Arthropod Flip ‘n go

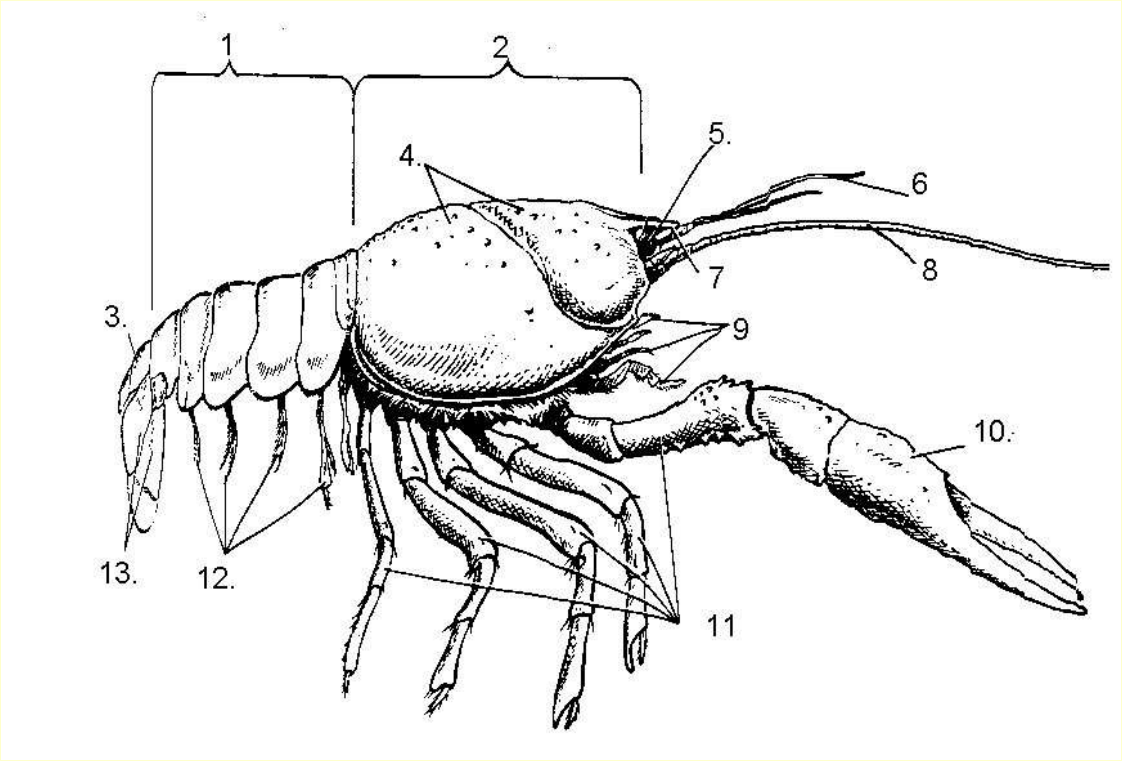
Kelly Riedell/Brookings Biology

Name 3 general characteristics of ALL ARTHROPODS

Invertebrate protostomes
Exoskeleton of chitin
jointed appendages
segmented bodies
Open circulation

In Latin the name ARTHROPODA means Jointed foot

This organism belongs to the class Arachnida



#12 =?

swimmerets

Image from: http://rcs.rome.ga.us/hargett/biology/arthpod/craydia.htm

Arthropods are **Invertebrate protostomes**

invertebrate protostomes
invertebrate deuterostomes
vertebrate deuterostomes

Crayfish are called DECAPODS because they have **10 legs**

Tell one way crayfish are SIMILAR to earthworms.

Both have/are:

- dorsal heart/ventral nerve cord
- cerebral ganglia
- segmented body
- eucoelomates
- cephalization
- external fertilization
- 2 part stomach (crop/gizzard : cardiac/pyloric)
- invertebrate protostomes
- have heart to pump blood
- sexual reproduction
- bilateral symmetry

Respiratory organ in a crayfish

gills

The large pincher claws on a crayfish are called Chelipeds

(key-luh-peds)

The larva found in crustaceans with 3 pairs of appendages and an eye in the middle of its head

nauplius

Crayfish, lobsters, and crabs belong to the class of arthropods called _____

crustaceans

Tell two ways a crayfish is LIKE a clam

Have a heart & OPEN circulatory system
Have adductor muscles
Bilateral symmetry
Both are eucoelomates
Both are invertebrate protostomes
 have gills for respiration
Indirect development (start as larvae)
Sexual reproduction

#2 = ?

Green glands

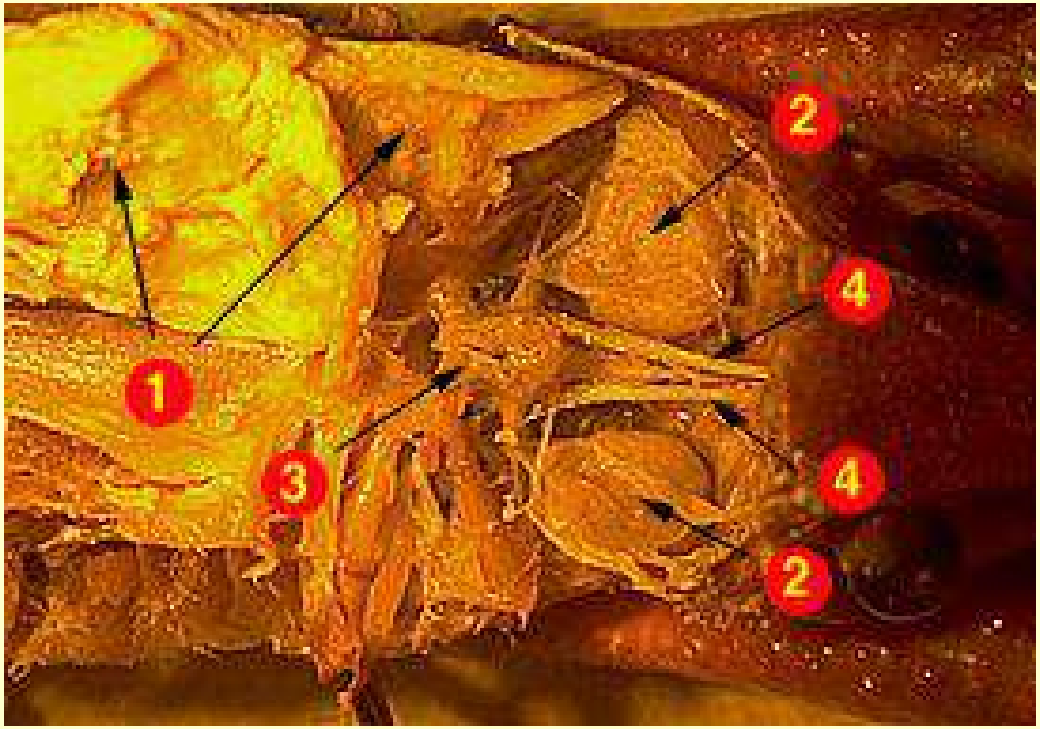


Image from:
http://biog-101-104.bio.cornell.edu/BioG101_104/tutorials/animals/crayfish.html

#2 is part of the **excretory** system

#4 is part of the **nervous** system.

Type of symmetry seen in arthropods bilateral

The name CRUSTACEAN comes from the Latin word CRUSTA which means flexible shell

Crayfish belong to the

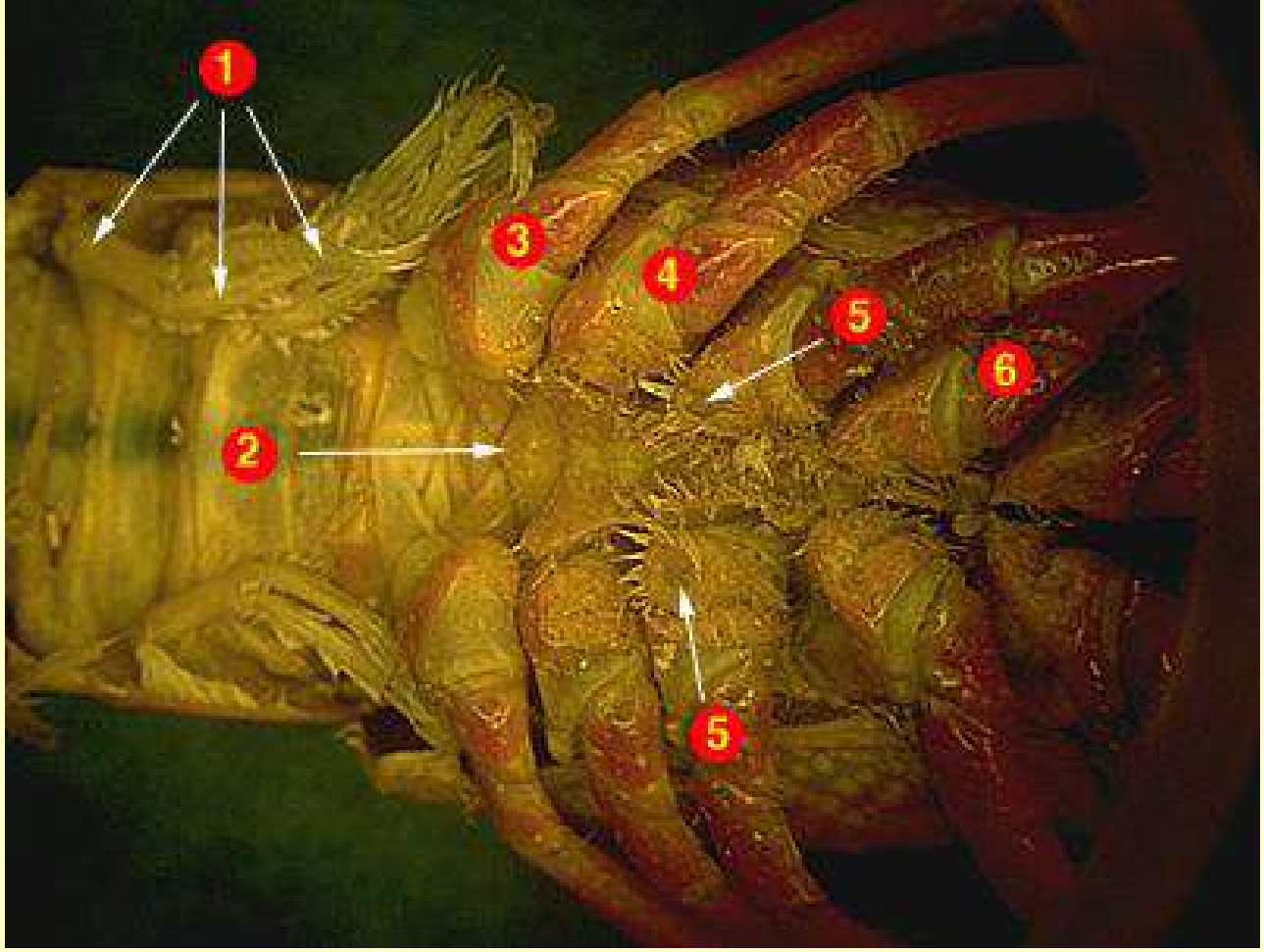
Kingdom Animalia

Phylum Arthropoda

Class Crustacea

Eye composed of many individual light detectors each with its own lens

Compound eye



This crayfish is a female

male female

Image from:

http://biog-101-104.bio.cornell.edu/BioG101_104/tutorials/animals/crayfish.html

The process in which the exoskeleton is shed periodically is

molting

Type of circulatory system found in crayfish **open**

Organ that makes bile, helps finish digestion, and absorbs nutrients in a crayfish

Digestive gland

The portion of the crayfish's stomach found closest to the mouth

Cardiac stomach

Crayfish have gills and spiders have

Book lungs

The head and thorax of a crayfish are fused into one segment called the

cephalothorax

Pincher-like mouthparts found in Arachnids

Chelicera (kuh-li-sera)

Crayfish live in **freshwater**

fresh water **ocean water**

Fertilized eggs and immature larva are carried on the crayfish female's swimmerets

The paddle-like segment in the center of a crayfish's tail is the telson

A larger body segment made by the fusion of smaller body segments

Tagma (*pl. tagmata*)

An example of a tagma in crayfish is the cephalothorax

The swimmerets in a crayfish are attached to this body segment.

abdomen

The fan-like sections on either side of the telson in a crayfish's tail

uropods

Green glands, nephridia, Malpighian tubules and coxal glands are all _____ organs.

excretory

Respiratory digestive excretory reproductive

The appendage which chews the food in a crayfish

mandible

Tell two ways crayfish and starfish are ALIKE

- have an open circulatory system
- the digestive gland absorbs nutrients
- have separate sexes
- use calcium carbonate to make outsides hard
- ganglia connect to a nerve cord
- both are eucoelomates
- have ability to regenerate lost parts
- 2 part stomach (cardiac & pyloric)
- external fertilization
- indirect development (start as a larva)
- can do autotomy
- can do sexual reproduction

Tell two ways CRAYFISH & EARTHWORMS are different

CRAYFISH	EARTHWORMS
Separate sexes	hermaphrodites
Indirect development	direct development
Nauplius larva	no larva
Mother keeps embryos on body	eggs/embryos left in cocoon
Green glands for excretory	Nephridia for excretory
Gills to exchange gases	exchange gases thru skin
Open circulation	Closed circulation

Crayfish appendage used for taste and touch

Antenna, antennules, or maxillipeds

This appendage keeps water moving over the gills

Posterior maxilla (bailers) & walking legs

The crayfish appendage which is used to capture food and for defense

cheliped

If the first pairs of swimmerets on your crayfish bend upward toward the thorax in a V-shape, it is a _____

male

female **male**

Crayfish appendage that is used for touch, taste, and equilibrium

antennule

Crayfish have a _____ heart.

dorsal

ventral **dorsal**

Crayfish appendage that moves water over the gills and helps to manipulate food maxilla

Arthropods are eucoelomates

Acoelomates **pseudocoelomates** **eucoelomates**

Tell two ways CRAYFISH & STARFISH are different

CRAYFISHSTARFISH

Protostomesdeuterostomes
Only sexual reproductionsexual & asexual
Nauplius larvabipinnaria larva
Mother keeps embryos on bodyeggs/embryos left
Cardiac stomach stays insidecardiac stomach everts to eat
Cephalizationno cephalization
Cerebral gangliano cerebral ganglia
/ventral nerve cord nerve ring/radial nerves
Green glands for excretoryno actual excretory organ
nitrogen waste- thru skin gills
Gills to exchange gasesexchange gases thru skin gills
Heart to pump bloodno heart

Crayfish appendage used in locomotion Walking legs

The single tough covering over the cephalothorax in a crayfish is called the carapace

Tell two ways CRAYFISH & CLAMS are different

CRAYFISHCLAMS

Nauplius larvatrochophore larva

Mother keeps embryos on bodyeggs/embryos left behind

2 part stomach1 part stomach

Cephalizationno cephalization

Cerebral ganglia3 pair ganglia

/ventral nerve cord /2 pr nerve cords

Green glands for excretoryKidney for excretory

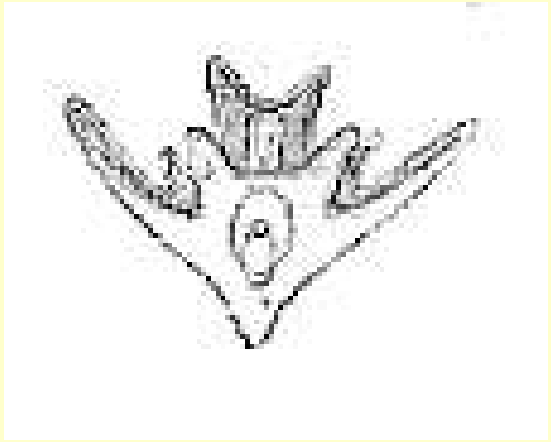
external fertilization external or internal fertilization

Excretory organ in a crayfish

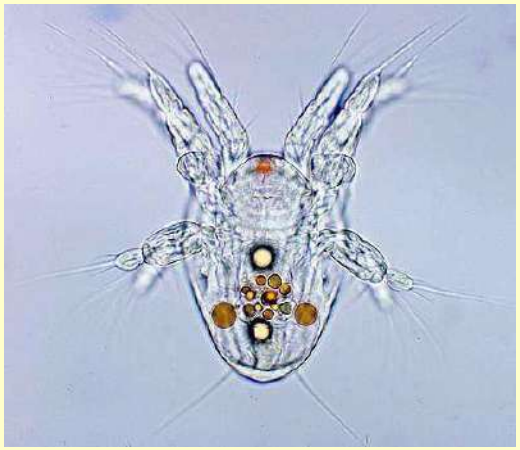
Green gland

The teeth of a crayfish are located in its stomach

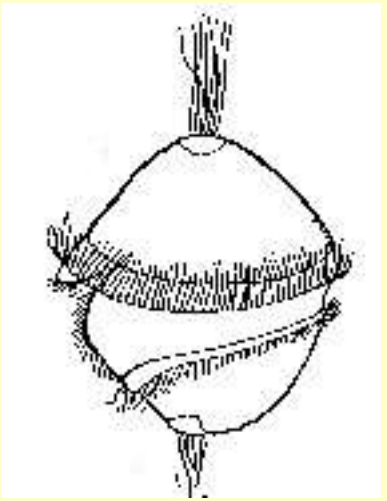
mouth stomach intestine



A



B



C

Type of larva found in arthropods

B (nauplius)

A = bipinnaria seen in echinoderms

C = trochophore seen in mollusks

Trochophore image: http://www.okc.cc.ok.us/biologylabs/Documents/Evolution/Trochophore_larva.htm
Nauplius image: http://www.micrographia.com/specbiol/crustac/copepo/cope0100/cycnaup1.htm
Bipinnaria image:

These appendages circulate water and help in reproduction

swimmerets

A coelom filled with hemolymph is called a hemocoel in animals with open circulation

The concentration of the nervous system including sensory organs in the anterior end of an animal is called cephalization

The ability to regrow lost body parts is called regeneration

T OR F

Crayfish can regrow their tails if they are lost.

False. Crayfish can only regenerate appendages and eyes.

The two main body regions in a crayfish

Cephalothorax and abdomen

Crayfish have green glands and spiders have **Malpighian tubules**

Spiders have **8** **legs**

Reproductive organ that makes eggs

ovary

T OR F

Crayfish are hermaphrodites

False; they have separate sexes

The appendage in a SPIDER that aids in holding food and chewing is the pedipalps

The poison fangs in a spider are called chelicera

The holes in the crayfish's heart where hemolymph reenters are Called ostia

Ostia movie: http://www.gsu.edu/~bioasx/heartbeat.html

The ability of an organism to "self ampute" or drop off parts for defense or repair is called

autotomy

Spiders, scorpions, and ticks belong to the class of arthropods called

Arachnida

The gills in a crayfish are attached to the tops of the **Walking legs**

Type of skeleton found in arthropods

exoskeleton

Image from: http://crayfish.byu.edu/crayfish_biology.htm

This crayfish is a Female

male female

Eggs on swimmerets

Insects are arthropods with

6 legs

Crustaceans are the only arthropods with 2 pairs of antennae

Name a way spiders use silk

Catch prey
wrap prey
build nests
protect eggs
Swing through the air

The structure through which silk is released on a spider.

spinnerets

These nerves connect the brain to the

Ventral nerve cord

Image from:

http://www.aa.psu.edu/div/mns/biology/crayfish/crayfishtable.htm

What is the difference between antenna and antennules in a crayfish?

Antennules are smaller;

both can sense touch and taste but antennules used in equilibrium

The portion of the exoskeleton that sticks out like a visor at the anterior end of a crayfish between the eyes

rostrum

Crayfish appendage used for taste, touch, and to manipulate food

maxilliped

The walking legs in a crayfish are attached to this body section.

thorax

The muscles that attach to the exoskeleton at the anterior end and run underneath to control the mouth parts

adductors

Organ that makes sperm

testes

The anus in a crayfish is located on the telson

#3 = ?

abdomen

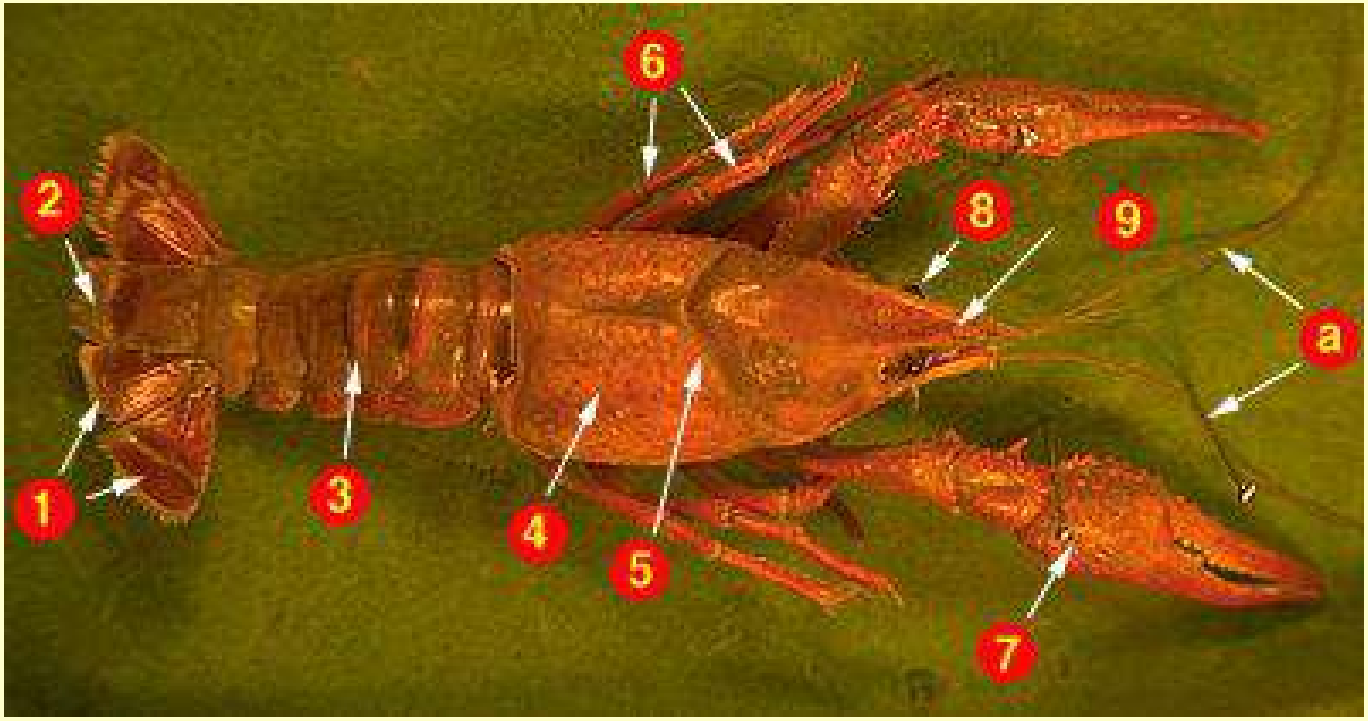


Image from:

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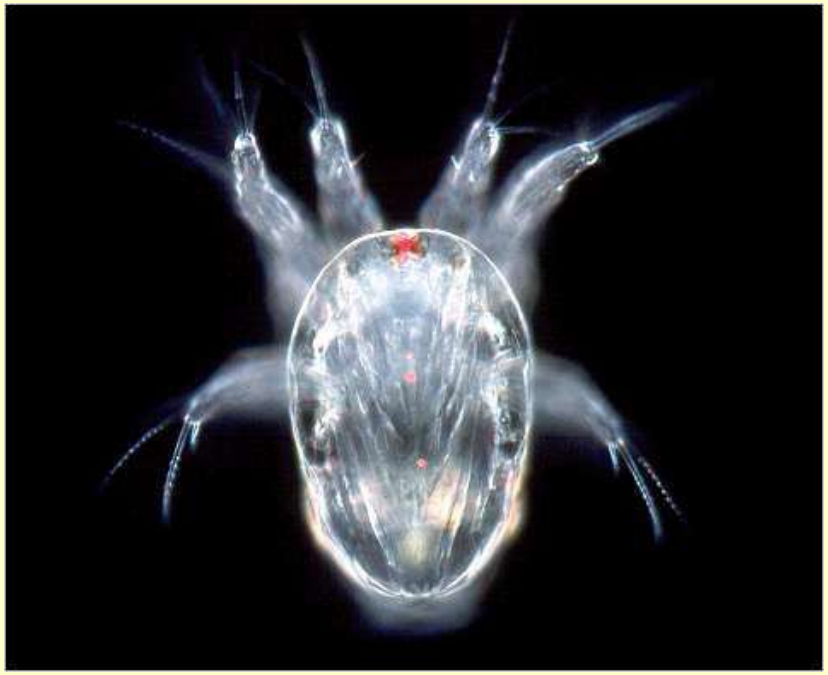
This free swimming larva seen in arthropods



nauplius

Name 3 appendages in a crayfish

Antenna, antennules, chelipeds, maxilla, mandibles, maxillipeds, walking legs, swimmmerets

Tell one way crayfish are DIFFERENT from spiders

Crayfish

have chelipeds
green glands
swimmerets
maxillipeds

gills instead of book lungs
10 legs
2 pair of antenna

Spiders

chelicera (fangs)/poison
spinnerets (spin silk)
Malpighian tubules
pedipalps

book lungs instead of gills
8 legs
no antenna

Match the part with its BODY SYSTEM

Gastric mill digestive

Vas deferens reproductive

Green glands excretory

Ostia circulatory

Gills Respiratory & excretory

Malpighian tubules excretory

Match the part with its BODY SYSTEM

Trachea/spiracles respiratory

ovary reproductive

arteries circulatory

Book lungs respiratory

Adductor muscles muscular

anus Digestive (not excretory)

Crayfish excrete their nitrogen waste in the form of ammonia.

Ammonia urea uric acid

Organ that makes sperm

testes

Compare

	Crayfish	Spiders	Insects
# of legs	10	8 6	
Respiratory organs	Gills OR	book lungs trachea/spiracles	Trachea/spiracles
Excretory organs	Green glands	Malpighian tubules	Malpighian tubules

Compare

	Crayfish	Spiders	Insects
Body segments	Cephalothorax Abdomen	Cephalothorax Abdomen	Head, thorax, & abdomen
Antenna?	2 pairs of Antenna	NO antenna	1 pair of antenna
Mouth parts	Mandible, maxillae, Maxillipeds	chelicera, pedipalps maxillae labium, labrum	mandible,
Eyes	Compound eyes	8 simple eyes	compound eyes

Compare Digestive and Nitrogen waste

	DIGESTIVE WASTE	NITROGEN WASTE
Made where?	In digestive tract	By body cells
Comes from?	Left over from undigested food	breakdown of proteins during metabolism
Removed by what body system?	Digestive	Excretory
Leaves body as?	Feces	ammonia, urea, OR uric acid

Match the FUNCTION with the body part

Teeth in stomach to grind and mash food Gastric mill

Carry sperm Vas deferens

Excrete nitrogen waste Green glands & gills

Exchange gases in crayfish gills

Sense taste, touch, & equilibrium antennules

Match the FUNCTION with the body part

Makes bile Digestive gland

Produce eggs ovary

osmoregulation Green glands

Used to capture food &

for defense cheliped

Sense taste, touch

Antennae, antennules, maxillipeds

Match the FUNCTION with the body part

Produce sperm testes

Chew food in a crayfish mandible

Make digestive enzymes digestive glands

Respiratory organ in spiders Book lungs

Create water currents over gills Maxilla (bailers) & walking legs

Match the FUNCTION with the body part

Transfer sperm to female swimmerets

Locomotion Walking legs

Protects eyes rostrum

Excretory organs in spiders & insects Malpighian tubules

Tail side sections that help with tail flips uropods

Match the FUNCTION with the body part

Carry eggs/embryos in crayfish swimmerets

Fangs in spider chelicera

Cover and protect gills carapace

Receive sensory info from antenna, antennules, sensory hairs Cerebral ganglia

Carry nerve messages to body Ventral nerve cord

Match the FUNCTION with the body part

Aid in holding food & chewing in a spider ___pedipalps___

Release silk in a spider ___spinnerets___

Vision in crayfish ___Compound eye___

Respiratory organs in insects ___Trachea & spiracles___

Let hemolymph back into crayfish heart ___ostia___

Match the FUNCTION with the body part

Fangs in spiders chelicera

Protects gills carapace

Pumps hemolymph heart

Carry blood away from heart arteries

Carry digestive waste to anus intestine

Body system that makes hormones which control other body organs?

ENDOCRINE

Tell one function controlled by the endocrine system in a crayfish?

Molting, sexual development, heart rate

Give an example of a CRUSTACEAN

Crayfish, crabs, lobsters, shrimp

Give an example of an ARACHNID

Spider, tick, scorpion, mite

Skeleton on the outside of the body exoskeleton

Circulatory system in which open
Circulatory fluid is NOT contained in vessels

Big pincher claw on a crayfish cheliped

Ability to drop off a body part to escape a predator autotomy

Ability to regrow a lost body part regeneration

Smaller feelers that sense touch, taste, and equilibrium antennules

Part of the exoskeleton in a crayfish that covers the cephalothorax carapace

Type of larva with 3 pairs of appendages and one eye nauplius

An eye composed of many light detectors each with it own lens _____ Compound eye

One of 10 bilaterally paired appendages on the abdomen of a crayfish that create water currents, transfer sperm (males) & carry young (females) _____ swimmerets

A heart shaped movable mouth part that functions in chewing in a crayfish _____ mandible

Blood in an animal with open circulation _____ hemolymph

Thoracic appendage in arthropods used to touch, taste, and manipulate food maxilliped

Larger segment made by fusing smaller sections together tagma

Structure through which spiders release silk spinnerets

Center section of a crayfish's tail telson

Side sections of a crayfish's tail uropods

Carbohydrate found in the exoskeleton of arthropods that makes it flexible chitin

Process of periodically shedding the exoskeleton to allow growth molting

Main excretory organ in most insects and some myriapods and arachnids Malpighian tubules

An organ for gas exchange in the abdomen of arachnids with parallel folds that resemble a book Book lungs

Free swimming larva seen in Crustaceans with 3 pairs of appendages and one eye Nauplius

Joining of egg and sperm outside the body External fertilization

Organ for osmoregulation and excretion of nitrogen waste in crayfish Green glands

Body system that uses hormones to control other body systems Endocrine

Maintaining the balance of water and ions in the body osmoregulation

Concentration of nervous and sensory tissue in the anterior end of an animal cephalization

Ability to self-amputate body parts autotomy

Ability to regrow lost body parts regeneration

Respiratory organ that exchanges gases with water gills

Reproductive organ that makes sperm testes

General term for reproductive organs gonads

Nerve center found in the head Cerebral ganglia

Small tubules that carry sperm to the exit Vas deferens

Reproductive organ that makes eggs ovary

Part of the exoskeleton that covers the cephalothorax carapace

A pincer-like mouthpart in some arthropods like arachnids chelicera

System of tubes in spiders that carry air directly to the tissues through openings in the exoskeleton ___tracheae___

Appendages that manipulate food and draw water currents over the gills in a crayfish ___maxilla___

Openings in the exoskeleton that let air into the trachea ___spiracles___

Blood vessels that carry blood away from the heart ___arteries___

Stomach closest to the mouth ___cardiac___

Teeth in the stomach of a crayfish that help grind food ___Gastric mill___

Organism with “jointed legs” and an exoskeleton ___Arthropod___

Organism with a backbone vertebrate

Organism whose blastopore becomes its mouth protostome

Body cavity formed within the mesoderm that surrounds the internal organs coelom

Outside body covering in an animal integument

Joining of an egg & sperm inside the female's body _____ Internal fertilization

Kind of development in which offspring hatch as larva and must undergo metamorphosis to become adults _____ Indirect development

Term used to describe a female crayfish carrying eggs or larvae _____ "in berry"

Holes in the crayfish's heart that allow the return of blood _____ ostia

Blood vessels that carry blood back to the heart _____ veins _____

In animals the body plan where the left and right sides are mirror images of each other _____ Bilateral symmetry

Body section made by fusion of the head and thorax _____ cephalothorax

Organisms with 10 legs _____ decapods _____

Side sections of a crayfish's tail that help in "tailflips" ___uropods___

Term used to describe a female crayfish carrying eggs or larvae ___"In berry"___

Section of exoskeleton that covers the cephalothorax in a crayfish ___carapace___

Type of circulation in which hemolymph is NOT contained in blood vessels and flows loose inside the body spaces ___Open circulation___