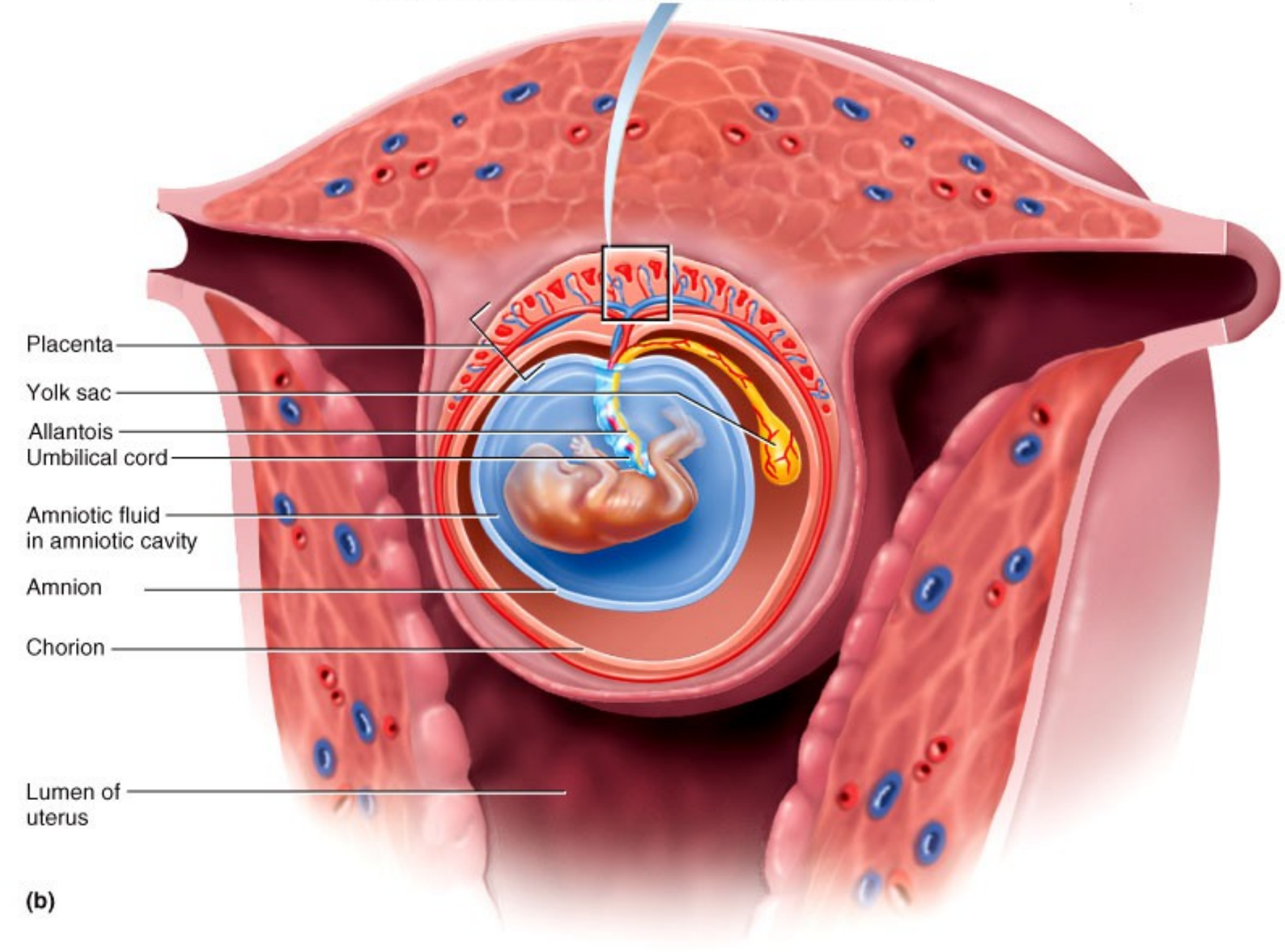
Chapter 20 (3)

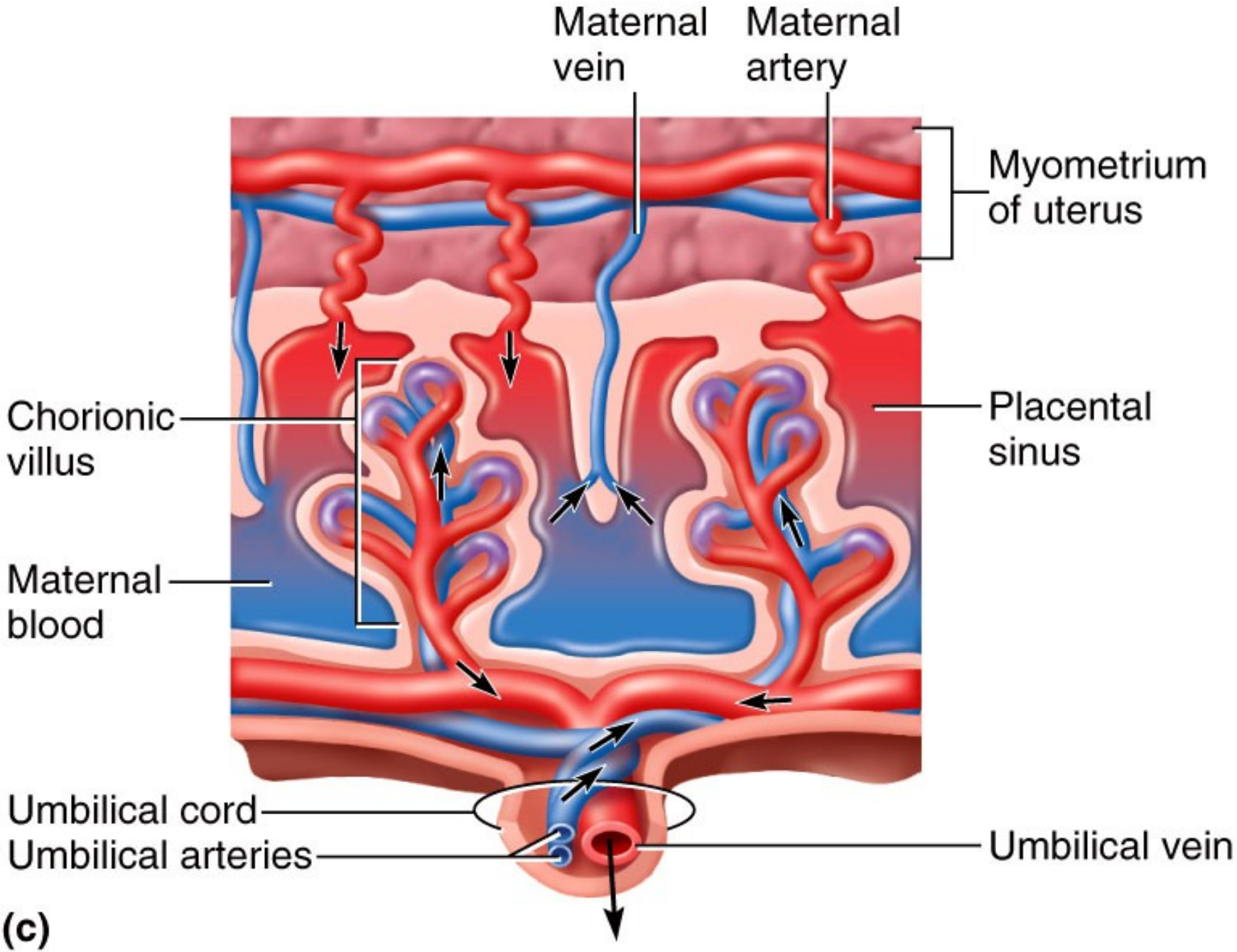
Special Circulatory Routes

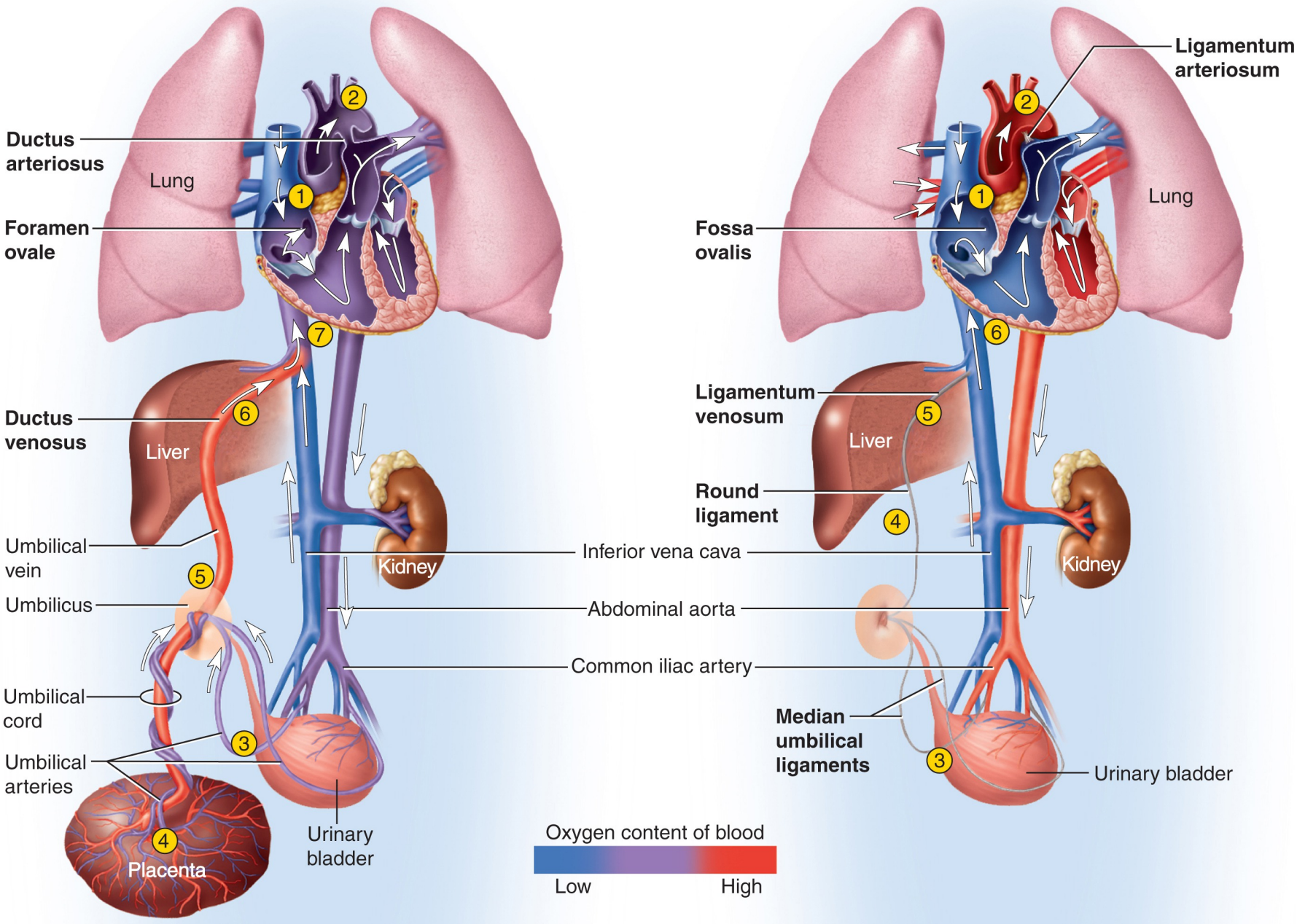
Lecture Objectives

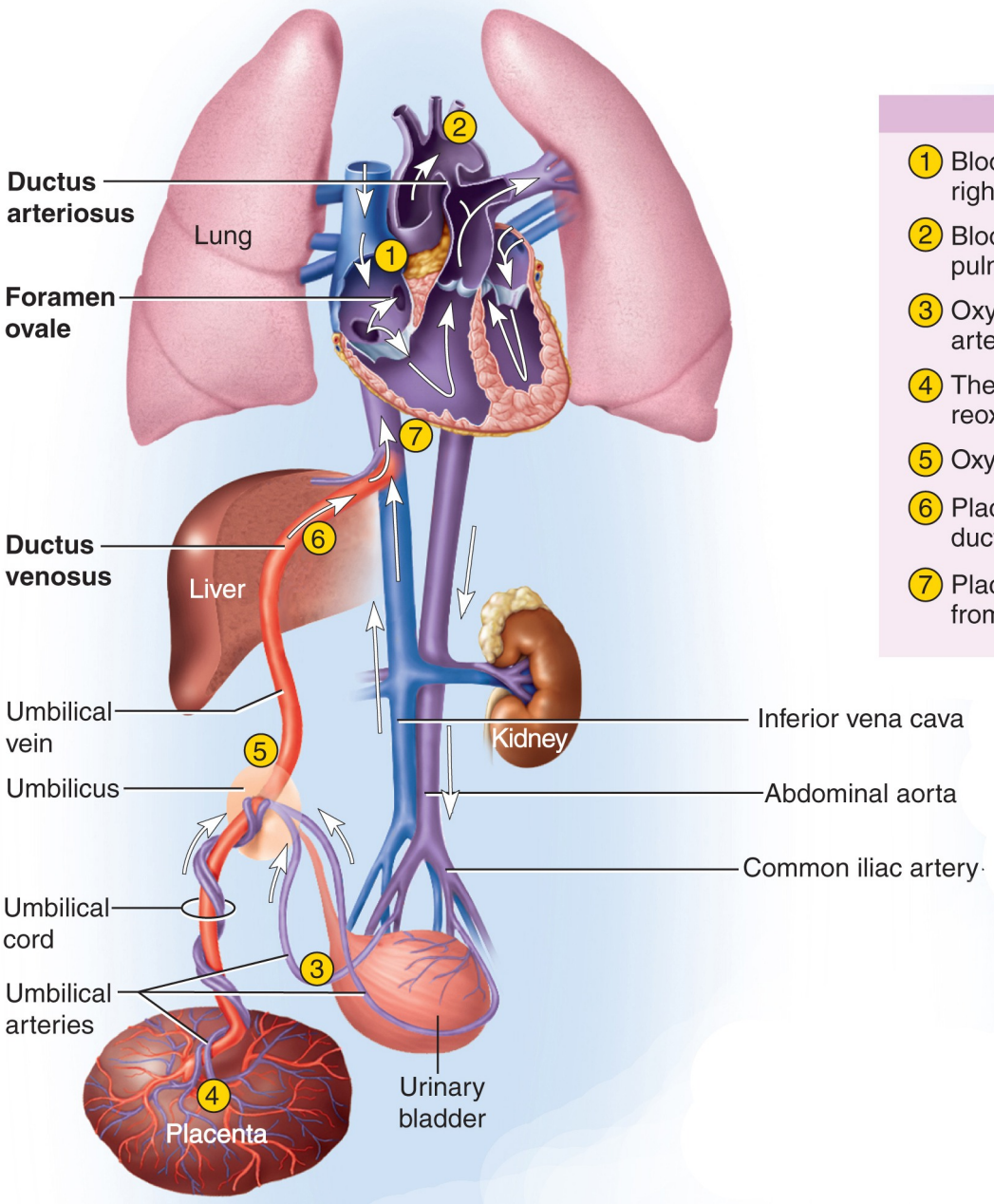
- **Describe the fetal circulatory system and the changes which occur in it following birth**

- **Describe the structure and importance of the hepatic portal system, including the unique content of blood passing through the hepatic portal vein.**



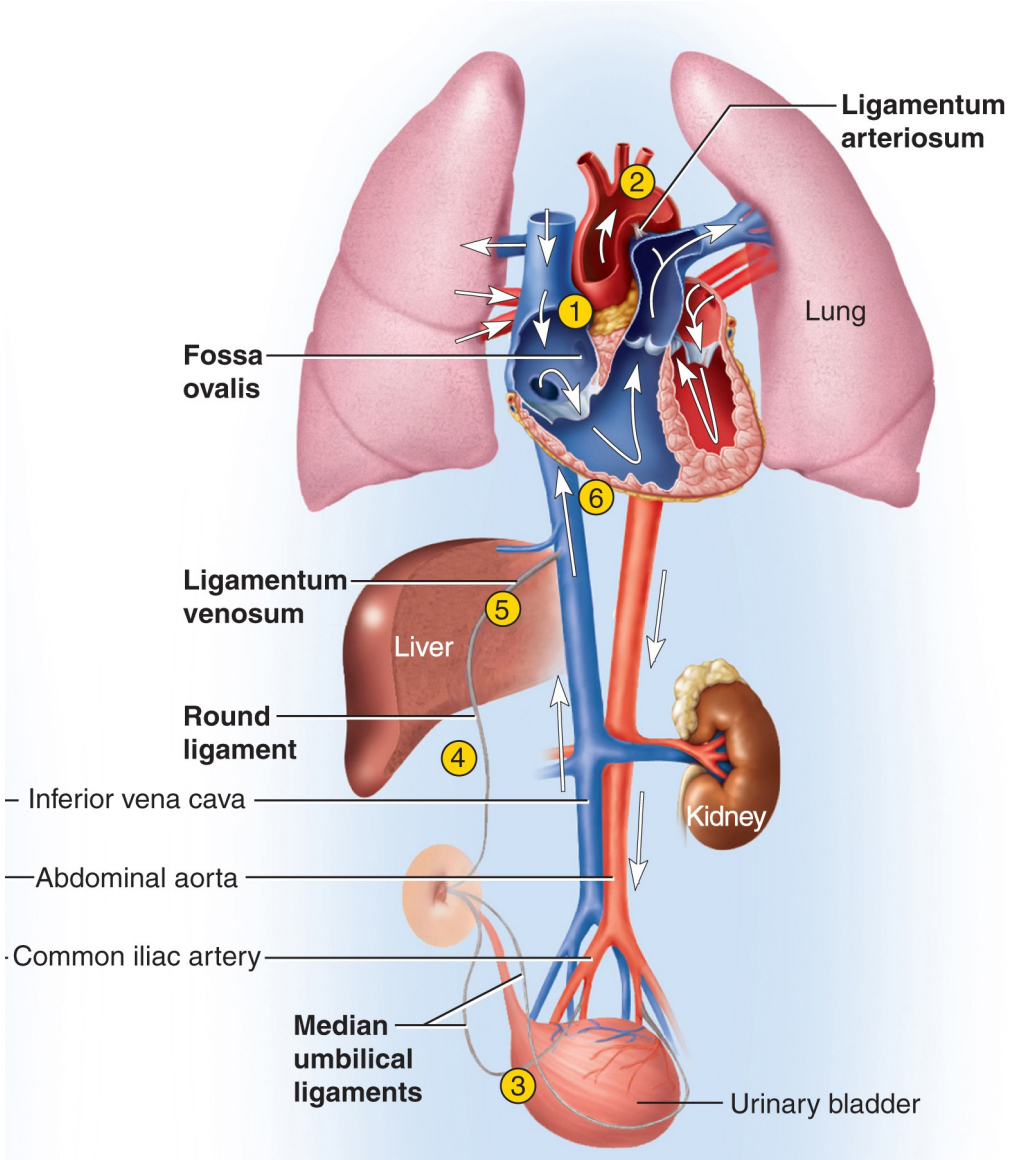






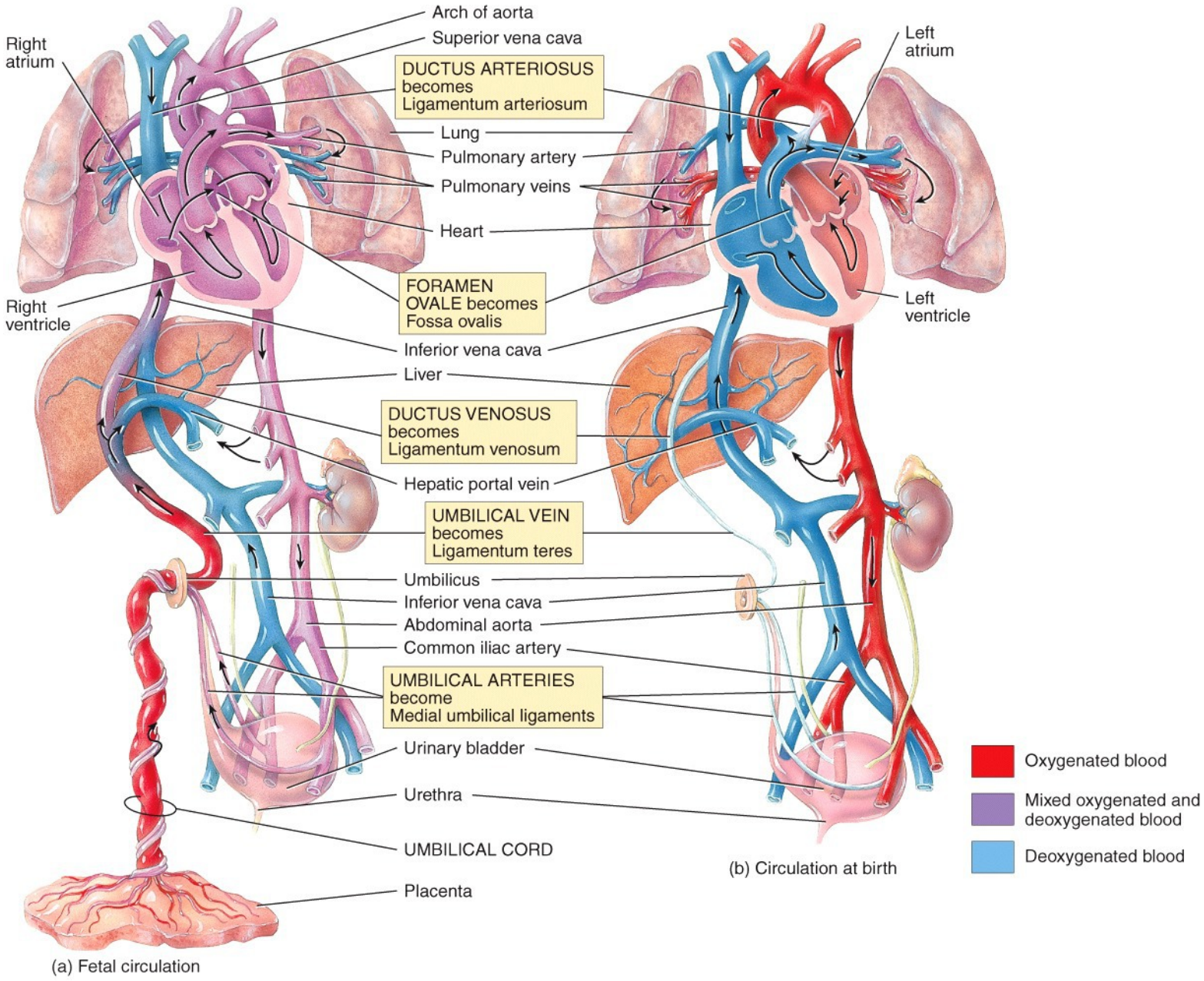
(a) Fetal circulation

1. Blood bypasses the lungs by flowing directly from the right atrium through the foramen ovale into the left atrium.
2. Blood also bypasses the lungs by flowing from the pulmonary trunk through the ductus arteriosus into the aorta.
3. Oxygen-poor, waste-laden blood flows through two umbilical arteries to the placenta.
4. The placenta disposes of CO_2 and other wastes and reoxygenates the blood.
5. Oxygenated blood returns to the fetus through the umbilical vein.
6. Placental blood bypasses the liver by flowing through the ductus venosus into the inferior vena cava (IVC).
7. Placental blood from the umbilical vein mixes with fetal blood from the IVC and returns to the heart.

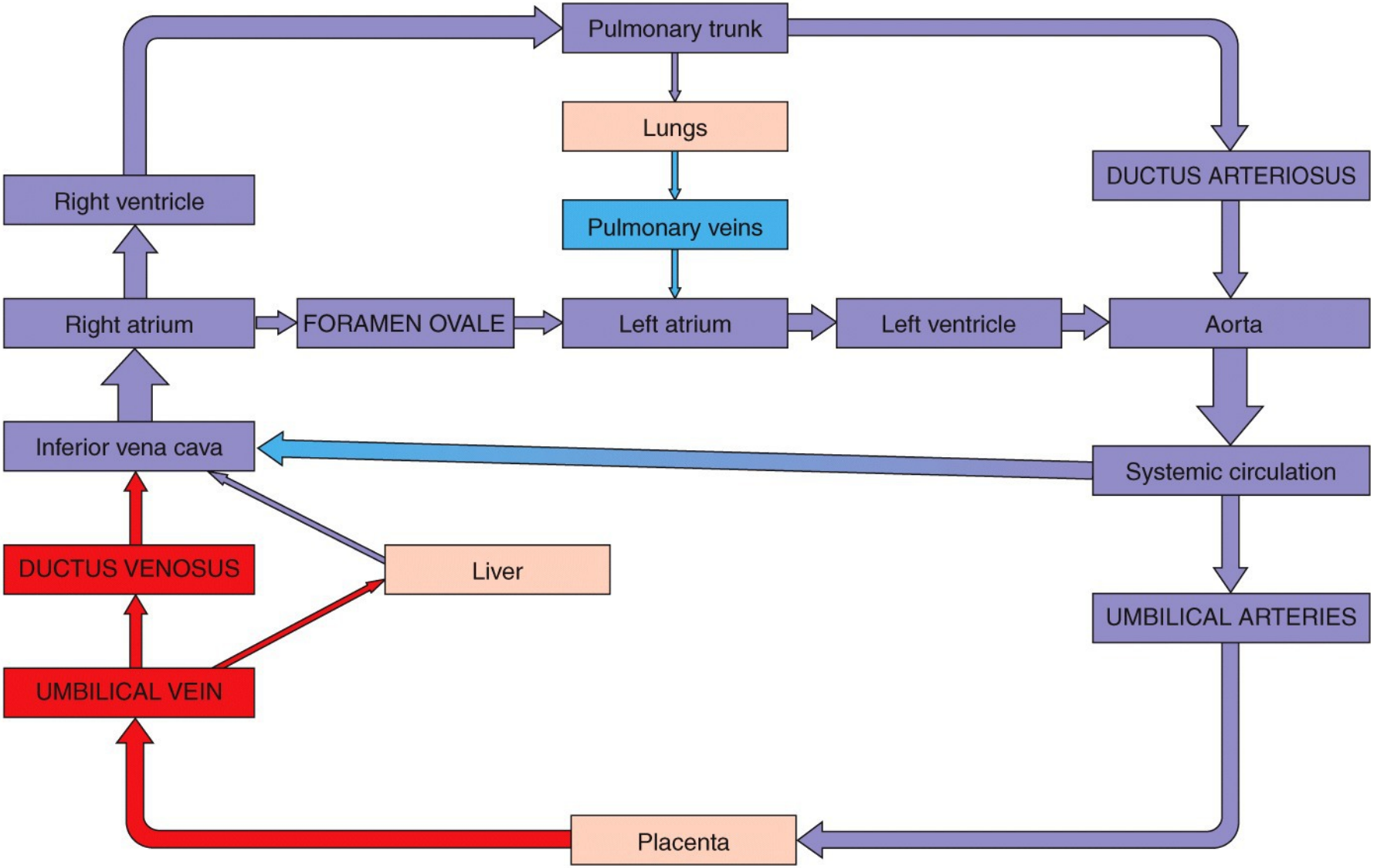


(b) Neonatal circulation

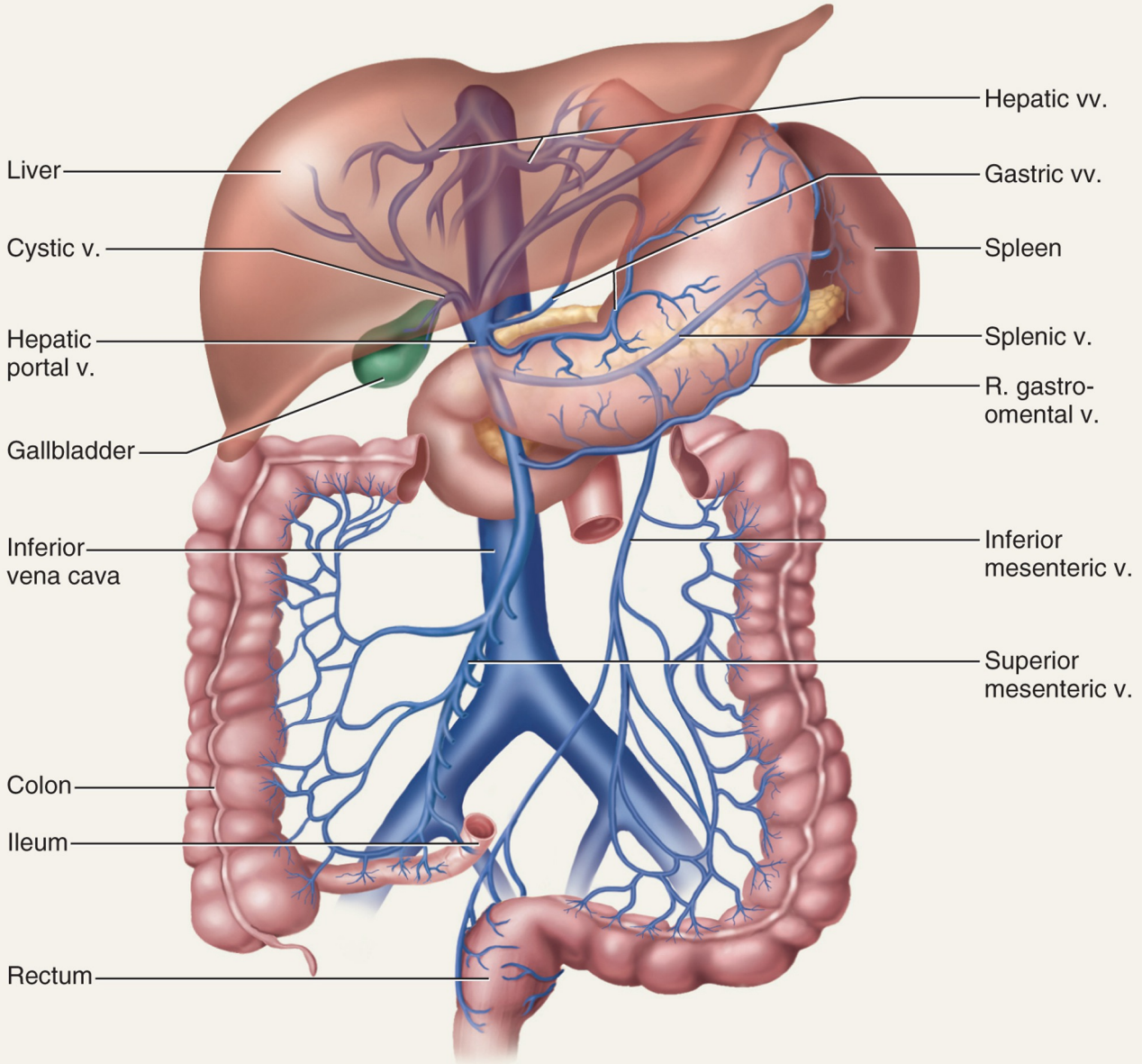
1. Foramen ovale closes and becomes fossa ovalis.
2. Ductus arteriosus constricts and becomes ligamentum arteriosum.
3. Umbilical arteries degenerate and become median umbilical ligaments.
4. Umbilical vein constricts and becomes round ligament of liver.
5. Ductus venosus degenerates and becomes ligamentum venosum of liver.
6. Blood returning to the heart is now oxygen-poor, systemic blood only.


Arch of aorta
Superior vena cava
Right atrium
DUCTUS ARTERIOSUS becomes Ligamentum arteriosum
Lung
Pulmonary artery
Pulmonary veins
Heart
FORAMEN OVALE becomes Fossa ovalis
Right ventricle
Inferior vena cava
Liver
DUCTUS VENOSUS becomes Ligamentum venosum
Hepatic portal vein
UMBILICAL VEIN becomes Ligamentum teres
Umbilicus
Inferior vena cava
Abdominal aorta
Common iliac artery
UMBILICAL ARTERIES become Medial umbilical ligaments
Urinary bladder
Urethra
UMBILICAL CORD
Placenta
(a) Fetal circulation
Left atrium
Left ventricle
(b) Circulation at birth
Oxygenated blood
Mixed oxygenated and deoxygenated blood
Deoxygenated blood

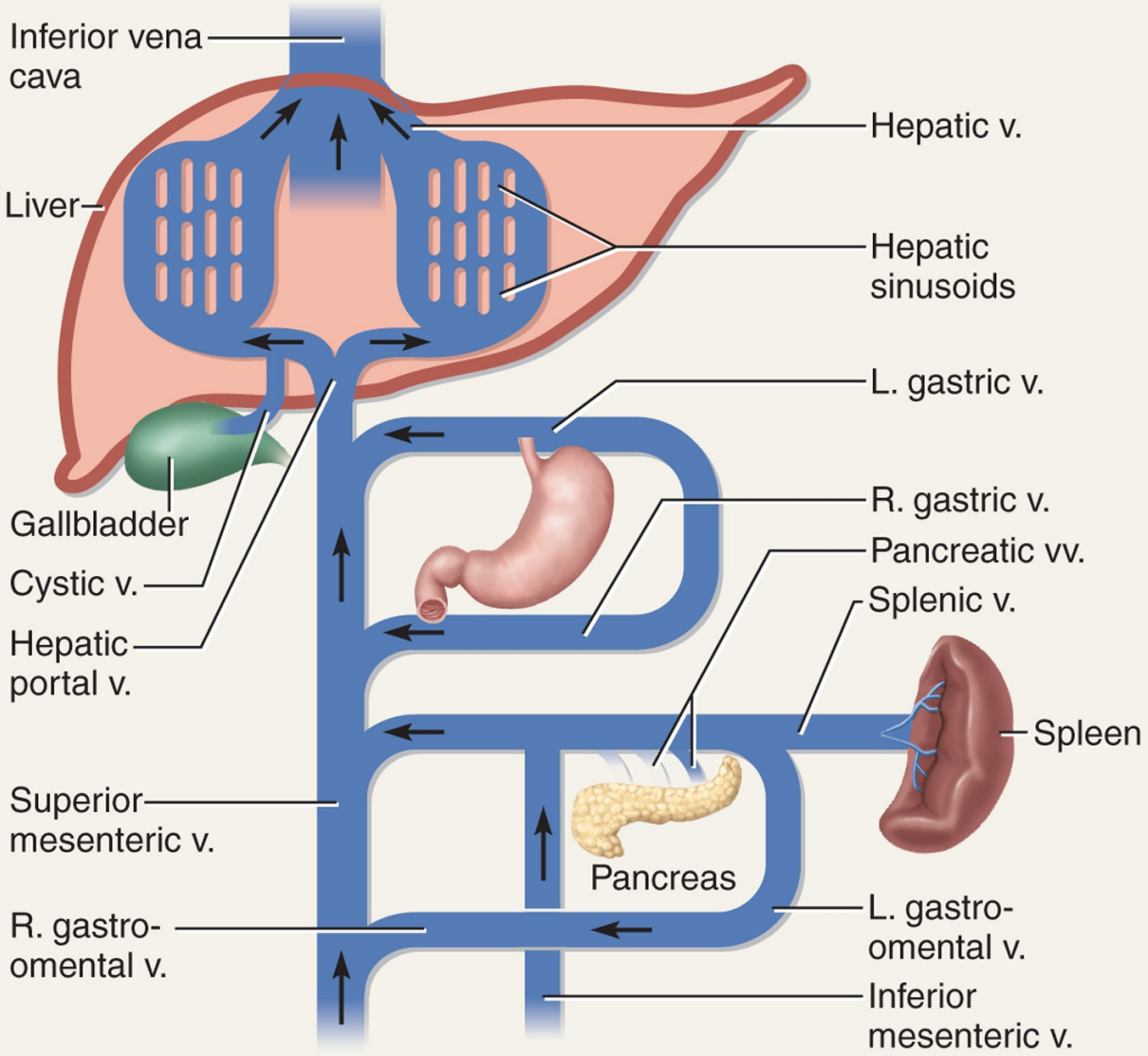
Scheme of Fetal Circulation



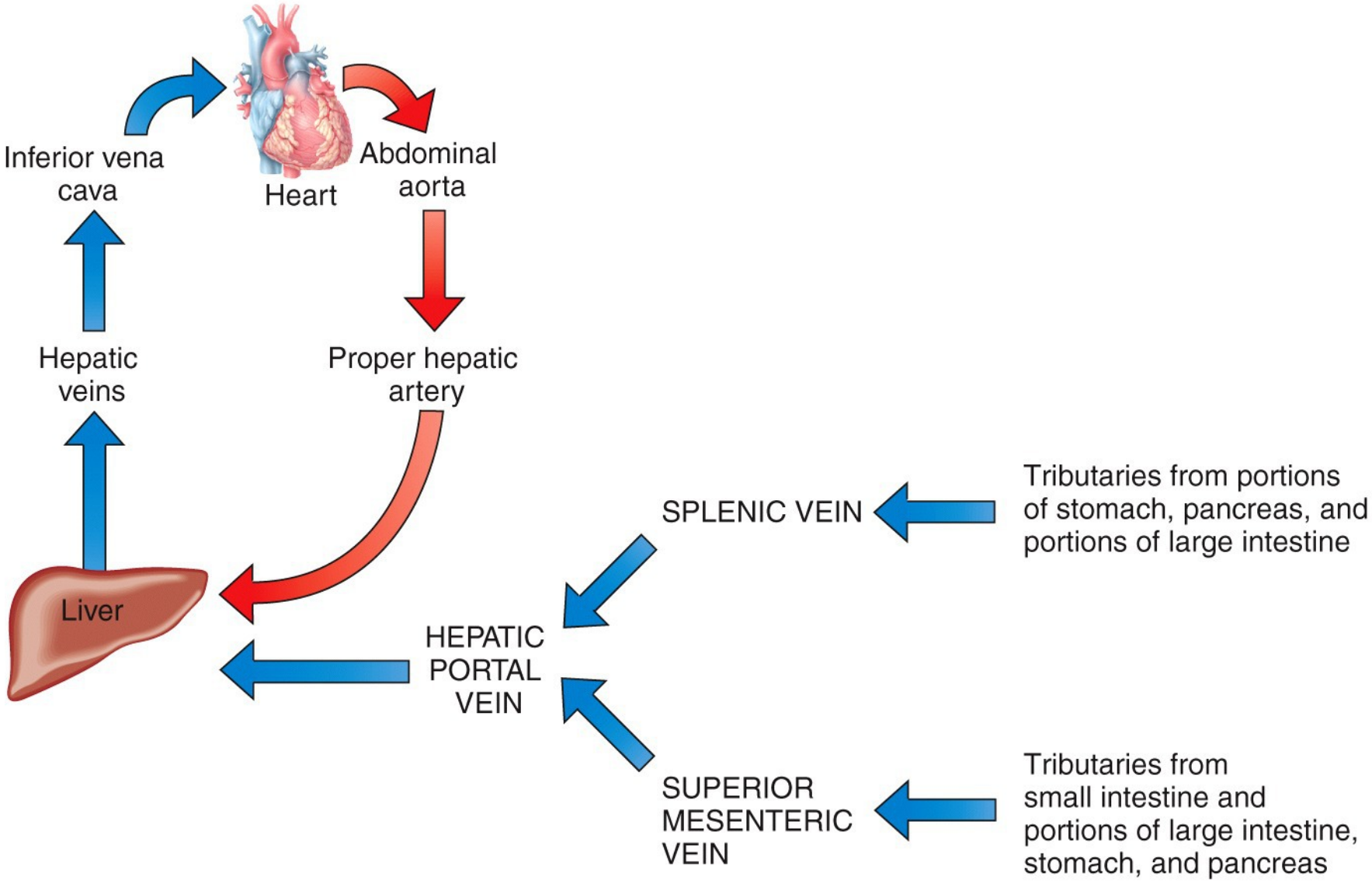
Hepatic Portal Circulation



(a) Tributaries of the hepatic portal system



(b) Blood-flow schematic



(b) Scheme of principal blood vessels of hepatic portal circulation and arterial supply and venous drainage of liver