

## Arthropod Classification



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## Welcome

### Welcome to the first unit in ENY 3005/5006, the Principles of Entomology!

During this unit you will learn what an insect really is. Surprisingly, most people really don't know!



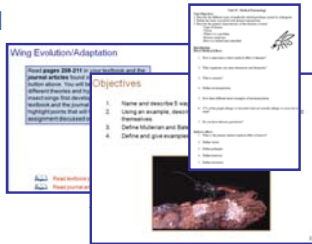
**Journal Assignment:** Please post a discussion topic titled "Bug Story". This story should be a short introduction of yourself along with a story involving an insect. Please see the syllabus for grading information and journal due dates.

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## Welcome continued

Lecture Components:

- Slides
- Study guides
- Video clips
- Textbook readings
- Journal readings
- Journal assignments



Lecture Objectives: listed in the lecture and on the study guide.

Icons:



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## Objectives

1. Define classification.
2. Describe the hierarchy in classifying any organism.
3. Describe what Linnaeus did for classification.
4. Give an example of an organism's classification, from its domain to its kingdom to the species level.
5. Describe the characteristics of the phylum Arthropoda.
6. Differentiate the major arthropod classes and orders.



Robber fly - Asilidae

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## Introduction

Have you ever wondered what an insect actually is?


Can you guess which of the following are insects?

- Grasshopper
- Tick
- Scorpion
- Millipede
- Beetle
- Earthworm
- Caterpillar
- Crayfish
- Spider
- Roly-poly



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## Answers

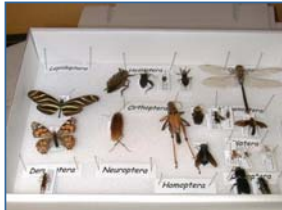
Insects	Non-Insect Arthropods
Grasshopper	Tick
Beetle	Scorpion
Caterpillar	Millipede
	Crayfish
	Spider
	Roly-poly

Were you surprised to find that a millipede is not an insect, but a caterpillar is? By the end of this unit, you will be an arthropod expert. Wait, what is an arthropod? Well, read on.

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## Classification System

What things do we classify?  
How do we know where to place living organisms?

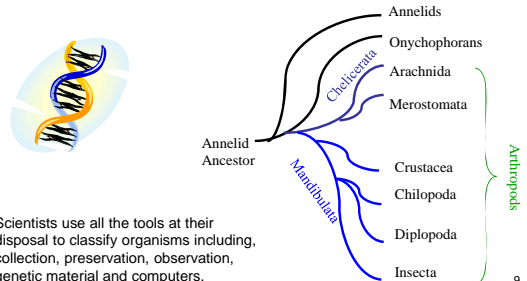


Scientists have a system of classification to determine where different organisms belong and how they are related.

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## Classification Scheme

As science progressed, the classification scheme was adapted to include information about how organisms are related to each other. This modern system is known as **taxonomy** or cladistics.



Scientists use all the tools at their disposal to classify organisms including, collection, preservation, observation, genetic material and computers.

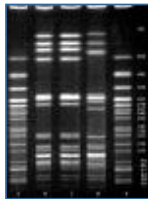
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## Taxonomy

**Classification** – Scheme of categorizing organisms

**Taxonomy** – Basic work of recognizing, describing, naming, and classifying of insects.

**Nomenclature** – The science of naming living organisms.



PCR gel that indicates genetic similarities

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## Nomenclature

•Multiple common names (nicknames), but only one true scientific name.

•Based on Latin.

•**Binomial Nomenclature** (2 parts)

1. Genus
2. species or specific epithet

(The genus name should be capitalized, and both the genus and species names should be **italicized**.)



As an introduction, please read textbook pages 4-15, then read pages 440-443.

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Read textbook pages 4-15, 440-443

## Father of Classification

**Carolus Linnaeus** (kärO'lus linA'us)



Carolus Linnaeus (1707-1778) the "Father of Classification."

In 1735, he wrote *Systema naturae*, which addressed the classification of animals, plants, and minerals. Two years later, he wrote *Genera plantarum*, an explanation for classifying plants. Linnaeus fine-tuned the classification system in 1753 when he wrote a 2-volume book called *Species plantarum*. *Species plantarum* was the first book to actually assign plants to a specific genera and species. Using this same format in 1758, Linnaeus wrote the 10th edition of *Systema naturae* and classified approximately 7,700 species of plants and 4,400 species of animals.



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## Classification Example

*Dasyutilla occidentalis* Linnaeus

The cow killer wasp, *Dasyutilla occidentalis* Linnaeus.

Genus: *Dasyutilla*  
Species: *occidentalis*  
Named by: Linnaeus



Some scientific names have cultural references.

*Norasaphus monroeae* – trilobite

After Marilyn Monroe; part of the "head" is shaped like an hourglass.

*Preseucoila imallshookupis* - gall wasp

After Elvis Presley, specifically after one of his songs.

*Greeffiella beatei* - nematode

A shaggy nematode named after the mop top Beatles.



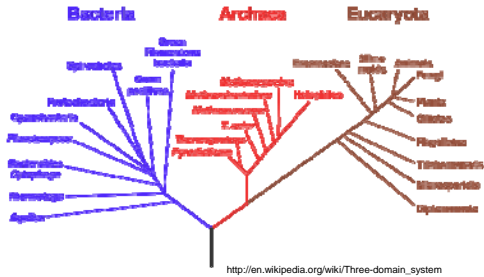
In 2005, some slime mold beetles were named by some entomologists at Cornell for George Bush, Dick Cheney, and Donald Rumsfeld. (*Agathidium bushi*, *A. cheneyi* and *A. rumsfeldi*.) They also named one for Darth Vader, *A. vaderi*.

For more interesting scientific names, please see <http://edis.ifas.ufl.edu/IN661>.

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## Classification: The Three Domain System

### Phylogenetic Tree of Life



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## Domains and Kingdoms



### Bacteria

- Prokaryotic cells
- Unique peptidoglycan cell walls
- Sensitive to traditional antibiotics

### Archaea

- Prokaryotic cells
- Live in extreme environments (halophiles, methanogens, hyperthermophiles)

### Eukarya

- Eukaryotic cells
- Divided into 4 Kingdoms
  - Protista – slime molds, euglenoids, algae, and protozoans
  - Fungi – yeast, mold, sac fungi, and club fungi
  - Plantae – flowering plants, conifers, ferns, and mosses
  - Animalia – sponges, worms, arthropods (including insects), and vertebrates

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## Order of Classification

The list below should help you remember the order in which an organism is classified. If the "kings play chess on fine gold saddles" ditty doesn't work for you, make up your own that you will remember.

- Domain
- Kingdom
- Phylum
- Class
- Order
- Family
- Genus
- Species




Do  
Kings  
Play  
Chess  
On  
Fine  
Gold  
Saddles?

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## Classification of a Lion

Below is a visual aid to help you better understand how an organism is classified. This table gives you an example of how a lion is classified.

Kingdom	Kingdom Plantae	Kingdom Animalia	Kingdom Fungi	Kingdom Protista (Unicellular eukaryotes)
Phylum		Chordata		
Class		Mammalia		
Order		Carnivora		
Family		Felidae		
Genus		Panthera		
Species		<i>Panthera leo</i>		




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## Examples of Classification

Here are few examples of animal classification that might help you better understand how to classify an organism. Fill out **question 1g** on your study guide and come up with some of your own examples besides the lion, beetle, or velvet ant.

Kingdom	Kingdom Plantae	Kingdom Animalia	Kingdom Fungi	Kingdom Protista (Unicellular eukaryotes)
Phylum		Chordata	Arthropoda	
Class		Mammalia	Insecta	
Order		Carnivora	Coleoptera	
Family		Felidae	Scarabaeidae	
Genus		<i>Panthera</i>	<i>Scarabus</i>	
Species		<i>Panthera leo</i>	<i>Scarabus sacer</i>	



Note: Notice that the genus and species names are italicized and the genus name is capitalized.

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## Arthropod Characteristics

- Segmented Body
- Jointed external skeleton (exoskeleton)
- Paired jointed appendages on each segment
- Dorsal brain
- Ventral nerve cord
- Open circulatory system
- Dorsal heart
- Molts



cockroach brain

There is a set of characteristics, besides just the jointed feet or appendages, that distinguishes arthropods from other animals. As was mentioned previously in the lion example, in order to be classified as a chordate, an organism usually has a dorsal nerve cord and usually has a tail (either short or long) that extends beyond the anus. However, an arthropod has neither of these characteristics.

Fill out question #2 on your study guide as you read.

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## Arthropod Similarities

### Phylum Arthropoda

- Exoskeleton made of Chitin
- Externally segmented bodies
- One pair of appendages per segment
- Appendages modified for feeding
- Ventral nerve cord and dorsal brain

### Class Insecta

- 6 legs
- 3 body segments

### Order Orthoptera – grasshopper

### Family Tettigoniidae – katydid

### Genus *Scudderia* – bush katydid

### Species *Scudderia furcata* - fork-tailed bush katydid



fork-tailed bush katydid

*Note: Notice that the species name includes the genus name too. If someone asks for a species name, be sure to give both the genus and species name.*

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## What is an insect?



"Look, I caught an insect!"

And you replied, "No, that's not an insect. That's a millipede."

"Why?"

Now, how would you go about explaining why the millipede is a millipede and an insect is an insect?



To understand what an insect is, we first need to learn about arthropods (members of the Phylum Arthropoda).

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## Arthropod Activity

### Phylum Arthropoda

- Insects
- Spiders
- Crabs
- Scorpions
- Millipedes
- Centipedes
- Isopods
- Ticks
- Mites
- Crawfish
- Lobster



**ACTIVITY** –Take some time to do the arthropod activity now. This activity is **NOT** a graded assignment, but the information you gain by completing this task is fair game for the exam.

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## Greek roots

### Arthropod

"arthro" joint	"pod" foot	jointed foot
		 Grasshopper hind leg

Did you notice how the appendages worked during your observation? Those appendages are how arthropods get their name.

Look again at the organisms you observed in the **Arthropod Activity**.

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## Exoskeleton

Can you think of some advantages and disadvantages of having a body of STEEL, oh sorry, chitin and proteins?



### Advantages

1. protection
2. retardation of water movement
3. protection - physical damage and abrasion
4. barrier
5. concealing colors and shapes



### Disadvantages

1. special modification for gaseous exchange and sensory pickup
2. major restriction on growth

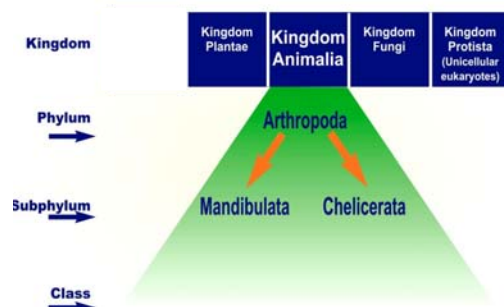
Can you think of others?????



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Fill out question 2d on your study guide.

## Arthropod Subphyla



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## Chelicerata

**Celicerae** -Truly the stuff of horror movies. Here you see a sowbug-eating spider. Notice his large chelicerae hanging down just below his eyes. Also note that chelicerates do not have antennae or jaws.

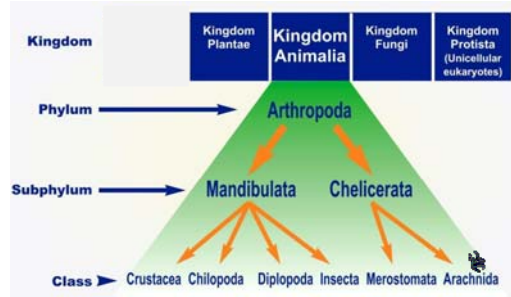


<http://taipan.nmsu.edu/buolab/spiderkey/Couple1%203.html>

sowbug-eating spider

Did you know that when a spider molts, even the fangs molt? 26

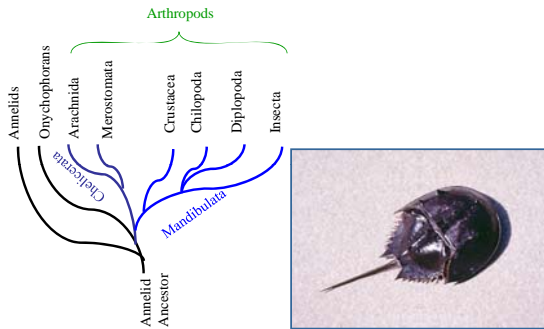
## Class Merostamata and Arachnida



As I stated before, **Chelicerata** is a subphylum of Arthropoda.

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## Merostomata – horseshoe crabs



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## Body Structure

**Insects:** head, thorax and abdomen.  
**Spiders:** cephalothorax (or prosoma) that includes both the head and thorax and the abdomen (or opisthosoma).



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## Arachnida

opisthosoma or abdomen



cephalothorax



Scorpion



Tick



Harvestman

Fill out questions 4-5 on your study guide.

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## Arachnid Orders

See how well you know your arachnids. Can you guess the arachnid order from the description?



Araneae (Spiders)



Uropygi (Whipscorpions)



Opiliones (Harvestmen)

If you can identify all of these orders (2 slides) without your notes, you have mastered part of the lesson objective.

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## Arachnid Orders Continued



Scorpiones (Scorpions)



Acari (Ticks & Mites)



Pseudoscorpiones (Pseudoscorpions)

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## U1 Arachnid Quiz

Point Value: 10

Question 1 of 1

Please match the correct Arachnid order name to its description. You should drag the order name and click it in place next to the correct description.

Any of numerous arachnids of tropical and warm temperate regions, resembling a scorpion but having an abdomen that ends in a slender, nonvenomous whip.

Acari

Any of numerous spider-like arachnids having a compact rounded body and extremely long, slender legs.

Uropygi

Any of numerous predaceous arachnids most of which spin webs that serve as nests and as traps for prey.

Araneae

Any of numerous arachnids widely distributed in warmer parts of the world, having a long, narrow, segmented tail that terminates in a venomous sting.

Opliones

### PROPERTIES

On passing, "Finish" button:

Goes to Next Slide

On failing, "Finish" button:

Goes to Previous Slide

Allow user to leave quiz:

At any time

User may view slides after quiz:

At any time

Properties

Edit in Quizmaker

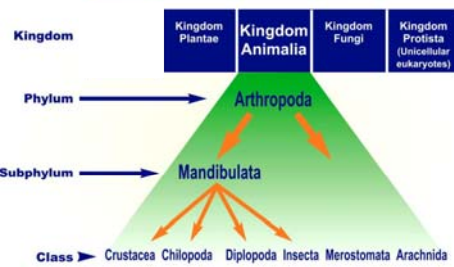
## Arachnid Order Quiz Answers:

- Uropygi.** "Any of numerous arachnids of tropical and warm temperate regions, resembling a scorpion but having an abdomen that ends in a slender, nonvenomous whip." *Whipscorpions*
- Opliones.** "Any of numerous spiderlike arachnids having a compact rounded body and extremely long, slender legs." *Harvestmen*
- Araneae.** "Any of numerous predaceous arachnids most of which spin webs that serve as nests and as traps for prey." *Spiders*
- Scorpiones.** "Any of numerous arachnids widely distributed in warmer parts of the world, having a long, narrow, segmented tail that terminates in a venomous sting." *Scorpions*
- Acari.** "Any of numerous bloodsucking arachnids, somewhat larger than the related mites and having a barbed proboscis for attachment to the skin of warm-blooded vertebrates; some ticks are vectors of disease. Also any of the numerous small to microscopic arachnids including species that are parasitic on animals and plants or that feed on decaying matter and stored foods." *Ticks & Mites*
- Pseudoscorpiones.** "Any of several small arachnids that resemble a tailless scorpion and that feed chiefly on small insects." *Pseudoscorpions*



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## Mandibulata



Four mandibulate classes:

- Crustacea (shrimp, crabs, and lobsters)
- Chilopoda (centipedes)
- Diplopoda (millipedes)
- Insecta (insects)

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## Crustacea

We need to learn to differentiate among the different mandibulate classes. Be sure to familiarize yourself with the characteristics of crustaceans and fill out the table on your study guide.



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## Class Crustacea



- Exoskeleton of chitin
  - Some hard with calcium (crawfish)
- Periodic molting
  - The free-swimming larvae or nauplius has an unsegmented body and three pairs of appendages.
- Two or three body segments – head, thorax or cephalothorax, and abdomen
  - Has a carapace/shield
- Two pair of antennae
- One median eye and two lateral eyes.
- Three pair of biting mouthparts – mandibles and two sets of maxillae
- First pair of thoracic appendages often modified into pincers
- Breathe with gills
- Sexual reproduction

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Fill out your study guide table (see question 7a).

## Crustacean orders



Isopoda



Decapoda

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## Characteristics

### Class Chilopoda

- nocturnal
- one pair of legs per segment
- one pair of antennae
- jaws
- 2 pair of maxillae
- carnivorous
- exoskeleton



centipede

### Class Diplopoda

- two pair of legs per segment
- chewing mouthparts
- detritivorous – eat decaying organic matter
- exoskeleton



millipede

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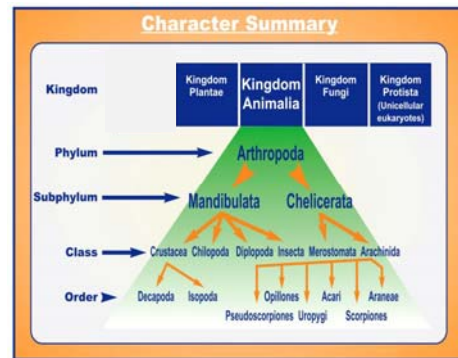
## Class Insecta Characteristics



- exoskeleton of chitin
- 3 body segments
  - Head
  - Thorax
  - Abdomen
- 3 pair of mouthparts
- 1 pair of antennae
- compound and simple eyes
- 3 pair of legs
- varied appearance

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## Character Summary



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## Summary Table

I bet you can do this with your eyes closed. Ok, here goes. Arachnids and lobsters have two body regions, while insects have three. Arachnids do not have any antennae, while the crustaceans and insects do. Crustaceans and insects eat differently than arachnids because of their mandibles. And lastly, these three groups differ in their number of legs. Arachnids have eight, insects six, and crustaceans have many. This table summarizes the differences between arachnids, crustaceans, and insects. Study it carefully. Be sure you understand the objectives and have completed the study guide. This concludes the first unit.

	Arachnids	Crustaceans	Insects
<b>Mouth Parts</b>	Chelicera	Mandibles	Mandibles
<b>Body Regions</b>	Two	Two	Three
<b>Antennae</b>	None	Two Pair	One Pair
<b>Legs</b>	4 Pair (8)	Many	3 Pair (6)



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