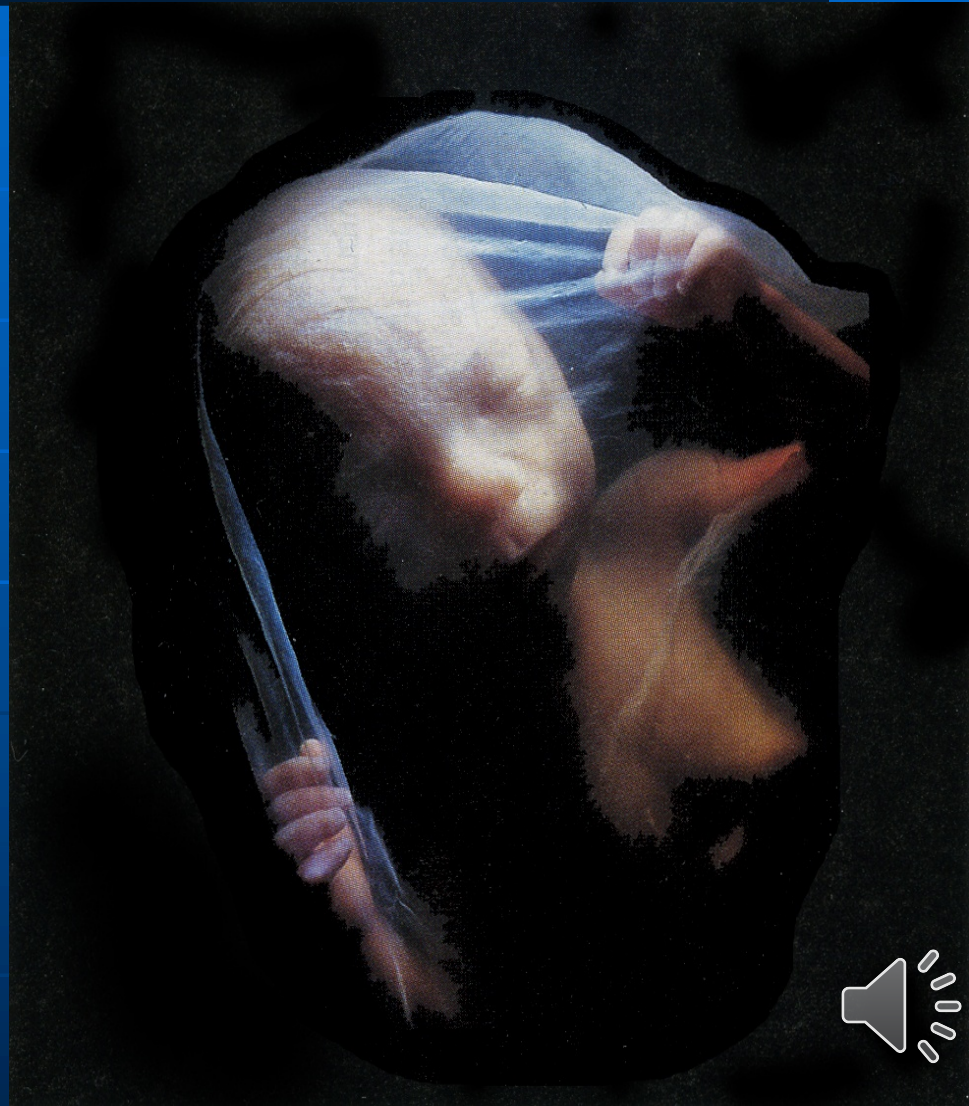


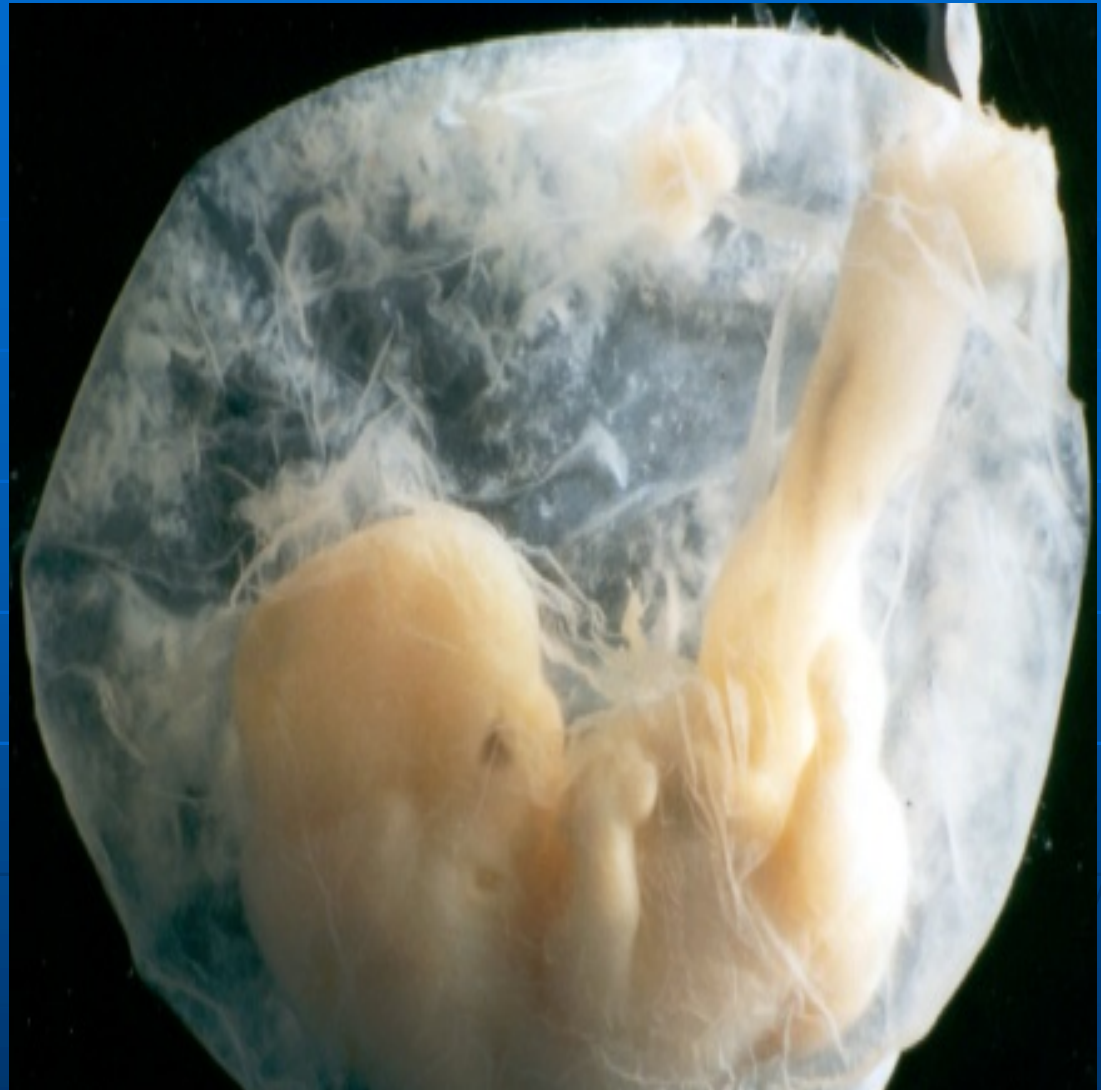
Fetal Circulation & Postnatal Changes

Prof. Saeed Abuel Makarem



- **Fetal Cardiovascular system is designed for 2 purposes:**

- 1-To serve prenatal needs.
- 2-To permit modifications at birth, which establish the neonatal circulation.



Good respiration in the newborn infant is dependent completely upon normal circulatory changes that occurs at birth.



■ Three structures are very important in the transitional circulation:

1- *Ductus venosus.*

2- *Ductus arteriosus.*

3- *Foramen ovale.*

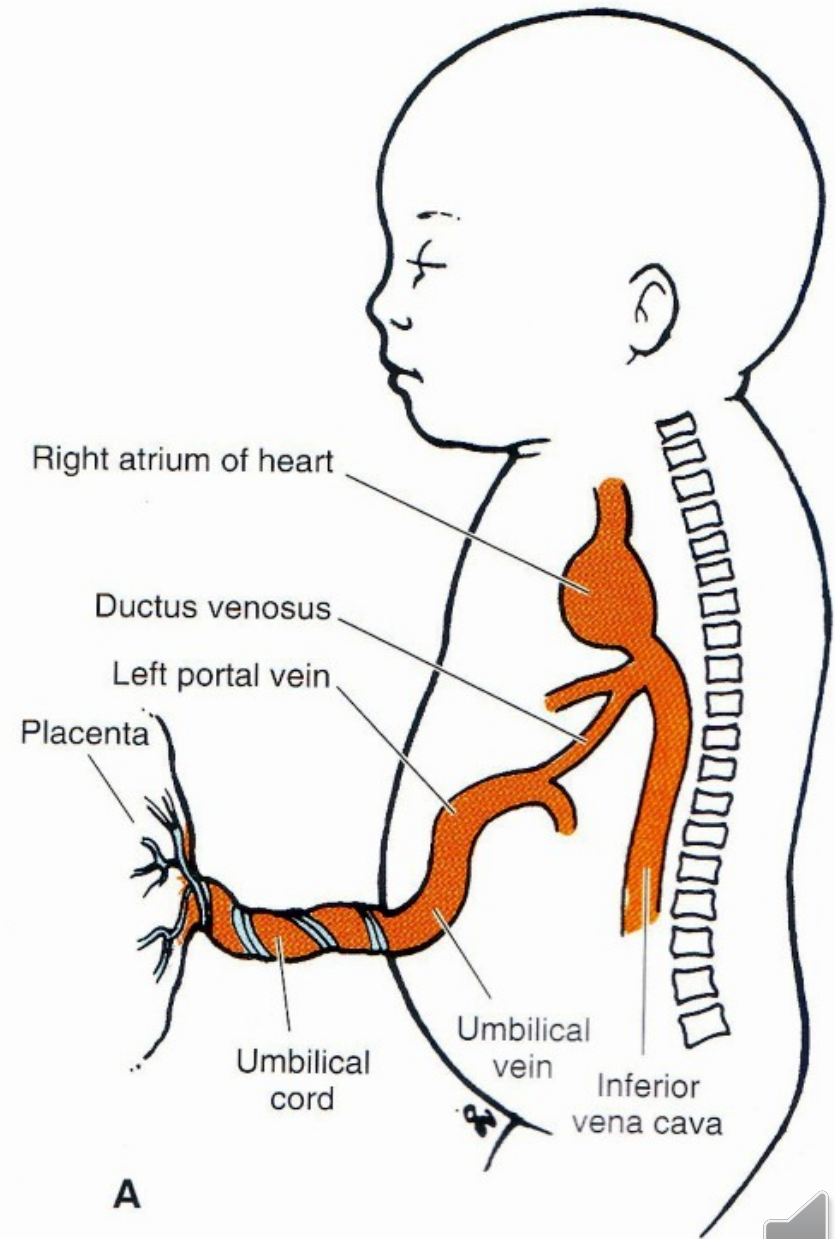


- Blood reaches & leaves the fetus through the umbilical cord.

The umbilical cord

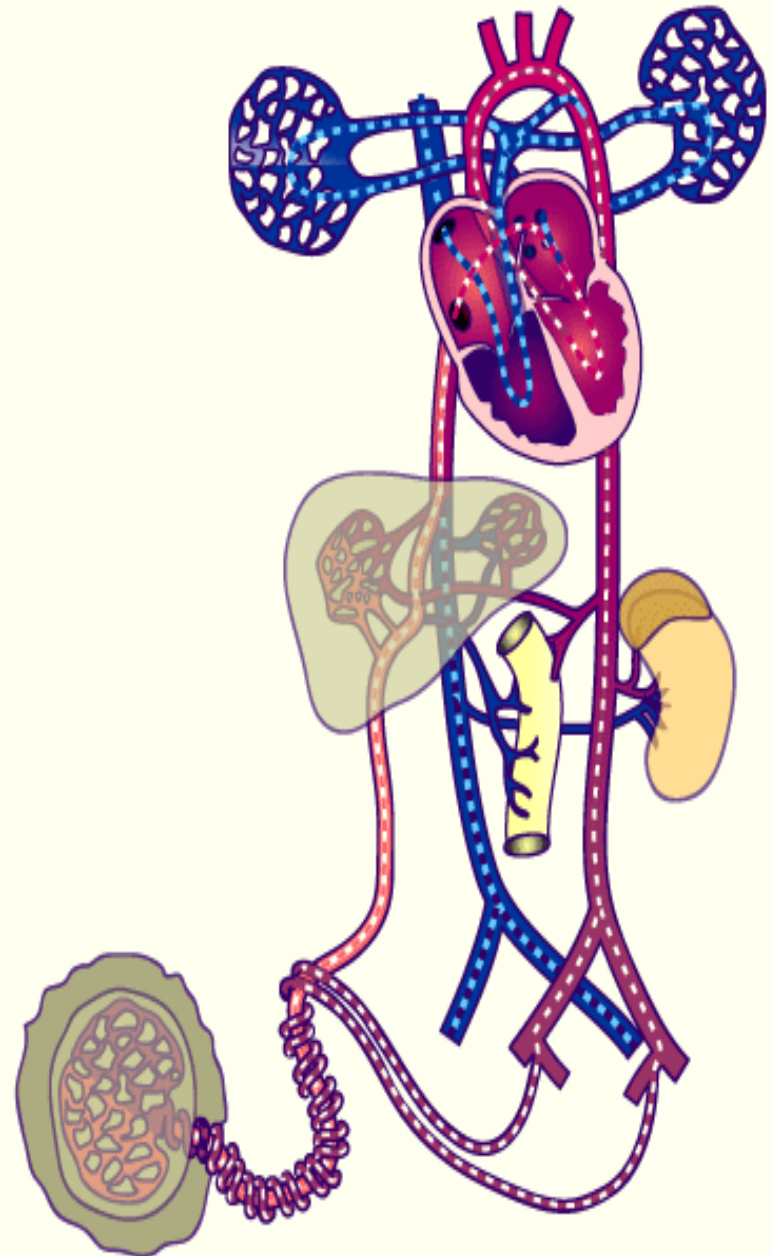
Contains:

**TWO ARTERIES &
ONE vein.**



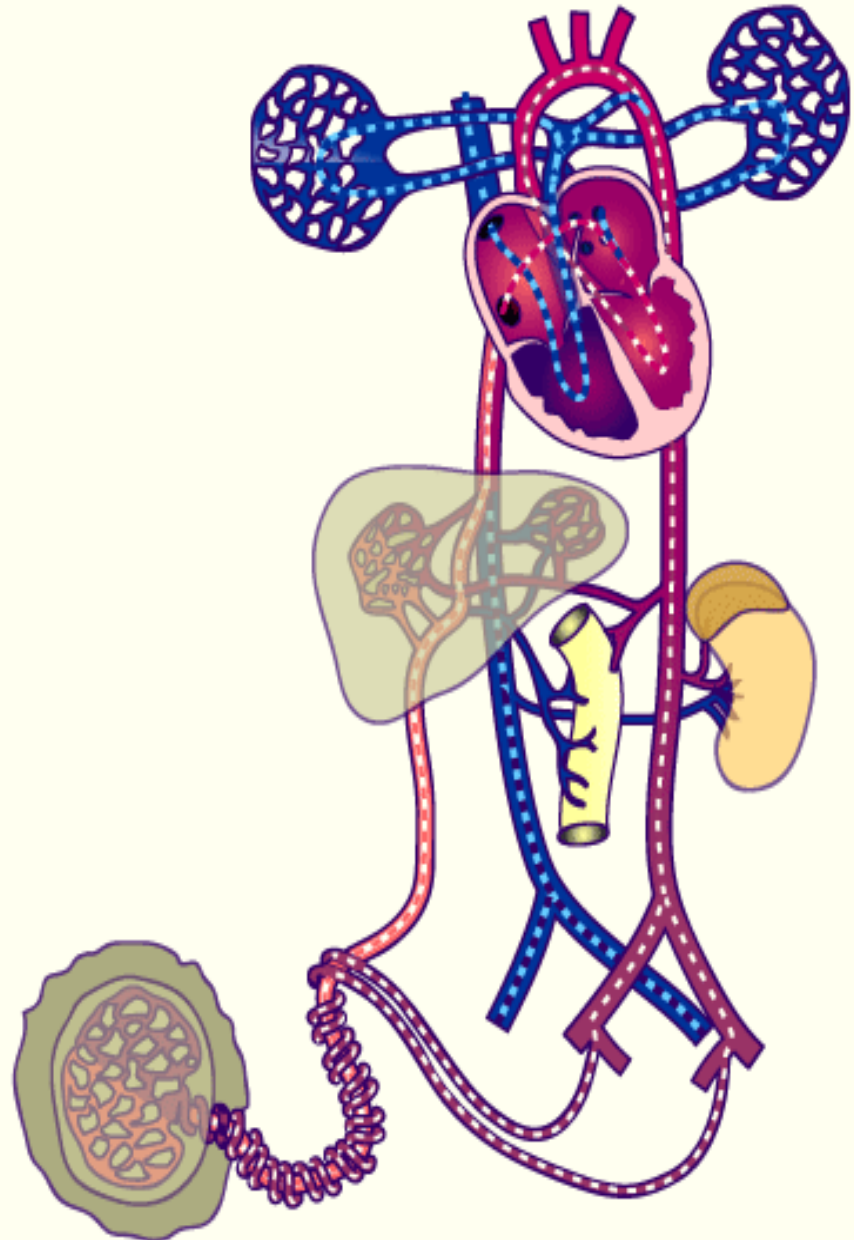
- Highly oxygenated blood passes from the placenta through the umbilical vein.
- **Half** of this blood reaches the IVC directly through the **ductus venosus**.
- The other half passes first to the liver sinusoids then to the IVC.

before birth



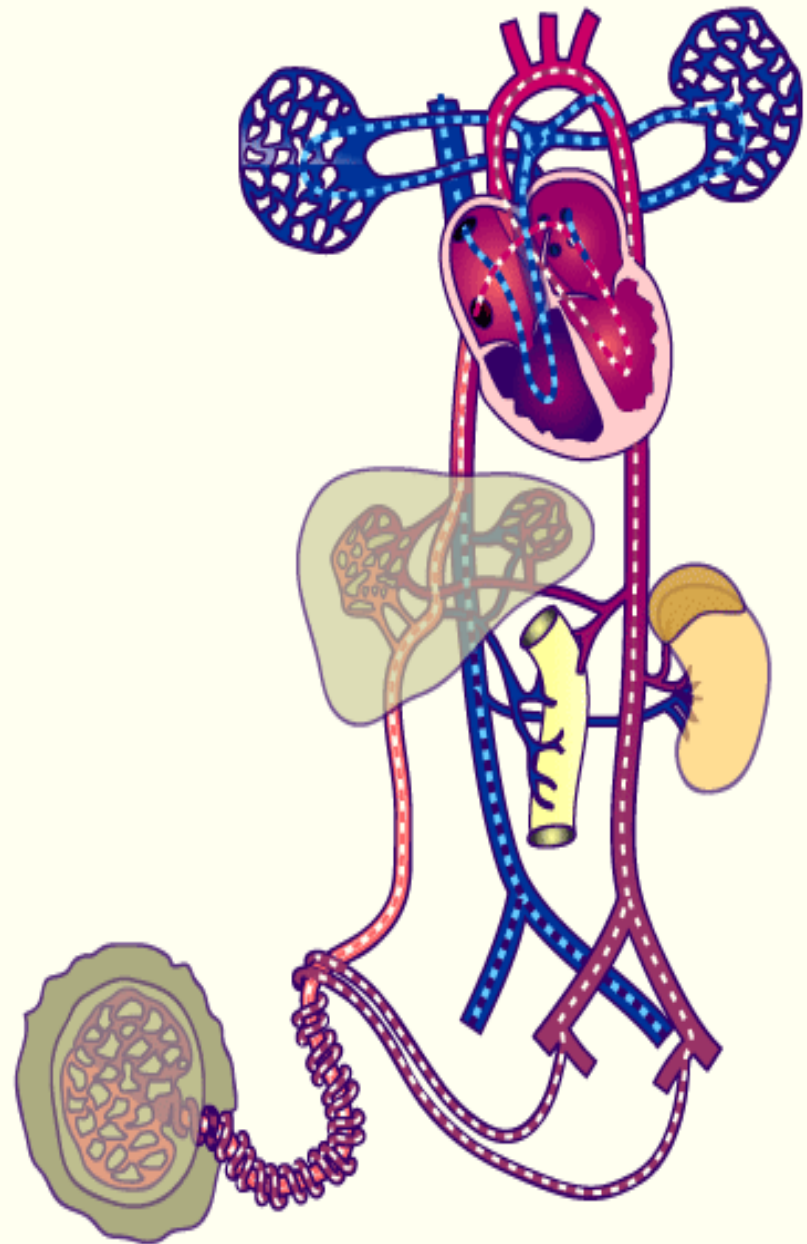
- It is believed that there is a valve in the liver at the entrance of the umbilical vein.
- This valve controls the amount of blood going either to liver sinusoids or to the **Ductus venosus.**

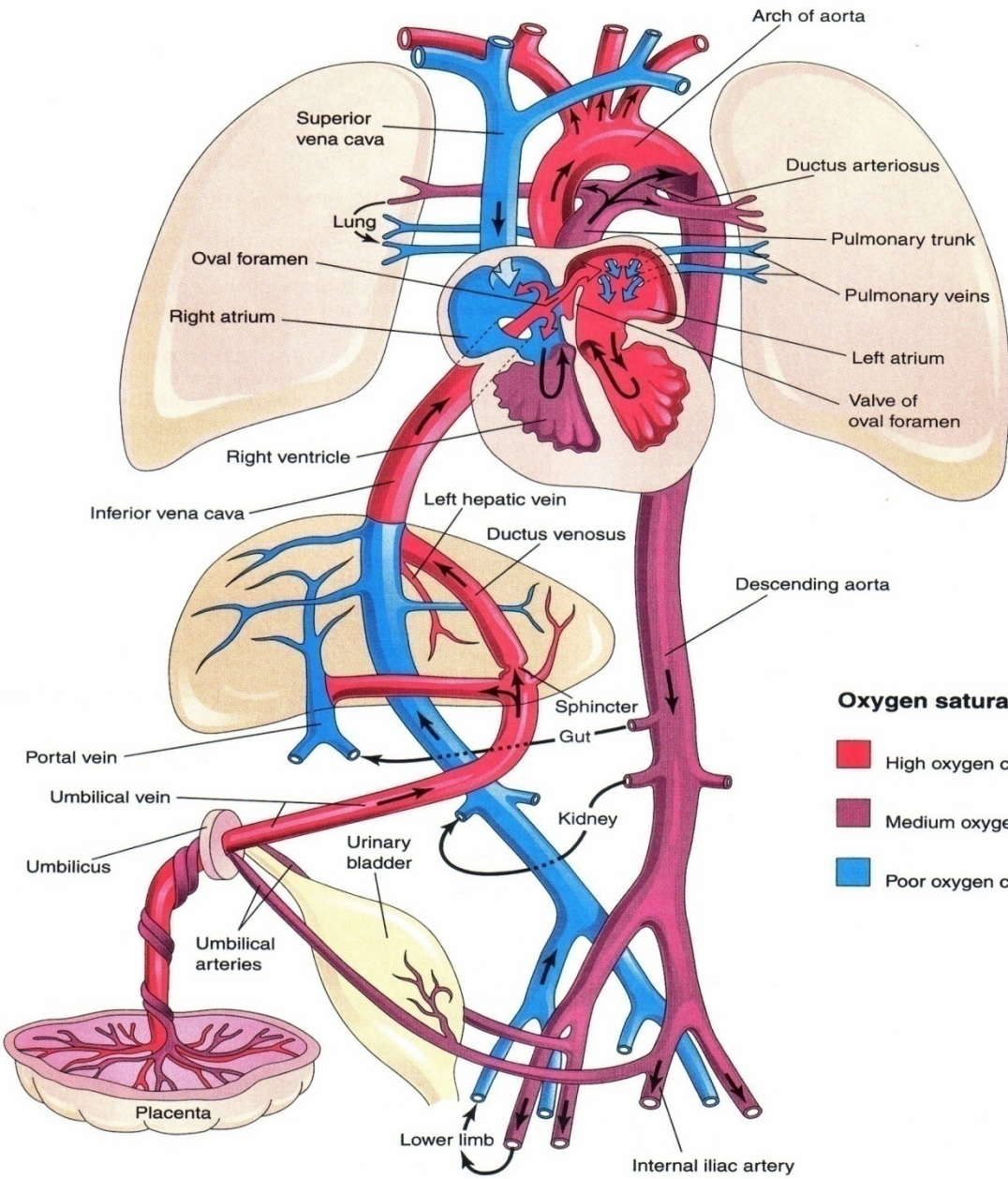
before birth



- Blood of the IVC which is highly oxygenated reaches the right atrium, then directly to the left atrium through the **Foramen Ovale**.
- Then to the left ventricle to the ascending aorta, and the aortic arch.
- So **the head and neck brain, heart & upper limbs** receive this highly oxygenated blood.
- Also the **liver** receives highly oxygenated blood.

before birth





Oxygen saturation of blood

- High oxygen content
- Medium oxygen content
- Poor oxygen content

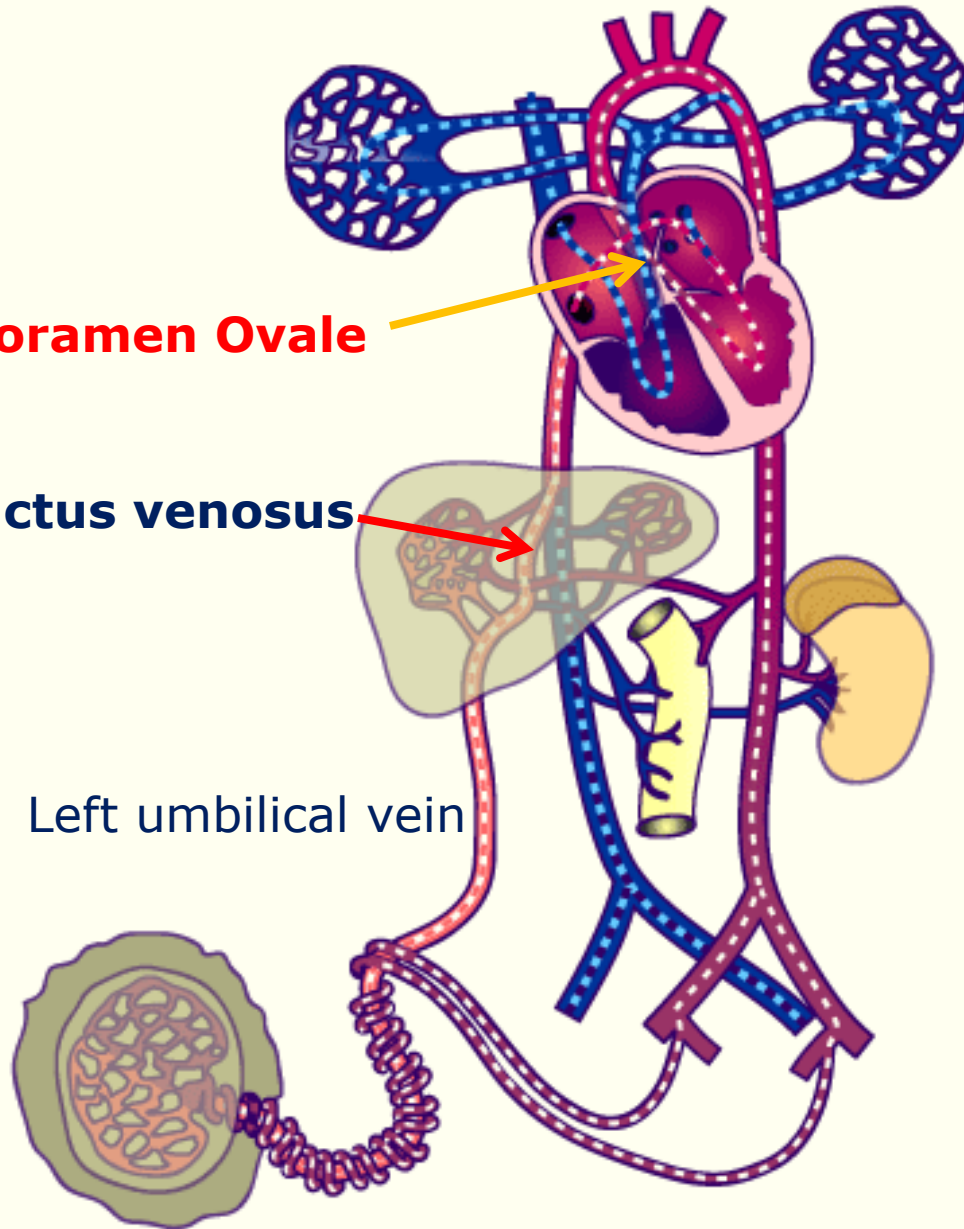


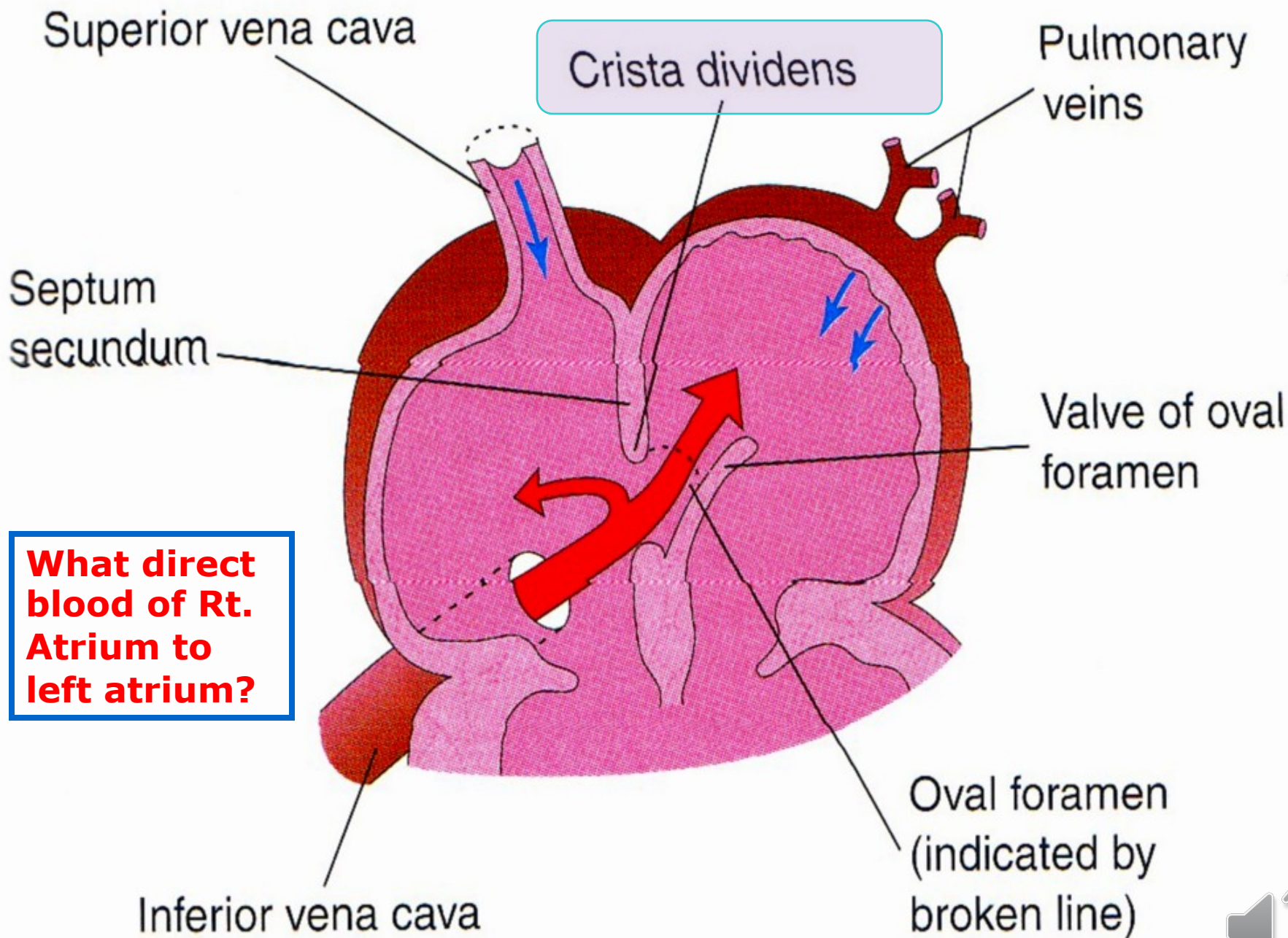
before birth

Foramen Ovale

Ductus venosus

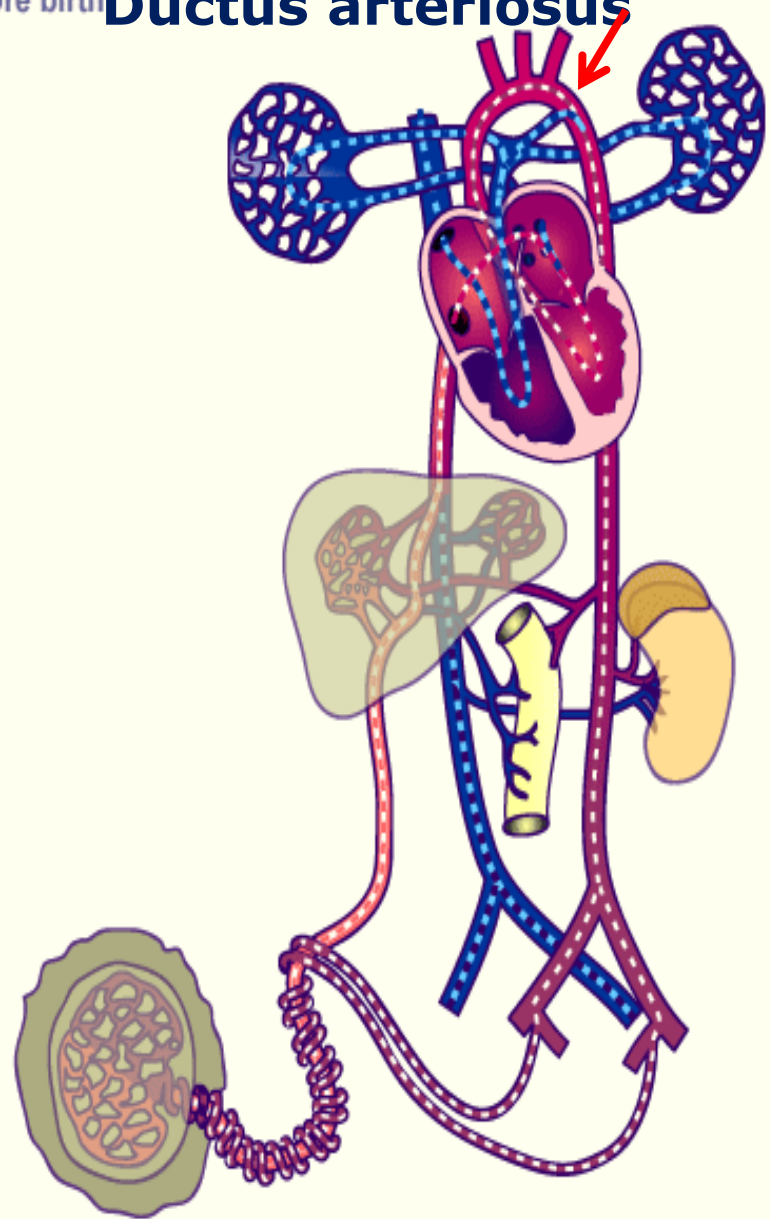
Left umbilical vein





- Small amount of highly oxygenated blood that remains in right atrium mixes with venous blood of the **SVC** passes to **right ventricle**.
- Then to the pulmonary artery then to **ductus arteriosus** to the descending aorta, to the lower half of the fetal body.
- Then back to placenta via the umbilical arteries.

before birth **Ductus arteriosus**



CHANGES AFTER BIRTH



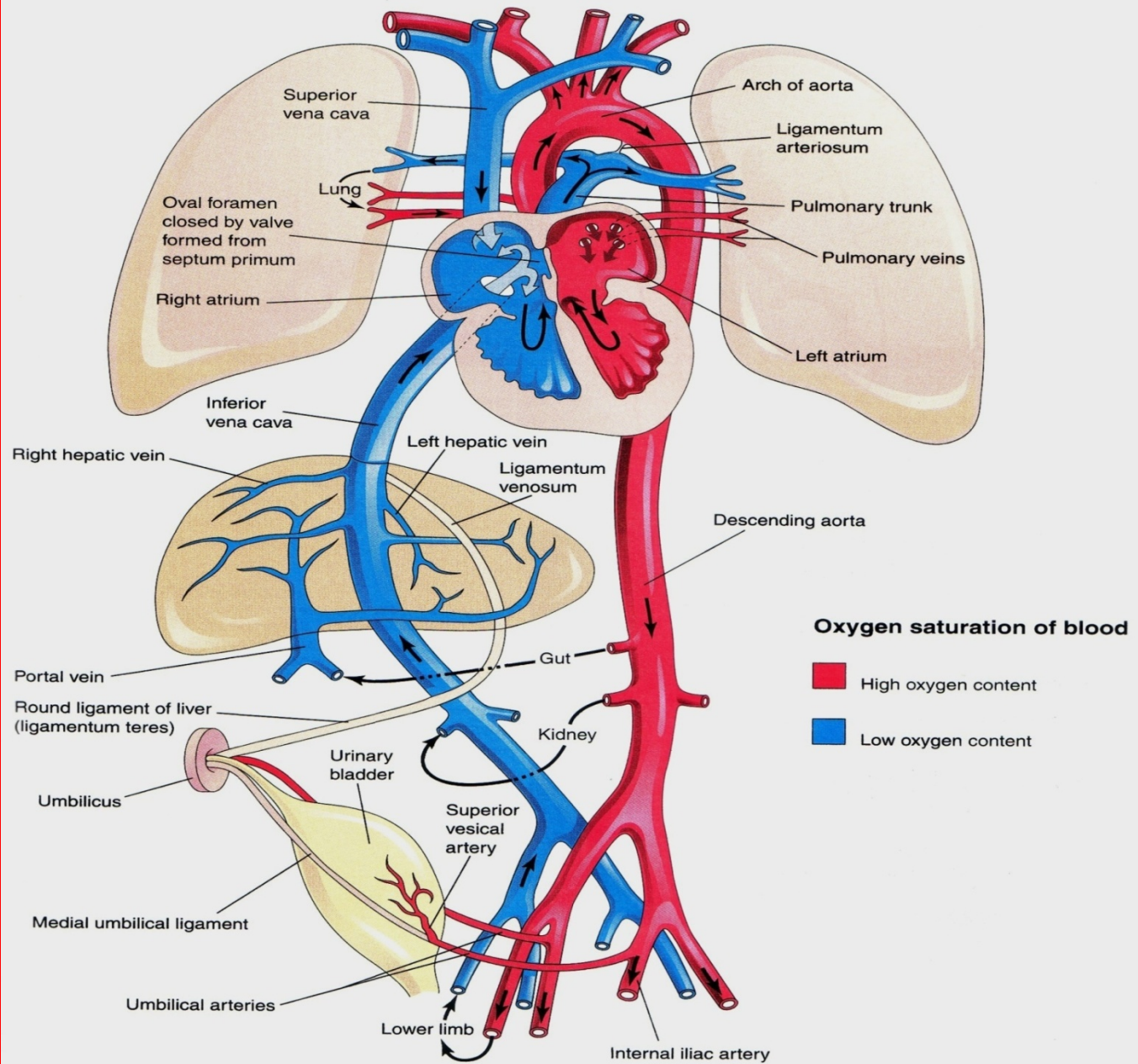
What happens after ligation of the umbilical cord?

- Sudden fall of blood pressure in the IVC and the **right Atrium**.
- So, the valve of the ductus venosus constricts.

After Aeration of the lungs at birth:

- 1- Marked increase in the pulmonary blood flow.
- 2- Dramatic fall in pulmonary vascular resistance.
- 3- Thinning in the wall of the pulmonary arteries.





Changes after birth

- **1- Closure of foramen ovale:**
 - a. Physiological closure, (immediately).
 - b. Anatomical closure, (12 weeks).
- **2- Constriction of ductus arteriosus.**
- By the end of the first 24 hours **20%** of the lumen of the ductus is closed.
- By the end of 48 hours **82%** is closed.
- By 96 hours **100%** of the duct is closed.



Bradykinin:

It is believed that, there is a substance released from fetal lungs during their initial inflation called **Bradykinin**.

This substance has a contractile effect on the smooth muscles of the ductus arteriosus.

The action of this substance appears to be dependant on the high **Oxygen** saturation of the aortic blood.



When oxygen tension reaches 50 mmHg in the ductus arteriosus it causes constriction of its smooth muscles.

During intrauterine fetal life (before birth), the patency of ductus arteriosus is controlled by the low concentration of oxygen in the blood passing through it.

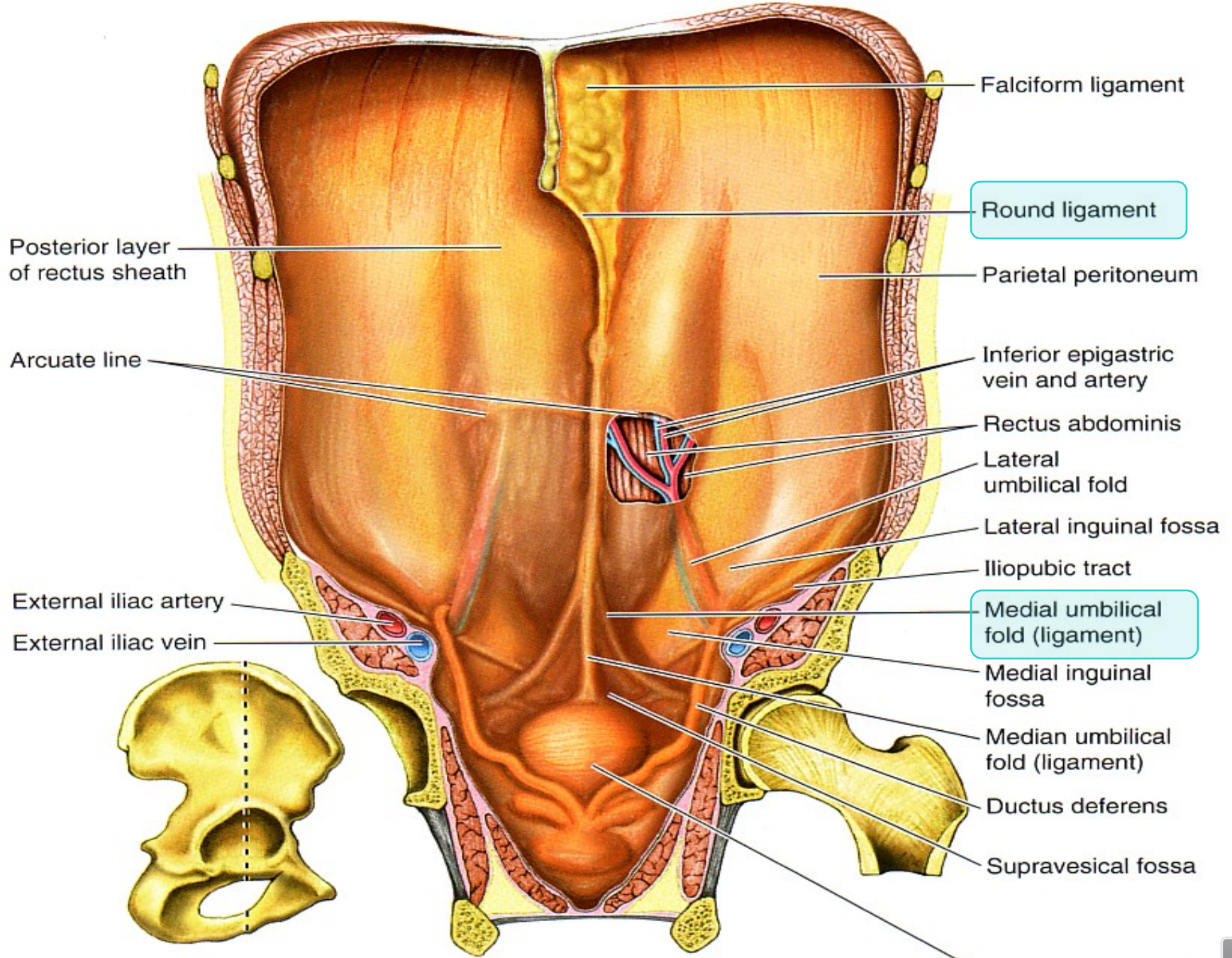
So hypoxia and other ill-defined factors keep the ductus arteriosus patent.



Adult derivatives of fetal vascular structures

- 1- Umbilical vein-----Ligamentum teres.
- 2- Umbilical arteries—medial umbilical ligaments.
- 3- Ductus venosus-----Ligamentum venosum.
- 4- Ductus arteriosus---Ligamentum arteriosum
- 5- Foramen ovale----fossa ovalis.





Lateral view of right hip bone showing plane of section in



Thank You

&

Good Luck

