

INTRODUCTION TO THE FETAL PIG

For most students, this is their first major dissection. A few words of introduction are in order.

The fetal pigs are unborn animals. In processing the sows (mature female swine) for meat, the *uterine horns* often reveal unborn litters. These are removed and made available for biological study. Note the *umbilical cord* of your specimen. There are usually 7 to 12 young in a single litter.

Determination of the Age of the Fetal Pig

The age of the fetal pig is determined by its length. Measure body length along the back following the natural curvature of the spine from the tip of the snout to the base (the start) of the tail, not to its tip. Use a string for this. The actual length is determined by measuring the string with a centimeter ruler.

Refer to the following table which relates the body length to the number of days of gestation. Convert the *centimeter* values shown in the first column to *millimeters* and enter these in the second column.

LENGTH OF FETUS		APPROXIMATE AGE (days)
cm	mm	
1.1		21
1.7		35
2.8		49
4.0		56
22.0		100
30.0		Full term 112-115

The fetal pig assigned to you measures _____ cm (_____ mm) in length. It seems to be approximately _____ days old.

Two students will share one specimen and will be responsible for it till the end of the course.

The Domestic Pig

Domestic hogs belong to the same species as the European wild hog, *Sus scrofa*. They belong to the *Order Artiodactyla* (even-toed hoofed mammals) which includes such varieties as cattle, sheep, goats, deer, camels, giraffes, and hippopotamuses.

Sus scrofa is *omnivorous* like man, feeding both on plant and animal matter. The *body temperature* of an adult pig is slightly higher than that of man. The life span of the pig is 15 to 20 years. There are many biochemical similarities between man and pig (composition of body fluids, specific enzymes, etc.). Pigs are valuable experimental animals for the study of effects of drugs and radiations. A "mini-pig" has been developed for this purpose; it weights 100-150 pounds when fully grown, rather than the 900 pounds reached by some domestic breeds (e.g., Yorkshire).

The Mammals

Since we are about to study the structures and functions of a type of mammal, we ought to consider this most highly developed animal form more closely.

Both the pig and man belong to the class of vertebrates known as Mammalia. Mammals are the most highly developed animal form. While our dissection subject is the pig, we will be making constant reference to man in both the text and in the diagrams presented.

Mammals are a class of *Vertebrates* or backboneed animals, that also includes the:

Fish

Amphibians (frog, toads, and salamanders)

Reptiles (lizards, snakes, turtles, and crocodiles)

Birds

Mammals range in size from minute shrews, which weigh only about two grams (0.002 kg) to giant blue whales, which weigh up to 115 tons (115,000 kg).

The two chief mammalian characteristics which set these animals off from the other classes of Vertebrates are:

Skin covered with hair or fur.

Milk-producing glands (mammary glands) in the female to nurse the young.

The most primitive living mammals belong to the Order *Monotremata*. These animals, native to the Australian region, include the duck-billed platypus and the spiny anteater. They lay a reptilian type of egg. When hatched, the young receive nourishment from the mother's mammary glands.

A more advanced form of mammal, belonging to the order of the pouched mammals, the *Marsupialia*, gives birth to live young (viviparous). However, the young are born at a very early stage of development and continue their maturation in a pouch, where they attach to nipples of the mammary glands. Australian kangaroos and American opossums are members of this order.

The most familiar mammals belong to the subclass *Eutheria*, or *placental* mammals. They include the pig as well as man. Other members of this diverse group include the dogs, cats, cattle, rats, whales, lions, tigers, apes, monkeys, giraffes, and hippopotamuses, and many others.

Their embryos develop within the *uterus* (womb) and are nourished by a special structure, the *placenta*, until they emerge highly developed. Most can walk and even run within a few days of birth; man, however, is helpless for the longest period of time.

During *gestation* (the period during which the embryo develops within the uterus), there is an exchange of substances between the blood of the mother and the embryo across the placenta through the *umbilical cord*.

Students in the Health Sciences, please note that although your primary interest is the human organism, most organs and tissues of the pig are structurally and functionally similar to those of man. Even their names are quite similar, most often identical. Charts, models, and skeletons of human anatomy should be made available to you while you are studying comparable features of the pig.

ANATOMICAL TERMINOLOGY

Some basic biological terminology should be studied at this time. Familiarize yourself with the following words and learn to use them in referring to the location of the body parts of your specimen.

Directions or Positions

Anterior (Cranial)	— toward the head
Posterior (Caudal)	— toward the tail
Dorsal (Superior)	— toward the backbone
Ventral (Inferior)	— toward the belly
Lateral	— toward the side
Medial	— toward the midline
Proximal	— lying near the point of reference
Distal	— lying further from the point of reference

Note: The terms in parentheses are synonymous only when referring to a quadruped such as a pig. In man these terms have different meanings (see diagrams at the end of this section).

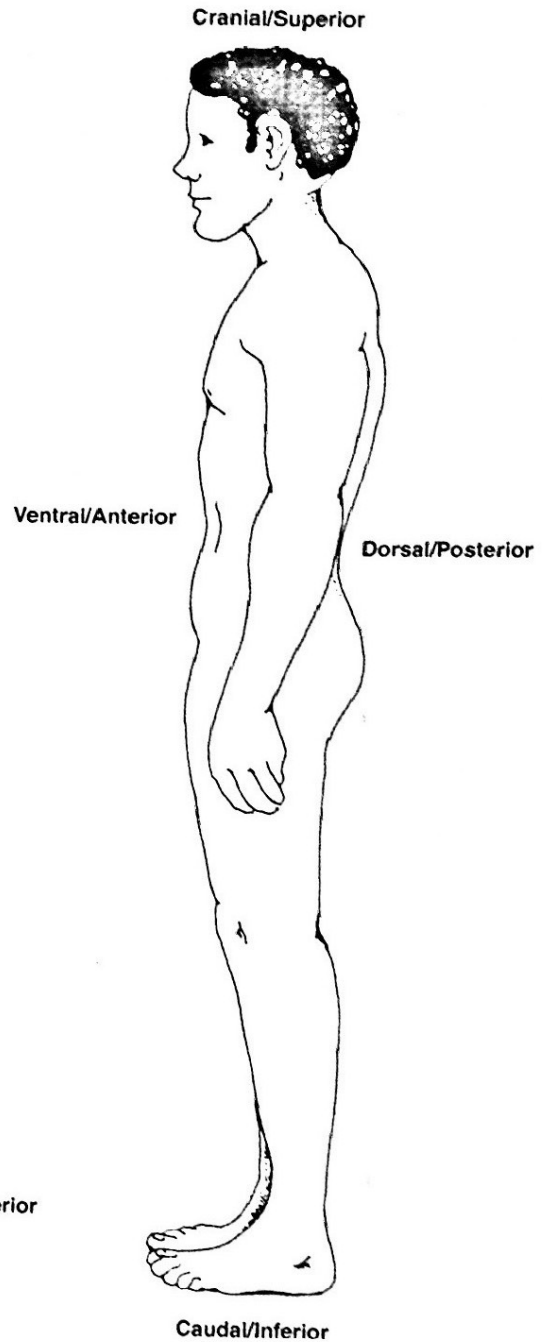
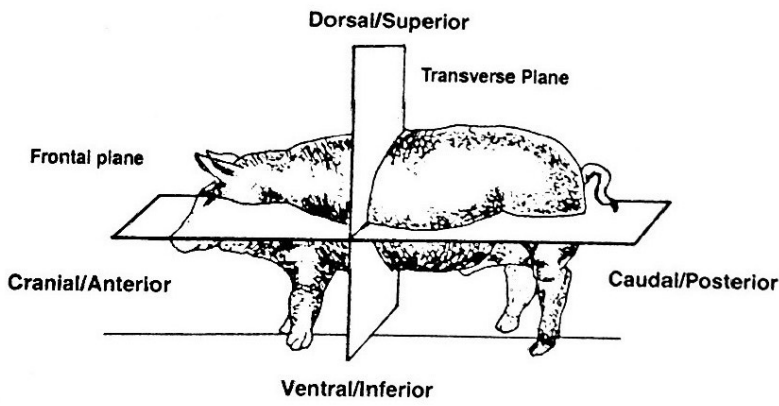
Planes or Sections Through the Body

Transverse (Cross Section)	— perpendicular to the long axis of the body
Sagittal	— a longitudinal section separating the body into right and left sides
Frontal (Coronal)	— a longitudinal section dividing the specimen into dorsal and ventral parts

In man, the *anterior* and *ventral* surfaces are identical; both terms refer to a person's front or belly side. Similarly, the terms *posterior* and *dorsal* are identical, referring to a person's back surface, the area near the spinal cord.

In the pig and other four-legged animals these terms are not at all identical. *Ventral* still refers to the belly portion, but the pig's belly is not at its *anterior* or head end, but on the lower (*inferior*) surface. *Dorsal* still refers to the area of the spinal cord, but the rat's spine is not located along its *posterior* or tail end, but on its upper (*superior*) surface.

Other terms indicating position or direction will appear in the text. For example, the terms *superficial* (or external) and *deep* (or internal) will be used when describing muscles. The terms *cranial* and *caudal* will indicate the head and tail ends respectively.



DIRECTIONAL TERMS for the Pig and Man

EXTERNAL FEATURES

Preliminary Procedures

When you obtain your specimen remove it carefully from the plastic bag container and place into a dissection pan. Do not discard the preservative fluid in the bag. The animal will be returned to the bag at the end of each lab session and the fluid will keep the specimen in good moist condition.

Obtain an identification tag and a rubber band for your specimen bag. At the close of each session, after the pig has been returned to the bag, twist the top of the bag and seal tightly with the rubber band. Then, attach the tag. Write your name, your partner's name, the section number, and the instructor's name, on the label.

Examination

Examine the specimen you have received. Lay the pig on its side as in the first photo.

The body is divided into four readily identifiable areas:

- head (cranial)
- neck (cervical)
- trunk (thoracic and abdominal)
- tail (caudal)

Appendages (Limbs)

The pig is a *quadruped*, in contrast to man who is a *biped*. This refers to four- and two-legged locomotion, respectively. The pig walks on the toes; this is called *digitigrade* locomotion. Man walks on the sole of the foot; this is called *plantigrade* locomotion.

In the photo note the positions of the elbow and wrist, ankle and knee. Count the digits (toes) on each foot. Each foot has four toes. The middle two are flattened and have hooves.

Head

Locate the following parts of the head:

Snout — The snout of the pig has a blunt tip, ending with a disc-like, pliable but firm structure composed of *cartilage*. The tip of the nose is also strengthened by bone. This permits the pig to use the snout to push, lift weights and dig.

External Nares — These are nostrils opening in the cartilaginous disc of the snout. They open into the nasal cavity. Here the inhaled air is warmed, filtered and humidified.

Pinnae — These are the external ears. They are also composed of cartilage, just as the human ear. The *external auditory meatus* is the opening for the *external auditory canal* which leads to the *tympanic membrane* (eardrum), and to the *middle ear*.

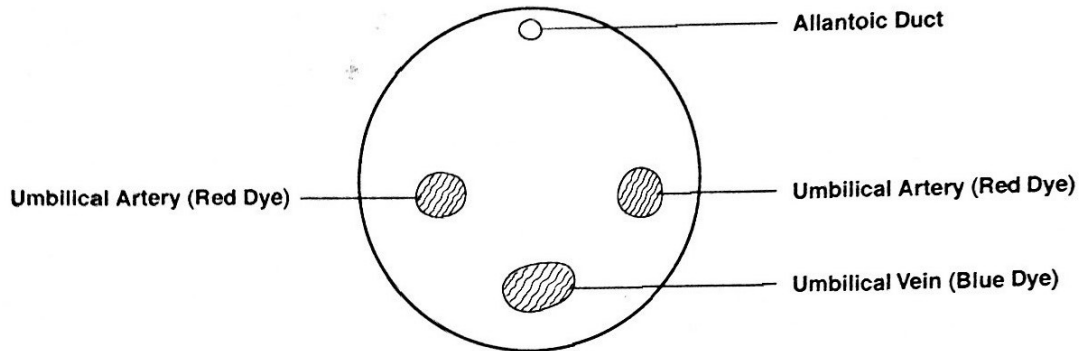
Eyes — Spread the upper and lower eyelids. In the inner corner of the eye locate a third lid-like structure, the *nictitating membrane*. Does the pig have eyelashes?

Trunk

Locate the following parts of the trunk:

Umbilical Cord — This structure more than any other, identifies the animal as a fetus. It extends from the mid-ventral abdominal surface to the *placenta*. It functions in the procurement of food and oxygen for the fetus from the mother, and the movement of wastes from fetus to mother.

Use your scissors to cut the umbilical cord about a half inch from the abdomen. Observe the two red *umbilical arteries* and the much larger blue *umbilical vein* running through the cord. A smaller *allantoic duct* will also be found.



UMBILICAL CORD (Cross Section)

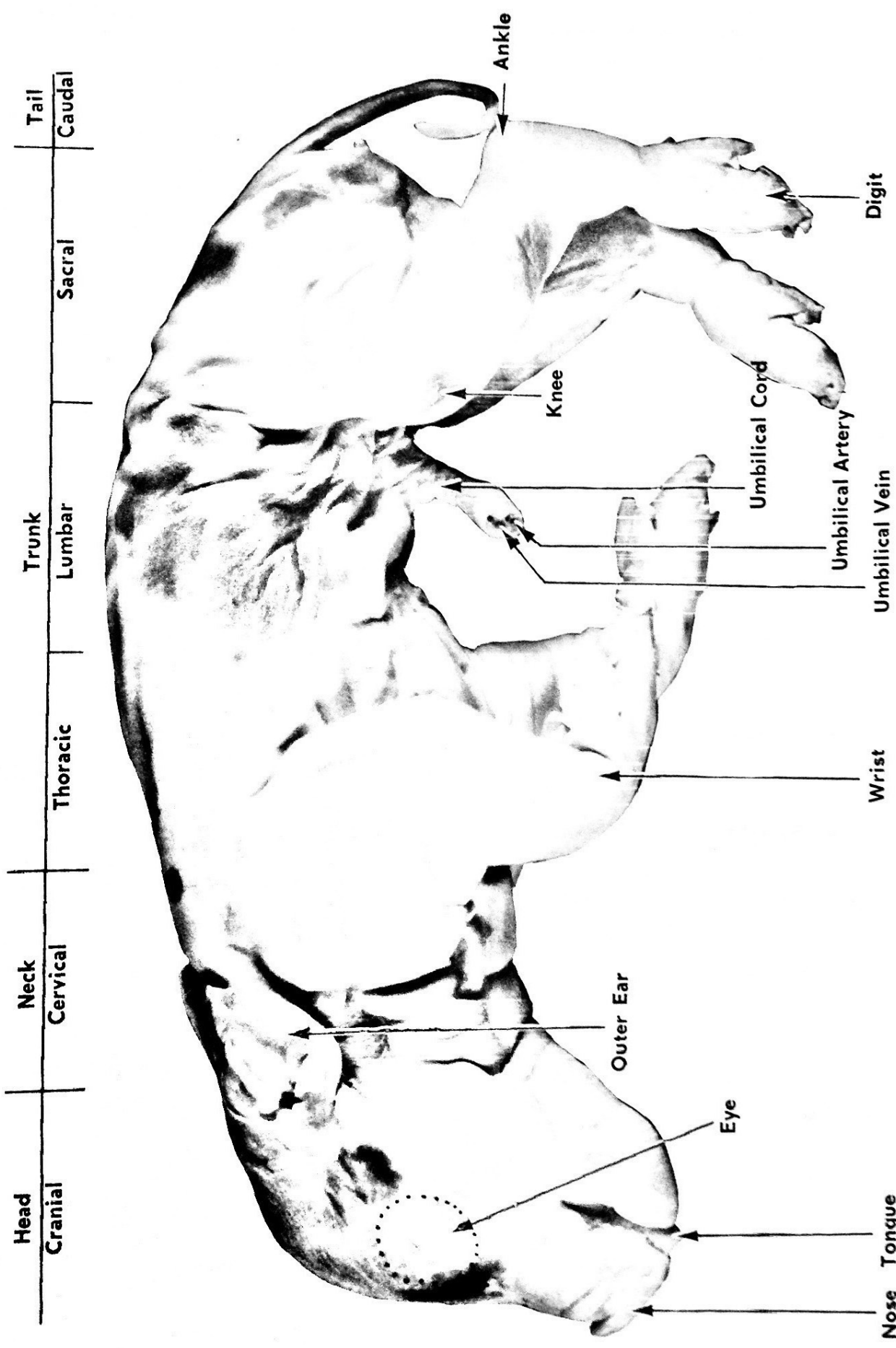
Anus — This is the terminal opening of the digestive tract. It is located just ventral to the base of the tail in both males and females. Simply lift the tail to find the anus.

Urogenital openings and *mammary papillae* will be described in the next section. Note the paper-thin covering upon the fetal pig's entire body, the *periderm*. This may easily be peeled off.

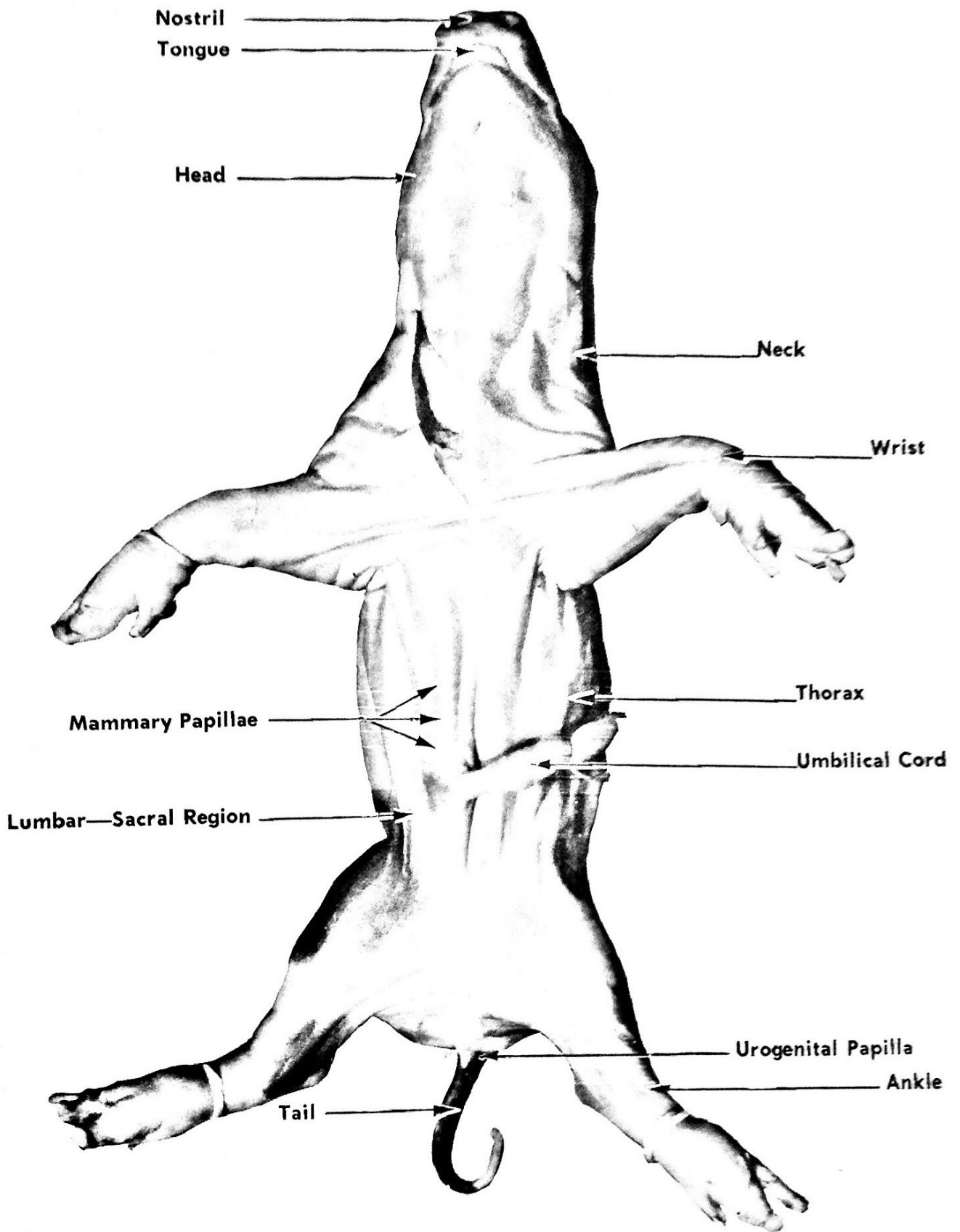
At the end of each dissection session, replace the pig in the plastic bag. Add an ounce or two of preservative fluid. Twist the top and seal securely with a rubber band. This prevents your specimen from drying out between dissection sessions. Attach the identification tag to the outside of the bag.

Note the large incision on the pig's neck in the photo (p. 8). This was made at the time the colored latex was injected into the pig's blood vessel.

In the same photo you can also observe how the fetal pig is positioned for most of the following dissection sessions. He is tied down in the dissection pan, ventral surface upward. The string extends from one limb across to the other, passing beneath the bottom of the pan. A slip knot facilitates the tightening and loosening of the string as needed during the dissection.,



EXTERNAL STRUCTURES



EXTERNAL STRUCTURES (Ventral View)

MALE AND FEMALE

Although the animals are as yet unborn, differences between the sexes are readily seen. The older the specimen the more pronounced these external differences will be.

Female: (Symbol ♀)

The female is identified by the *urogenital papilla*. This is a small fleshy conical projection ventral to the anus. (The anus is ventral to the tail and is clearly seen in both males and females, when the tail is lifted.) Locate the female's *external genital opening* at the base of the urogenital papilla. As the term urogenital indicates, this is the external opening for both urinary wastes and the reproductive or genital system.

Male: (Symbol ♂)

The male's *testes* (testis singular) lie in the *scrotum*, a double pouch structure ventral to the tail. In older specimens this area is enlarged and readily visible. In younger animals it may be necessary to touch the area to detect the testes.

The *urogenital opening* in males is located on the mid-ventral surface, posterior to (below) the umbilical cord. It is the opening of the *penis*.

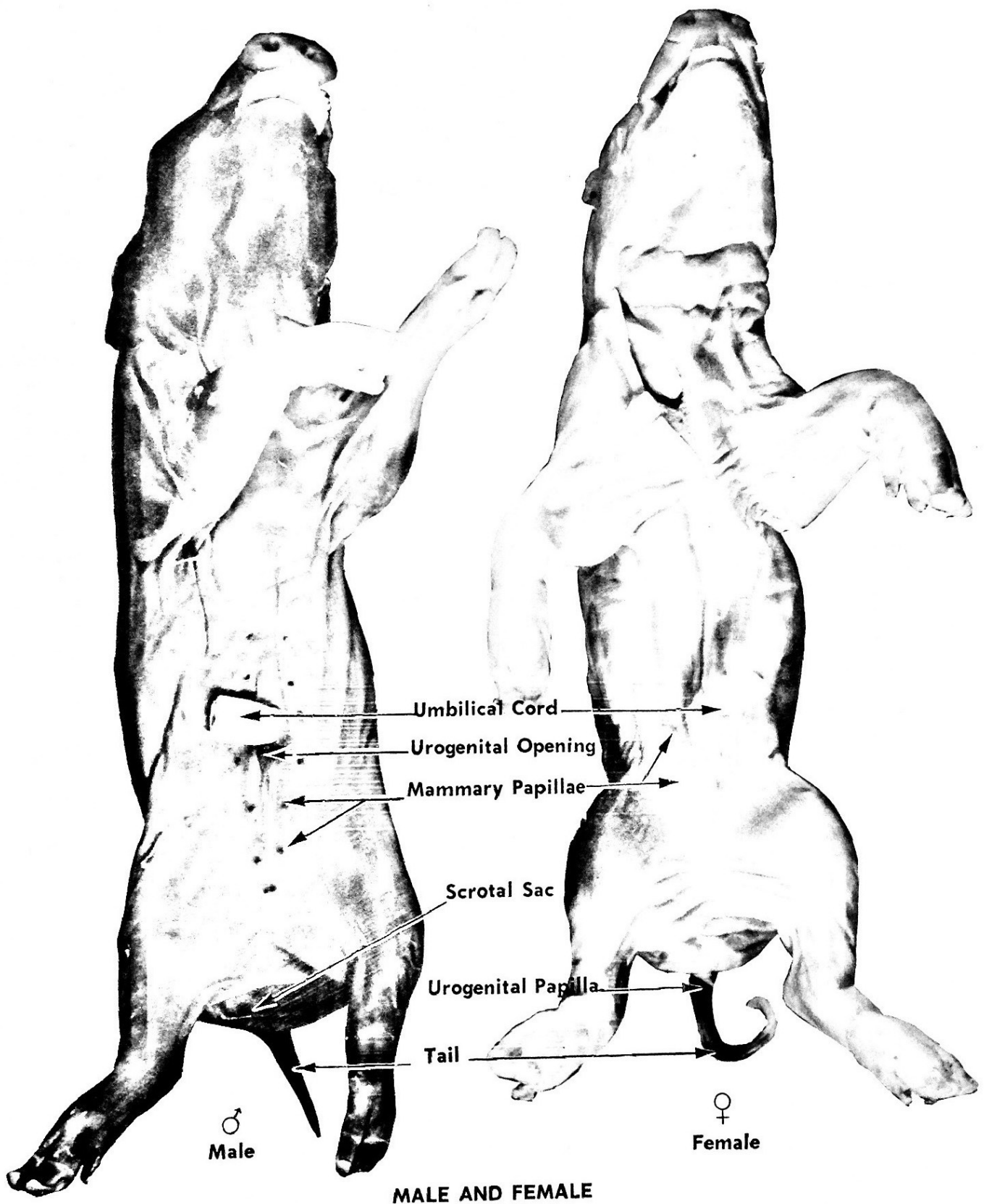
The *penis* is internal, but may be detected under the skin by pressing with your finger tip (palpating) along the mid-ventral surface, between the urogenital opening and the scrotum.

Males and Females:

Both males and females possess *mammary papillae*. In mature females these become the nipples by which the young receive the milk from the *mammary glands*. In males and in these fetal animals, the glandular milk producing structures are not developed. However, the mammary papillae are present in all specimens.

How many pairs of mammary papillae do you count in your specimen? Do all specimens in the class possess the same number?

Examine the fetal pigs of other students to determine the sex of the specimens.



MALE AND FEMALE