Understanding the Cardiac Cycle and Heart Failure

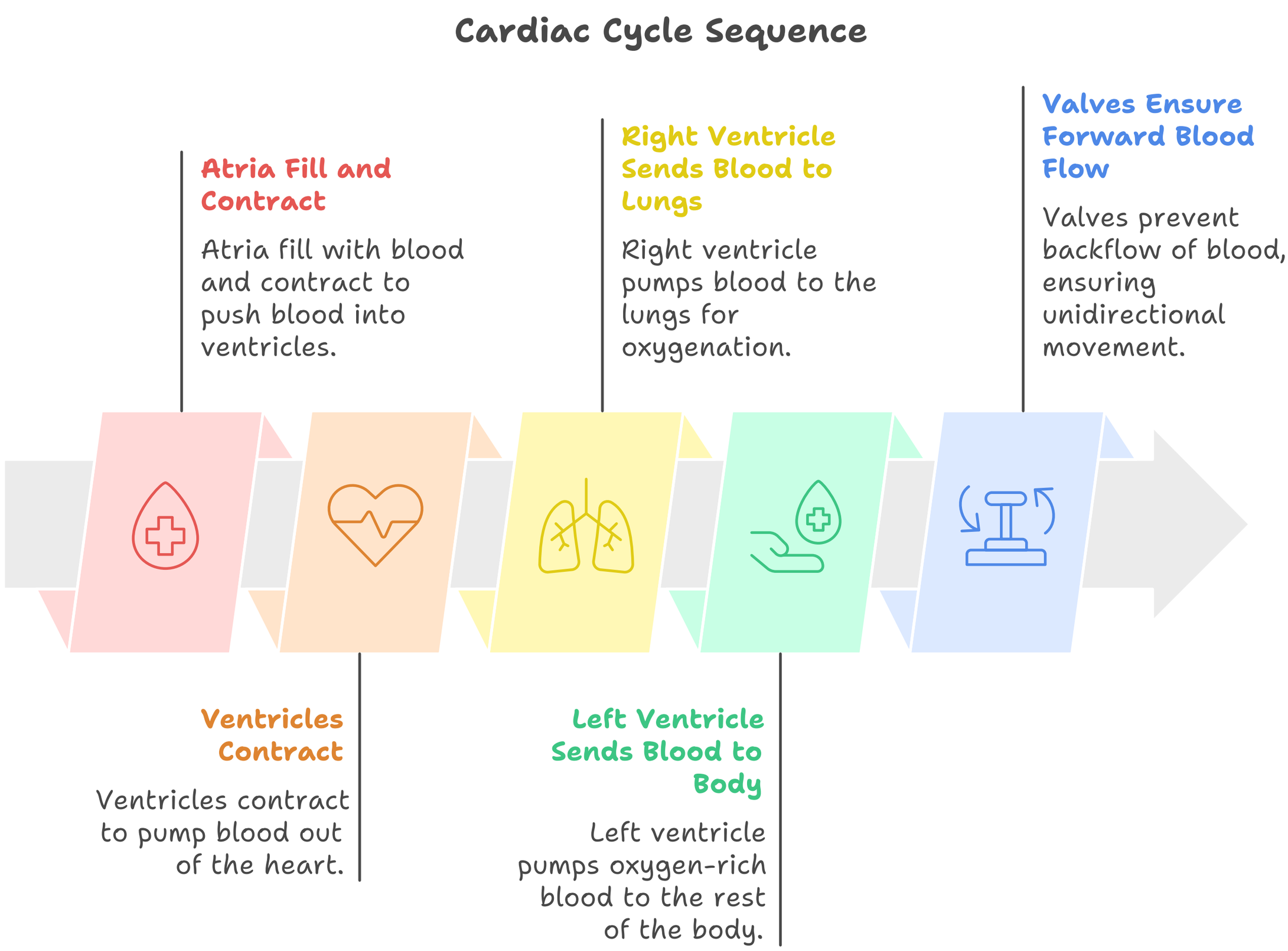
Human Anatomy & Physiology – Undergraduate Level

1. The Cardiac Cycle – The Heart's "Pump Routine"
Think of the heart as a **two-sided pump** working in perfect rhythm to keep blood moving.
Each heartbeat has **two main phases**:

- **Diastole (Relax Phase):** The heart chambers relax and fill with blood.
- **Systole (Contract Phase):** The chambers contract and pump blood out.

Step-by-step :

1. **Atria fill and contract** → push blood into the ventricles.
2. **Ventricles contract** → push blood out of the heart:
    - **Right ventricle** → sends blood to the lungs (to pick up oxygen).
    - **Left ventricle** → sends oxygen-rich blood to the rest of the body.
3. **Valves** (like one-way doors) ensure blood moves forward, not backward.



Everyday analogy: Think of filling and squeezing a water balloon. When you squeeze (systole), water shoots out. When you release (diastole), the balloon fills again—this repeats with every beat.

2. How Heart Failure Develops

Heart failure doesn't mean the heart stops—it means it's **not pumping effectively enough** to meet the body's needs.It can happen on the **right side**, **left side**, or both.

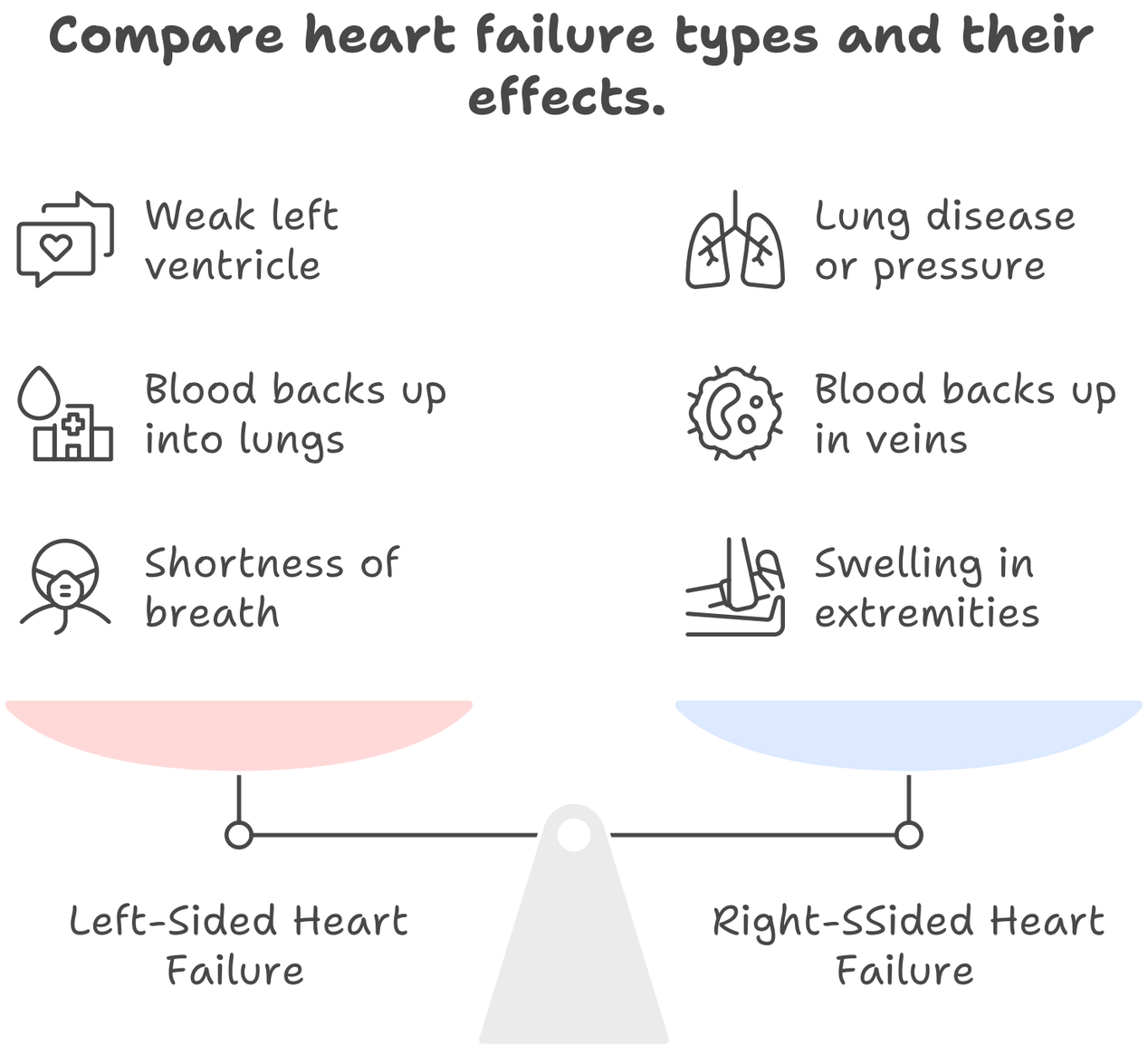
A. Left-Sided Heart Failure

- **Cause:** The left ventricle becomes weak or stiff and can't pump blood efficiently to the body.
- **What happens:**
    - Blood backs up into the lungs.
    - Fluid leaks into lung tissue → causes **shortness of breath**, especially when lying down or during activity.

Everyday example: Imagine a garden hose (the left ventricle) that's clogged. Water (blood) can't flow out properly, so it backs up into the supply tank (lungs), causing overflow (fluid buildup).

B. Right-Sided Heart Failure

- **Cause:** Often follows left-sided failure, or results from lung disease or high pressure in lung arteries.
- **What happens:**
    - Blood backs up in the body's veins.
    - Leads to **swelling** in the feet, ankles, and abdomen.



Everyday example: Think of traffic jam spillover: if the main road (left side) is blocked, cars (blood) back up into the side streets (body veins).

3. Summary Chart

Left	Pumps oxygen-rich blood to body	Blood backs up into lungs	Shortness of breath, cough, fatigue
Right	Pumps blood to lungs for oxygen	Blood backs up in body	Leg/ankle swelling, weight gain, enlarged liver

4. Key Takeaways

- The heart works as a coordinated **pump with two sides**.
- **Left failure** affects the **lungs** (back pressure).
- **Right failure** affects the **body** (fluid buildup).
- Both reduce oxygen delivery and energy—leading to tiredness and shortness of breath.