**ZOOLOGY Packet**

April 20th-May 1st, 2020

Summer King

**This packet contains:**

1. A scientific news article covering a subdiscipline of Zoology (this week we are learning about Herpetology)

2. Assignment for the weeks of Apr 20-May 1

3. Information from encyclopedia.com to assist you in researching your assigned topics

4. Information about compound eyes and grasshoppers

**What needs to be turned in for a grade?**

* Your research on the following phyla: Annelida, Platyhelminthes, Arthropoda, Insecta

**Optional/Enrichment included:**

* Scientific article on Herpetology
* Picture of a compound eye
* Article about grasshoppers and their vision

*\*\* If labs are completed or you do something hands on that correlates with what we are reading about or what you are researching for the Animal Phyla project, please let me know! Send me pictures on remind/email, or tag @TheBurgScience and #Team DCS on Twitter! \*\**

*Environmentalscience.org*

What is a Herpetologist?

Herpetology is the branch of zoology which deals with the study of reptiles and amphibians such as snakes, turtles, and iguanas. It deals with their behaviors, geographic ranges, physiologies, development, genetics, and more.

A herpetologist is a zoologist who studies reptiles and amphibians such as frogs and salamanders. Many herpetologists focus on conservation of these species. Others use them to assess overall environmental conditions in a particular area.



What Does a Herpetologist Do?

Herpetologists study animals in the wild, where they determine or assess potential threats from pollution, invasive species, disease, and other factors. They often inventory or estimate animal populations. Herpetologists study their behavior, development, genetics, and distributions to better understand their ecological niches, the ecosystem services they supply, and the challenges they face. They may make recommendations to policy makers on how to protect them. Since many reptiles and amphibians are considered "indicator species", their research may be used to evaluate overall changes in the environment. Herpetologists may plan and manage disease control and conservation programs. Many conduct environmental impact studies or wildlife impact studies for the government. They may share their research findings by writing journal articles or presenting at professional conferences. Some educate the public through programs and talks.

Collection managers at museums care for preserved specimens of amphibians and reptiles. They catalog, organize, and document them, and make them available to researchers. These jobs usually require a master's degree in biology or museum studies.

Zoo curator and supervisor jobs are administrative positions that involve running a herpetology department, managing educational programs, and related duties. They usually only work with reptiles and amphibians.

The work of herpetologists is important for the conservation of threatened and endangered species like American crocodiles and sea turtles. Many species of frogs are barraged by various threats, including disease and climate change. Herpetologists may focus on saving this species, or using them to evaluate overall environmental conditions in an ecosystem.

Where Does a Herpetologist Work?

Many herpetologists work as faculty members or research staff at colleges and universities. Others are employed by government agencies that deal with wildlife and the environment. Many get jobs in museums where they work with exhibits and collections and participate in public programming. Others work for zoos where they work with live animals and the public. Industrial and medical biotechnology now offer new employment opportunities for biological researchers. Other large companies hire herpetologists as environmental specialists. Some herpetologists teach biology in high schools.

A herpetologist's work environment will likely depend on his or her area of research. Research studying the developmental, anatomical, or genetic aspects of reptiles and amphibians is generally done in laboratories. Research on a species' ecology, behavior, reproduction, population biology and distribution usually involves a lot of fieldwork. Fieldwork can be strenuous and isolating, and may require night hours when dealing with nocturnal species.

Assignment for April 20th -May 1st

This week I want you to research:

1. Phylum Annelida

2. Phylum Platyhelminthes

3. Phylum Arthropoda

4. Class Insecta

\*\* Remember - For each of the phyla/class, the following information is required:

* Name of the phyla/class
* Vertebrate or Invertebrate
* At least one picture of an organism in the group (labeled with the name)
* List of at least 5 organisms in the group
* Habitat
* Mode of reproduction
* Body plan (symmetry)
* Locomotion (do they move, how do they move?)
* Interesting facts

You can type up your information or it can be handwritten. Either way is fine as long as it is neat! Below is information from Encylcopedia.com to help aid your research. However, my hope is that if you are able that you will do your own research on the internet and find some interesting facts about these organisms/animals. If you do something interesting (say…dissect a dead worm or bug you find in your yard or driveway), then send me a picture! Email is the best way to contact me at this time. It’s: [summer.king@dcsms.org](mailto:summer.king@dcsms.org).

*Encyclopedia.com*

**Annelida (Phylum)**

The phylum Annelida includes three main groups: the earthworms, the leeches, and the bristleworms. Annelids are found worldwide, and inhabit terrestrial, freshwater, and marine **ecosystems** . There are over 15,000 described species.

**Characteristics of Annelids**

All annelids are segmented. Segments, also called metameres, are structures that occur repeatedly along the body of the animal. Each annelid segment contains units of the circulatory, nervous, and excretory systems. In the earthworms and bristleworms, but not the leeches, segmentation extends to the interior of the body, and includes the **coelom** , which is partially divided into units by structures called septa.

The annelid body is covered by a moist outer cuticle that is secreted by the **epidermis** . Both earthworms and bristleworms also possess hairlike setae, composed of **chitin** , the hard material that also forms the **exoskeletons** of insects. These are absent in leeches.

Annelids have a true coelom, that is, one that is lined with cells originating from the embryonic **mesoderm** . The coelom is fluid-filled, which creates hydrostatic (water) pressure and acts as a **hydrostatic skeleton** . Annelids have a well-developed, closed [circulatory system](https://www.encyclopedia.com/medicine/anatomy-and-physiology/anatomy-and-physiology/circulatory-system) (one in which blood is limited to vessels) that is segmentally arranged. They also have a complete, one-way digestive tract with a mouth and anus. The digestive tract is not segmented.

Respiration in annelids occurs primarily through their moist skin, although certain species have evolved specialized gills or use paired projections called parapodia in gas exchange. The annelid excretory system consists of paired nephridia found in each segment which function in excreting nitrogenous waste. In terms of [nervous system](https://www.encyclopedia.com/medicine/anatomy-and-physiology/anatomy-and-physiology/nervous-system) structure, annelids possess a pair of ganglia (masses of nerve tissue) at the front end of the body, and sends branches into each segment. Annelids have many types of sensory receptors, including **tactile** (touch) receptors, **chemoreceptors** (smell or taste), and **photoreceptors** for light. Some have well-developed eyes.

Annelids possess both circular and lengthwise muscle fibers. These, combined with their segmentation and hydrostatic skeleton, allow for great flexibility in movement. One part of the body is able to contract, or change its diameter and length, without affecting the rest of the body. It is believed that the need for elaborate mechanisms to control motion led to the development of the comparatively complex [nervous system](https://www.encyclopedia.com/medicine/anatomy-and-physiology/anatomy-and-physiology/nervous-system) of annelids.

Some annelids are **hermaphroditic** while others are **dioecious** , that is, the sexes are separate. Some species have direct development, in which eggs develop directly into miniature versions of the adult. In other species, there is a larval stage. The annelid larval form is called the trochophore larva. Some annelid species can also reproduce asexually by **budding** .

**Classes of Annelids**

Annelids have been divided into three classes. The Polychaeta is exclusively composed of the bristleworms, the Oligochaeta the earthworms, and the Hirudinea include the leeches.

**Polychaeta.**

The Polychaeta, or bristleworms, are a large and diverse group that includes polychaete worms, lugworms, ragworms, and sandworms, among other groups. It is the largest annelid class, with over 10,000 species, most of which are marine. Bristleworms are found in a wide variety of habitats and employ various feeding strategies. There are active burrowers whose habitat is at the bottom of the water, that which live within tubes they secrete, and pelagic (open ocean-dwelling) forms. Some are sedentary **filter feeders** that extract small food particles from the water while others process sediment. Also, some species are active predators; these generally prey on small invertebrates.

Bristleworms are characterized by paired paddle-like appendages called parapodia, used for gas exchange. These are covered with setae ("polychaete" means "many hairs"). Bristleworms have a well-developed head region, often with tentacles, and well-developed sense organs, including paired eyes, antennae, and sensory palps (projections). They are unusual among annelids because their reproductive organs are developed only during the breeding season; afterward, they wither away. The sexes are separate. **Gametes** (eggs and sperm) are shed into the water, and fertilization is external. Development is indirect, via a trochophore larval stage.

The polychaetes are believed to be the most primitive of the annelid classes. Some species, however, are highly specialized.

**Oligochaeta.**

The class Oligochaeta includes the familiar terrestrial earthworms, found just about everywhere, as well as some freshwater annelid species. Approximately 3,000 oligochaete species have been described.

"Oligochaete" means "few hairs," and oligochaete species generally have fewer setae than bristleworms. Oligochaetes lack parapodia, eyes, and tentacles. Many aquatic oligochaete species have gills to aid in gas exchange. Species typically feed on debris and algae. Earthworms are critical components of land-based ecosystems. By passing large quantities of soil through their guts, they speed the rate of nutrient turnover. Their burrowing activity also supplies the soil with air.

Most oligochaete species are hermaphroditic, with each individual producing both eggs and sperm. Earthworms, however, generally do not self-fertilize. During mating, two worms line up next to each other, with swollen regions called clitella placed next to each other. Sperm is released through grooves in the skin by both individuals, and these are passed to sperm receptacles in the other worm. The clitellum of each then secretes a ring of mucus that carries eggs from the oviduct (a tube for transporting eggs) and collects sperm from the sperm receptacles. This ring slides over the head of the worm, drops into the soil, and closes off, forming a cocoon. Fertilization takes place within the cocoon and a few eggs hatch two weeks later. Development in earthworms, as well as in the other oligochaetes, is direct, without a larval stage.

**Hirudinea.**

The Class Hirudinea consists of the leeches. Leeches differ from other annelids in that most have a fixed number of segments. Leeches lack the hairlike setae of the other annelids and their bodies are somewhat dorsoventrally flattened (i.e., in such a way that the back and belly are close together). As with the oligochaetes, leeches are primarily hermaphroditic and exhibit direct development. There are about 500 described species.

Most leeches are aquatic, and of these, nearly all are found in freshwater environments. A few species are terrestrial, but are found only in fairly warm, moist habitats. Leeches are almost all **ectoparasites** , which attach to the external surface of the host (as opposed to **endoparasites** , which live within their hosts). Segments at the front end of the animal are specialized to form suckers, while back-end segments are specialized for attaching to the host. The mouth contains teeth that are used to make an incision in the host. Leeches secrete an anticoagulant that keeps the blood of their host from coagulating, or clotting. They have been put to medical uses for thousands of years. In fact, bloodletting was extremely common as a standard prescription for a wide variety of ailments. The anticoagulants produced by leeches are still of great interest to medical scientists.

**Platyhelminthes (Phylum)**

The **phylum** name Platyhelminthes literally means "flatworms." Members of this phylum are soft, thin-bodied, leaf or ribbonlike worms, including the familiar planaria of ponds and streams, as well as the flukes and tapeworms parasitic in human and other animal bodies. Some defining characteristics of the phylum are that flatworms are acoelomate (they have no body cavity), triploblastic (the body has three tissue layers), and **bilaterally symmetric** (they have symmetric right and left sides and usually a definite head), and they have organ systems, including an excretory, digestive, reproductive, and [nervous system](https://www.encyclopedia.com/medicine/anatomy-and-physiology/anatomy-and-physiology/nervous-system), but no [respiratory system](https://www.encyclopedia.com/medicine/anatomy-and-physiology/anatomy-and-physiology/respiratory-system).

The class Turbellaria includes all free-living members of the phylum, as well as a few **parasites** . It includes many marine forms, whose beautiful colors serve as a warning of their toxicity to would-be predators, as well as the more drab freshwater planarians (*Dugesia* ). Some Turbellaria can swim by undulations of the body margins, but most of them glide gracefully over surfaces along a trail of mucus, pushed by **cilia** on their ventral surface.

The class Trematoda, commonly called flukes, are unsegmented parasitic flatworms that usually parasitize a snail as an intermediate host (in which they reproduce asexually) and a human or other vertebrate as a definitive host (in which the worms mate and lay eggs). Many species have other hosts between these two, such as fish or frogs. Trematodes usually have a pair of suckers for crawling and clinging to the host's tissues. Many humans are infected with blood flukes, liver flukes, lung flukes, and other trematode parasites of great medical importance.

The Cestoda, commonly called tapeworms, are segmented, ribbonlike parasites usually found as adults in the small intestines of vertebrate animals. Unlike the other classes, they have no digestive tract, for they can absorb predigested nutrients from the host's intestine. The body consists of a long chain of segments, each with its own reproductive system. The anterior end is a knoblike holdfast called a scolex, equipped with suckers and often hooks for attachment to the host's intestine. In general, tapeworm infections are not as medically serious as trematode infections, but some tapeworms can be lethal

**Arthropoda (Phylum)**

The phylum Arthropoda is the largest and most varied in the animal kingdom. It includes well over one million described species. This represents approximately three-quarters of all known biological organisms, living or extinct. Countless arthropods remain undescribed (not yet named and studied), and the actual number of living species could be as high as ten million or more. Some of the more well-known arthropods include insects, crustaceans, and spiders, as well as the fossil **trilobites** . Arthropods are found in virtually every known marine (ocean-based), freshwater, and terrestrial (land-based) ecosystem, and vary tremendously in their habitats, life histories, and dietary preferences.

**Characteristics of Arthropods**

Despite the remarkable variety of arthropod species, all share aspects of a single basic body plan. All arthropods possess a stiff **exoskeleton** (external skeleton) composed primarily of **chitin** . In some species, lipids, proteins, and [calcium carbonate](https://www.encyclopedia.com/science-and-technology/chemistry/compounds-and-elements/calcium-carbonate) may also contribute to the exoskeleton. The external skeleton offers organisms protection as well as support for the body. Its walls provide anchors for the attachment of muscles. The exoskeleton is incapable of growth, and is **molted** (shed) repeatedly during the growth of the animal. This process is called ecdysis. Molting allows for rapid growth until the newly secreted exoskeleton hardens.

Arthropod bodies are divided into segments. However, a number of segments are sometimes fused to form integrated body parts known as tagmata. This process of fusion is called tagmosis. The head, thorax, and abdomen are examples of tagmata. Arthropods also have appendages with joints (the word "arthropod" means "jointed feet"). In early, primitive anthropods, each body segment was associated with a single pair of appendages (attachments). However, in most species some appendages have been modified to form other structures, such as mouthparts, antennae, or reproductive organs. Arthropod appendages may be either biramous (branched) or uniramous (unbranched).

Some arthropods have highly developed sense organs. Most species have paired **compound eyes** , and many also have a number of simpler eyes called ocelli. Arthropods have an open [circulatory system](https://www.encyclopedia.com/medicine/anatomy-and-physiology/anatomy-and-physiology/circulatory-system) (without blood vessels) that consists of a tube that is the heart and an open **hemocoel** , the coelom of the animal, in which blood pools. Arthropods also have a complete gut with two openings, the mouth and the anus.

Gas exchange in the phylum occurs in various ways. Some species have gills, while others employ tracheae, or book lungs. The tracheal [respiratory system](https://www.encyclopedia.com/medicine/anatomy-and-physiology/anatomy-and-physiology/respiratory-system) consists of external openings called spiracles that are linked to a system of branched tubules which allow respiratory gases to reach internal tissues. Arthropods are characterized by a brain as well as a nerve ring around the area of the pharynx, in the oral cavity. A double [nerve cord](https://www.encyclopedia.com/plants-and-animals/zoology-and-veterinary-medicine/zoology-general/nerve-cord) extends backwards along the **ventral** surface of the body, and each body segment is associated with its own ganglion, or mass of nerve cells. In most arthropod species, the sexes are separate. Fertilization usually occurs internally, and most species are egg laying. While some species exhibit direct development, in which eggs hatch as miniature versions of adults, other species pass through an immature larval stage and undergo a dramatic metamorphosis before reaching adult form.

**Major Groups of Arthropods**

Arthropods are divided into four subphyla. These are the Chelicerata, the Crustacea, the Uniramia, and the Trilobita. The last consists exclusively of extinct forms.

**Subphylum Chelicerata.**

The chelicerates include the **horseshoe crabs** , scorpions, spiders, ticks, mites, sea spiders, and other related species. They are characterized by the presence of two tagmata (fused segments), a cephalothorax (fused head and thorax), and an abdomen. They possess six pairs of unbranched appendages. These include a pair of **chelicerae** , a pair of pedipals, and four pairs of legs.

The class Arachnida includes scorpions, spiders, ticks, and mites. There are over 100,000 described species in this class. The majority are land-based and most are found in fairly warm, dry habitats. Like other chelicerates, arachnids have six pairs of appendages. The first pair, the chelicerae, is typically adapted for killing and consuming prey. The second pair, pedipals, have a sensory function, and may include both receptors sensitive to touch and receptors sensitive to chemical changes. The final four pairs of appendages are walking legs. Arachnids have fairly simple eyes that register only changes in light levels. Of the arachnids, spiders (which make up the Order Araneae) are the most diverse. All spiders are able to spin webs using modified appendages called spinnerets. These are located in the rear abdomen. Webs are used for a variety of purposes in different species. In many, they are used to catch prey and to build nests. Spiderwebs can even be used for movement, as in those species that create parachutes to catch the air, enabling them to descend safely. Many spiders have toxic poisons to immobilize prey or to use in self-defense; perhaps the most famous of these is the [black widow](https://www.encyclopedia.com/plants-and-animals/animals/zoology-invertebrates/black-widow). Spiders prey primarily on insects, and are often ecologically important for this reason. Scorpions (order Scorpiones) are arachnids characterized by a pair of claws and a long, jointed tail with a poisonous sting at the end. Ticks and mites (order Acari) are ectoparasites. They embed themselves in the skin of vertebrate animals and feed on blood. Certain tick species carry diseases such as [Lyme disease](https://www.encyclopedia.com/medicine/diseases-and-conditions/pathology/lyme-disease) and [Rocky Mountain spotted fever](https://www.encyclopedia.com/medicine/diseases-and-conditions/pathology/rocky-mountain-spotted-fever).

The class Merostomata includes the horseshoe crabs. [Horseshoe crabs](https://www.encyclopedia.com/plants-and-animals/animals/zoology-invertebrates/horseshoe-crabs) are an extremely ancient marine lineage. Only five species have survived to the present. They are characterized by a long appendage called a telson that projects from the rear end of the body, which is used in flipping the animal over when it is lying on its carapace. They use book gills to breathe and generally feed on small invertebrates.

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The class Pycnogonida consists of the sea spiders. There are 2,000 described species, all of which are marine. Most species are fairly small. Like spiders, they have small bodies with long legs. They use an extensible proboscis to suck nutrients from the bodies of soft invertebrates.

**Subphylum Uniramia.**

Uniramia is the largest subphylum within the arthropods. It includes the centipedes, the millipedes, and the insects, as well as a few smaller related groups. The name Uniramia comes from the unbranched appendages that characterize members of the group. Species generally have two or three tagmata. There are one pair of antennae and two pairs of maxillae. Respiration occurs via tracheae. Uniramians generally have separate sexes.

The class Chilopoda includes the centipedes, a diverse group of over 5,000 species. These terrestrial organisms are characterized by a very large number of segments, often well over 100. The largest centipedes reach lengths of up to 25 centimeters (10 inches). Each centipede body segment, aside from a few at the head and tail of the organism, is associated with a single pair of legs. All centipedes are carnivorous, and the appendages that are frontmost have been modified to form large poisonous fangs that are used to immobilize prey. Centipedes feed primarily on earthworms and insects. Species of centipedes are generally egg laying, and in some, the female remains to guard the eggs. Development is direct—there is no larval stage. In some species, juveniles hatch with the same number of segments as an adult, while in others, individuals add segments with each molt.

The class Diplopoda consists of the millipedes, a group that includes over 8,000 described species. Like centipedes, millipedes have a large number of segments. However, they differ from centipedes in that each segment has two pairs of legs rather than just one. Millipedes do not have fangs, and in fact, most species are either herbivorous or scavengers. Many millipedes do, however, exude (ooze) poisonous or noxious substances as a defense against potential predators. Millipedes are often found in decaying [organic matter](https://www.encyclopedia.com/earth-and-environment/ecology-and-environmentalism/environmental-studies/organic-matter) or in moist soils. They are effective burrowers. Like some species of centipedes, they lay eggs in nests that are attended by the female. Millipedes add body segments as they grow and molt.

**Subphylum Trilobita**

The subphylum Trilobita includes only extinct species found in fossil form. The trilobites were a primitive group of marine species that was particularly abundant during the Cambrian (570 million years ago) and Ordovician (505 million years ago) periods. The group became extinct at the end of the Permian (286 million years ago). Trilobites had flattened, oval-shaped bodies. Most were a few inches long, although one species is known to have attained a length of 0.6 meters (2 feet).

**Insecta (Class)**

The class Insecta is the largest class in the animal kingdom. There are nearly one million described species, and no doubt countless others that have yet to be named. Insects are found in a wide variety of terrestrial and freshwater habitats, and there are even a few marine forms.

Insects have three tagmata, or fused segments: a head, a thorax, and an abdomen. They have a pair of antennae; a series of complex, highly variable mouthparts, which vary greatly from species to species; and three pairs of legs. Both the antennae and mouthparts are evolved from modified appendages (walking legs, most likely). Most insect species also have two pairs of wings, although these are absent in a few very primitive species and have been reduced in others, becoming nonfunctional or adapted for a different purpose. Insect legs and wings are associated with the thorax, not the abdomen, which does not usually carry appendages except for appendages that are evolved into reproductive organs. A theory of the origin of insect flight maintains that wings evolved from external gills that were present in certain primitive groups. Aside from their breathing function, these gills served as flaps that assisted insects in leaping and jumping, and were advantageous because they made escape from predators more likely. Gradual increases in wing size allowed for gliding movement, and ultimately for flapping flight.

Insects have highly elaborated sense organs. For example, they may possess a pair of compound eyes as well as several cranial ocelli, or simple eyes. The [compound eye](https://www.encyclopedia.com/medicine/anatomy-and-physiology/anatomy-and-physiology/compound-eye) is made up of hundreds of individual facets, or parts. Each facet points in a different direction. An individual facet provides information regarding the color and intensity of light but does not provide a complete image. Together, however, the numerous facets create a combined, mosaic image of the world. Compound eyes are particularly effective for seeing nearby objects; distance vision is not as good. The greatest advantage of compound eyes is that they are able to register changes in the visual field much more quickly than eyes with lenses. This is particularly important for detecting motion, as well as for the rapid maneuvering required during flight. Many insects also have well-developed ears. Some species also have an extraordinary ability to detect chemicals. This is especially true in species that use chemical signals called **pheromones** for detection of a sexual partner. The pheromones are emitted by receptive females and picked up by males, which use them to locate potential mates. Insects breathe through the tracheal system, described earlier. Because of limits on the spread of gas in the trachea, insects are restricted to a comparatively small size. The excretory system of insects consists of structures known as Malpighian tubules. The sexes are separate in insects, and fertilization occurs internally in most species.

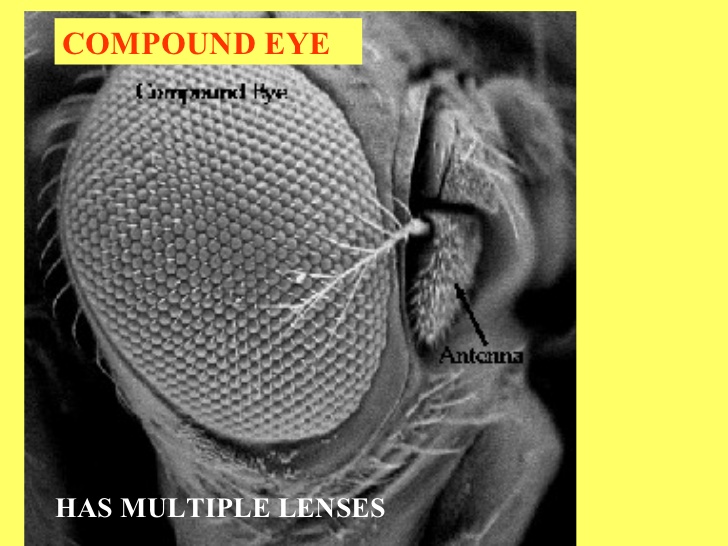
The variety in patterns of insect development is exceptionally high. Most insects pass through several stages before reaching the final adult form. Insects may be described as either hemimetabolous or holometabolous. In hemimetabolous forms, the hatched young resemble adults reasonably closely, although they may be sexually immature and may lack wings. In holometabolous insects, on the other hand, there is a distinct larval stage that is dramatically different from the adult stage in almost all ways: morphology (form and structure), diet, and habitat. In holometabolous insects, there are usually several different larval stages separated by molts. After a period in which the larva grows, it then enters a sessile pupal phase during which a dramatic metamorphosis occurs, and the insect emerges from the pupa with its adult form.

Certain insect groups are highly social. Termites and many species of Hymenoptera (ants, wasps, and bees) are **eusocial** , meaning that their colonies include a caste (a segment of the population) that reproduces as well as a large number of individuals that do not. The evolution of nonreproductive species seems to pose a problem because it appears to defy [natural selection](https://www.encyclopedia.com/science-and-technology/biology-and-genetics/genetics-and-genetic-engineering/natural-selection), which emphasizes the production of offspring. However, direct reproduction is not the only way for an individual to pass on its genes. For example, because an individual's siblings share some of its genes, contribution to the production of a large number of siblings will also result in an individual's genes being represented in the population. This is what occurs in the eusocial insects. In addition, unusual behaviors in termites (repeated cycles of inbreeding) and unusual genetic systems in hymenopterans (haplodiploidy, in which males of the species are haploid while females are diploid) increase the proportion of genes shared by siblings.

Insects play many vital roles in maintaining ecological systems. Many insects act as pollinators to higher plants. Others are important in decomposition. Many species are agricultural pests or parasites, and have a dramatic impact on humans. The [fruit fly](https://www.encyclopedia.com/plants-and-animals/animals/zoology-invertebrates/fruit-fly) Drosophila melanogaster is one of the most well-studied biological organisms and serves as a model species for studies of **genetics** , development, and evolution.

Some well-known insect groups include the Thysanura (silverfish), Ephemeroptera (mayflies), Odonata (dragonflies), Orthoptera (grasshoppers, crickets, katydids), Blattaria (cockroaches), Isoptera (termites), Heteroptera (true bugs), Homoptera (cicadas and aphids), Coleoptera (beetles), Siphonaptera (fleas), Diptera (flies), Lepidoptera (butterflies and moths), and Hymenoptera (ants, bees, and wasps).

**The class INSECTA have unique eyes called Compound Eyes.**



What Are the Functions of a Grasshopper's Compound Eyes?

By Naomi Millburn



The vision of grasshoppers is markedly different from that of human beings -- and from many other organisms, for that matter. The insects are equipped with five eyes in total, three of which are simple eyes and two of which are compound. The sizable compound eyes are situated on the sides of their heads, while the other eyes are directly between them.

**The Design of Compound Eyes**

Compound eyes consist of ommatidia in the thousands -- divisions that are all equipped with lens. These lenses are all hexagonal in outline. These ommatidia -- or miniature eyes -- are situated in tight and dense masses. They all take in small portions of light from the full image that a grasshopper is observing. Once all of these individual "shots" make their way over to the grasshopper's brain, they merge into one big picture.

**Abilities of Compound Eyes**

Grasshoppers' compound eyes function not only to pick up on motion and basic form, but also to discern the distance between their bodies and other things -- perhaps sources of food, for example. Grasshoppers' eyes are not capable of moving like those of humans. Their compound eyes' ommatidia are useful in that they all look off into different directions, all of which work together to illustrate extensive images -- not only from the front, but also from the backs and sides. They operate, essentially, in order to stop grasshoppers from having to rotate their heads all the time. Without compound eyes, a poor grasshopper couldn't know whether something was moving or totally still.

**Ocelli or Simple Eyes**

The grasshopper's simple eyes are also referred to as the "ocelli." These eyes are nowhere near as complex as the compound eyes. For instance, they are completely free of ommatidia. They only have the means to differentiate between dark and light -- something the compound eyes cannot discern.

**Compound Eyes Shape**

If you ever see a grasshopper's face up close, you might notice the compound eyes have circular general outlines. Despite that, some grasshoppers' compound eyes are actually more egg-shaped, especially if they have particularly sloping heads.×