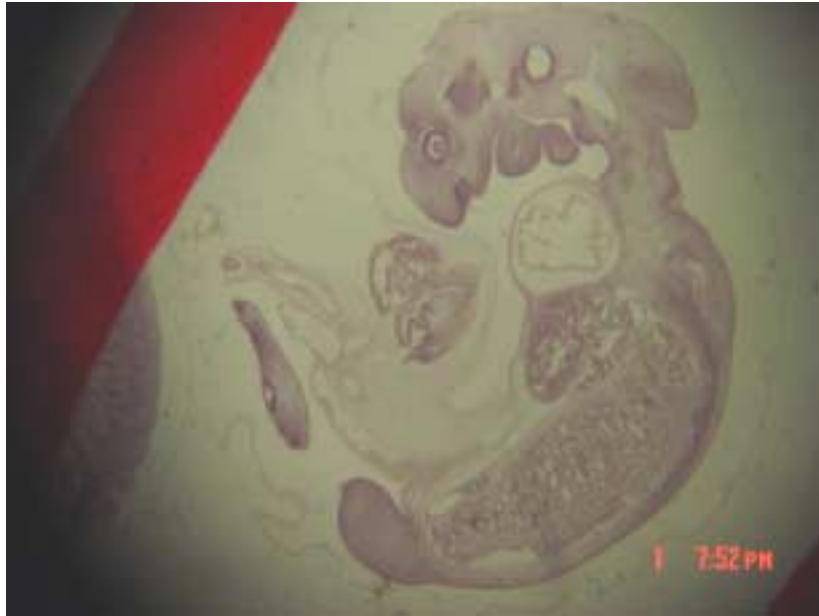


SLIDES 6 AND 10 MM PIG SLIDES; TRANSVERSE SECTIONS AND SAGITAL; FETAL PIGS-1-8INCH; HUMAN SAGITAL SECTION  
 DIAGRAMS: DRAWINGS OF THE PIG SECTIONS TO BE LABELLED, AND FOUR DRAWINGS TO BE MADE. REFERENCES: PATTEN: HUMAN EMBRYOLOGY; Embryology of the pig. PRELAB; OBJECTIVES To learn to envision a three dimensional embryo from 2-D cross sections; to see the changes in organs systems from the 6 to the 10 mm pig.

REQUIRED TASKS: examine slides and fetal pigs and make drawings, label



diagrams **IN THIS SECTION YOU WILL DETERMINE THE RELATIONSHIP BETWEEN the heart and the bulbus as they become compartmented into right and left sides which are systemic and pulmonary; the development of the vena cavae, vitelline and umbilical derivatives; the regions of the brain, and the cranial nerves; the various evaginating organs of the digestive system; the urogenital system.** Great use can

be made of the stereoptican cards of rat embryos which are labelled to tell you which



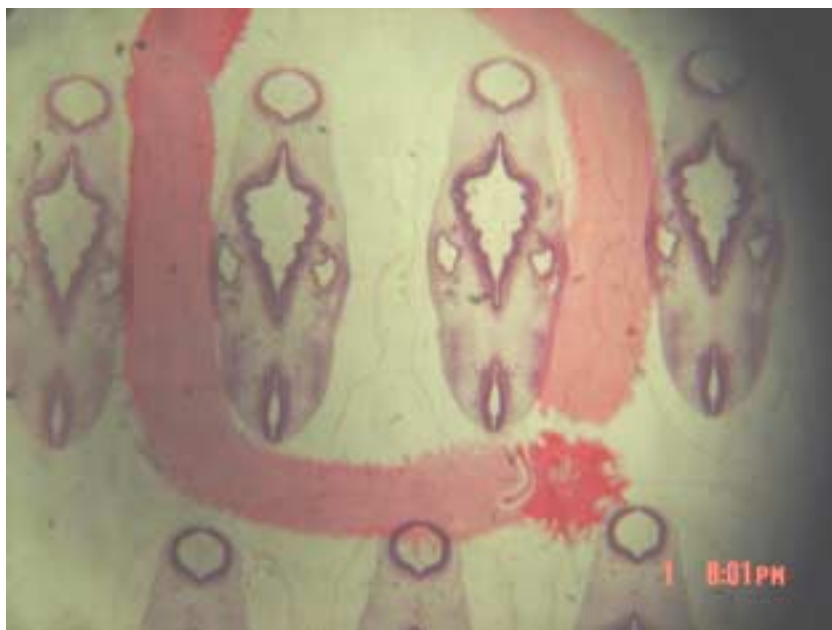
structures are which and which give a 3D view of dissections. The pig embryo sectioned model is also useful, with digestive system in yellow, heart in red, kidneys in green. This will help correlate external appearance which we have become familiar with, to the internal structure which you need to find in the slides and later identify on the older fetal pigs. Notice the visceral arches in the region of the head, with the first one giving rise to the jaws. In the sections, the visceral arches look like blocks with holes in the center which are the

aortic arches. Between the arches are the visceral pouches of the pharynx which extend outward to the ectoderm. The first pouch gives rise to the middle ear cavity and the eardrum. The ventral part of it will give rise to the thyroid. Notice what the brain looks like in section. The shape of the section of the brain varies according to which part of the



brain you are in, so you can tell where you are when you become familiar with how it is laid out. The forebrain is divided into three parts; the two anterior telencephalon bulbs which will give rise to the cerebral cortex and the single diencephalon region behind that to which the eyes (optic stalks) and pituitary (infundibulum and Rathke's pouch) are attached. The midbrain is the large round bulb

which is the top of the head in the embryo. The hindbrain is the thin roofed part behind that and will give rise to the cerebellum, pons, from the metencephalon, and medulla from the myelencephalon. The cranial nerves are nerves coming to or from the brain and the sensory ones often go to the special sense organs such as eyes, ears, nose, taste buds. Find nerves 3,5,7,8,9,10. Nerve 3 is a motor nerve, going to eye muscles, and



therefore comes out the ventral part of the brain, in the mesencephalon region. Nerve 5 is just behind the eyes, next to the midbrain-transition to hindbrain, the sensory part of it is in a ganglion next to the first neuromere of the metencephalon. Nerves 7 and 8 are just in front of the ear vesicles, 9 is just behind the ear vesicle. The ear vesicle becomes the inner ear and the endolymphatic ducts and the semicircular canals can be seen as knobs on it. There is one

large nerve of the parasympathetic nervous system (cranial and caudal nerves), the vagus (nerve 10) which goes to all the viscera (the soft digestive and reproductive organs and the heart and lungs.) 10 is just behind 9. Use the chick models to see the placement of the nerves, then try to find them in the pig sections. Go posteriorly until you get out of

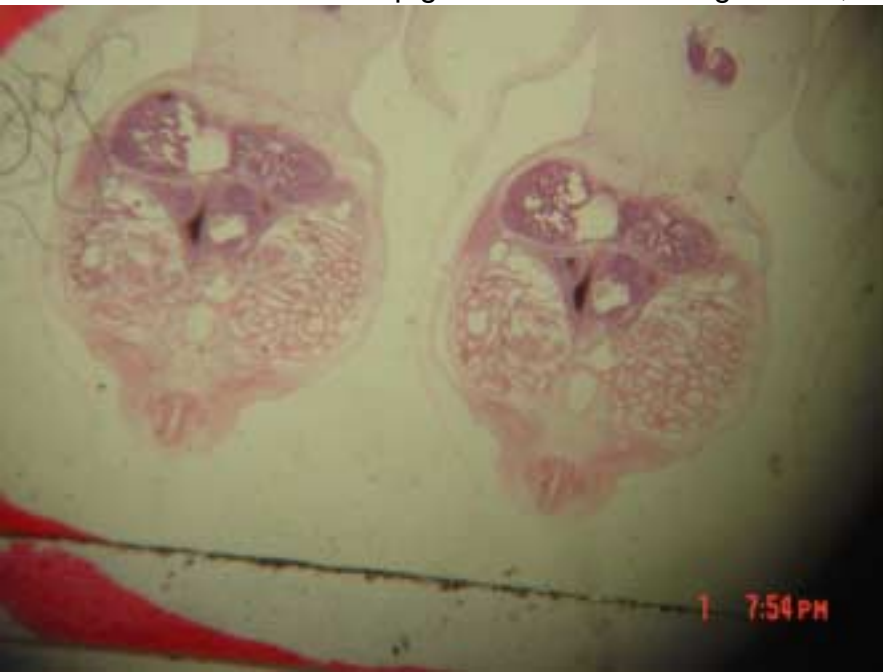


the brain, and you will see how much smaller the spinal cord is. You can also see the dorsal spinal ganglion next to it on each side. That is where all the sensory cell are found, and they extend processes out to the sense organs, and other cell processes into the spinal cord to the association neurons of the alar plate. The motor areas of the basal plate are seen as enlargements, and their nerve fibers

extend out the ventral root to combine with the dorsal root fibers to break up into dorsal and ventral ramus which go out to the dorsal and ventral parts of the outer body tube. The grey or sympathetic ramus can be seen in the thoracic region going out to the sympathetic ganglia which look like eyebrows over the paired dorsal aortae. In this region you can also see the paddle-like limb buds. Can you see the nerves coming out to the limbs as the cervical plexus? Just trace them from the spinal cord. They are pink because nerves just contain fibers, the ganglia contain the cell bodies and you can see the nuclei there, which are purple. Motor nerves grow out from the ventral half of the spinal cord. Then both sensory and motor nerves grow out into the limb together, but motor nerves only attach to muscles, and sensory nerves only attach to sense organs.

In the fetal pig dissections with sagittal cuts, the choroid plexus of the brain ventricles can be seen hanging down into them. The enlargement of the telencephalon growing over the rest of the brain can also be seen.

**DIGESTIVE SYSTEM: EXAMINE THE PHARYNX.** Find the visceral pouches, arches, grooves. Notice that a developing tongue appears in the floor of the pharynx, made of two rudiments, the tuberculum impar and the copula. The pharynx extends back to the laryngo-tracheal groove, where



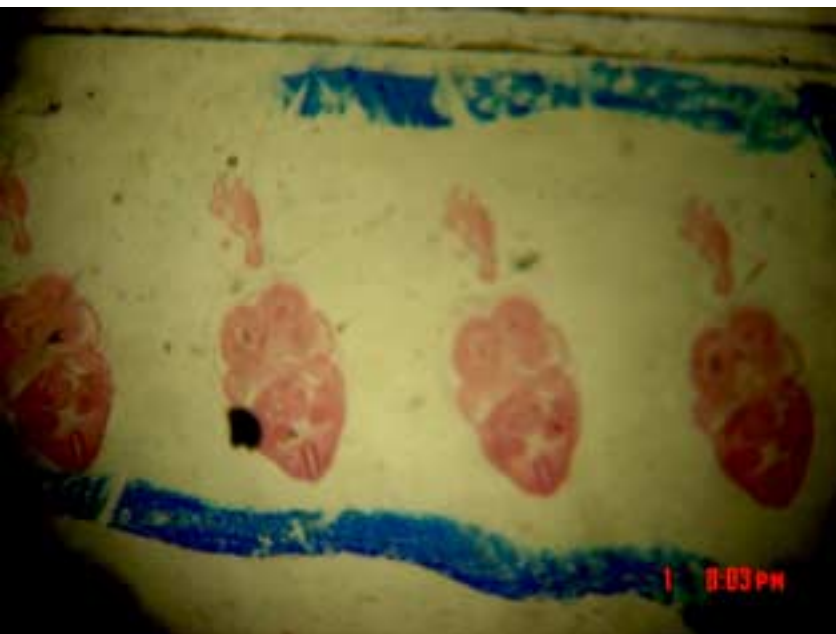
the trachea separates off and ultimately gives off the lung buds. Find the esophagus, and the trachea and lung buds. Notice the pleural cavities, the pericardial cavity, and the peritoneal cavity, which we saw in our dissections. The esophagus leads to the stomach which is larger and thicker walled. Below the stomach, you can see the huge liver which is full of sinusoids making it like a honeycomb. The liver is connected to the duodenum, find this connection at the common bile duct, notice the unbranched part of the liver which will become the gall bladder.



In the 10 mm pig sections, in this same region, you can see the pancreas growing out from the duodenum. It looks like a wavy flag, coming out from it, just posterior to where the bile duct enters the duodenum, and more dorsally, in the vicinity of the portal vein, which develops from the vitelline vein. It is not hollow yet. You can see it branching into the splanchnic mesenchyme. draw a section with the

liver and the pancreas, spinal cord, body cavities

**HEART** Compare the 6mm and 10 mm slides in the heart region. The heart has become more fully separated into right and left sides in this period of development. Draw the section including heart of the 10 mm pig on the lab sheet to be turned



The sinus venosus is becoming incorporated into the wall of the right atrium, and there are valves there still, at the junction. The SV will become the pacemaker of the heart since its cells beat the fastest. Can you find the foramen ovale? It is not seen in the section where the rest of the heart is seen

in its characteristic view with the four chambers. You have to go a little bit forward until you can only see the atria and the bulbus. Notice the folds in the bulbous



which are coming together to make the division in it. Now compare the heart to the 6 mm to see the changes, especially in the bulbous. The bulbous region is splitting into the pulmonary artery and the systemic artery, just as the heart split into right and left sides. Trace the arteries out of the heart and see if you can find the ductus arteriosus on the left label the brain regions and cranial nerves in the diagram



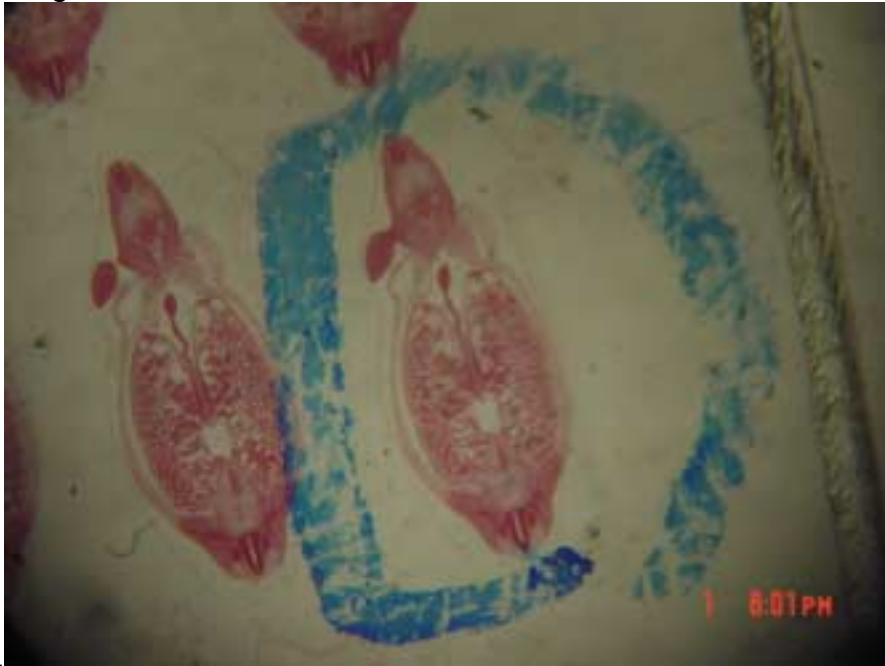
side. Remember it is a part of the 6th aortic arch. Look at the aortic arches and find which ones are present. Find the internal carotid, stapedial arteries. Find the large anterior cardinal which becomes the superior vena cava and takes blood to the sinus venosus at this stage. The left common cardinal is in the process of becoming the coronary sinus. Where does it empty? draw the heart of the 10 mm pig; label sinus venosus, rt. and lft. atrium, rt. and lft. ventricle, interatrial septum, interventricular septum

Now look at the differences of the umbilical circulation in the 6 and 10 mm. In the 6 mm, both of the umbilical veins are present and both go through the body wall and the liver. Trace them from the allantoic region, the umbilical cord to the



heart. In the 10 mm, the left umbilical is much larger and crosses into the left bottom quadrant of the liver, then up to the vena cava in the right top quadrant. The right one will be lost. Vena cava

development as far posterior as the subcardinal anastomosis can be seen at these stages. Trace it from the subcardinal anastomosis right between the two mesonephric kidneys across the caval mesentery, a part of the dorsal mesentery of the intestine to the liver (top right quadrant.) Don't get it confused with the hepatic portal which we saw with the pancreas, and which also goes to the liver to break up into the sinusoids. Trace the vena cava to the sinus venosus. Find the coeliac and mesonephric arteries off the dorsal aorta. Find glomerular arterioles. Find the umbilical



arteries.



Label the pictures

