooflike over the abdomen
  - Most are nocturnal; are attracted to lights
  - Long bristle-like antennae often as long or longer than body
  - Hairy wings rather than scales; tibial spurs on legs conspicuous
  - Mandibles mostly absent; maxillary and labial palps often prominent

(Google Images)

Order: Trichoptera (caddisfly)

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Order: Coleoptera (beetles)

- Highly variable
- Sclerotized head
- Chewing mouth parts; sometimes readily visible
- Various levels of lateral and terminal filaments
- May have one or two tarsal claws

(Google Images)

Order: Coleoptera (beetles)

(Google Images)

Order: Coleoptera (beetles)

- Chewing mouthparts
- Legs with swimming hairs or modified for swimming
- Wings folded over back
  - Hard elytra covers membranous wings
  - Wings folded create a straight line along dorsal side

(Google Images)

Order: Coleoptera (beetles)

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Order: Diptera (midges, mosquitos)

- Approximately 10% of all dipterans species are aquatic in their larval stage
- Lack jointed thoracic legs
- Show tremendous structural variation
- Usually fleshy (resembling a grub)
- Various amounts of sclerotization

(Google Images)

Order: Diptera (midges, mosquitos)

(Google Images)

Order: Diptera (midges, mosquitos)

- Two pairs of wings, second highly reduced
  - Halteres are reduced and highly specialized metathoracic wings that serve as balancing organs to maintain stability during flight

- The identification of flies relies heavily on the number, size, position, and arrangement of bristles (largely on the head and thorax) – called chaetotaxy

- Mouth parts - Two types: piercing-sucking and lapping-sucking (sponging)

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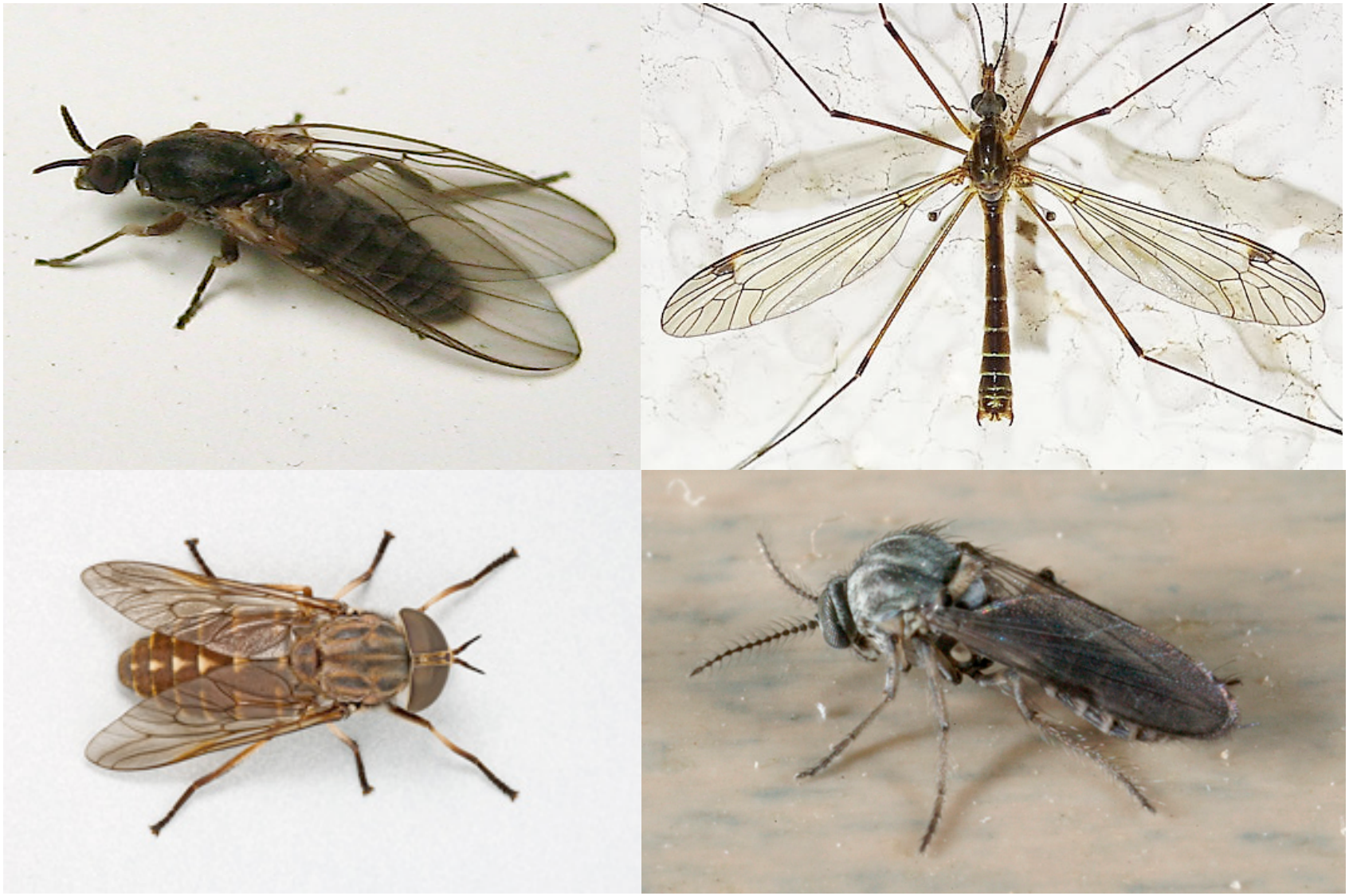
Order: Diptera (true flies)



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Order: Lepidoptera (moths, skippers, and butterflies)

- Three pairs of thoracic legs; additional pairs of fleshy, abdominal prolegs; generally five pairs
  - Prolegs with tiny hooks called crochets – not present in sawfly larvae
- Mandibles heavily sclerotized, bearing teeth
- Large paired labial silk glands modified from salivary glands; mandibular glands act as salivary glands
- Antennae short; 6-7 stemmata on each side of head; often with setae over much of the body

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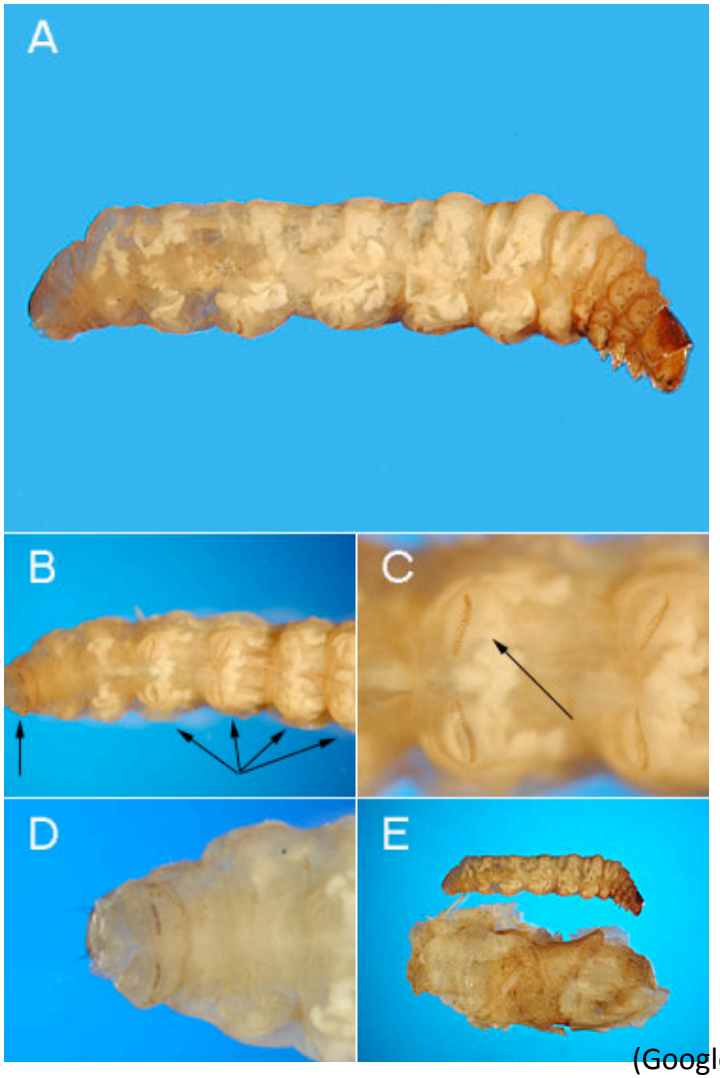
Order: Lepidoptera (moths, skippers, and butterflies)



(Google Images)

Order: Lepidoptera (moths, skippers, and butterflies)

- Two pairs of wings
- Broad overlapping scales on head, body, and appendages
- Most have a long coiled proboscis
- Small drab moths with finely patterned hind wings
  - Front wings usually less than 15 mm long
  - Hind wings are sometimes held rooflike over the abdomen
  - Mouth siphon is well developed and coiled
  - Middle and hind legs of some species possess swimming hairs

Order: Lepidoptera (moths, skippers, and butterflies)

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And “Others”

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