

DEV3022 Notes/Questions:

Heart Development:

- Primitive heart tube formation (occurs during 3rd week gestation):
 - The bilateral endocardial heart tubes fuse together to form a single primordial heart tube - this fusion begins cranially and extends caudally and is facilitated by apoptosis
 - 3 layers are formed - endocardium, myocardium and epicardium
- Heart looping occurs during the 4-5th week of gestation and allows the heart tube to form the structure seen in the adult heart
- Partitioning of the primordial heart (begins middle of 4th week):
 - Partitioning of the atrioventricular canal occurs first which will then develop into the 4 chambers
 - End of 4th week - the endocardial cushions form on the dorsal and ventral walls of the atrioventricular canal
 - And during the 5th week - these endocardial cushions fuse to divide the AV canal into right and left canals
 - AV valves also begin to form to separate the atria and the ventricles
- Partitioning of the primordial atrium and ventricle:
 - Partitioning of the primordial atrium begins at the end of the 4th week
 - ◆ The primordial atrium is divided into right and left atria by the formation of the septum primum (first) and then the septum secundum (second) - when the septum secundum forms - part of the septum primum remains and acts as the valve across the foramen ovale
 - Partitioning of the primordial ventricle
 - ◆ By the end of the 7th week, the bulbar ridges fuse with the endocardial cushions, causing the interventricular foramen to close and the IV septum wall to form
 - ◆ When the septum between the two ventricles is formed, the pulmonary trunk is in communication with the right ventricle and the aorta is in communication with the left ventricle
- Partitioning of the Bulbis Cordis and Truncus Arteriosus:
 - By the time the interventricular septum begins to form - the bulbis cordis elongates
 - The bulbar ridges undergo a 180° spiral to create the aorticopulmonary septum - which puts the left ventricle in contact with the aorta and the right ventricle in contact with the pulmonary trunk
 - This spiralling nature causes the pulmonary trunk to twist around the aorta
- Valve formation:
 - During the above process, we also see the formation of the right tricuspid AV valve and the left bicuspid AV valve
 - As well as the semi-lunar valves which are formed from the bulbar ridges and subendocardial valve tissue - and these separate the aorta/LV and pulmonary trunk/RV

Haemodynamic transition at birth:

- Fetal circulation:
 - The fetal circulation is independent of the maternal circulation and involves oxygenated blood being attained via the placenta
 - Oxygenated blood from the placenta enters the fetus through the umbilical vein
 - Some of this oxygenated blood flows to the liver, however most of it bypasses the liver via the DUCTUS VENOSUS and combines with deoxygenated blood in the inferior vena cava
 - Blood then joins deoxygenated blood from the superior vena cava and empties into the right atrium
 - Since pressure is higher in the RA compared to the LA, most of the blood is shunted over to the LA via the FORAMEN OVALE
 - From the left atrium - the blood passes to the left ventricle and leaves via the ascending aorta which provides oxygenated blood to the head, heart, neck and upper limbs
 - Some of the blood however goes into the right ventricle (instead of LA), and then leaves via the pulmonary trunk
 - Some of this medium oxygenated blood goes to the lungs, however most of it bypasses these pulmonary arteries and enters the descending aorta via the DUCTUS ARTERIOSUS where blood is distributed to the fetal body and back to the placenta via the umbilical arteries
- Post-natal circulation
 - With the first breath, increased alveolar O₂ pressure causes vasodilation in the pulmonary vessels causing an increase in pulmonary blood flow
 - Circulation of fetal blood through the placenta ceases
 - Blood pressure in the LA is now higher than the RA which causes the foramen ovale to close and become the Fossa Ovalis
 - The DUCTUS ARTERIOSUS completely constricts by 96 hours to become the ligamentum arteriosum
 - And the DUCTUS VENOSUS also constricts (and the ductus venosus sphincter constricts) which forms the ligamentum venosum
 - The umbilical arteries also constrict
 - Now deoxygenated blood enters the RA >> RV >> through the pulmonary artery to the lungs >>> into the LA >>> LV and out through the aorta to the rest of the body >> where it then comes back to the RA via the superior/inferior vena cava