

Fetal Pig Anatomy

**Bio 6A/ Sanhita Datta
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Last time, you explored some anatomical features of fish. Today, do the same with a mammal: the pig. The pigs we have are fetuses from the pork industry. They show all the standard mammalian features; they also still have an umbilical cord and some features of the circulatory system that are unique to fetuses.

Web Links

There are some excellent web sites showing fetal pig anatomy, and I borrowed pictures from some of them. Take a look at some of the links below.

Bio 225 from Western Kentucky University, with good interactive graphics:
<http://bioweb.wku.edu/courses/biol225/images/Zoolab5b.htm>

Biodidac: a nonprofit site with lots of biology pictures; unlabeled. Photos in this handout are from biodidac.

<http://biodidac.bio.uottawa.ca/>

Navigational Terms

These terms help you understand where the various body parts are.

- **Dorsal:** toward the back.
- **Ventral:** toward the front (belly).
- **Anterior:** toward the head.
- **Posterior:** toward the tail.
- **Lateral:** toward the side.
- **Medial:** toward the center.

External Anatomy

Examine your pig externally before you begin your dissection. Locate and understand the functions of the following structures:

- | | | |
|-------------------------------|----------------------------------|---------------------------------------|
| • head | • tail | • urogenital opening (males) |
| • mouth | • thorax | • urogenital papilla (females) |
| • eyes | • abdomen | • anus |
| • nose | • umbilical cord | • scrotal sac (males) |
| • vibrissae (whiskers) | • umbilical vein/arteries | |
| • neck | • teats (nipples) | |
| • trunk | | |

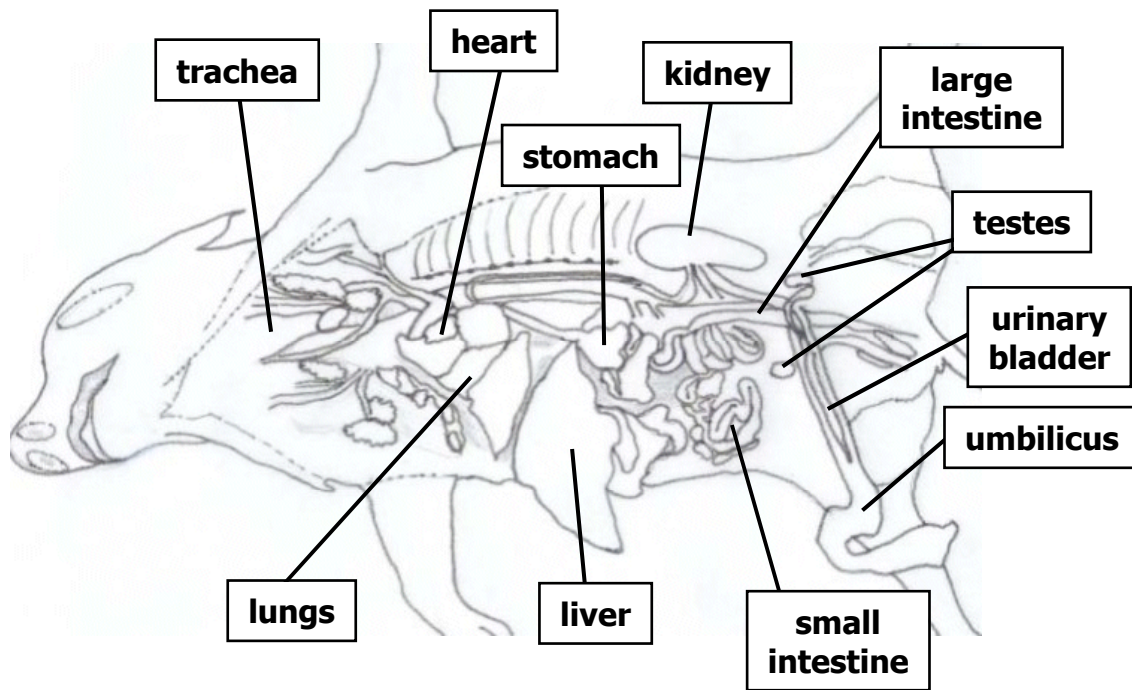
Is it male or female? The genital organs on a fetal pig aren't very obvious, but you can tell if your pig is male or female. Females have a **urogenital papilla** just below the anus. Males don't have a urogenital papilla, but they do have a tiny **urogenital opening** just behind the umbilical

cord. On males, you may also be able to see the beginning of a **scrotal sac**, visible as a swelling just ventral to the anus. Both males and females have nipples, just as in humans.

Internal Anatomy

The instructor will give you some suggestions on how to do the dissection. You should cut as little as possible. Once you open the body cavity, you will generally be able to separate the different organs by simply pulling them apart with your fingers, forceps, or a probe. The more you cut things up, the harder it will be to figure out what you're looking at.

Anatomy Overview



Neck region

Begin your dissection in the neck region. Cut midline on the ventral surface of the neck to expose the underlying muscles. Carefully separate the muscles to observe the underlying structures. Locate and understand the functions of the following structures:

- | | | |
|-----------------------|------------------------|--------------------|
| • larynx | • thyroid gland | • esophagus |
| • thymus gland | • trachea | |

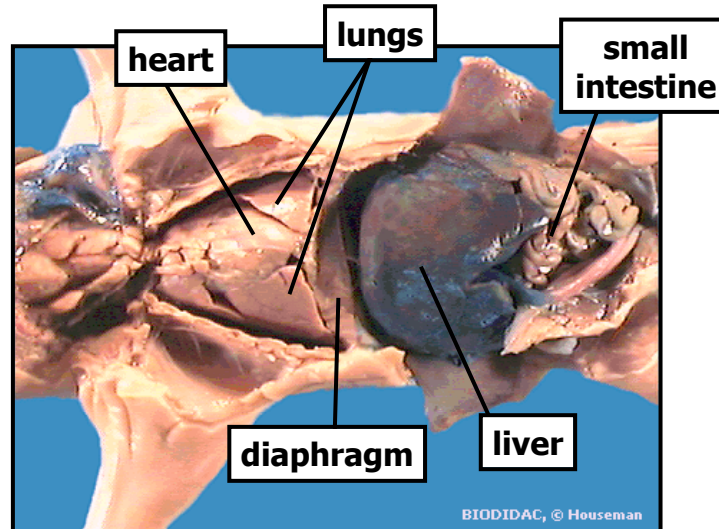
There are two big tubes running from the mouth into the body. The **trachea** carries air, and it is reinforced with cartilage so it doesn't collapse. The **esophagus** carries food, and it is softer but more muscular than the trachea.

The **larynx** is an enlarged structure on the trachea. If you cut it open, you can see the vocal cords inside.

The **thymus** is an endocrine (hormone-secreting) gland that helps regulate the immune system. It's a large, spongy structure covering the ventral surface of the trachea.

The **thyroid** is another endocrine gland; it's a small bilobed structure just posterior to the larynx. The thyroid secretes hormones that help regulate metabolism.

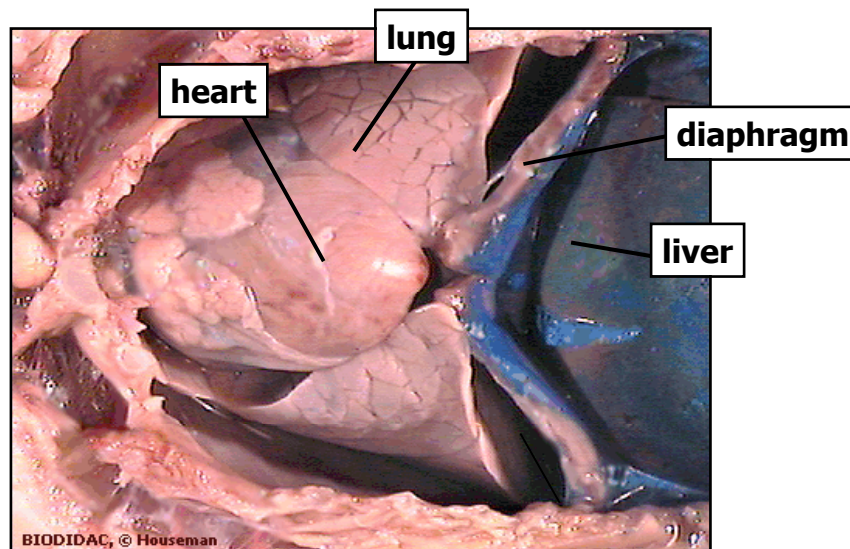
Thoracic & Abdominal Cavities



Thoracic cavity

Vertebrates have true coeloms. In mammals, the coelom is divided into two main cavities: the **thoracic cavity**, which contains the lungs, and the **abdominal** (or peritoneal) **cavity**, which contains the digestive system. The thoracic cavity and the abdominal cavity are separated by the **diaphragm**, a sheet of muscle and connective tissue that helps in breathing. Note the many membranes lining the coelom and holding the organs in place.

Thoracic Cavity

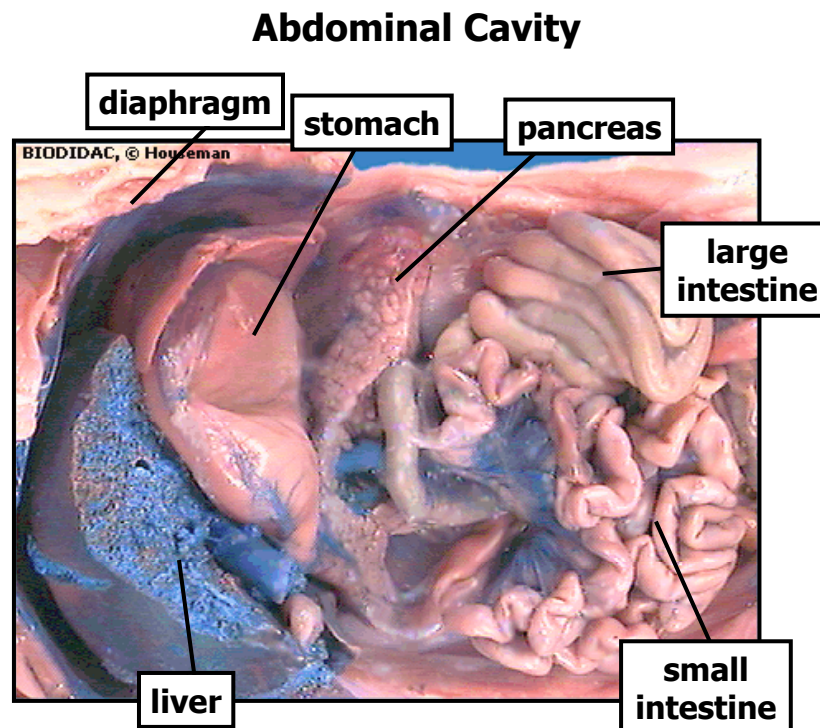


Look for these structures in the thoracic cavity:

- **lungs**
- **heart**

The **lungs** have several lobes. Note the how spongy the tissue is.

The **heart** is muscular and easy to find. Note the aorta, where high-pressure blood leaves the heart on its way to the systemic circulation. You may also see the right and left carotid arteries, which supply blood to the head. For now, don't spend too much time on the various lobes of the heart and the many blood vessels. Come back to this later.



Abdominal cavity: digestive organs

Locate and understand the functions of the following structures:

- | | | |
|--|---|--|
| <ul style="list-style-type: none">• liver• stomach• esophagus | <ul style="list-style-type: none">• small & large intestine• esophagus• pancreas | <ul style="list-style-type: none">• gall bladder• mesenteries• rectum |
|--|---|--|

The **liver** is very large and dark. It has several lobes. You'll need to lift it out of the way to see the organs beneath. The **gall bladder** is a small organ attached to the liver.

The **stomach** is may be hidden beneath the liver. Note the esophagus leading into the stomach and the **duodenum** leading out. The duodenum is the first part of the **small intestine**. After passing through the **large intestine**, digested food goes to the **rectum** before being eliminated from the body.

Note that the intestinal tract is attached to the wall of the coelom by **mesenteries**, which are thin sheets of connective tissue containing blood vessels.

The **pancreas** is white and looks a little bit like cauliflower. It secretes digestive enzymes and buffers.

Abdominal cavity: other organs

Locate and understand the functions of the following structures:

- | | |
|--|---|
| <ul style="list-style-type: none">• kidneys• spleen• urinary bladder• urethra | <ul style="list-style-type: none">• males: testes• females: ovaries, uterus. |
|--|---|

The **spleen** is a flat organ located near the stomach. It produces new blood cells and destroys old ones.

The **kidneys** are attached to the dorsal wall of the abdominal cavity (just as they are in a fish). Urine from the kidneys goes into the **urinary bladder**, and then through the **urethra** as it is eliminated from the body.

A closer look at some organ systems

After you've located the major organs, it's time to remove some of them for closer examination.

Digestive tract

First remove the liver so you can get a better view into the abdominal cavity. Remove the digestive tract, from the stomach to the large intestine. Cut open the stomach and the intestine, and take a close look at their internal surfaces (use a dissecting scope). Note the large internal surface area. These organs need a lot of surface area for secretion and absorption. The stomach also has to be able to stretch enough to accommodate a large meal.

Circulatory system

With the digestive tract out of the way, you should have a clearer view of the circulatory system. Refer to fig. 9.83, 9.84 in the Photo Atlas. Note the following features:

Arteries, which carry high-pressure blood away from the heart, are generally thicker-walled than **veins**, which carry lower-pressure blood back to the heart.

Mammalian hearts have four chambers (see Campbell, p. 42.4). Each side of the heart has an **atrium** that receives blood from elsewhere in the body and a **ventricle** that pumps the blood out of the heart. The **right atrium** receives blood from the systemic circulation and passes it to the right ventricle, which pumps the blood to the pulmonary circuit. After the blood passes through the lungs it goes to the **left atrium** and then into the **left ventricle**, which pumps the blood into the systemic circuit. The first part of the systemic arterial circuit is the **aorta**, which soon branches out to supply various regions of the body.

Fetal circulation is different from adult circulation. In the fetus, blood doesn't get oxygenated in the lungs; it gets oxygenated at the placenta. The **umbilical arteries** carry blood from the fetus to the placenta. The **umbilical vein** carries blood from the placenta back to the fetus. (Remember that in the placenta substances are exchanged between fetal and maternal blood, but the blood itself does not mix.) Therefore, the most highly oxygenated blood in the fetus is in the umbilical vein. Blood from the umbilical vein gets mixed with the rest of the systemic circulation and returns to the right atrium. **The blood entering the right atrium is the most oxygenated blood in the fetal heart, but it's the least oxygenated blood in the adult heart.** The fetus has two key tricks to adapt to this fact:

- First, some of the blood that leaves the right ventricle bypasses the lungs. In an adult, this blood needs to go to the lungs to get oxygenated, but the fetus has a **ductus arteriosus**

that short-circuits this blood flow, allowing some blood to go directly into the aorta and then into the systemic circulation.

- Second, in the fetal heart, there is an opening between the right atrium and the left atrium. This opening is called the **foramen ovale**. The foramen ovale is helpful in the fetus because it lets the oxygenated blood from the placenta get circulated faster. The circulation pattern is somewhat similar to that of a frog (Campbell, p. 874). The foramen ovale normally closes up at birth, keeping blood flow of the two sides of the heart completely separate. In some people, the foramen ovale does not close up. This condition, called patent foramen ovale, can result in serious health problems.

Structures to remember:

Here are some structures or questions you're likely to see on the lab exam:

- Abdominal cavity
- Diaphragm
- Esophagus
- Gall bladder
- Heart
- Is this pig male or female?
- Kidney
- Large intestine
- Larynx
- Liver
- Lungs
- Mesenteries
- Ovaries
- Pancreas
- Small intestine
- Spleen
- Stomach
- Testes
- Thoracic cavity
- Trachea
- Urinary bladder