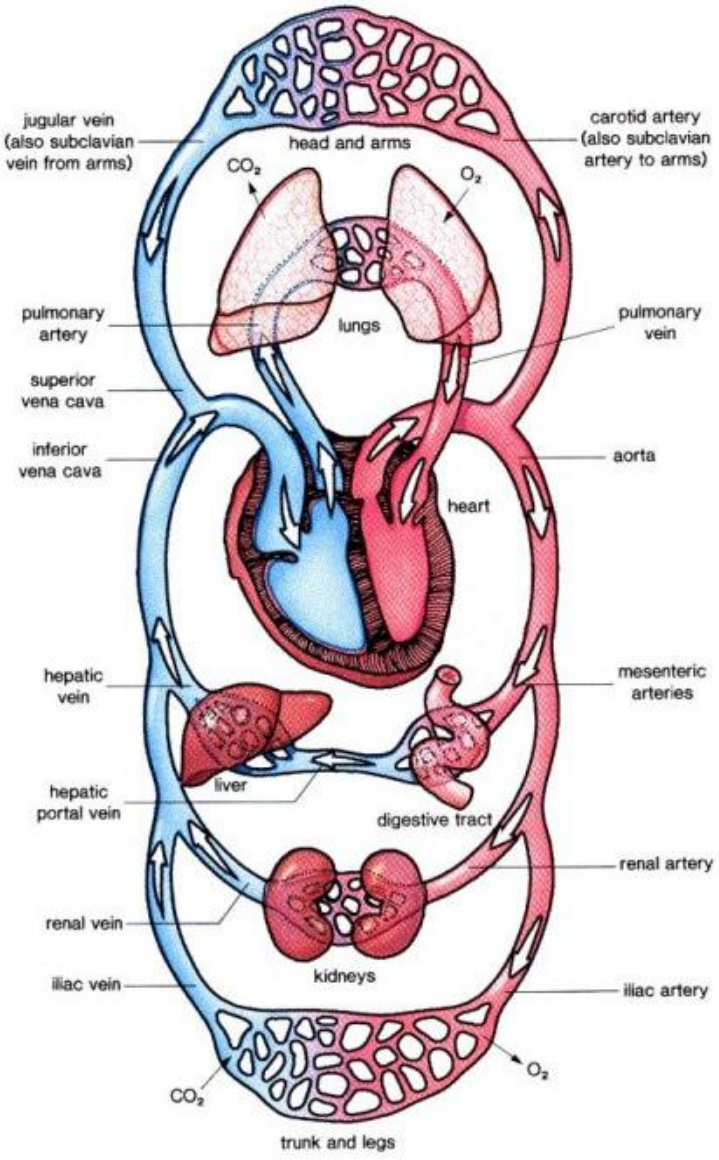
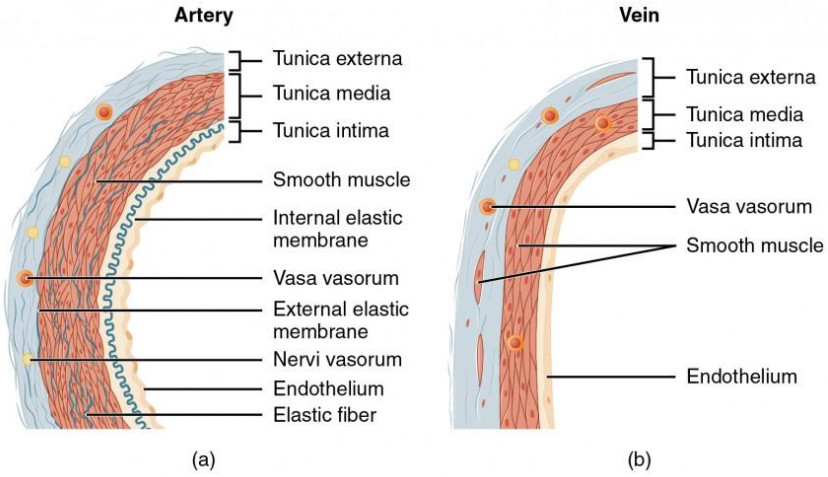
Card 1: Overview of the Main Blood Vessel Types

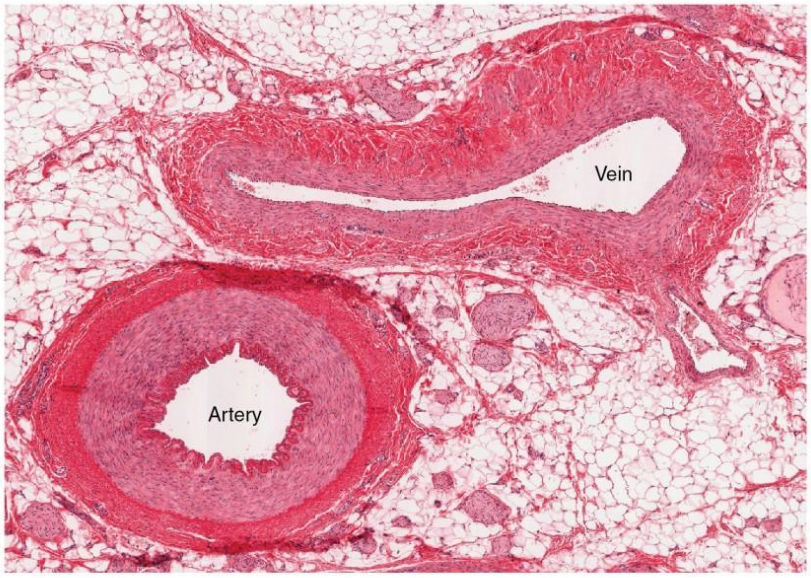
1. **Arteries** carry blood **away** from the heart under **high pressure**.
2. **Veins** return blood **towards** the heart under **lower pressure** and contain **valves**.
3. **Arterioles** are small branches of arteries that **regulate blood flow** into capillaries.
4. **Venules** collect blood from capillaries and **converge into veins**.
5. **Capillaries** are the **smallest** vessels; the site of **gas, nutrient, and waste exchange**.
6. All vessels have **three layers** (tunica intima, tunica media, tunica externa), though thickness varies by type.
7. **Pressure gradient**: Arteries (high) → Arterioles (moderate) → Capillaries (lower) → Venules → Veins (lowest).
8. Arteries and arterioles have more **smooth muscle** compared to veins and venules.
9. Veins often run **superficially** (near the surface) as well as **deep** (e.g., vena cava).
10. **Functionally**, arteries supply tissues with oxygenated blood; veins drain deoxygenated blood back to the heart (except in the pulmonary circuit where this is reversed).



Card 2: Artery Characteristics

1. Arteries have **thick, elastic walls** composed of **smooth muscle** and **elastic fibers**.
2. They carry blood under **high pressure** away from the heart.
3. The **aorta** is the largest **elastic artery**, expanding and recoiling with each heartbeat.
4. **Muscular arteries** (e.g., femoral, brachial) have a higher proportion of **smooth muscle** for controlling blood flow.
5. The **tunica media** (middle layer) is typically the **thickest** layer, rich in muscle and elastic tissue.
6. Arterial **elasticity** helps dampen pressure fluctuations from the heart's contractions.
7. The **endothelium** (tunica intima) provides a **smooth lining** to reduce friction.
8. Arteries help maintain **blood pressure** and consistent flow during **diastole** (heart relaxation) by elastic recoil.
9. **Coronary arteries** supply the heart muscle itself with oxygen and nutrients.
10. **Blood pressure** in arteries is pulsatile and **highest** close to the heart, decreasing gradually along the arterial system.





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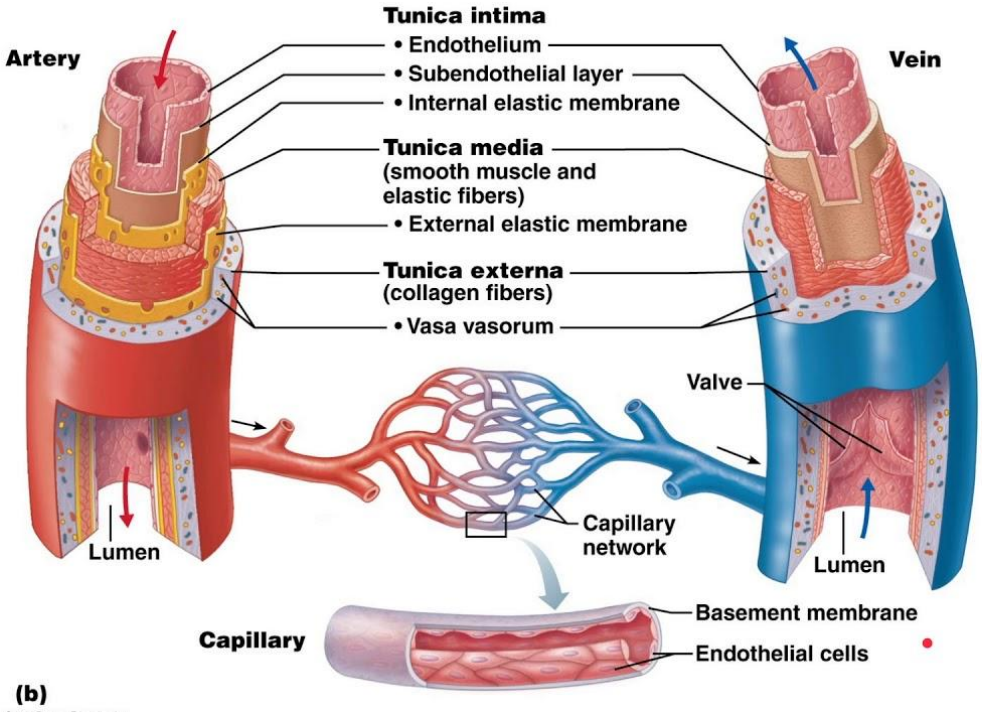
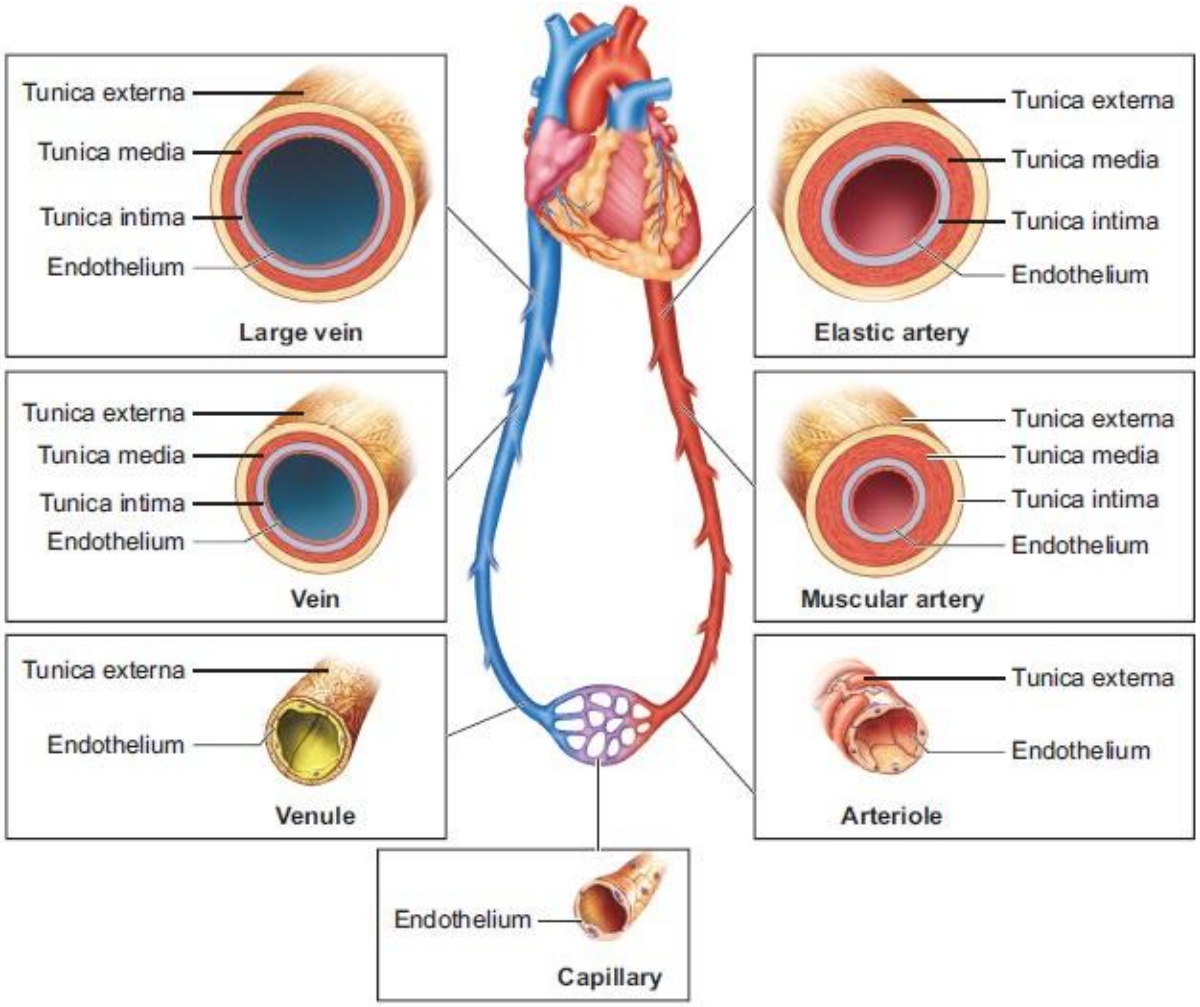
Card 3: Vein Characteristics

1. Veins have **thinner walls** than arteries, carrying blood at **lower pressure**.
2. Many veins contain **semilunar valves** to prevent backflow, especially in the limbs.
3. The **tunica media** in veins is relatively **thin**, with less smooth muscle.
4. Veins rely on **skeletal muscle contractions** to help push blood towards the heart.
5. **Superficial veins** (e.g., cephalic vein) lie close to the skin's surface; **deep veins** (e.g., vena cava) run deeper and carry the majority of returning blood.
6. The **outer layer (tunica externa)** is relatively **thick**, providing structural support.
7. The **pressure gradient** from venules to the vena cava is very **low**, necessitating valves to combat gravity.
8. **Respiratory movements** (pressure changes in the thorax) also aid venous return.
9. Veins can **hold more blood** than arteries (they are capacitance vessels), assisting in blood volume regulation.
10. **Varicose veins** occur when valves fail, causing blood pooling and distension in superficial veins.



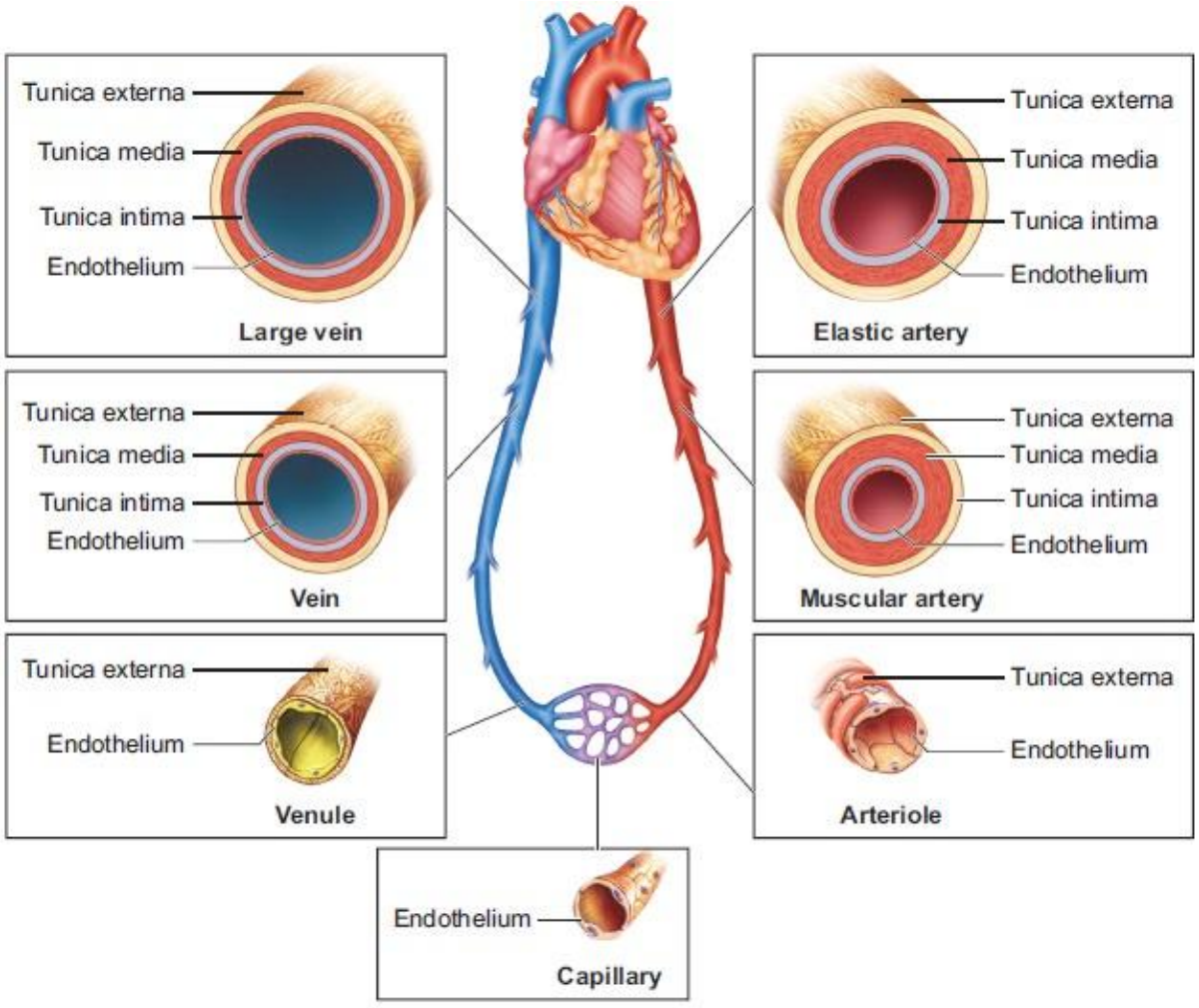
Card 4: Arterioles – “Resistance Vessels”

1. Arterioles are **small branches** of arteries that **lead** into capillaries.
2. Their **narrow diameter** provides **resistance**, helping regulate arterial pressure.
3. The **smooth muscle** in arteriole walls can constrict (vasoconstriction) or relax (vasodilation).
4. **Vasoconstriction** increases peripheral resistance and **raises blood pressure**.
5. **Vasodilation** decreases peripheral resistance and **lowers blood pressure**.
6. Arterioles distribute blood to various organs based on **tissue demand** (e.g., more flow to muscles during exercise).
7. The **tunica media** is relatively pronounced for their small size, enabling precise regulation of vessel diameter.
8. **Local chemical signals** (e.g., CO_2, pH) and **hormones** (e.g., adrenaline) influence arteriole tone.
9. Arterioles directly impact **capillary pressure**, ensuring optimal conditions for exchange.
10. Dysfunction in arteriole regulation can contribute to **hypertension** or inadequate tissue perfusion.



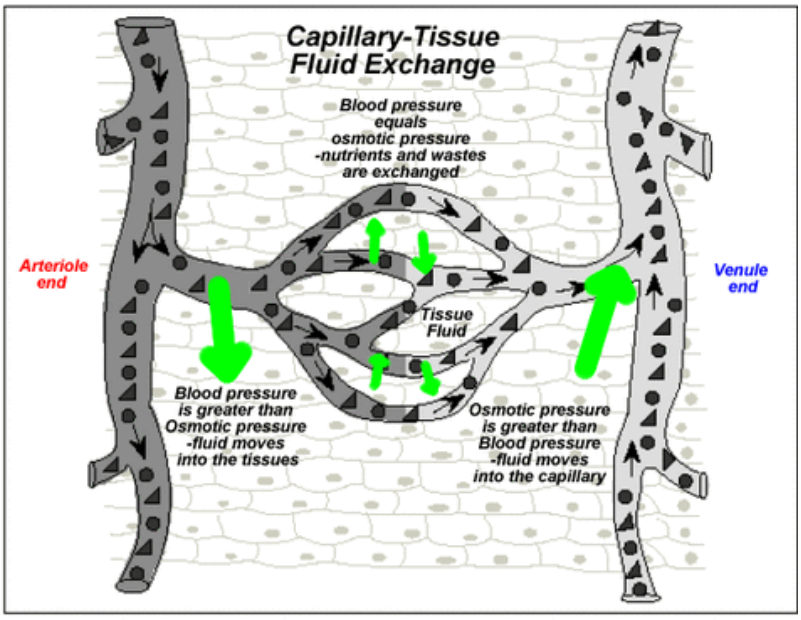
Card 5: Venules – The Small Veins

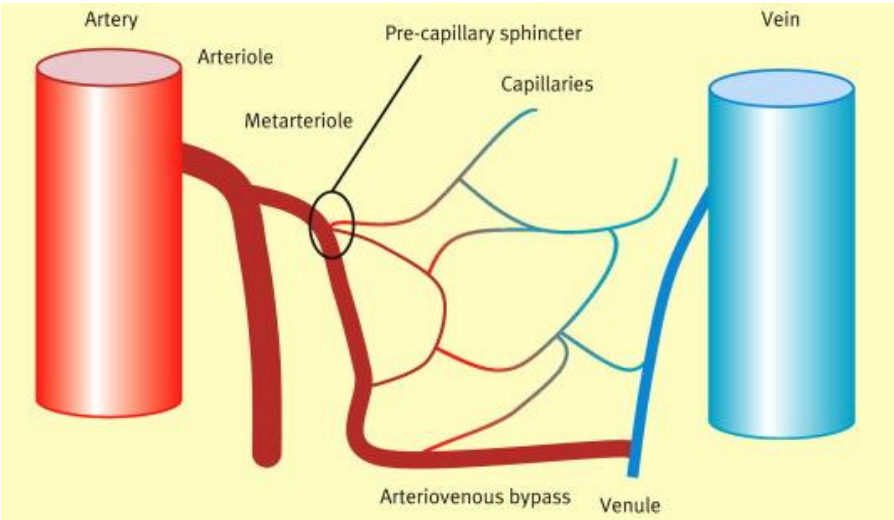
1. Venules are **small vessels** that collect blood from **capillary beds**.
2. They converge to form **larger veins**, eventually returning blood to the heart.
3. **Walls** are thinner than arterioles, reflecting **lower blood pressure**.
4. Like veins, venules have **three layers**, though the tunica media is much **less developed**.
5. **Valves** can be present in some venules, though less common than in larger veins.
6. They help regulate the **return of deoxygenated blood** from tissues.
7. **Inflammation** can increase venule permeability (allowing WBCs to exit blood vessels more easily).
8. **Pressure** in venules is still low, requiring continued assistance from muscular pumps to move blood.
9. Venule damage or blockage can cause local **edema** (fluid accumulation) by hindering proper drainage.



Card 6: Capillaries – The Exchange Vessels

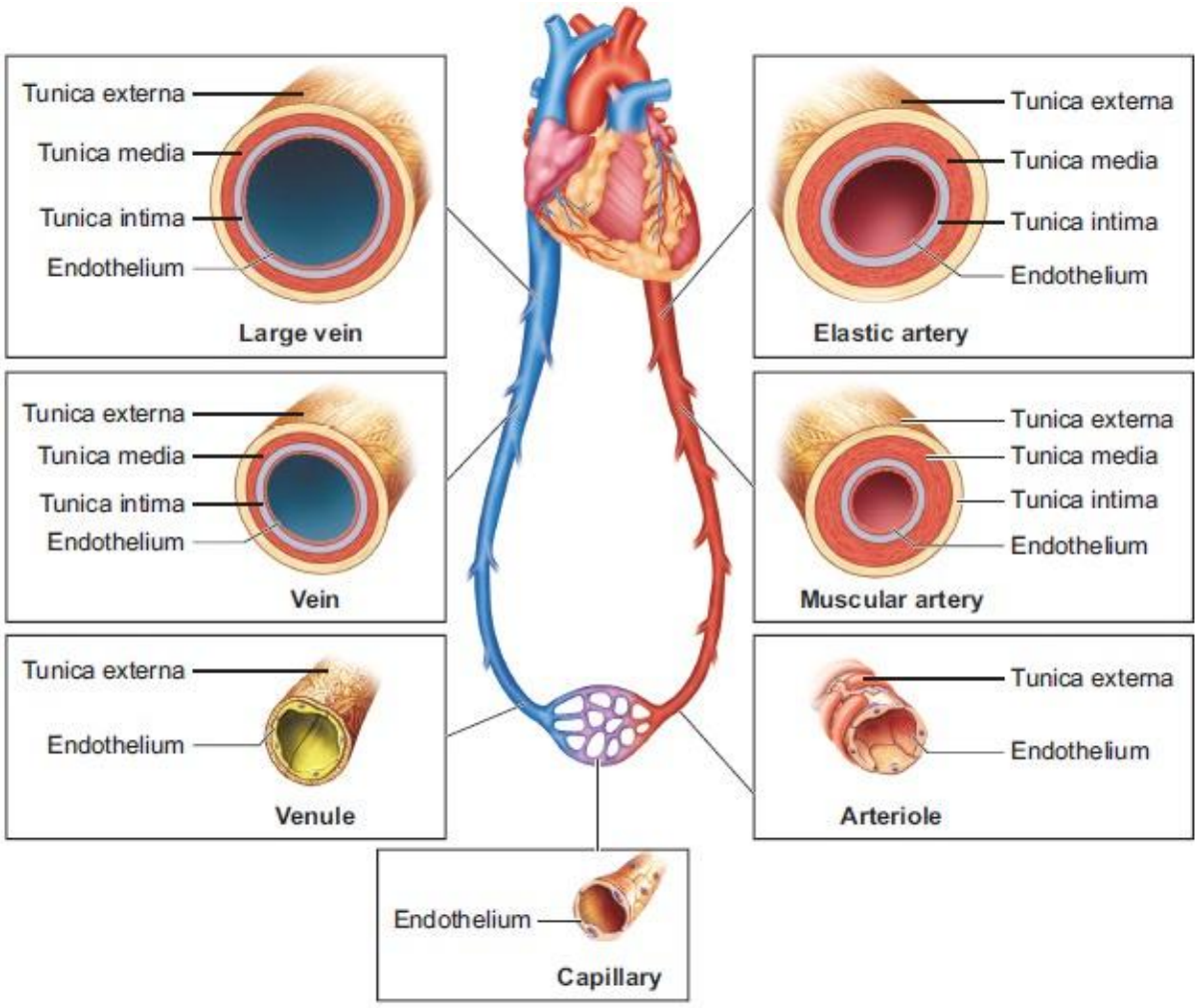
1. **Capillaries** are the smallest blood vessels, typically around **7 µm** in diameter.
2. They have a **single-layer** endothelium (tunica intima) with **squamous epithelial cells**.
3. This thin wall permits **rapid diffusion** of gases (O_2, CO_2), nutrients, and wastes.
4. RBCs often pass in **single file**, optimizing contact for gas exchange.
5. **Capillary beds** form an extensive network in most tissues, enhancing total surface area.
6. Blood flow is relatively **slow** through capillaries, allowing sufficient time for exchange.
7. Not all capillaries are **open** at once; **precapillary sphincters** regulate perfusion based on tissue needs.
8. **Continuous capillaries** (with tight junctions) are common in muscles, skin, and CNS.
9. **Fenestrated capillaries** have pores, found in kidneys and intestines for faster filtration.
10. **Sinusoidal capillaries** (with large gaps) exist in liver and bone marrow for passage of larger molecules/cells.





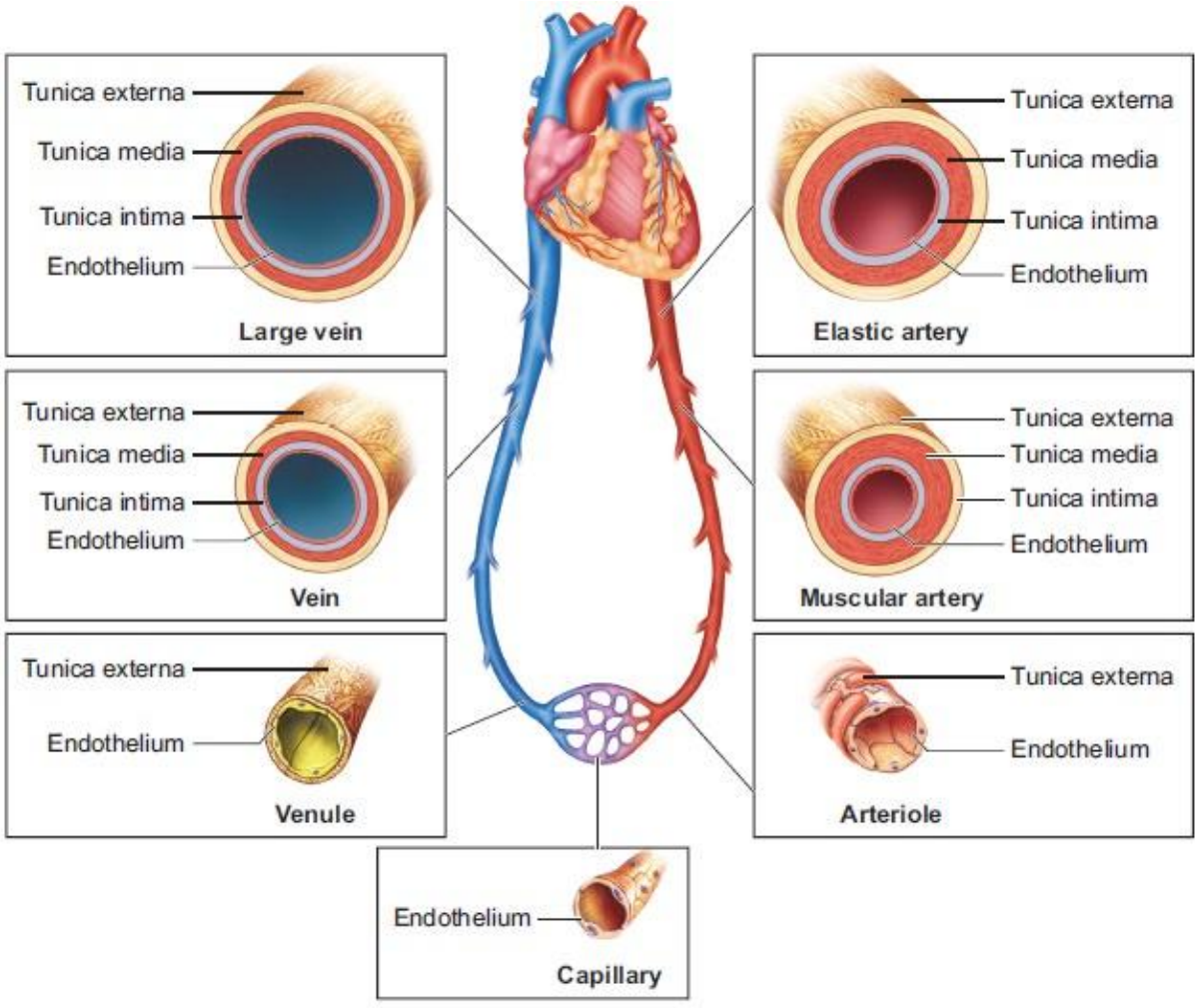
Card 7: Detailed Artery Structure & Function

1. **Three main layers**: Tunica intima (endothelium + elastic fibers), tunica media (smooth muscle + elastic tissue), tunica externa (collagen).
2. The **tunica intima** is crucial for **smooth blood flow**, reducing turbulence.
3. The **tunica media** is typically the **thickest** layer in arteries for **withstanding high pressure**.
4. The **tunica externa** provides **structural support** and anchors the artery.
5. **Elastic arteries** (e.g., aorta) have more **elastic fibers** to buffer pressure changes.
6. **Muscular arteries** have more **smooth muscle** for precise control over lumen diameter.
7. Arteries **supply organs** with well-oxygenated blood (except the pulmonary artery).
8. **Pulse** can be felt in muscular arteries due to pressure waves from the heart.
9. Arterial **elastic recoil** helps maintain blood flow even when the heart is in diastole.
10. **Atherosclerosis** (plaque buildup in arterial walls) impedes blood flow and can lead to cardiovascular disease.



Card 8: Detailed Vein Structure & Function

1. Veins also have **three layers** (tunica intima, tunica media, tunica externa) but with **less muscle and elastin**.
2. The **lumen** of a vein is typically **wider** than that of a corresponding artery.
3. **Valves** in veins are formed by folds of the tunica intima; they **prevent backflow** of blood.
4. The **thin tunica media** reflects lower blood pressure and less need for recoil.
5. Veins serve as **capacitance vessels**, capable of holding large blood volumes.
6. **Skeletal muscle pumps** in the limbs compress veins, aiding venous return against gravity.
7. **Respiratory pump**: Inhalation decreases pressure in the thoracic cavity, helping draw blood up from the abdomen.
8. **Deep veins** run close to major arteries; **superficial veins** lie beneath the skin.
9. **Phlebitis** (inflammation of veins) or **thrombi** (clots) can obstruct venous return.
10. Most veins carry **deoxygenated blood**, except for the **pulmonary veins**, which transport oxygenated blood from the lungs.



Card 9: Blood Pressure in the Circulatory System

1. **Systemic circulation**: Higher pressure to distribute blood throughout the entire body.
2. **Pulmonary circulation**: Lower pressure to protect delicate lung capillaries from damage.
3. **Arterial pressure** peaks during systole (ventricular contraction) and falls during diastole (ventricular relaxation).
4. **Mean arterial pressure (MAP)** is a useful indicator of tissue perfusion.
5. **Arterioles** are primary regulators of peripheral resistance, thus influencing overall blood pressure.
6. **Capillary pressure** is moderate, ensuring slow flow for nutrient and gas exchange.
7. **Venous pressure** is the lowest, relying on external pumps and valves to move blood back to the heart.
8. **Baroreceptors** in the carotid sinus and aortic arch detect blood pressure changes and regulate heart rate and vessel diameter.
9. **Hormones** (e.g., adrenaline, angiotensin II) also adjust arteriole constriction and influence blood pressure.
10. Chronic **hypertension** damages blood vessels and organs, while **hypotension** can lead to inadequate perfusion.

Suggested Image:
A simplified pressure graph across the vascular tree: high in arteries (near the heart), decreasing through arterioles, moderate in capillaries, and lowest in veins.

How to Use the Cards

1. **Distribute** these 10 cards among 10 students.
2. Each student **studies** their fact-rich card and **creates or finds** a relevant image (use the suggestions above).
3. They **teach** the group by explaining the **ten points** and using the **visual aid** to illustrate the concept.
4. This approach combines **visual learning** with **active teaching**, reinforcing A-Level Biology knowledge about blood vessels.