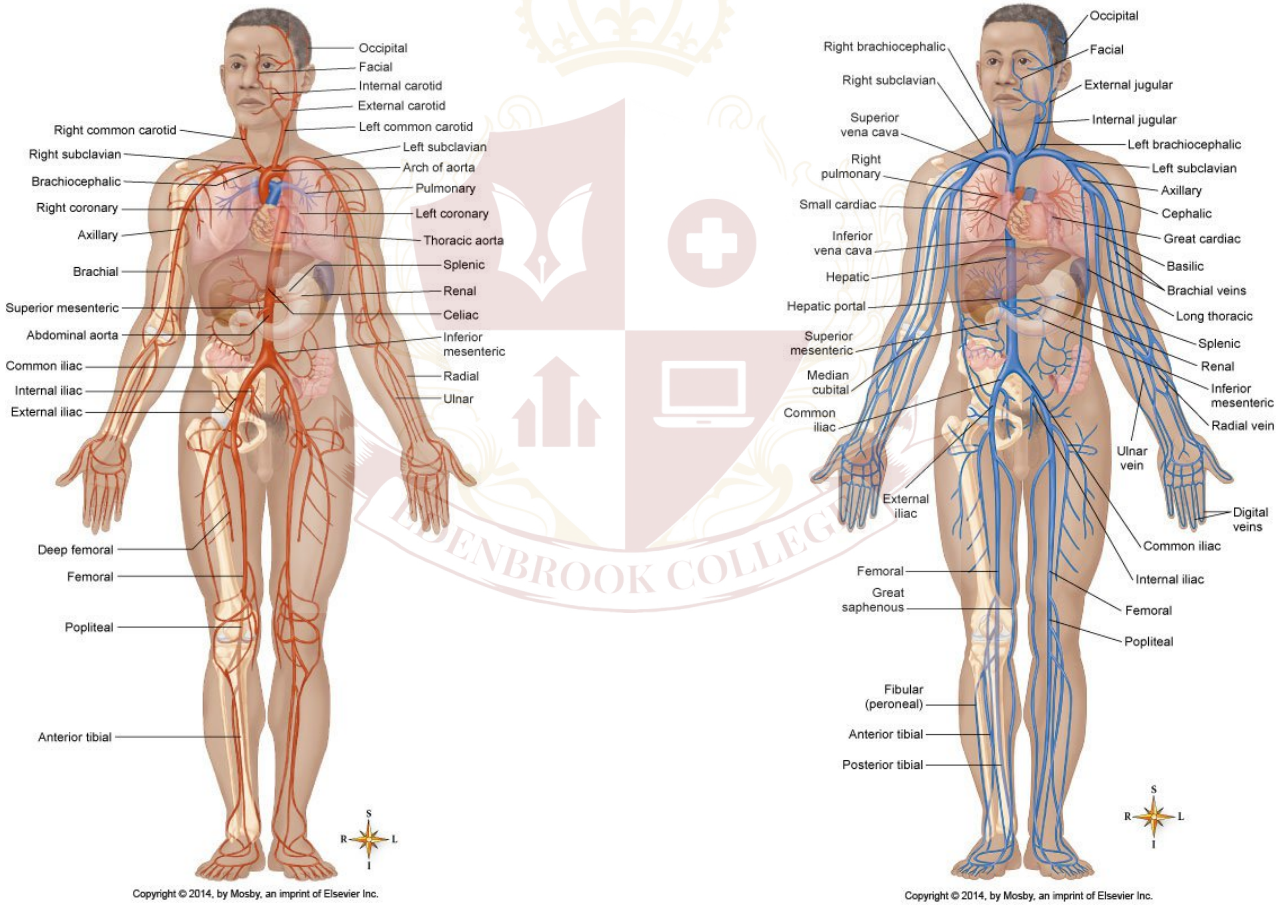
ANPH 1:

Circulation

Beyond the heart

The circulatory system's function is to transport blood to various tissues of the body.



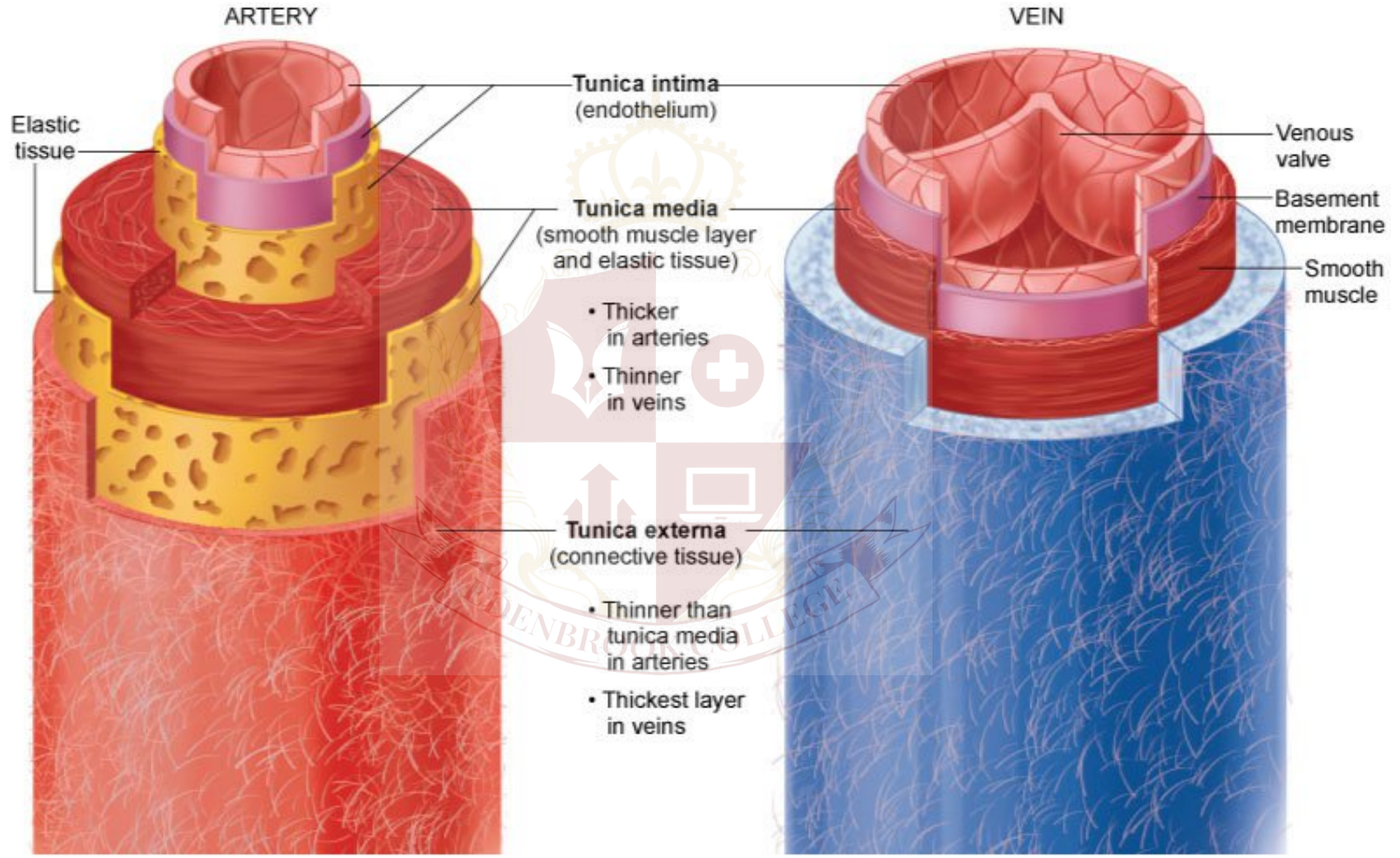
Blood Vessel Structure

- Outer layer- Tunica externa
-
    - connective fibrous tissue

- Middle layer- Tunica media
    - Smooth muscle tissue
        - Thicker in arteries than veins

- Inner layer- Tunica interna (intima)
    - Single layer of squamous epithelial cells (endothelium)

Arteries vs. veins



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Patton and Thibodeau Fig. 15-1

Arteries

- Carry blood away from the heart to the organs

Elastic Arteries

- The largest arteries such as the aorta, pulmonary trunk and branches of the aorta
- Their diameter is larger than other arteries, and the vessel walls are relatively thin, with a thick layer made up of elastic fibers

Elastic Arteries

- The largest arteries such as the aorta, pulmonary trunk and branches of the aorta
- Their diameter is larger than other arteries, and the vessel walls are relatively thin, with a thick layer made up of elastic fibers
- They help propel blood forward as the ventricles relax

Muscular Arteries

- Thicker walls with more smooth muscle than elastic fibers
- Capable of vasodilation and vasoconstriction, which controls rate of blood flow
- Can have a diameter up to 1 cm down to 0.5 mm

Arterioles

- Microscopic vessels that regulate the flow of blood into the capillary networks of tissue

Capillaries

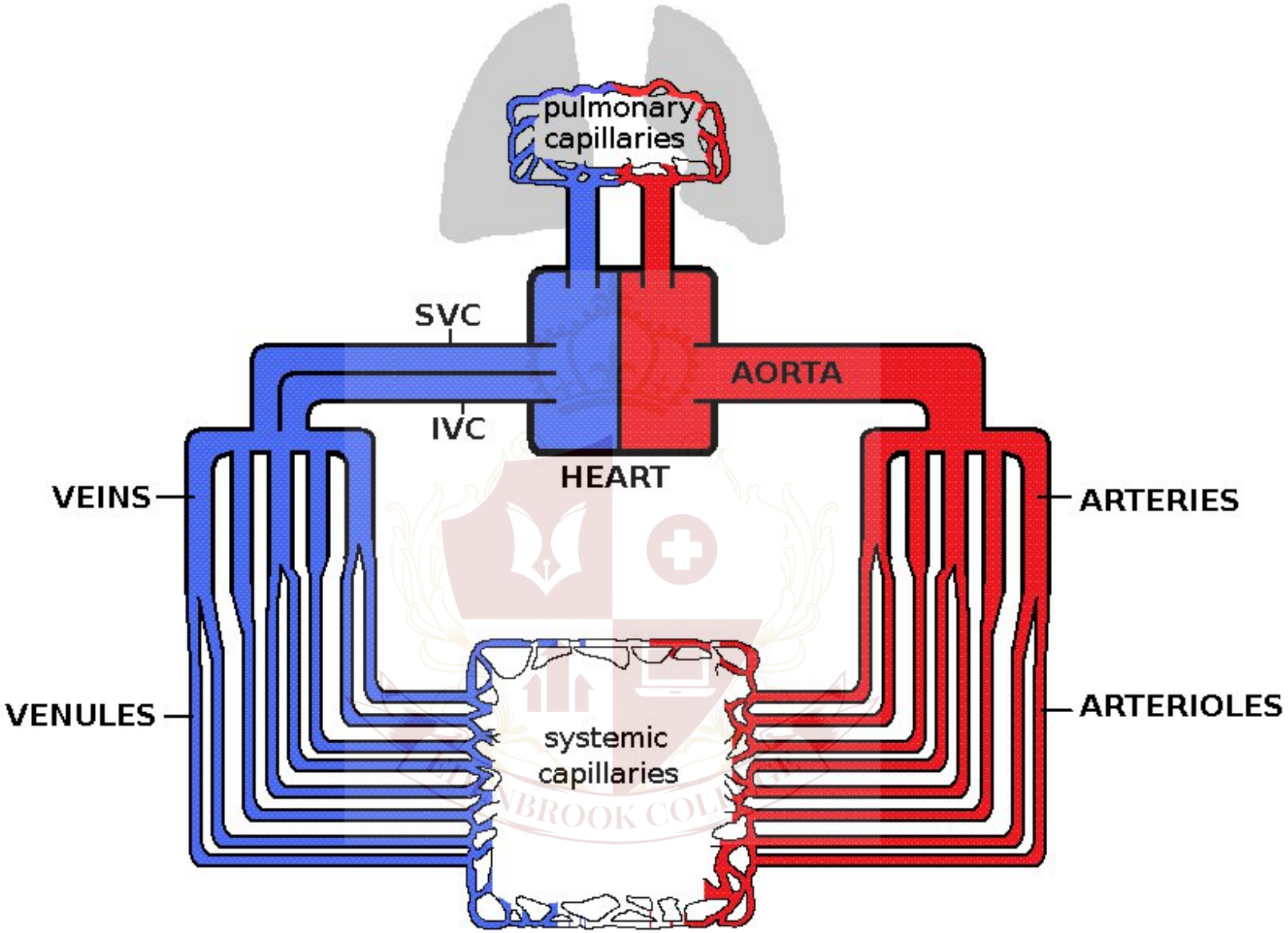
- Smallest blood vessels, connect the arterial outflow to the venous return
- Exchange oxygen and nutrients between the blood and interstitial fluid
- Extensive capillary networks are found in tissues and organs with high metabolic needs
    - Brain, liver, kidneys

Venules

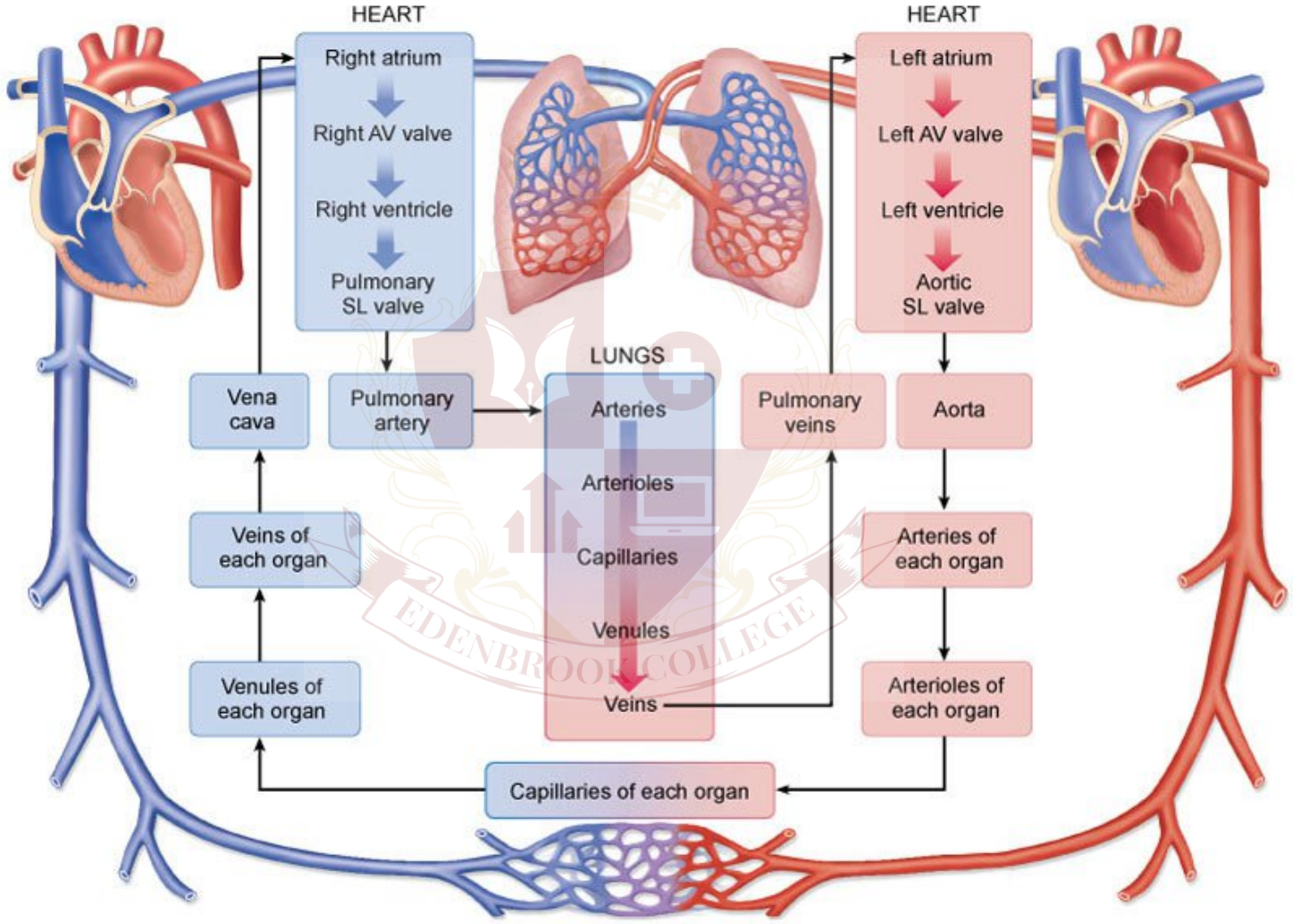
- Drain capillary blood and begin the return flow of blood back toward the heart

Veins

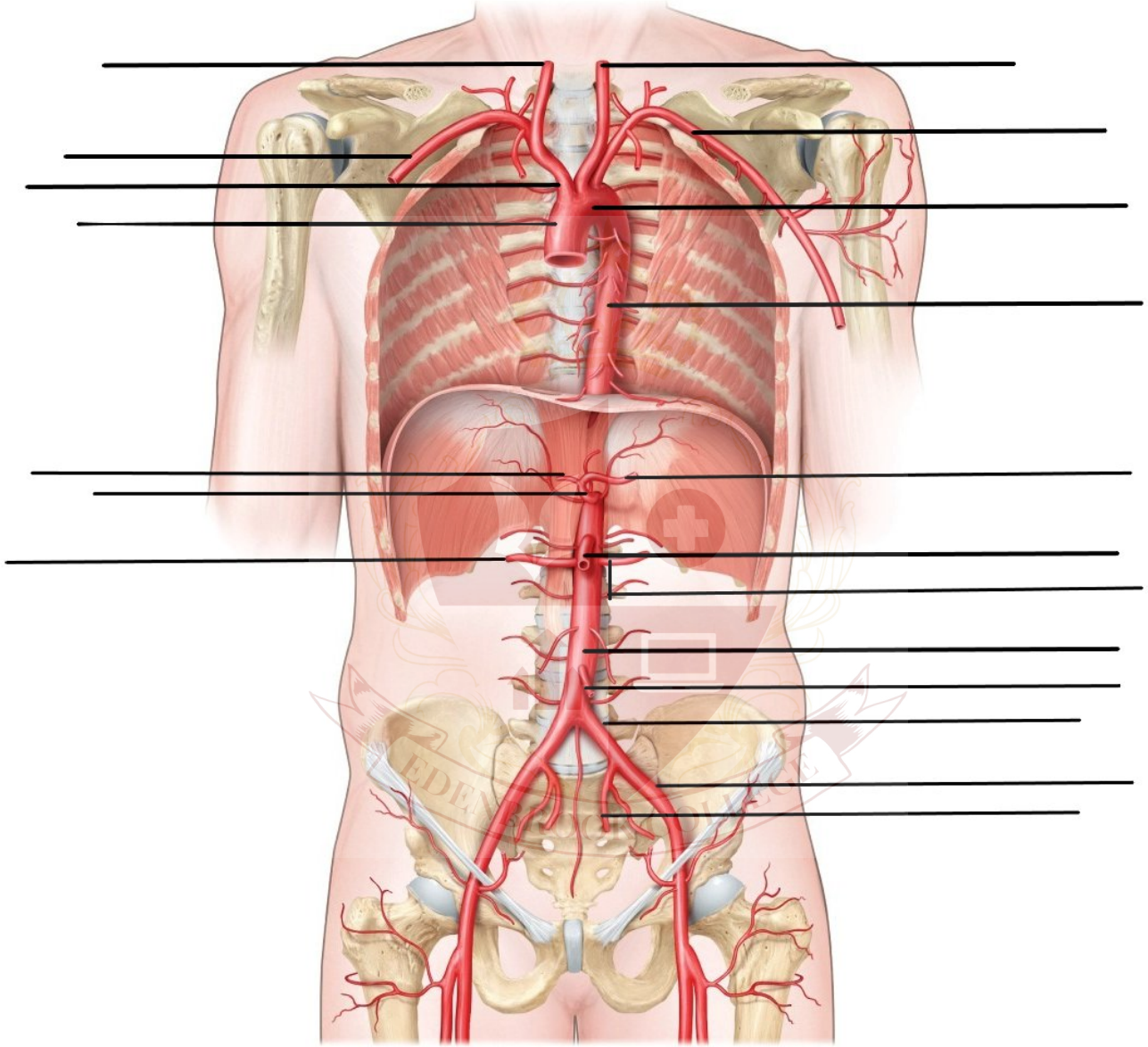
- Have thin walls relative to their diameter
- Range in size from 0.5 mm to 3 cm
- Do not have elastic properties of arteries, can adapt to changes in volume and pressure, but cannot withstand high pressure
- Venous blood pressure is lower than arterial pressure
- Contain valves which are thin folds of the tunica interna (or intima), forming cusps. The valves project into the lumen and point toward the heart

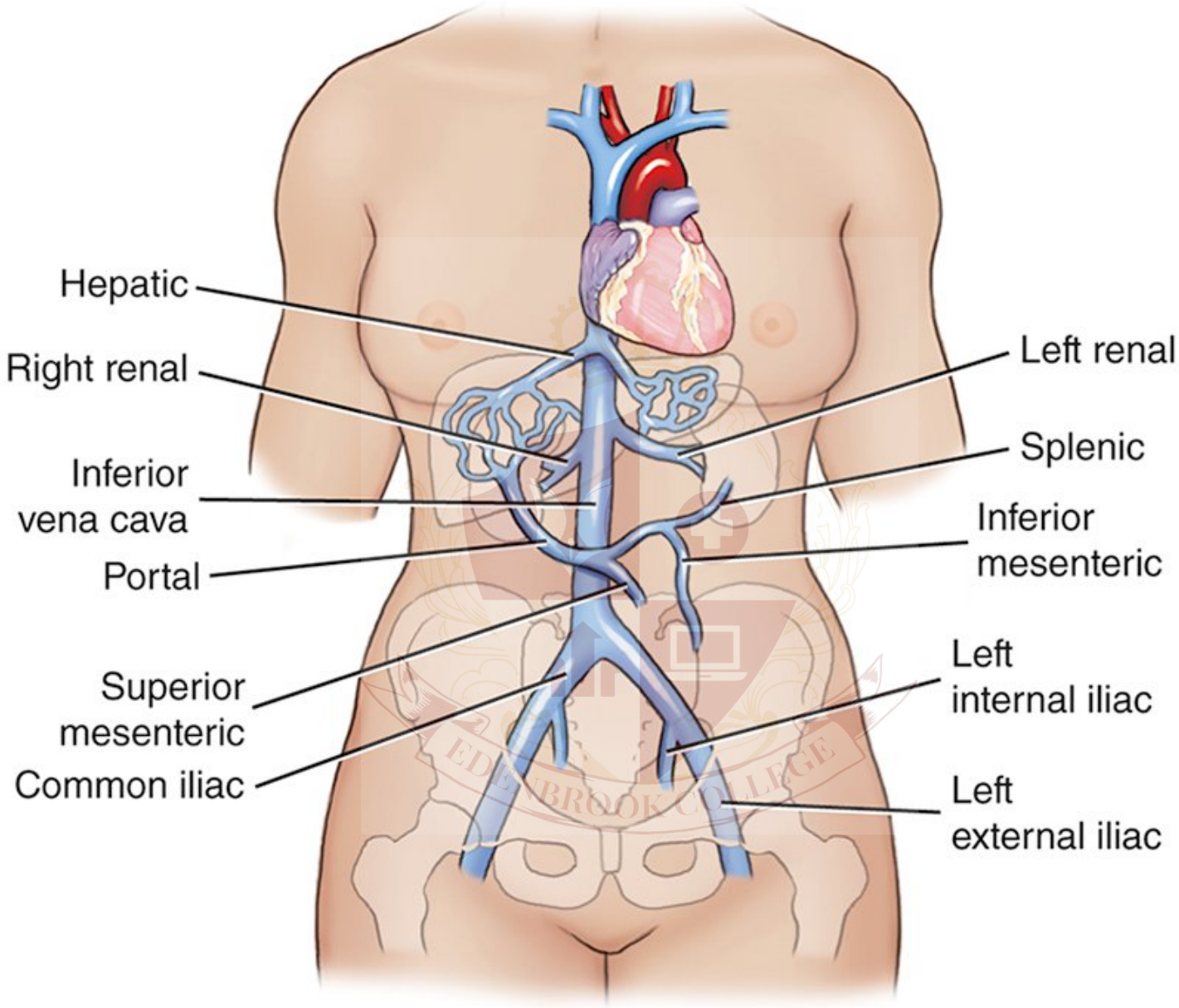

pulmonary capillaries
SVC
AORTA
IVC
HEART
VEINS
ARTERIES
VENULES
ARTERIOLES
systemic capillaries

Routes of Circulation



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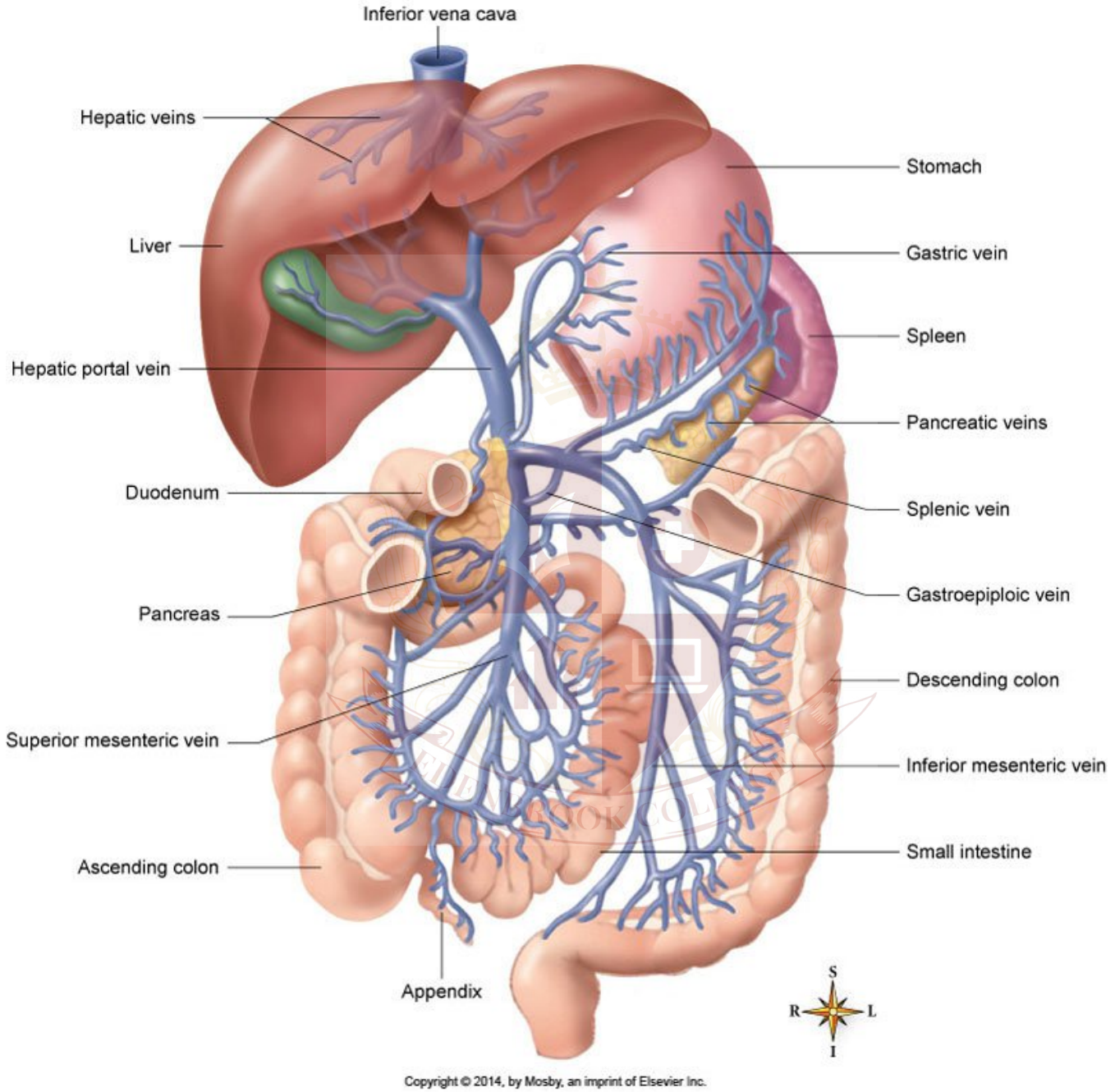
Hepatic Portal Circulation

Directs blood from most parts of the gastrointestinal tract and organs to the liver via the hepatic portal vein

Substances absorbed in the small intestine go to the liver before going to the heart.

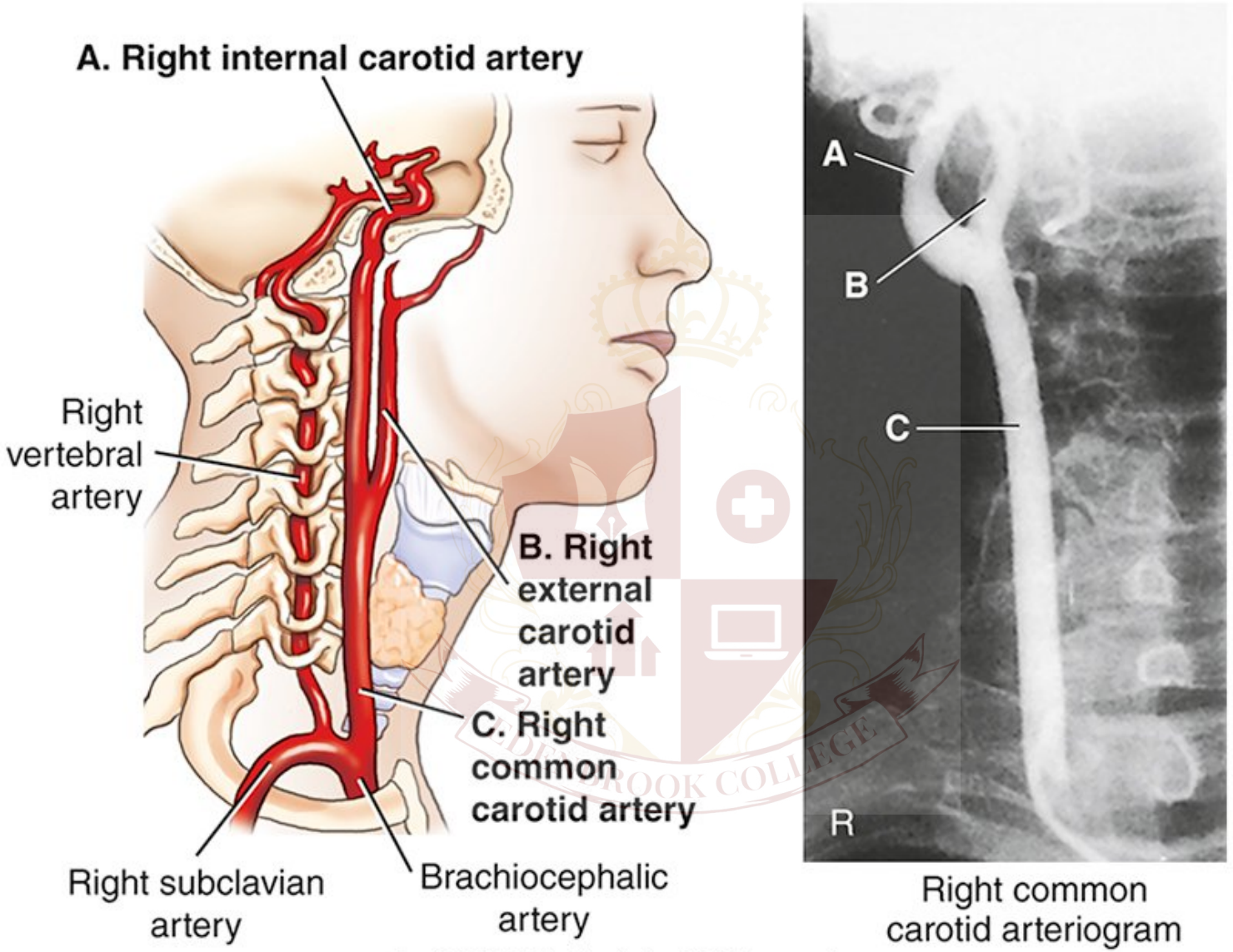
The liver removes excess glucose and stores it as glycogen

The liver removes and detoxifies various metabolites



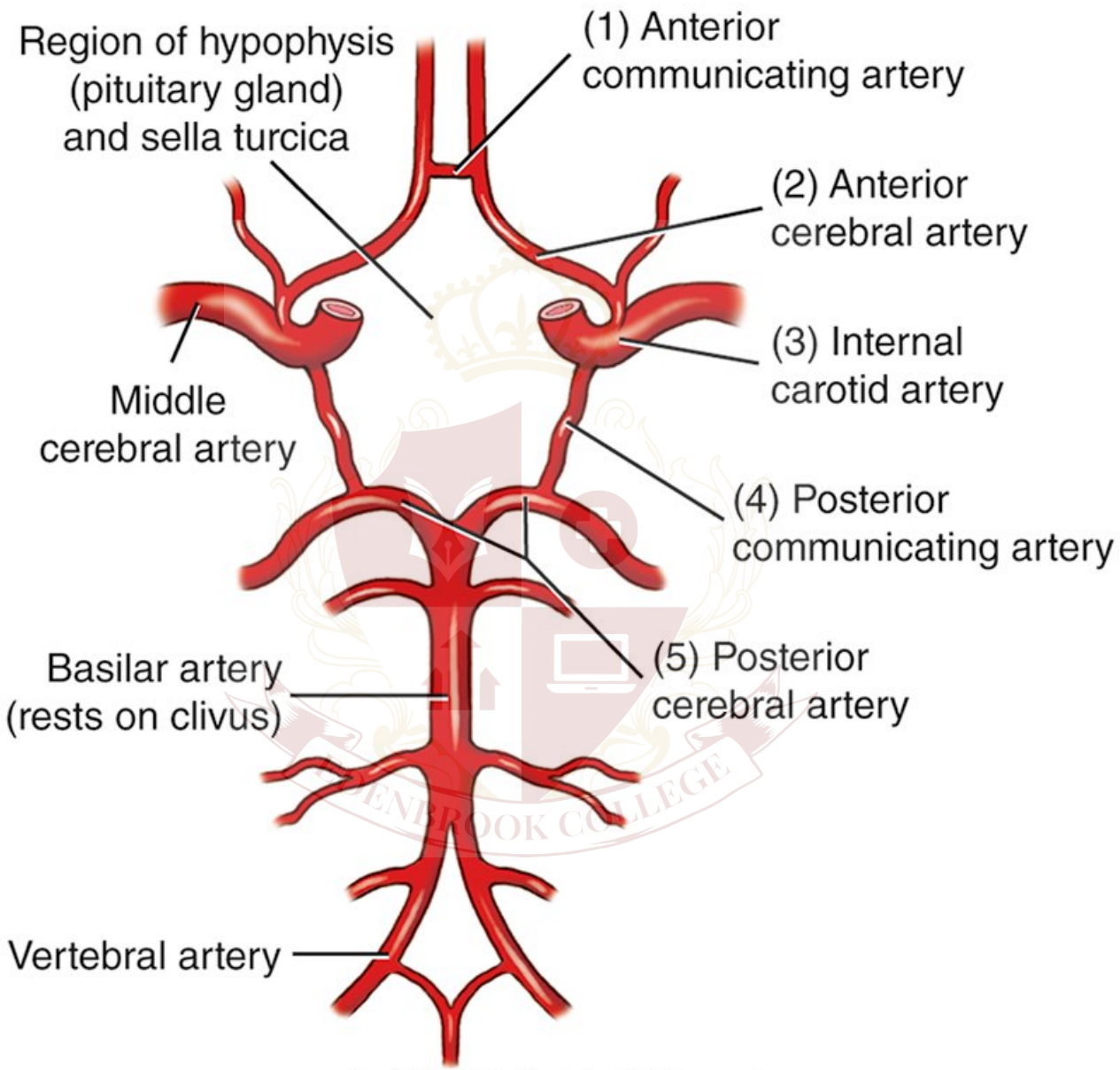
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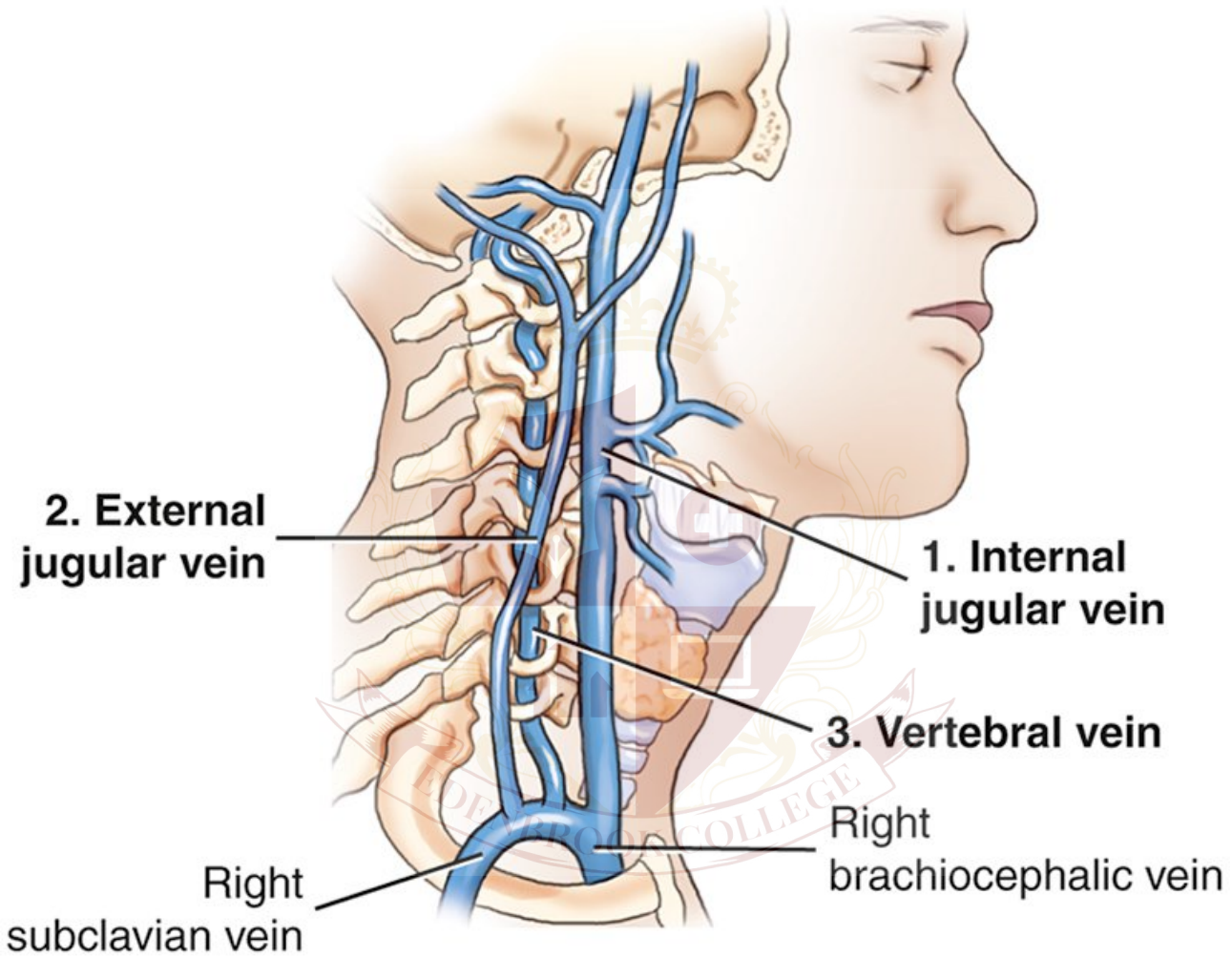


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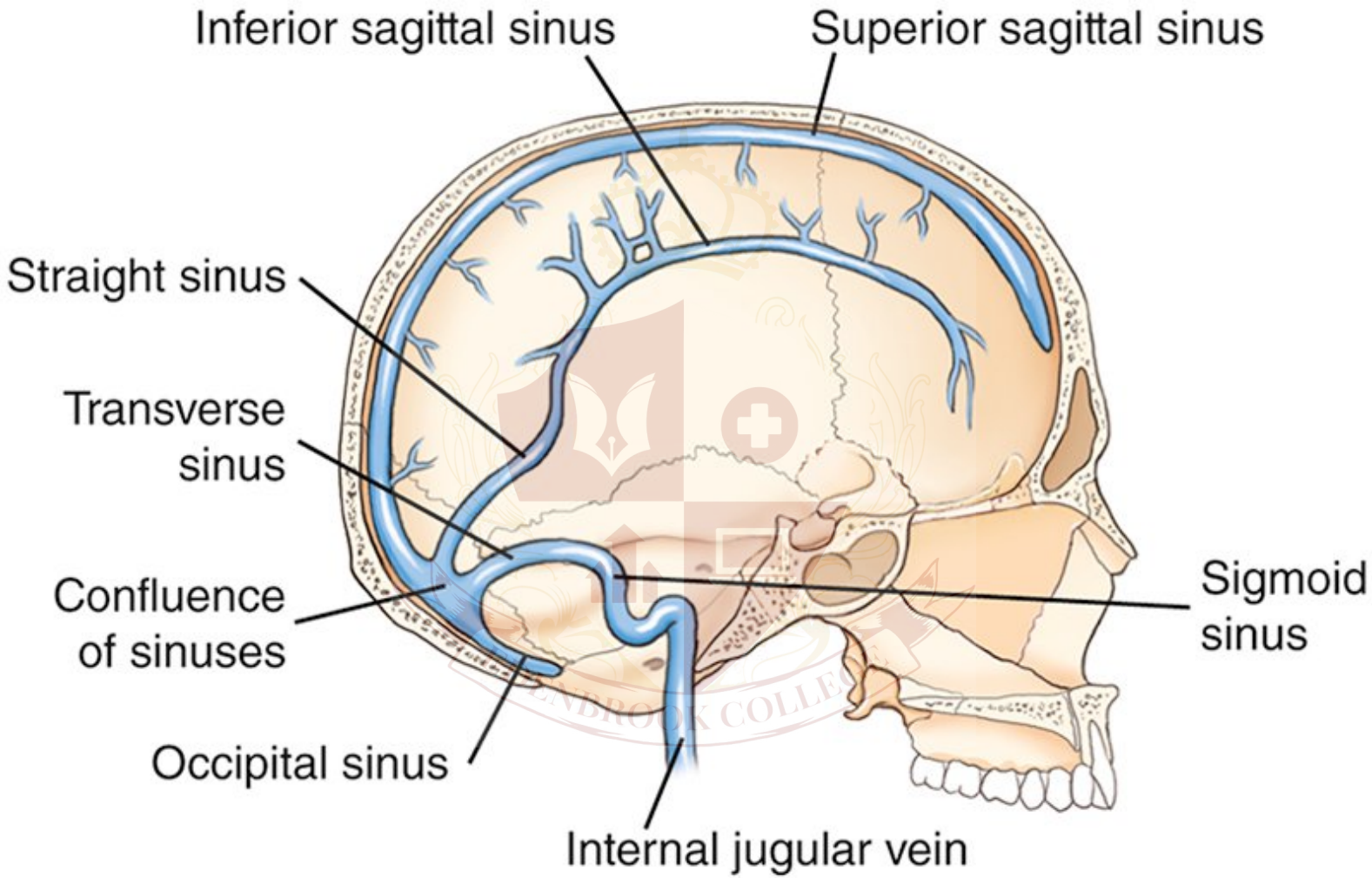
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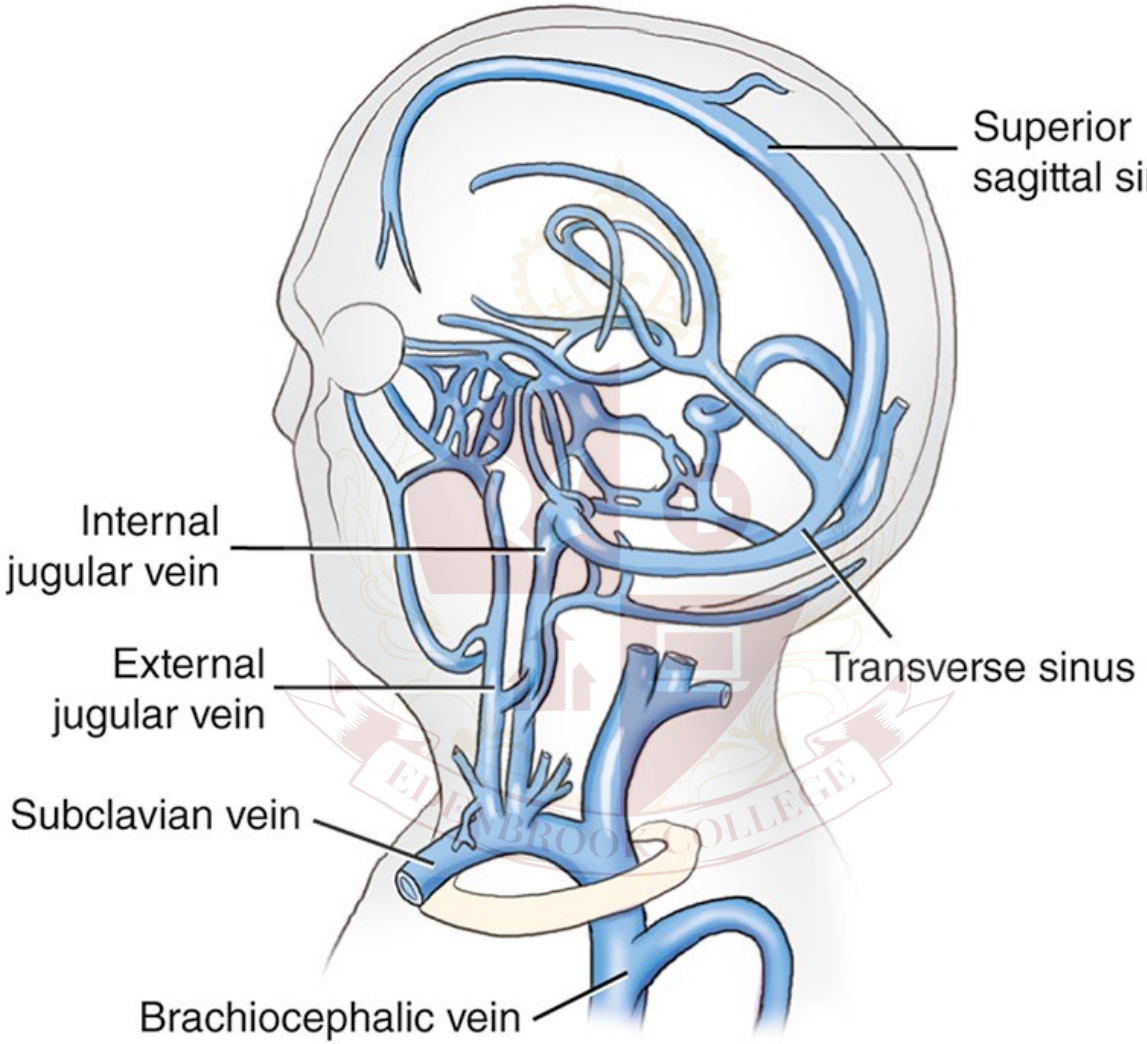


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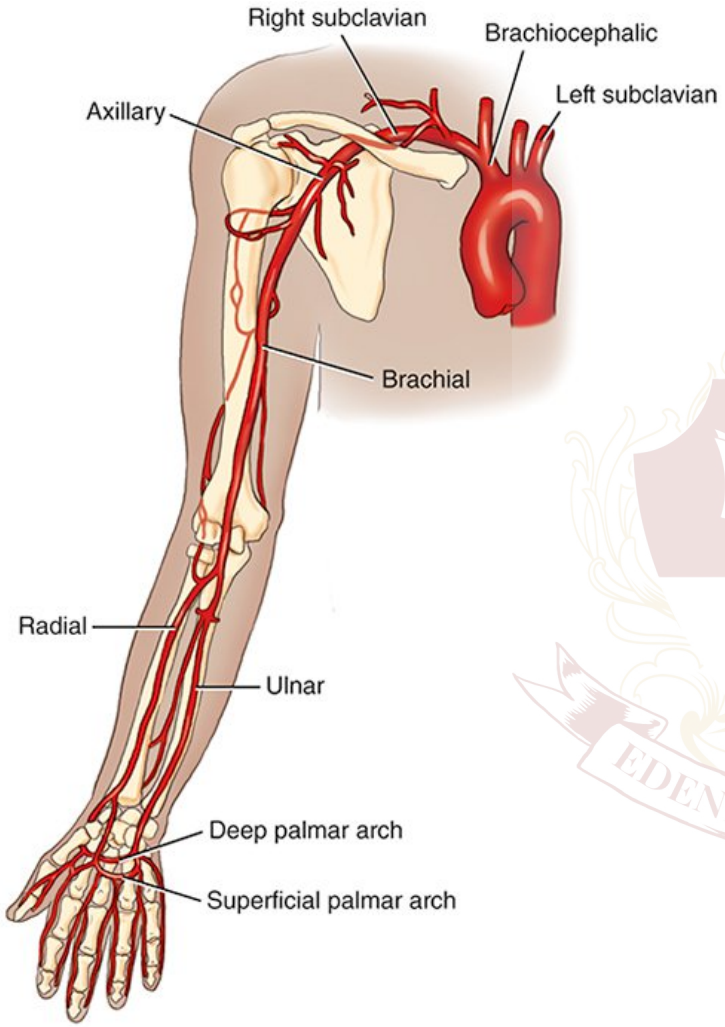
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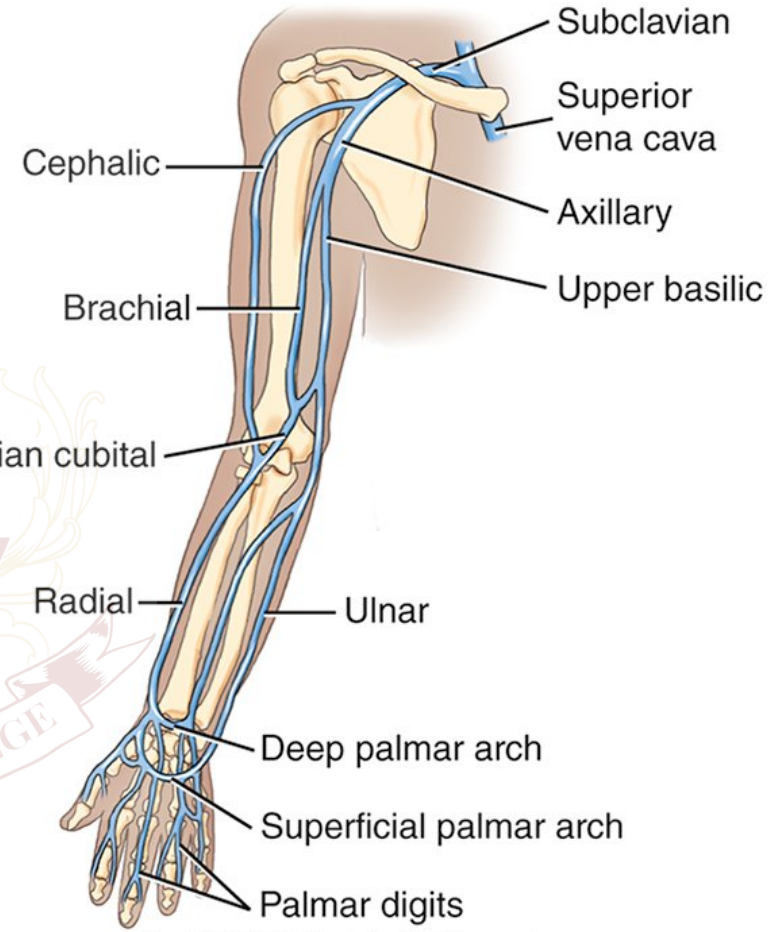


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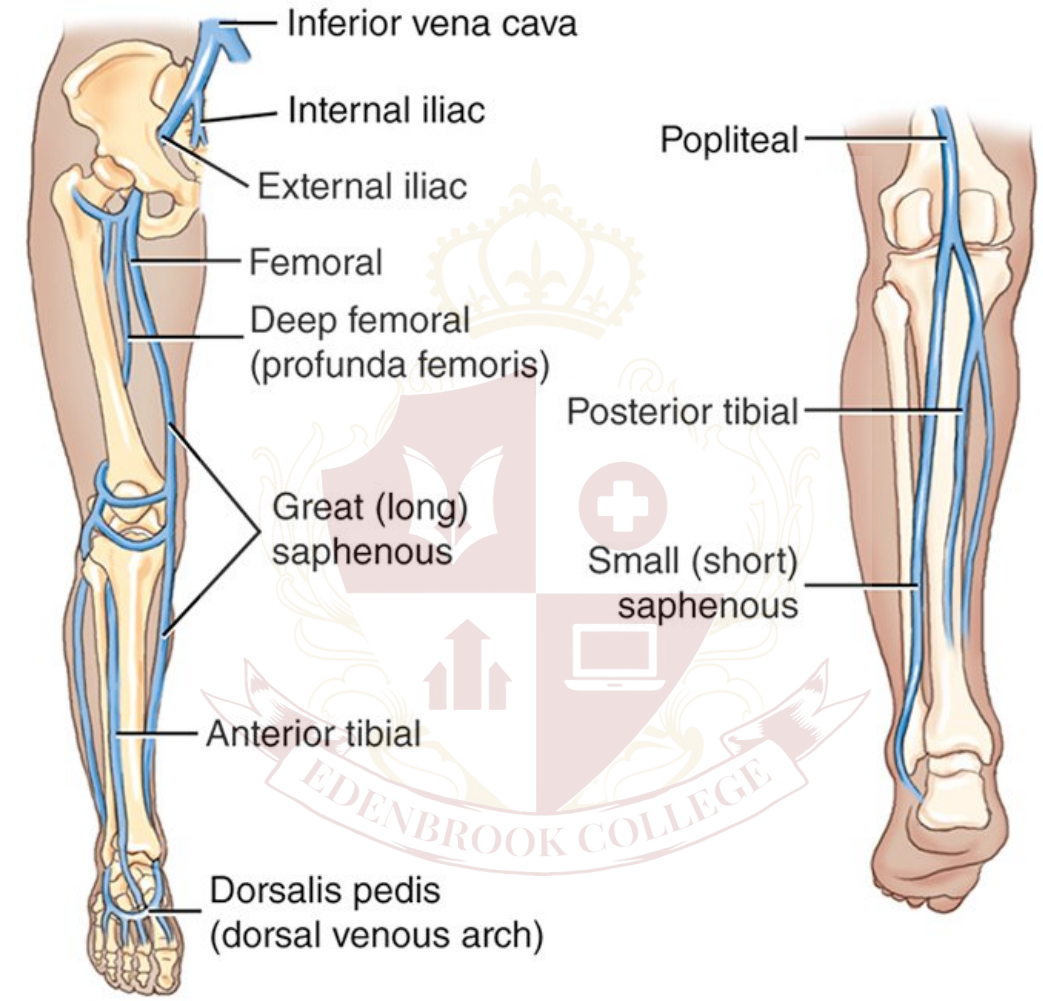


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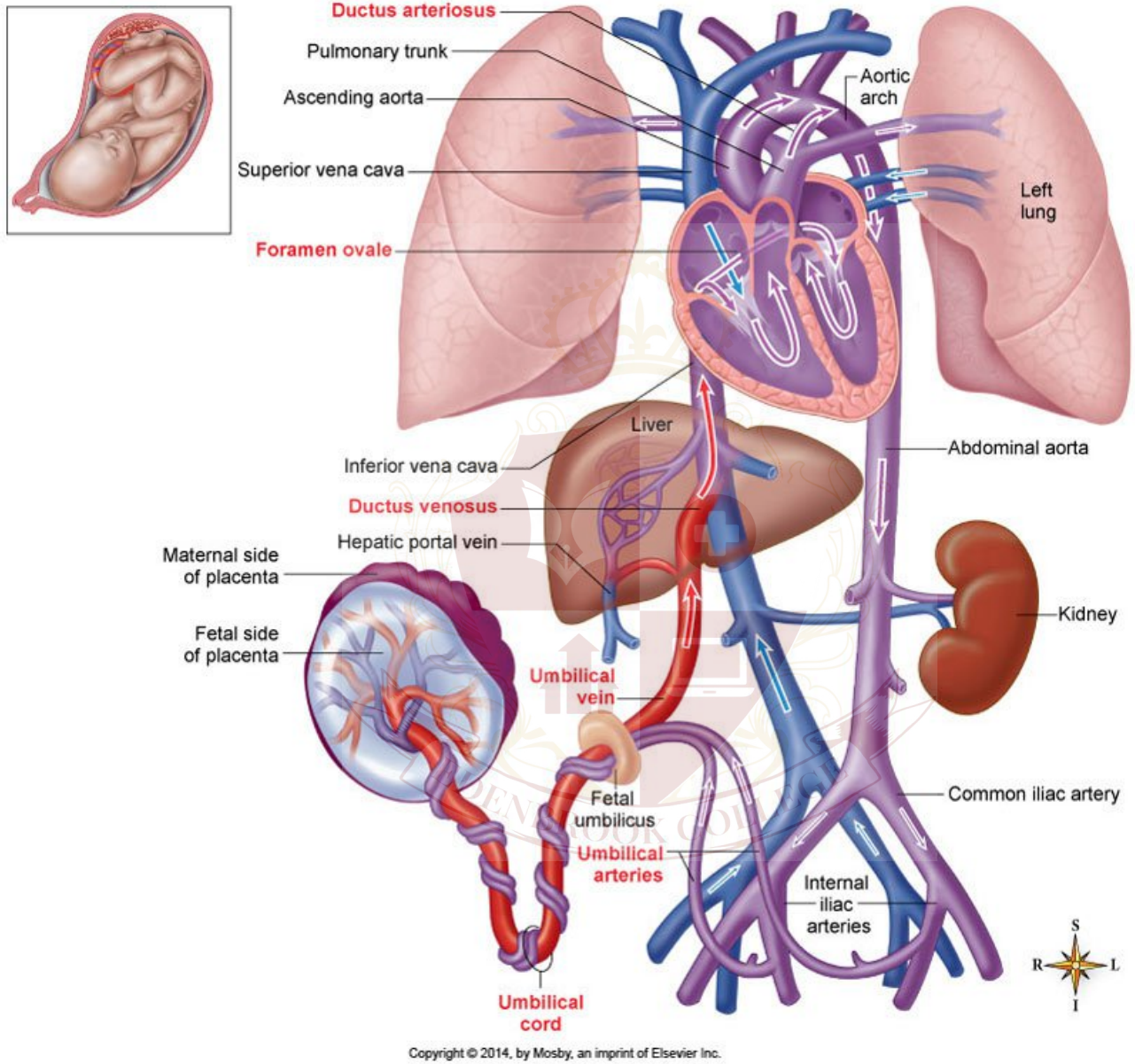
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Fetal Circulation

Differs since the fetus has to get oxygen from maternal blood via the placenta

The umbilical vein carries oxygenated blood to the heart and the umbilical arteries carry oxygen depleted blood

About half of the blood goes into the liver, and the rest enters the IVC via the ductus venosus

The blood enters the right atrium and most moves directly into the left atrium through the foramen ovale

The blood that enters the right ventricle gets pumped into the pulmonary artery but bypasses the lungs, due to the ductus arteriosis

The ductus arteriosis connects the pulmonary artery to the aorta

Blood flows into the left ventricle and then into the aorta, then circulates through the body

The blood returns to the placenta via the umbilical arteries, which branch from the internal iliac arteries

At birth, there are immediate changes to this system

The umbilical blood vessels become non-functional with cutting the cord, causing them to collapse

When the baby breathes for the first time, there is decreased resistance in the pulmonary vascular system. This causes increased pressure in the left atrium, compared to the right atrium and forces the closure of the foramen ovale.

As the baby breathes and there is more oxygen in the blood, the ductus arteriosis closes, closing the connection between the pulmonary trunk and the aorta. Blood is forced to go into to the pulmonary system, and with fully functioning lungs can oxygenate the blood.

Fetal	Develops
Foramen ovale	Fossa ovalis
Ductus arteriosis	Ligamentum arteriosum
Extra-hepatic portion of the fetal left umbilical vein	Round ligament of the liver
intra-hepatic portion of the fetal left umbilical vein	Ligamentum venosum
Proximal portions of fetal left and right umbilical arteries	Umbilical branches of the internal iliac arteries
Distal portions of the fetal left and right umbilical arteries	Medial umbilical ligaments