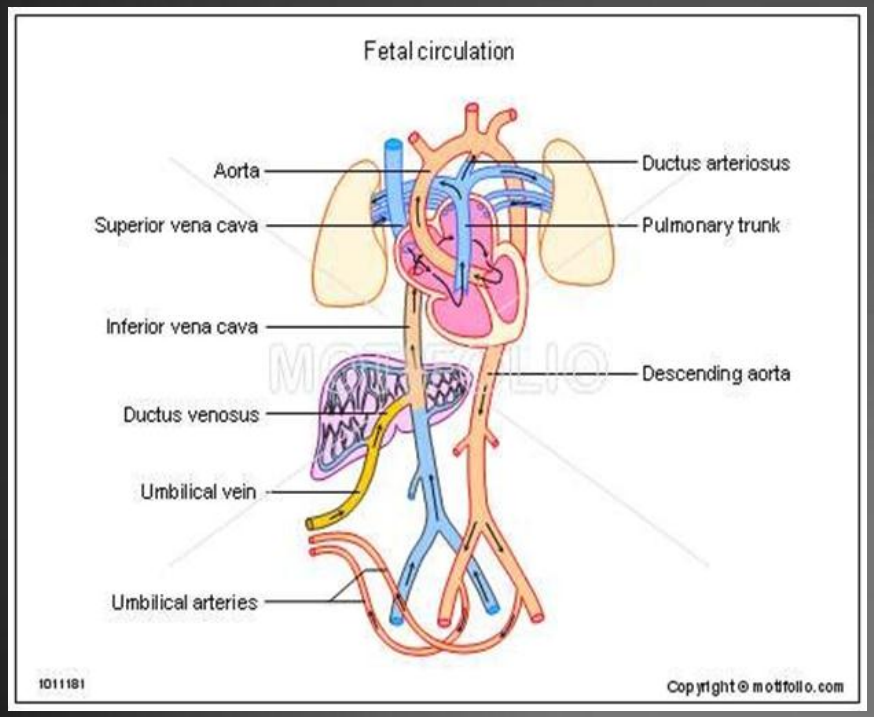
Fetal circulation



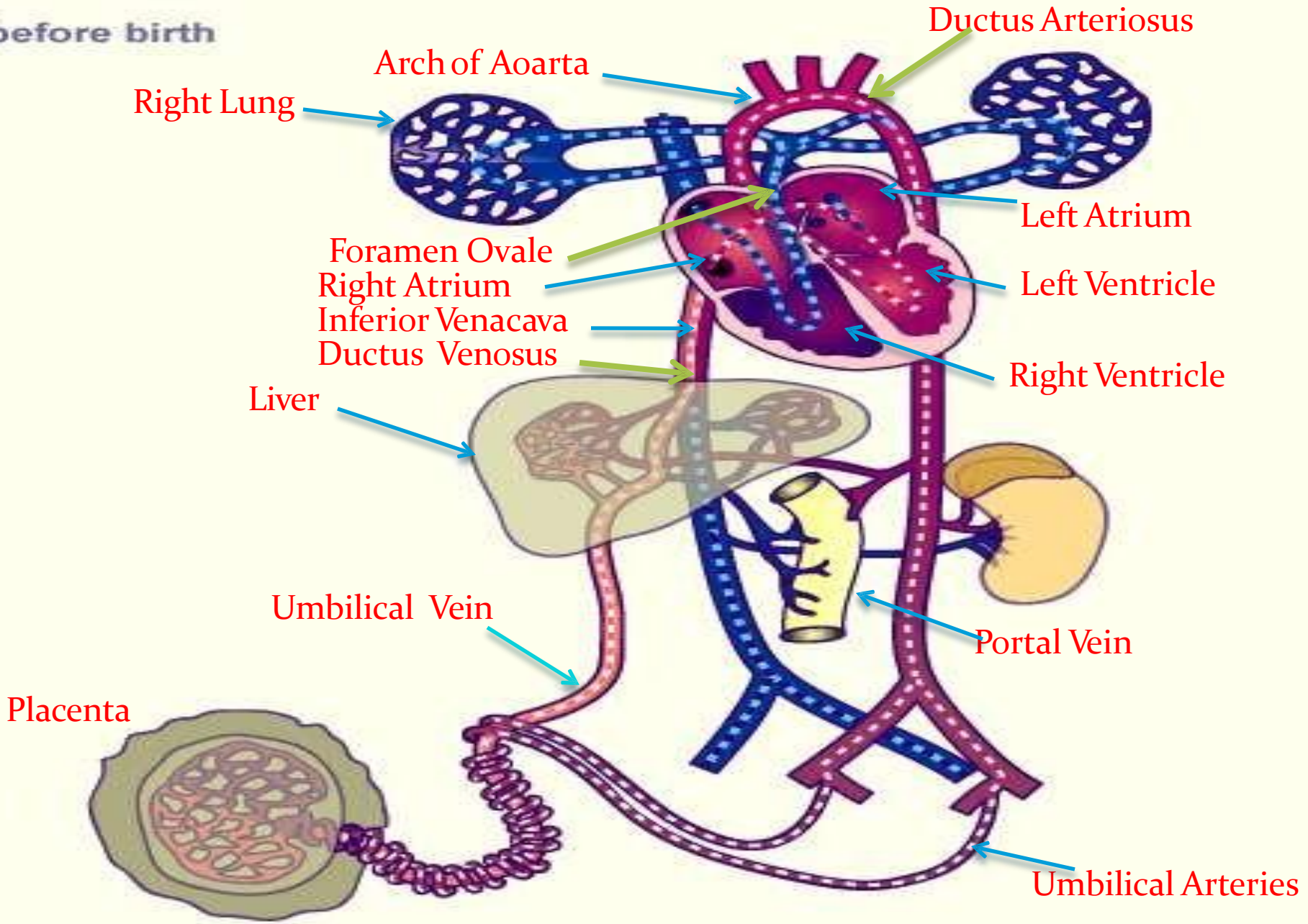
Dr. Shahab

DEFINITION

The **fetal circulation** is the circulatory system of a human fetus, often encompassing the entire fetoplacental circulation which includes the umbilical cord and the blood vessels within the placenta that carry fetal blood.

PATHWAY

before birth



Umbilical Cord

- **2** umbilical arteries:

  return non-oxygenated blood, fecal waste, CO_2 to placenta

- **1** umbilical vein:

  brings oxygenated blood and nutrients to the fetus

Three shunts are present in fetal life:

1. Ductus venosus: connects the umbilical vein to the inferior vena cava
2. Ductus arteriosus: connects the main pulmonary artery to the aorta
3. Foramen ovale: anatomic opening between the right and left atrium.

PATHWAY

Oxygenated blood from the placenta

↓ through umbilical vein

fetus

↓

liver

↓

Receives deoxygenated blood from the portal vein

↓ through **ductus venosus**

Inferior vena cava

↓

Right atrium of heart

↓ through **foramen ovale**

Left atrium of the heart

↓

Left ventricle of the heart

During ventricular systole

Left ventricular blood pumped

Ascending aorta and distributed by their branches to the heart, head,neck,brain,arms.

Right ventricular blood with < 02 content is discharged

Pulmonary arteries

Ductus arteriosus

Descending aorta

Hypogastric arteries

Umbilical arteries

Placenta

Cardiac Output

During fetal life
350ml per kg per min

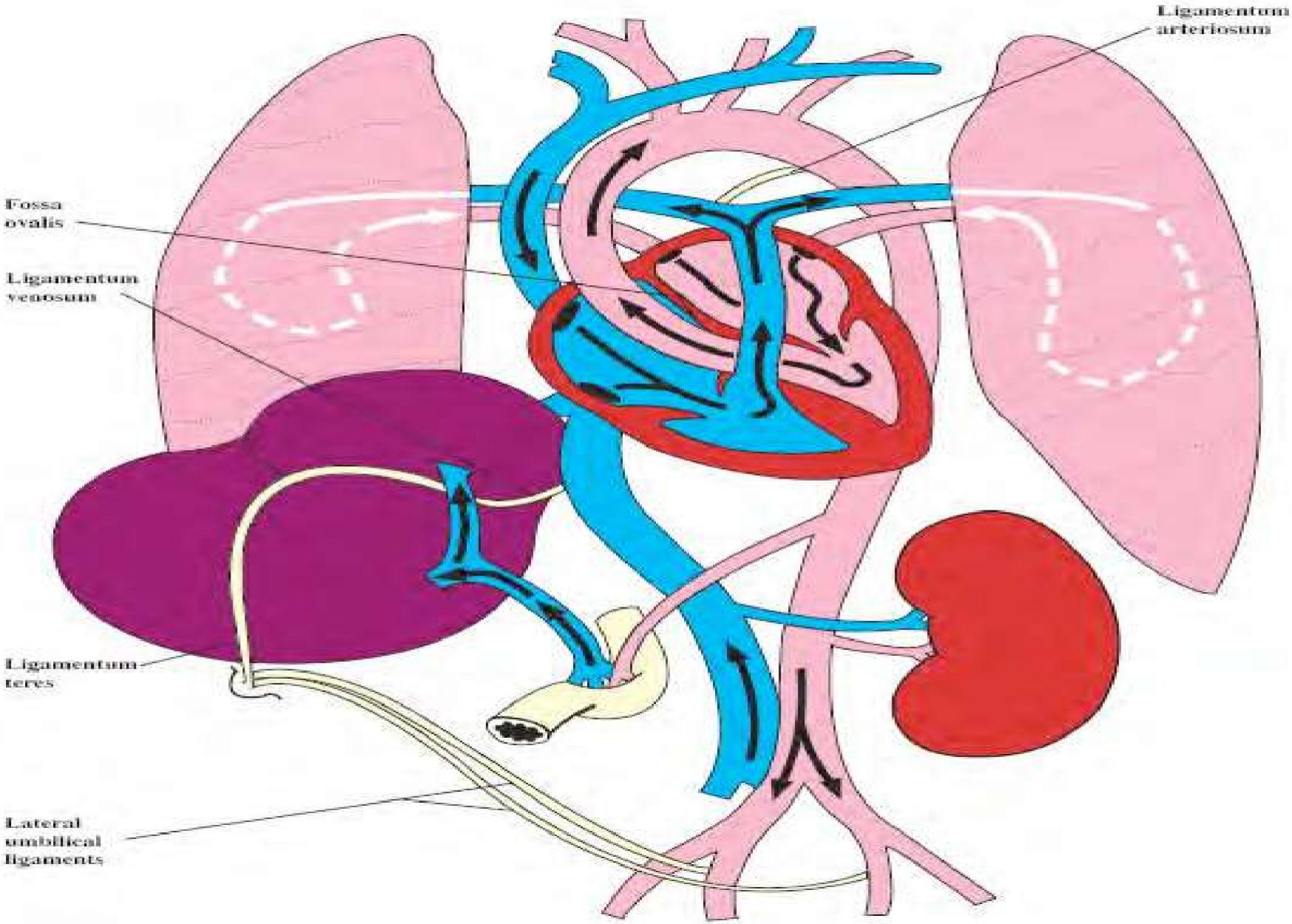
Following birth
500ml per min

Heart Rate → 120-140per min

At birth

- Clamping the cord shuts down low-pressure system
- Increased atmospheric pressure(increased systemic vascular resistance) causes lungs to inflate with oxygen
- Lungs now become a low-pressure system

Neonatal circulation



Changes in the Fetal Circulation after birth

Shunt	Functional closure	Anatomical closure	Remnant
Ductus arteriosus	10 – 96 hrs after birth	2 – 3 wks after birth	Ligamentum arteriosum
Formamen ovale	Within several mins after birth	One year after birth	Fossa ovalis
Ductus venosus	Within several mins after birth	3 – 7 days after birth	Ligamentum venosum

- Umbilical arteries → Umbilical ligaments
- Umbilical vein → Ligamentum teres

Fetal Vs Infant Circulation

Fetal	Infant
• Low pressure system • Right to left shunting • Lungs non-functional • Increased pulmonary resistance • Decreased systemic resistance	•High pressure system •Left to right blood flow •Lungs functional •Decreased pulmonary resistance •Increased systemic resistance

Thanks