

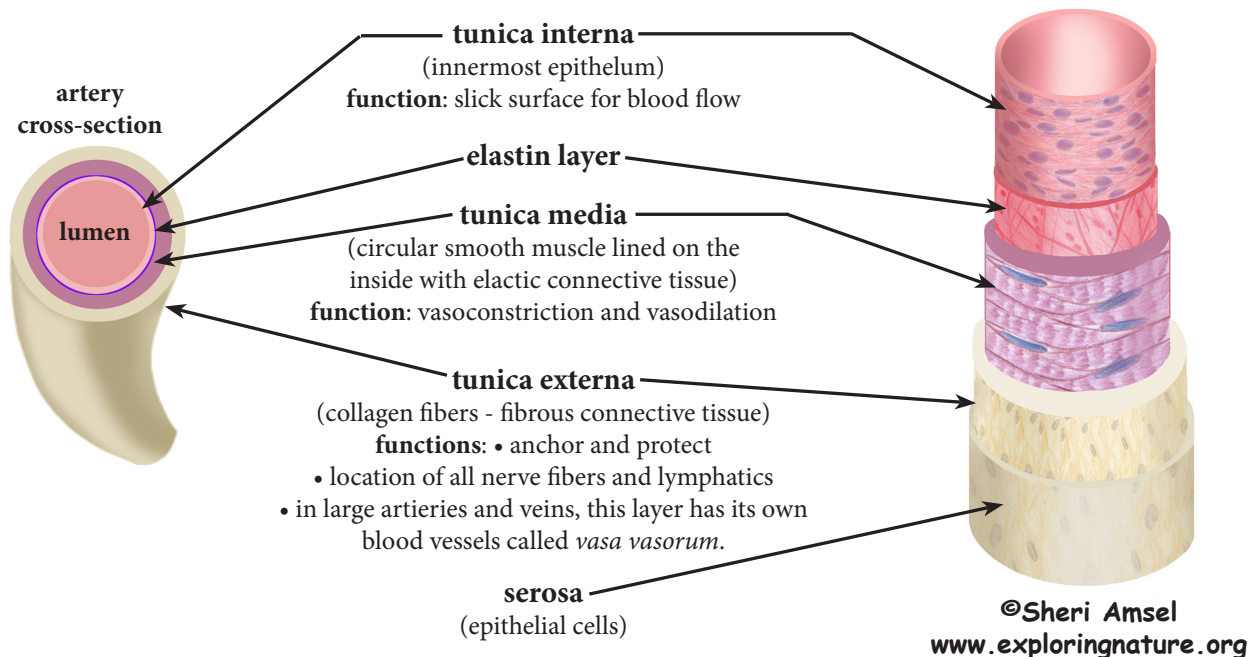
The Blood Vessels

It is estimated that there are 60,000 miles of blood vessels in the human body made up of arteries, veins and capillaries. Their function is to deliver oxygen (O₂) and nutrients to all the tissues of the body via arteries and take away the carbon dioxide (CO₂) and waste via veins.

Blood Vessel Structure

The structure of the blood vessels is designed for the ebb and flow of blood as its pumped through the body. Both arteries and veins (not capillaries) are made up of several layers or tunics.

1. The innermost layer is called the **tunica interna**. It is made up of *endothelium* and functions as a slick surface for unhindered blood flow.
2. The next layer is the **tunica media**. It is made up of *smooth muscle* with a very thin layer of *elastin* lining its inside. The tunica media has *vasomotor fibers* from the *sympathetic nervous system* that regulate blood flow by signaling for this layer to vasodilate or vasoconstrict as needed.
3. The outside layer is the **tunica externa**. It is made up of collagen fibers that anchor and protect the blood vessel. There are nerve fibers and lymphatics in this layer and in the largest blood vessels (aorta and vena cavas) there are even blood vessels feeding it oxygen called *vasa vasorum*.

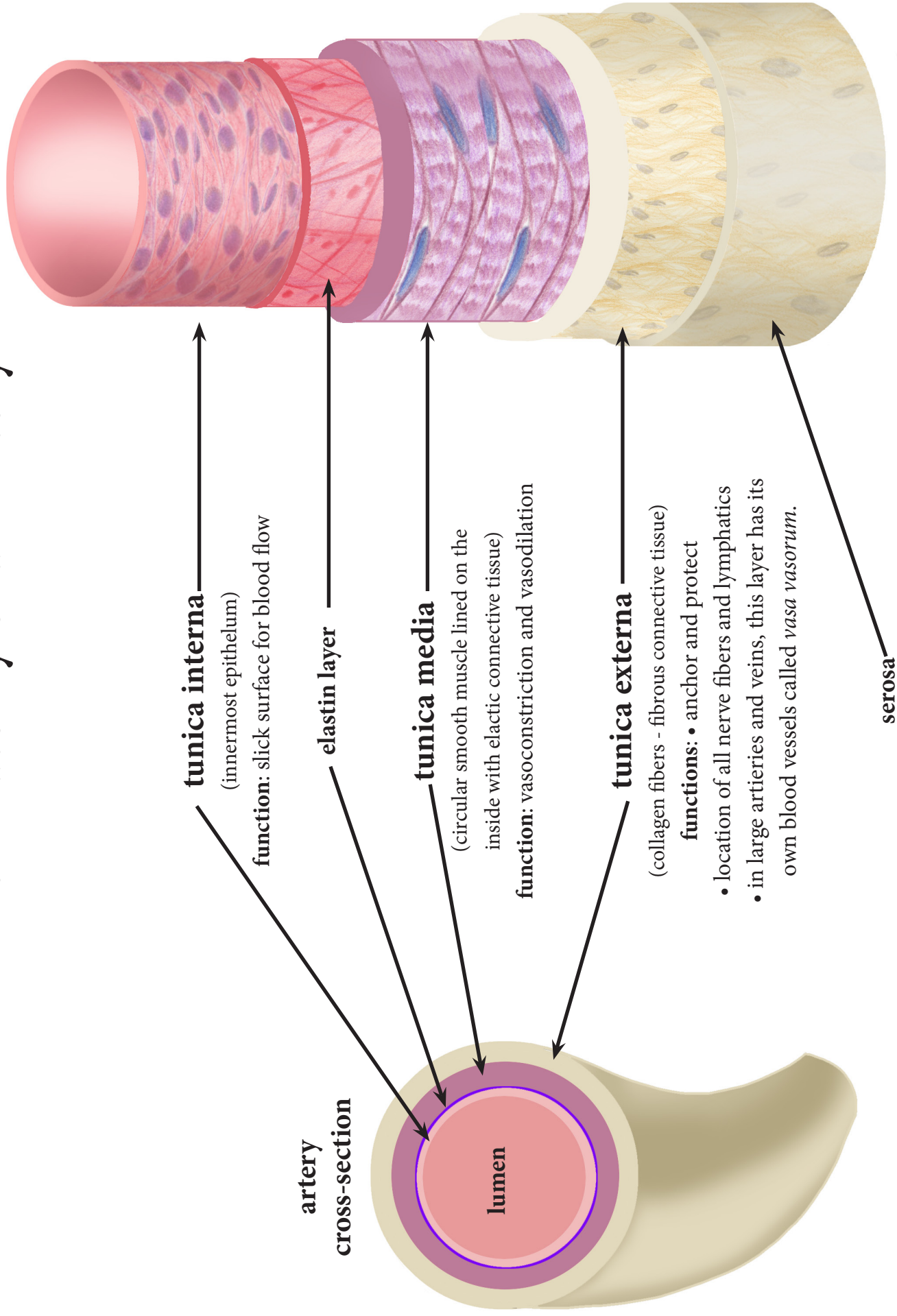


Arteries

Arteries generally carry blood away from the heart. There are three types:

1. **Elastic Arteries** - These are *conducting arteries*. They are the largest, most thick walled, most elastic and close to the heart (aorta and main branches). They have an elastic lamina sandwiching the tunica media to protect it from the changes in blood pressure from the pumping heart. They do not do much vasoconstriction.
2. **Muscular Arteries** - These are *distributing arteries*. They are medium to smaller arteries that conduct blood to different parts of the body.
They have more smooth muscle in the tunica media, so are active vasoconstrictors.
3. **Arterioles** - They are the smallest arteries. They feed the capillary beds. The vasoconstriction and vasodilation of the arterioles are the most important factor in determining blood flow in the capillary bed.

The Anatomy of an Artery



tunica interna

(innermost epithelium)

function: slick surface for blood flow

artery

cross-section

lumen

tunica media

(circular smooth muscle lined on the inside with elastic connective tissue)

function: vasoconstriction and vasodilation

tunica externa

(collagen fibers - fibrous connective tissue)

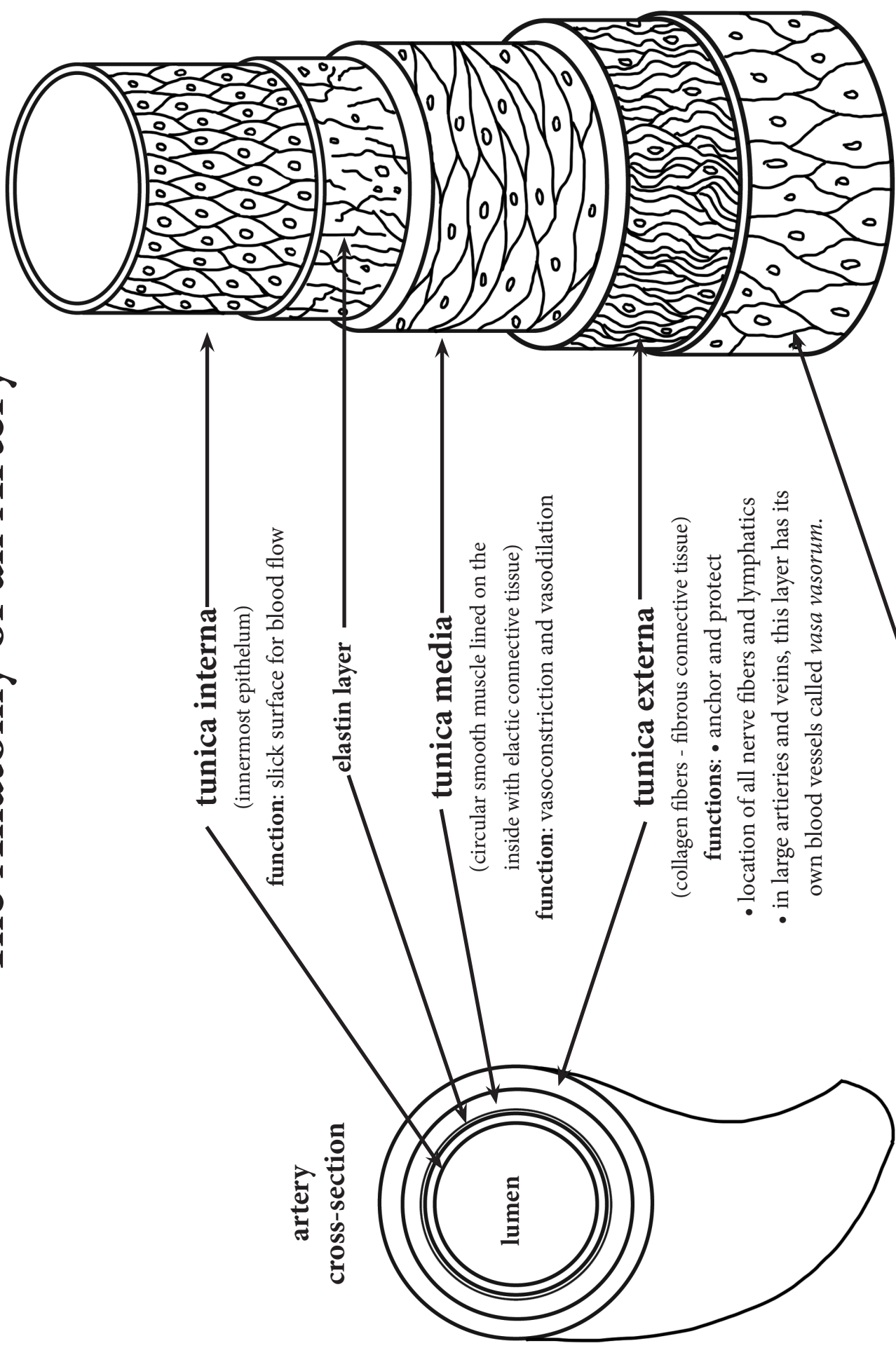
functions: • anchor and protect

- location of all nerve fibers and lymphatics
- in large arteries and veins, this layer has its own blood vessels called *vasa vasorum*.

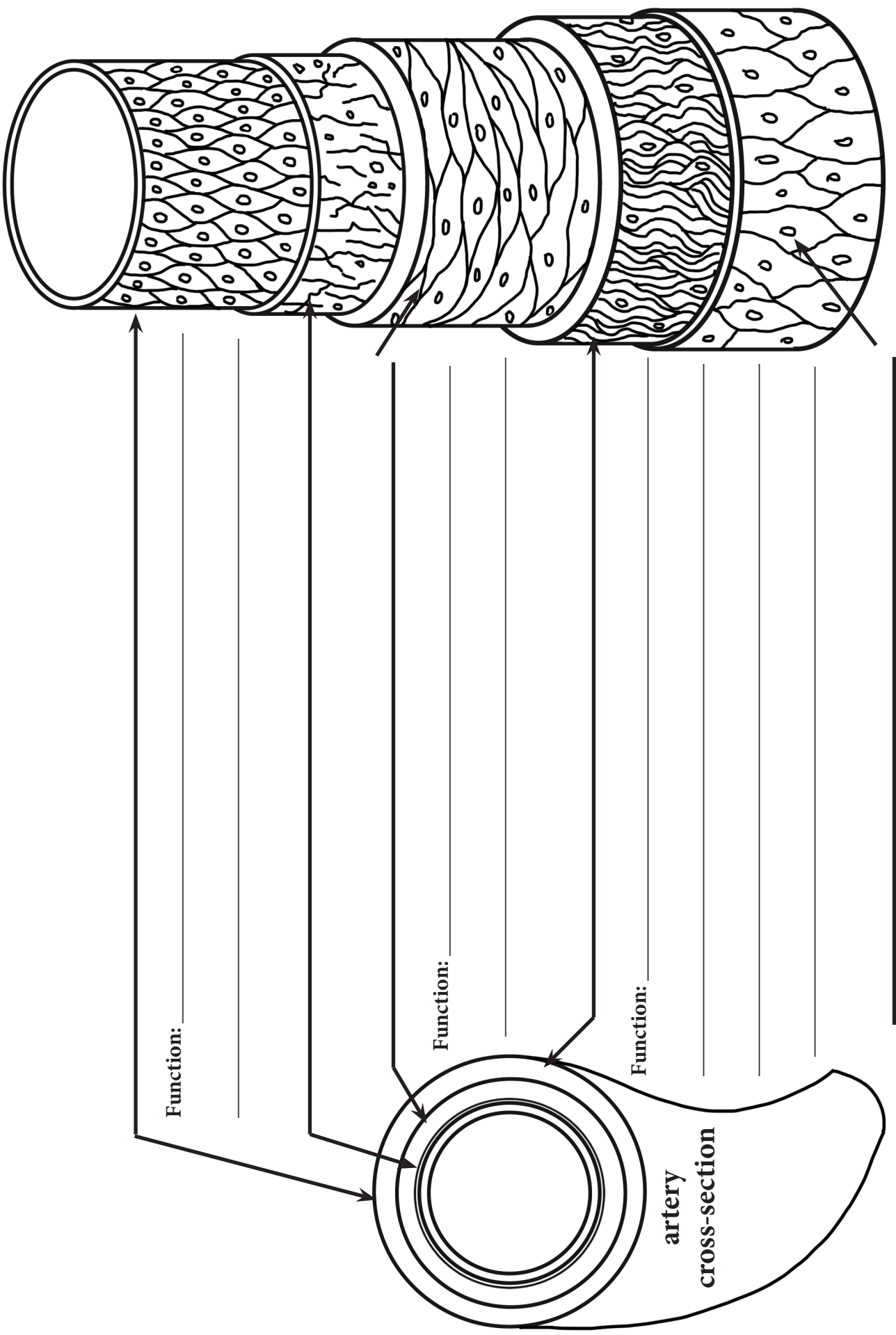
serosa

(epithelial cells)

The Anatomy of an Artery



Name the Layers of the Artery and the Functions of Each



Vein Structure

Vein structure is similar, but not identical, to arteries. They are made up of the same layers or tunics but they differ in the following ways:

- The vein **lumen** is larger.
- The walls of the tunics are thinner with little smooth muscle.
- The **tunica externa** is larger than the tunica media.
- The veins contain the blood reservoirs of the body. At any one time, the veins of the body contain 65% of the body's blood. This is why the veins are considered to be *capacitance vessels*.
- Veins have lower blood pressure than arteries. They are further from, so less influenced by, the pumping action of the heart.
- **Valves** in the veins prevent blood back flow in their low pressure environment. There are more valves in the limbs where the blood is flowing against gravity. The valves are made up of a flap of the **tunica interna**. Their shape is like the semilunar valves of the heart.
- Breathing in and out (respiration) helps to pump venous blood back to the heart, as does muscular movement.
**The London Guards, who stand very still all day, are taught to flex their muscles as they stand to keep their venous blood flowing back to the heart.*
- **Varicose veins** are the result of leaky valves. The veins become, over time, dilated and tortuous. Leaky valves result from heredity, obesity, pregnancy and standing professions.
- **Hemorrhoids** result from raised venous pressure from straining during defecation or childbirth. They are essentially varicose veins of the anal canal.

Venous Sinuses

The **venous sinuses** are specialized, flattened veins with thin endothelium walls. They are supported by the surrounding tissues.

- 1) There are venous sinuses in the cranium - **intracranial venous sinuses** (dural sinuses) that drain the blood from the brain and the cerebrospinal fluid around the brain. It is endothelium underlined by the dura mater (the brain covering).
- 2) There is a venous sinus around the heart - **coronary sinus** that drains the myocardium of the heart.