

UROGENITAL SYSTEM

REFERENCES: Balinsky, An introduction to embryology. Also any dissection manual from freshman biology lab for fetal pigs.

Urogenital system stands for urinary plus genital systems. They are interrelated because the male genital ducts arise from the mesonephric kidney and ducts and the exit of both kinds of ducts occurs at the UG-sinus. The kidneys and ducts arise from the intermediate mesoderm. The nephrotome is separated into three areas which give rise to different structures: anterior part giving rise to the pronephric regions which in mammals are very minimal, but which give rise to the pronephric duct. It is induced by the mesenchyme of the nephrotome to form branches as it grows back along the rest of the mesenchyme of the nephrotome and these branches induce the mesonephric kidney nephrons, forming a separate organ. This functions in fetal pigs because they have very non-intimate placentas so the fetal pig makes its own urinary products to concentrate and store in the allantois. When the pronephric duct reaches the cloaca, it opens up in the UG sinus region. The pronephric kidney deteriorates rapidly early and the duct becomes the mesonephric duct as the induced mesonephric nephron tubules fuse with it. Look at 10-20 mm pig cross sections, see the diagrams which follow, and label the numbered structures of UG system and skeleton. You will also be able to see the mesonephros organ in the littlest whole pigs which you make a sagittal section of and dissect.

The metanephric kidney will be induced as a separate organ which will become the adult kidney by the ureteric buds which grow out of the base of the mesonephric duct in response to the metanephric mesenchyme induction at the posterior end of the nephrotome. Nephrons will develop at the cortex of the metanephros and will fuse with collecting ducts induced as branches from the ureteric bud at the pelvis of the kidney. The branching and formations of nephrons may result from NGF stimulus on receptors of kidney cells. Look at the metanephros and mesonephros in 10-20 mm pigs and their sections, look for gonads in all the little pigs.

The ureter will move from opening into the UG sinus to opening into the base of the allantois which becomes the bladder. That allows the mesonephric duct to open separately into the UG sinus for males where sperm will not be forced into the bladder, but will go directly to the urethra.

The UG system is also related to the gut because the allantois base has grown out from the hindgut. The prostate and bulbourethral glands will develop at the juncture by outgrowth of branches from the endodermally lined urethra into the splanchnic mesoderm, to secrete lubricating seminal fluids and to close off the urethra from the bladder during erection. Find where the hindgut and UG ducts come together and where the allantois is given off. The base of the allantois will become the bladder.

The testes will descend from their position in the dorsal body wall into the scrotum via a shortening of the gubernaculum and descend through the inguinal canal.

In the male, the same duct (the urethra will release urinary and genital products. The old mesonephric duct becomes the Wolffian duct or vas deferens and where the connection is made to the old kidney nephrons, it becomes elongated and coiled to become the epididymus. The converted mesonephric tubules become the vasa efferentia connecting the testis seminiferous tubules and epididymus. Male sex hormones are necessary as well as hormone receptors on the somatic cells to make the male structures (mesonephric ducts and tubules) remain. They die in female embryos. Male hormones in males also kill off the female reproductive ducts which developed earlier, even in males (Mullerian or oviducts.)

In the female: genital products (eggs and embryos) are delivered out through the oviducts, uterus, vagina whereas urinary products go out the urethra. There is a complex development of cloaca and then separation into two parts-hindgut and UG sinus, then urethra (the connection between the allantois and the UG sinus) and vagina form separately from an opening-up of the base of the UG sinus so that now both open independently to the outside. The oviduct bases fuse with the uterus and cervix and that fuses with the vagina which forms partly by an evagination from the UG sinus and has a dual endodermal and mesodermal origin.

The external genitalia are in an indifferent stage at first with genital tubercle and UG sinus; then if there is no male hormone the default condition is the female pattern of development. The cloacal folds around the cloaca help separate it into anus and UG sinus with the genital tubercle at the front of it. The urethral folds separate the UG sinus into vagina and urethra behind the clitoris which develops from the tubercle. In the male, the urethral folds extend along the entire length of the growing penis and fuse along it, carrying the opening of the urethra to the tip of the penis. The UG folds also fuse, and instead of forming labia as in the female, they form scrotal sacs which close over the rest of the UG sinus opening.

Questions to answer:

1. At what size pig has the mesonephros disappeared or fused with the gonad?
2. At which size pig does the UG sinus separate from the anus?
3. How does the bladder arise?
4. What is the difference between ureter and urethra?
5. How can you tell male from female, in the pigs?

PLACENTA

Examine the preparation of the PIG fetus with fetal membranes: measure the length of the whole placenta. Can you see the folds on its surface which interdigitate with folds of the uterus)? There are no villi on pig chorion which correspond to those on the disc of the human placenta. The connection with the mother is much less intimate, so there is

little bleeding at birth of pigs. In order to see these folds, use the dissection microscope. Examine the fetal pig in the jar which has an injected placenta, with arteries in red and veins in blue. Compare it to placentas of sheep, cat, other mammals shown mounted in jars and to the human placentas we have seen. Next, cut open the fetal membranes (the chorion vesicle is outermost) carefully so you can keep them, BEING CAREFUL NOT TO CUT A SECOND MEMBRANE INSIDE, then examine the connection of the umbilical cord with the membranes and see if you can tell the difference between the allantois, (which is fused with the chorion and is used to store urine in pig development, and to bring the circulation to the uterine lining to get oxygen and release wastes) and the amnion, which contains the fluid which protects the embryo from drying and mechanical injury, and the outer chorion, and yolk sac.

Look at the slide of human placenta villi. The round or irregularly shaped structures are sections of the villi. Each villus after the fourth month has:

1. a blood vessel in it which will probably contain blood cells.

2. Around the blood vessel is connective tissue which contains a few cells and a lot of extracellular material which is fibers and matrix material.

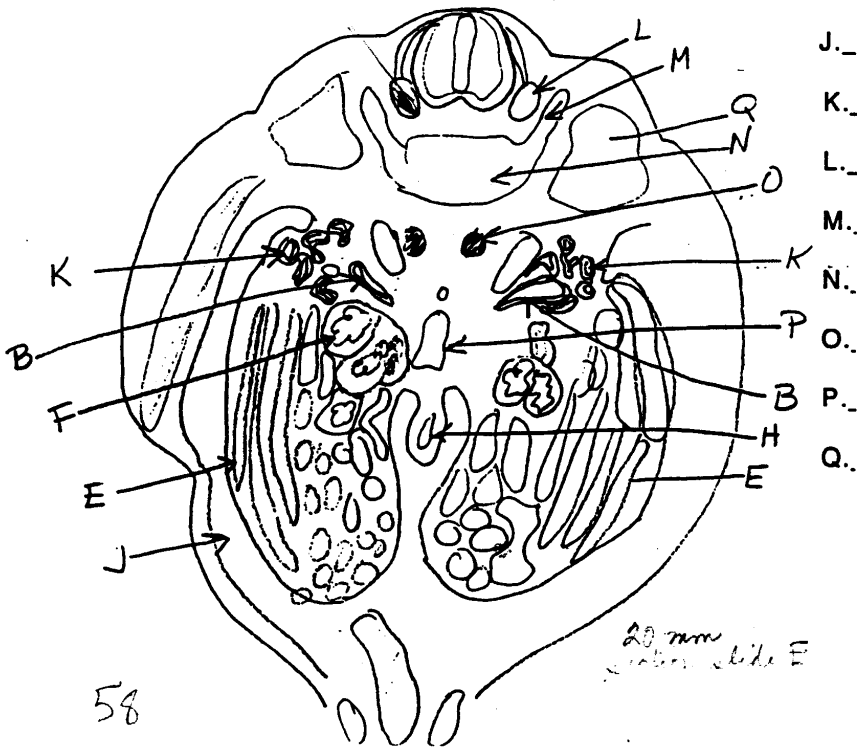
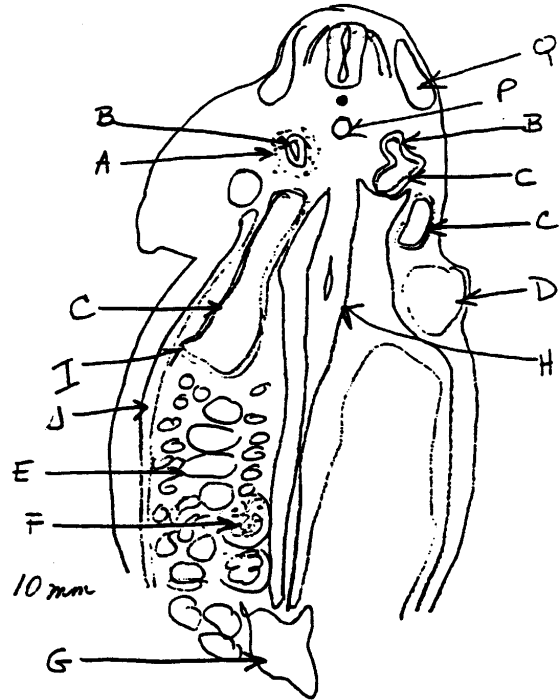
3. Around the connective tissue is the syncytiotrophoblast (syntrophoblast) which separates the mother's blood from the rest of the villus, since the mother's blood is in the

4. intervillous space or lacuna between the villi.

Urogenital Exercise 441L
 10mm and 20mm cross sections-kidney and skeleton

Name _____

- A. _
- B. _
- C. _
- D. _
- E. _
- F. _
- G. _
- H. _
- I. _



58

20 mm
 kidney like E