

28: EMBRYOLOGY: WEEK 4

We have two different types of cross sections in this drawing. A **sagittal cross section** is a lengthwise view, as if we are cutting the body down the midline from the head to feet, separating it into a left and right side. A **transverse cross section** is like the infamous “magician saws a woman in half” trick. (Or like chopping a carrot on a chopping board.) It is what we usually think of when we talk about cutting something in half. A transverse section of the body could be at any point--head, neck, upper chest, abdomen, or even a leg-- so we need to specify where it is. In our sagittal view you’ll see a dashed line. This is where our cut is for the transverse section. We will only see what is along that line. Therefore, in our transverse view we will not see the head or the brain or the lower (posterior) region.

In the 21 DAY sagittal cross section we again see the embryo in the lining of the uterus. As soon as there is enough of an umbilical cord to hold it securely, the embryo will tear free of the lining and simply be in the uterus itself. The maternal capillaries create a “pool” of blood around the chorion, so that the chorionic villi are surrounded by the maternal blood supply. The baby’s blood and the mother’s blood will never actually touch, as indicated in this picture. Notice that the embryo is beginning to curl in the head-to-foot direction. This is a very simple picture of the embryo and does not show the somites, the neural tube, the notochord, etc. The main point of this diagram is to show how the embryo is still embedded in the endometrium and its placement inside the chorion and the amnion.

We do see the three germ layers here, and we see that the endoderm has turned into the gut tube, the yolk sac, and a new feature called the **allantois** (al-an-TOE-is). (This word is Greek for “sausage,” which the allantois was thought to resemble.) The allantois (number 7) acts as a garbage bag, collecting waste products produced by the cells. When the embryo has its excretory systems up and running (kidneys, bladder, liver) and when the placenta is fully formed, the allantois will no longer be necessary. (However, a tiny remnant of it will remain as a piece of fibrous tissue sitting on top of the mature bladder.)

The 21 DAY transverse cross section is an imaginary cut along the dashed line. The main focus of this diagram is the rearrangement of cells in the three layers, especially in the mesoderm. We see that the somites have differentiated into muscle, dermis and bone tissues. Part of the somites turned into what will become vertebrae. We can’t properly call these new vertebrae “bones” because they have not turned into bone yet. They are still made of soft cartilage. As the months go by, cartilage will begin absorbing minerals and turning into hard bone. The middle part of the somites has turned into muscle tissue. These will be the muscles of your back, neck and stomach areas. Lastly, the outer parts of the somites have turned into dermis, the bottom layer of skin.

The ectoderm (blue) has now fully separated into epidermis (the top layer of skin) and the nervous system. The epidermis is now covering the whole embryo, and is joining with the dermis. The neural crest cells (those blue blobs above the neural tube) have turned into nerves that connect the muscles to the spinal cord. The neural tube is in the process of turning into a spinal cord. The notochord is still present, too.

The mesoderm is busy creating kidneys, blood vessels and the heart. Here the heart still looks like two tubes. The tubes will join together in the next few days and begin growing into a heart. Though we don’t show it in this picture, a lot of what is going on in the mesoderm areas we colored light red is formation of blood vessels that will connect all the organs. The ends of the mesoderm that we saw splitting in the last lesson are now turning into the **visceral peritoneum** and the **parietal peritoneum**. (“Viscus” was the Greek word for any internal organ. The plural, “viscera” was to the Greeks like saying “guts.”) The visceral peritoneum will become all the “bags” that surround each organ. The parietal peritoneum will become the outer bag, which can also be thought of as the inner lining of your skin. (Think of a formal jacket with a silky lining. The fabric of the jacket is your skin and the lining is the parietal peritoneum.) These membranes keep all the organs in place so they don’t slosh around, and they also provide a surface to which blood vessels and nerves can be attached. The fact that there are multiple membranes (bags within bags) allows for movement and flexibility of this support system.

The yolk sac has a thin layer of mesoderm around it. The mesoderm produces the blood islands that then produce many tiny sections of blood vessel. The tiny sections join together to become a complicated network of capillaries.

The 26-28 DAY illustration shows the blood vessel development that is going on during week 4. If all the details of embryology were shown in one drawing, it would be too confusing, so here we focus on just the developing vascular system. In this picture, the heart tubes have fused together and are starting to grow into a heart. We don’t have any chambers yet, just a bulging tube. However, even at this early stage, the cells begin to contract together in rhythm, the way they will for the rest of this embryo’s life. There are some very large vessels above the heart, the **dorsal aorta** and the **cardinal vein**. These will change and grow a lot over the next few weeks. We don’t have any lungs yet, so the arrangement of these vessels is temporary. As the vascular system develops, some vessels will grow and enlarge while others will shrink and disappear. Very often, diagrams of the vascular system make the vessels going away from the heart red (“arteries”) and vessels going toward the heart blue (“veins”). In the chorionic villi and in the yolk sac, the vessels change from going to/from the heart. Often this can indicate a chemical change, such as picking up oxygen or getting rid of carbon dioxide. In the yolk sac we also have nutrients going into the blood. The yolk sac provides a small amount of nutrition while the placenta is still forming. (The yolk sac will never grow larger than the size of a pea and will eventually be discarded, often getting trapped between the amnion and the chorion.)

Notice that the actual sizes of the embryos on this page are 1-2 millimeters. That’s small!