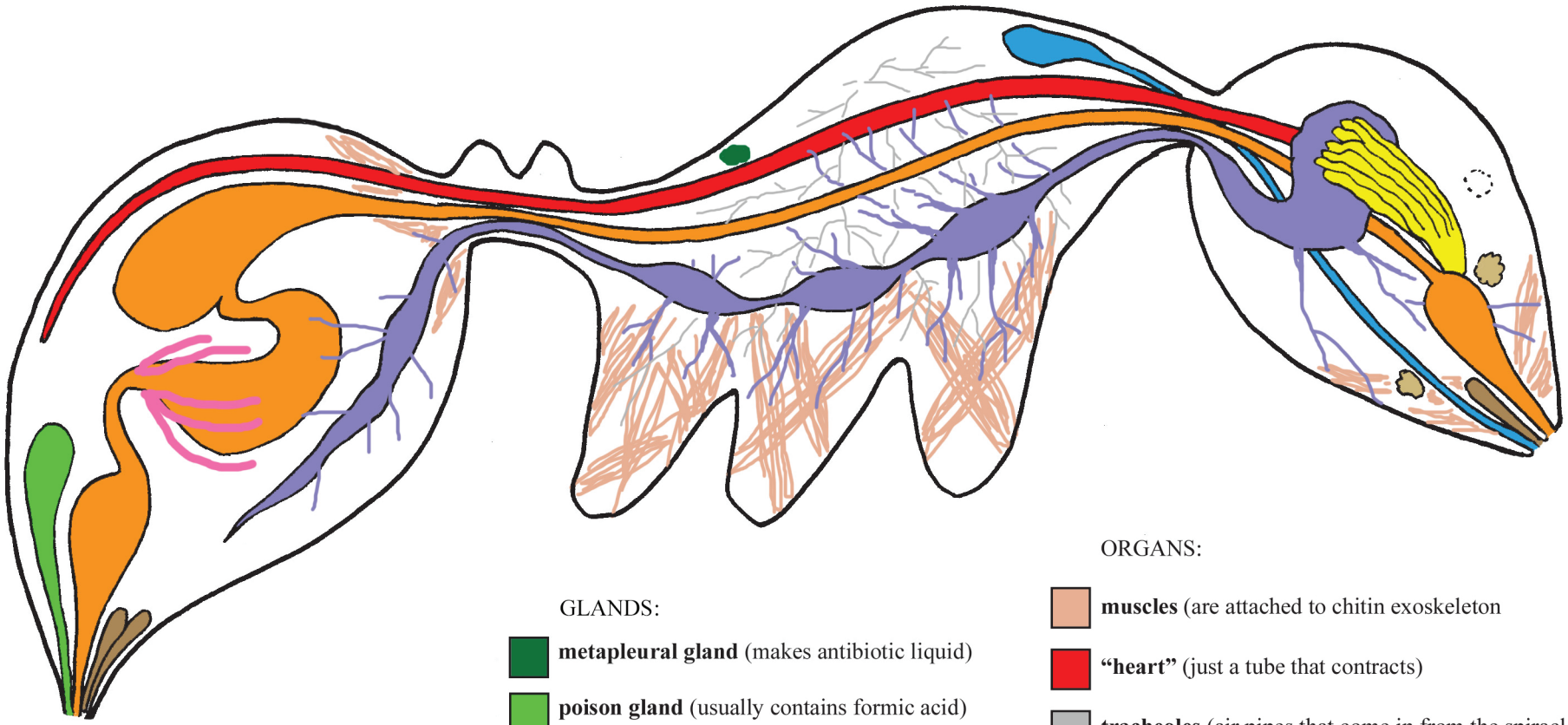
INTERNAL ANATOMY OF AN ANT

Insects are invertebrates, meaning they have no bones. Instead, they have a hard outer shell made of chitin. Their muscles are attached to the chitin shell in the same way that our bones are anchored to our muscles. They have nerves, like we do, but their "heart" is nothing like ours.



NUMBER CODE:

1- **brain**

2 - **pharynx** (throat)

3 - **esophagus**

4 - **crop** (social stomach)

5 - **stomach** (a one-way valve separates it from the crop)

6 - **hind gut**

GLANDS:

metapleural gland (makes antibiotic liquid)

poison gland (usually contains formic acid)

communication glands (secrete pheromones used in laying trails and sending messages)

pharyngeal gland (makes and stores a yellow, oily substance from the food as it passes by)

labial gland (similar to our salivary glands)

digestive glands (similar to our pancreas)

ORGANS:

muscles (are attached to chitin exoskeleton

"heart" (just a tube that contracts)

tracheoles (air pipes that come in from the spiracles)

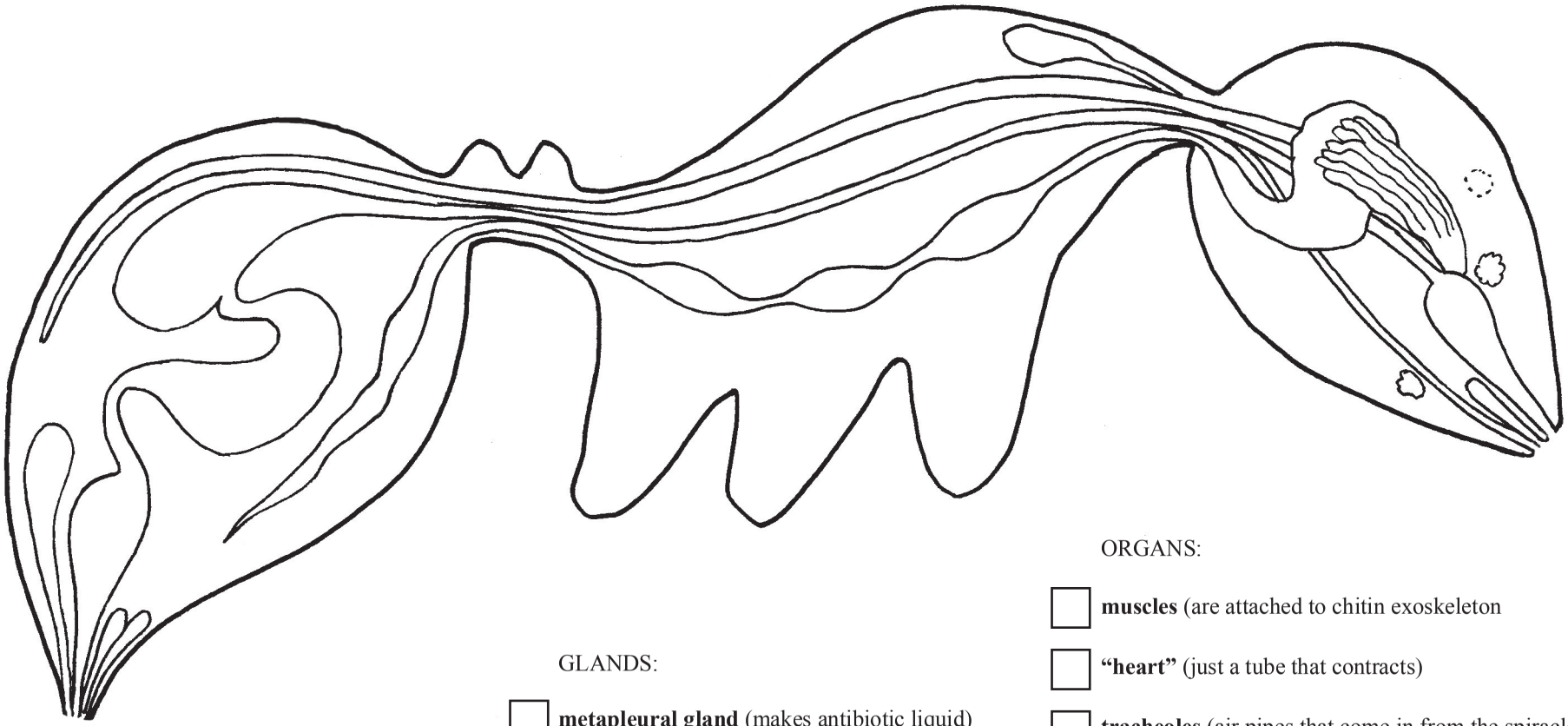
nervous system (nerves control muscles, glands, and also receive information and take it to the brain)

digestive system (pharynx, esophagus, crop, stomach, hind git)

Malpighian tubules (collect wastes, much like our kidneys do)

INTERNAL ANATOMY OF AN ANT

Insects are invertebrates, meaning they have no bones. Instead, they have a hard outer shell made of chitin. Their muscles are attached to the chitin shell in the same way that our bones are anchored to our muscles. They have nerves, like we do, but their "heart" is nothing like ours.



NUMBER CODE:

1- **brain**

2 - **pharynx** (throat)

3 - **esophagus**

4 - **crop** (social stomach)

5 - **stomach** (a one-way valve separates it from the crop)

6 - **hind gut**

GLANDS:

- ☐ **metapleural gland** (makes antibiotic liquid)
- ☐ **poison gland** (usually contains formic acid)
- ☐ **communication glands** (secrete pheromones used in laying trails and sending messages)
- ☐ **post-pharyngeal gland** (makes and stores a yellow, oily substance from the food as it passes by)
- ☐ **labial gland** (similar to our salivary glands)
- ☐ **digestive glands** (similar to our pancreas)

ORGANS:

- ☐ **muscles** (are attached to chitin exoskeleton
- ☐ **"heart"** (just a tube that contracts)
- ☐ **tracheoles** (air pipes that come in from the spiracles)
- ☐ **nervous system** (nerves control muscles, glands, and also receive information and take it to the brain)
- ☐ **digestive system** (pharynx, esophagus, crop, stomach, hind git)
- ☐ **Malpighian tubules** (collect wastes, much like our kidneys do)

ANT INTERNAL ANATOMY DIAGRAM

NOTE: You do not have to use the same colors as shown here. As long as your colors match your own answer key, that's what's important. For example, if you want to make the heart blue, that's fine as long as you color the box next to the word "heart" blue also.

1) MUSCLES Before we color any of the organs, we need to draw some muscles. We'll make them look like they are going behind the organs. The thorax is packed with muscles that move the legs. Also, there are many muscles in the head that move the mandibles and palps. The muscles that control the mandibles are very strong. The muscles attach to the inside of the chitin exoskeleton. Our muscles attach to our bones. Since an insect doesn't have bones, the muscles attach to the hard outer exoskeleton instead. It is almost impossible to find pictures of insect muscles (other than a few very simple ink drawings of flight muscles), so we'll just do our best and not worry about it too much. Just make it look like there muscles in the thorax and head. You can also put some reaching into the abdomen because ants can move their abdomens up and down, so there must be muscles there to move it.

2) "HEART" This is in quotes because it is not very much like our heart at all. It does not have any chambers. It is more like a blood vessel because it is just a tube. The tube does contract, and does have one-way valves that circulate the fluid inside the body, so it does function like a pump, the way our heart does. Since the tube contracts, there must be muscles around it that make it move. However, these muscles would be very small and therefore difficult to put into our drawing. But you can add some circular muscles around the tube if you wish.

NOTE: Insects do not have blood. The watery fluid inside their bodies is called **hemolymph**. Although this fluid gets pumped around by the "heart" tube, it does not carry oxygen like our blood does. Oxygen comes in through the spiracles and travels through the tracheole tubes. Hemolymph would supply the muscles with water and sugars.

3) BRAIN and NERVOUS SYSTEM An insect's nerves are similar to ours. Some nerves travel out from the brain and connect to muscles and glands, telling them what to do. Other nerves travel into the brain, bringing information from the senses such as the antennae and sensory hairs. You can add colored lines branching out from the nervous system, forming small nerves that go to the muscles (and heart, and glands, and actually most other parts, but just put lines going to the muscles and heart). Those bumps along the line are called **ganglia**, and are places where there are groups of nerve cells. The ant's brain is not like our brain. It is very simple and is more like a big ganglion (group of cells). Even though it is simple compared to ours, the ant's brain is programmed with some very sophisticated social behaviors.

4) DIGESTIVE SYSTEM The first part of the digestive system is the **pharynx**. The world "pharynx" means "throat." The ant does have a mouth, also, right at the front of the pharynx, but it is just a hole, not an actual mouth like ours. Then comes the **esophagus**. This is very much like our esophagus and goes down into the stomach. Notice that the ant's esophagus passes through the brain. Also, notice how narrow the ant's waist (petiole) is. Large solid food cannot pass through. Basically only liquids can get through. In the pharynx, the ant strains out any large particles and spits them out. Solid chunks of food are fed to the larvae who digest it using powerful enzymes. The liquid that results can be consumed by the adult ants or the larvae. So when you see ants carrying pieces of food back to their nest, it's for the larvae.

The ant has several stomachs. The first stomach is the **crop**, sometimes called the **social stomach**. No digestion takes place here—this is just a storage bag. The ant can bring food from the crop up into the pharynx again and then give it to another ant. There is a one-way valve between the crop and the next stomach. Once the food passes through this valve it cannot return to the crop. In the real **stomach**, the liquid food gets digested much like it does in ours. The ant does not have a pancreas or liver, though, to help with digestion. In the stomach, sugars are taken out of the food and the ant uses them for energy to move its muscles. The **hind gut** area is where the food is turned into feces, similar to our large intestine. The ant also has an anus, just like all humans and animals do. (Labeling optional.)

5) MALPIGHIAN TUBULES *(mal-PIG-ee-an)* You will need to add these, using the key as a guide. These tubes function a bit like our kidneys and remove chemical wastes from the hemolymph fluid. They are located around the stomach and attach to the digestive system so that their wastes will exit the anus.

6) LABIAL GLAND This is like our salivary glands and produces a saliva-like substance that provides moisture for the mouth area and also makes some digestive enzymes. (Notice how far away from the mouth this gland is!)

7) DIGESTIVE GLANDS near the mouth make enzymes that begin to dissolve the food.

8) POST-PHARYNGEAL GLAND "Post" means "after" so this gland comes right after the pharynx. It is made of a series of tubes that are attached to the back of the pharynx. This gland takes some of the food as it passes by and turn it into a yellow, oily substance. This fatty substance can be used for food by larvae or by the adult ant itself, but can also be used for communication purposes.

9) COMMUNICATION GLANDS There are quite a few types of communication glands, even more than are shown here. Each one produces some type of chemical, called a **pheromone**, that does a certain job, such as marking a trail or alerting other ants to danger.

10) POISON GLAND (also called VENOM GLAND) This gland often makes **formic acid**, a substance that creates a burning sensation when it touches human skin. Ants don't make the same type of venom that snakes or tree frogs do. Other types of venom can affect the nervous system. The "poison" of ants is just very irritating, not life-threatening.

11) METAPLEURAL GLAND This gland produces an antibiotic substance that kills germs. Yes, ants can get sick just like we can, and they live in places that are filled with bacteria and fungi. This gland has a tube that leads to the outside of the exoskeleton, so the liquid can come out onto the surface. The ant can use its legs to pick up some of this substance and then rub it all over its body. This kind of behavior is part of "grooming." (Another grooming action is to clean dust particles off their antennae.) Scientists are studying the chemicals made by the metapleural gland, hoping they might be usable in humans. Bacteria manage to become resistant to our antibiotic medicines, but they don't seem to be able to resist the metapleural chemicals.

12) TRACHEOLES (or TRACHEAL TUBES) You will need to draw these in. You can even use a regular pencil to draw them. Make branched lines going around the thorax. As with the muscles, it is very hard to find good diagrams showing exactly how these go, so whatever you draw will be fine. The tracheal tubes come from the **spiracles** (air holes) on the exoskeleton. Air enters through the spiracles and then flows into these tubes and eventually reaches the muscles and other organs. Air goes both in and out as the ant moves around. The ant cannot actively breathe like we can because it has no diaphragm muscle.