

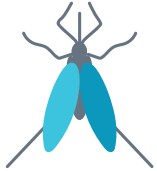


**FASEB**

Federation of American Societies  
for Experimental Biology

## Research with Invertebrates

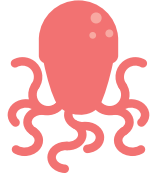
Invertebrates are a group of animals that do not have a vertebral column (also known as a spine or backbone). As the largest group in the animal kingdom, invertebrates are a diverse species that live both on land and in water. Because of their unique properties, research with invertebrates helps scientists understand basic biological development as well as many human diseases. A few examples of invertebrates in research include:



Mosquito/Tick



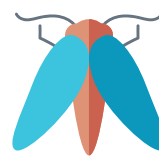
Honeybee



Octopus



*C. elegans* (roundworm)



*Drosophila* (fruit fly)



Squid



Starfish

### Why Invertebrates?

A powerful way to understand and treat human diseases



#### ***Drosophila*: Important for studying genetics, neurodevelopment, and heart disorders**

Research in *Drosophila* led researchers to understand how genetic traits are passed on by confirming that genes are stored in chromosomes, structures inside cells that carry our DNA. The *Drosophila*'s genetic pathways and cardiac system are very similar to mammals, allowing scientists to use this species to understand how our hearts and brains develop. In 2023, researchers completed a full map of the *Drosophila* brain and its connections. This helps scientists develop therapies for various diseases like autism spectrum disorder.



#### ***C. elegans*: Important for studying aging and terminal illnesses**

Even as a simple organism, *C. elegans* are a great way for scientists to study human diseases because its genes are similar to what we find in humans. For example, through research with *C. elegans*, scientists better understand the signals that control aging. This helps researchers determine potential treatments for age-related diseases such as dementia. *C. elegans* also help scientists investigate the genetic causes of diseases like Amyotrophic Lateral Sclerosis (ALS) by learning how the neurons controlling our muscles deteriorate.



#### **Honeybee: Important for studying memory, cognition, and neurological disease**

Honeybees have a very sophisticated memory, which allows scientists to better understand the neural basis of learning and cognition. In 2006, researchers completed sequencing of the honeybee genome and found it is more similar to humans than any other insect. The honeybee's unique genetic and cognitive characteristics help scientists understand the mechanisms involved in many neurodegenerative diseases, including Alzheimer's.

# Cephalopod Research

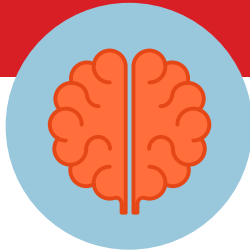
Cephalopods are a group of marine invertebrates that includes octopus, squid, and cuttlefish among many other diverse animals. Their characteristics enable scientists to explore various features and applications of biology important for advancing science and medicine.

## The Value of Cephalopod Research

### Neuroscience Research

Cephalopods are highly intelligent animals. They have the largest and most complex brains among all invertebrates.

Octopuses help neuroscientists not only study brain development, limb movement, and memory, but also find ways to treat brain diseases.



### Treating Eye Diseases

The octopus has the highest sensitivity to light polarization which help researchers study the pigments in our eyes that filter blue light and protect vision.

This allows researchers to learn more about eye diseases like macular degeneration and develop new therapies.



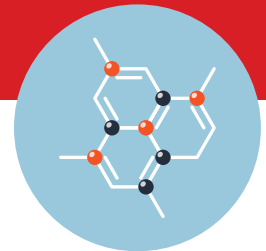
### Improving Gene Therapy

Cephalopods can edit their RNA, allowing them to control the proteins they make. Scientists use this feature to create new therapies for genetic diseases such as muscular dystrophy by fixing damaged genes. This is called gene therapy.



### Developing Prosthetics

Cephalopods can regrow their muscles, nerves, and arms/tentacles. This property helps researchers develop therapies like prosthetics for humans with tissue, organ, or limb damage, such as those occurring from spinal cord injuries.



## How are Cephalopods Cared For in Research?

Researchers and veterinarians treat cephalopods with the utmost care just like all animals in research. Cephalopod studies are routinely monitored to ensure excellent health and well-being.

**IACUC:** Federal laws require that institutions have an Institutional Animal Care and Use Committee (IACUC) made up of scientists, nonscientists, veterinarians, and members of the public to make sure studies follow all rules and regulations. Oversight bodies such as IACUCs, ensure that cephalopod care and use is appropriate and humane. This includes making sure people who work with cephalopods are properly trained and have the resources to provide appropriate care.

**AAALAC:** In addition to following federal and local laws, many institutions volunteer to participate in AAALAC International programs such as accreditation and assessments. AAALAC is a private organization that promotes the humane treatment of all animals in science, including invertebrates such as cephalopods. Therefore, AAALAC-accredited institutions using cephalopods refer to AAALAC's detailed guidance.