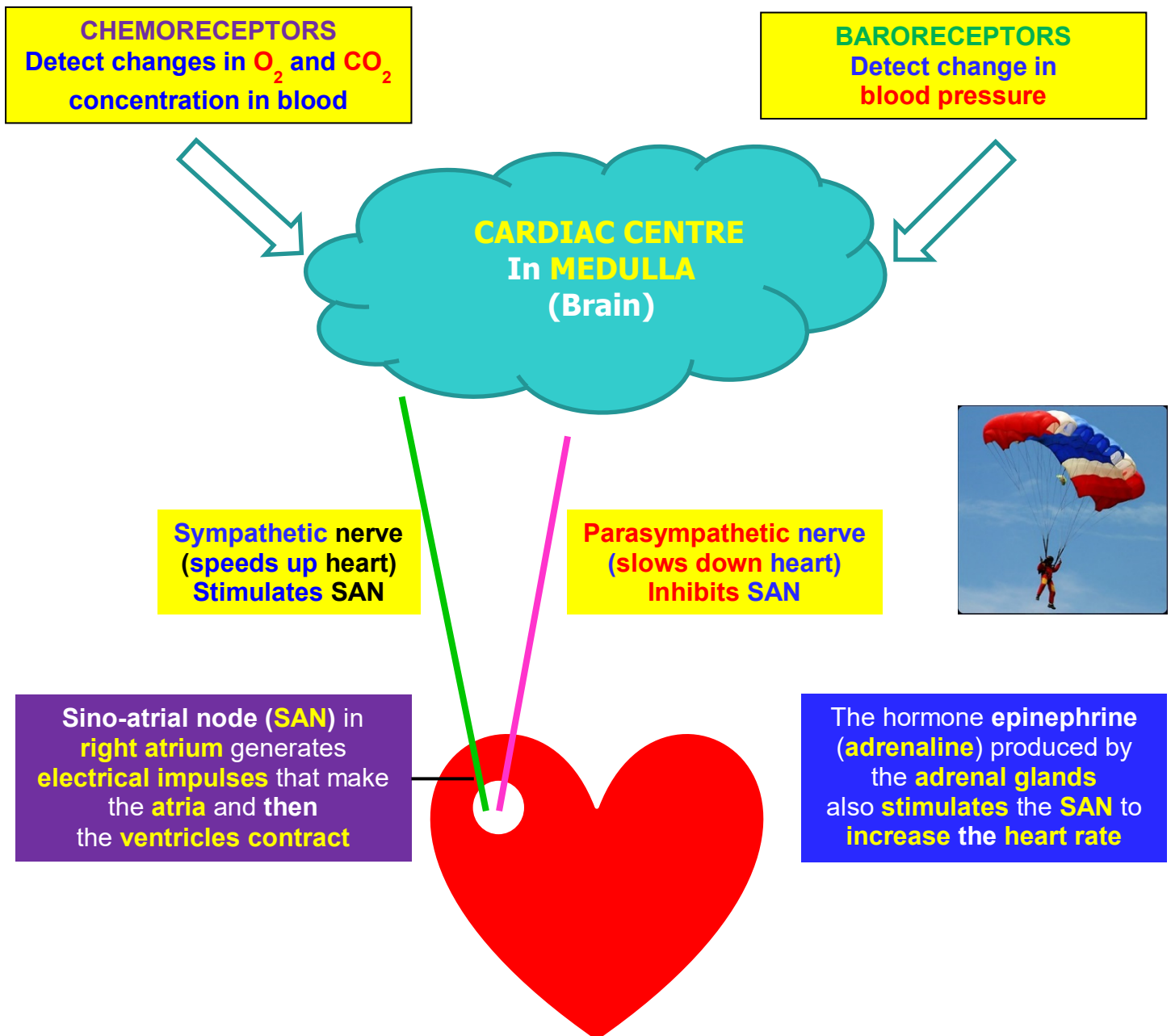


## A. CONTROL OF HEART RATE

- Heart muscle is **myogenic** - it can **contract** on **its own**, **without** being **stimulated** by **nerves**.
- However, **nerves** are **needed** to **change** the **rate** at which it **beats**.
- The **right atrium** contains a group of **specialised muscle cells** called the **sinoatrial node (SAN)**.
- The **sinoatrial node** acts as a **pacemaker**.
- It sends out **electrical impulses** that stimulate **contraction** of the heart **muscle** as they travel through the **walls** of the **atria** and then the **walls** of the **ventricles**.
- The **heart rate** can be **increased** or **decreased** by **impulses** brought to the **sinoatrial node** through **two nerves** from the **medulla** of the brain.



THE **HEART RATE** DEPENDS UPON **HOW MANY IMPULSES** ARE SENT ALONG THE **SYMPATHETIC NERVE** RELATIVE TO THE **PARASYMPATHETIC NERVE**

## B. THE CARDIAC CYCLE

- This is what happens in the **heart** during **one beat**.
- '**Systole**' means **contract** and '**Diastole**' means **relax**.



### 1. ATRIA CONTRACT (ATRIAL SYSTOLE)

- **Atria** muscle walls **contract**.
- **Atrioventricular valves open** as **atria pressure > ventricle pressure**.
- **Semilunar valves are closed** as **artery pressure > ventricle pressure**.
- **Ventricles fill** with **blood**.



### 2. VENTRICLES CONTRACT (VENTRICULAR SYSTOLE)

- **Ventricle** muscle walls **contract**.
- **Atrioventricular valves close** when **ventricle pressure > atria pressure**.
- This prevents **backflow of blood** into the **atria**.
- **Semilunar valves open** as **ventricle pressure > artery pressure**.
- **Blood** pumped into **arteries**.
- **Atria refill** with **blood** from the **veins**.



### 3. VENTRICLES RELAX (VENTRICULAR DIASTOLE)

- **Ventricles stop contracting** so **pressure** inside them **falls**.
- **Semilunar valves close** as **ventricle pressure < artery pressure**.
- This **prevents backflow of blood** into the **ventricles**.
- **Atria fill** with **blood**.
- **Atrioventricular valves will open** when **ventricle pressure < atria pressure**.
- **Next cardiac cycle starts** when the **walls of the atria contract**.

### C. GALEN (2<sup>ND</sup> CENTURY)



**“Blood is produced by the liver, pumped out by the heart and consumed in the other body organs”**

### D. WILLIAM HARVEY (17<sup>TH</sup> CENTURY)



1. **Blood flow** through **vessels** is **unidirectional** (one-way) with **valves** that **prevent backflow**.
2. **Blood pressure** in **arteries** is **too high** for **blood** to be **consumed** by **body organs** after being pumped out by the heart!
3. The heart pumps **blood out** in **arteries** and **blood returns** to it in **veins**.
4. Predicted **small, fine vessels**, which would **connect** arteries to veins (= capillaries).

**Suggest which discovery was an indication that the heart pumps blood to the body through arteries?**

- A. The amount of blood pumped exceeds that of blood produced
- B. Blood could easily be pushed up a limb vein, but not down
- C. The observation that there were pores between the right and left atria
- D. The heart swelled up when the arteries were tied in an animal experiment ✓

**NOTE:** The other responses have **nothing to do** with the **conclusion**.