Special Circulation

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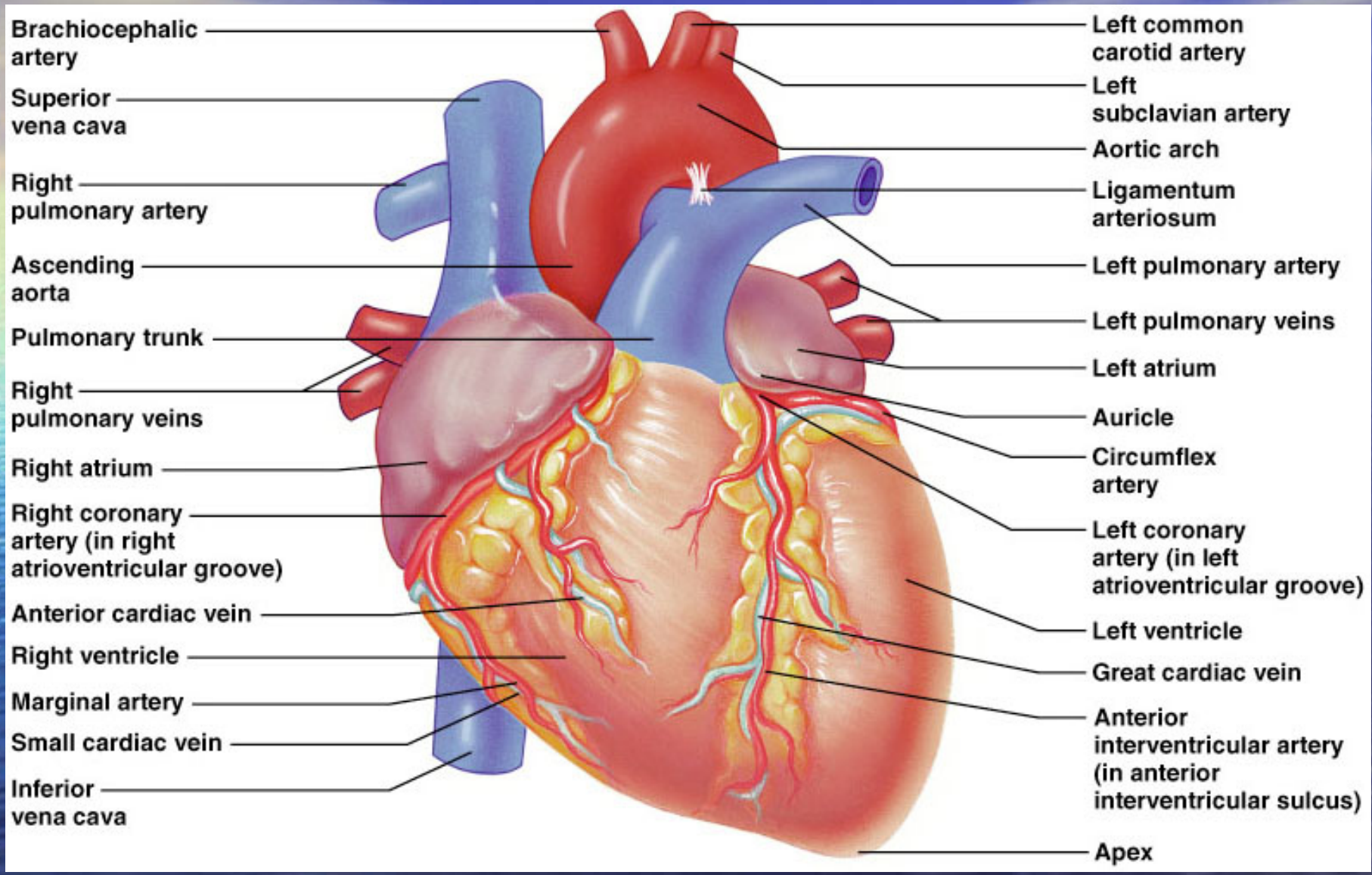
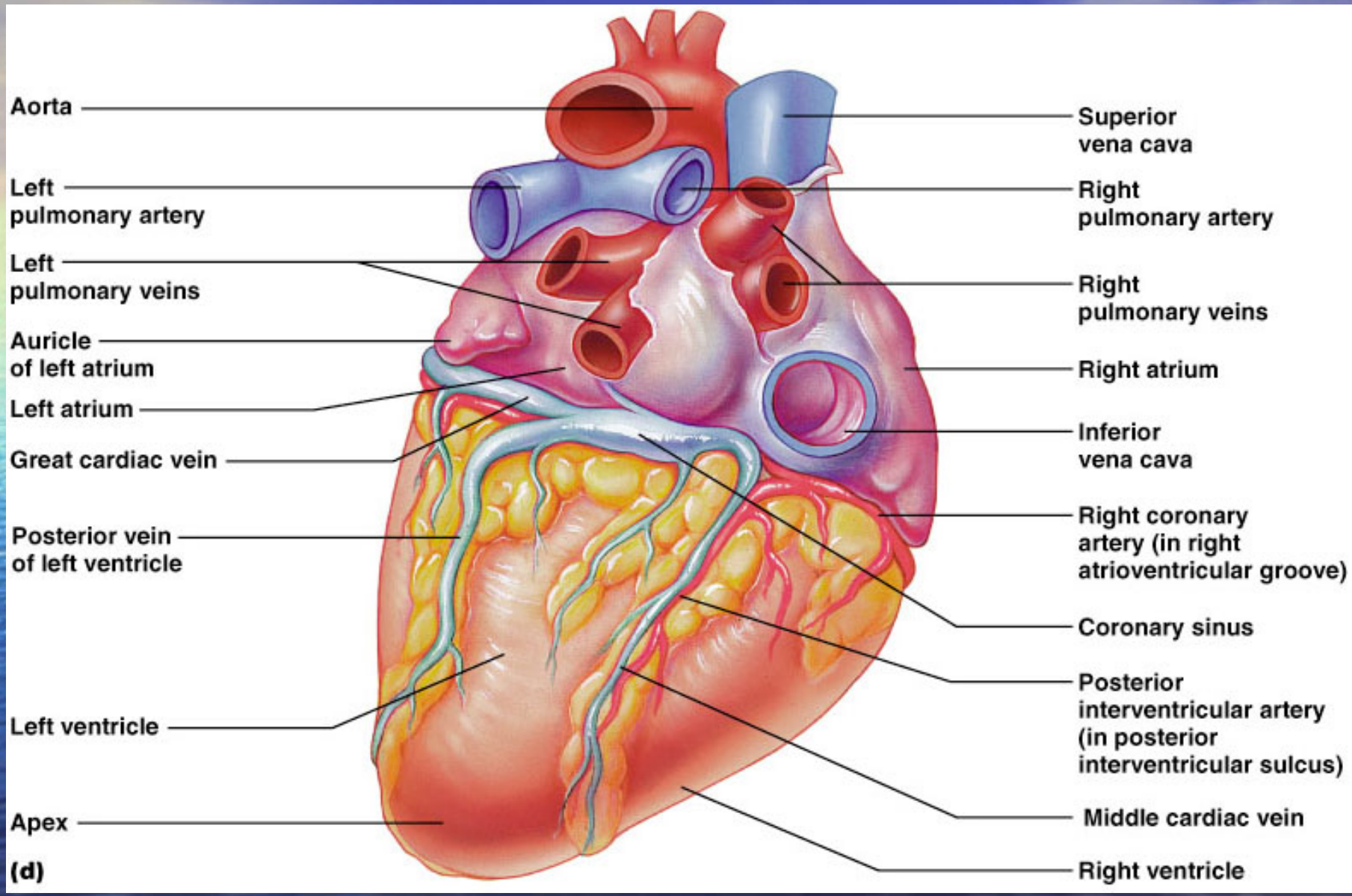
CORONARY CIRCULATION

- Provides blood flow to the heart
- Heart m. consumes as much O2 as does equal mass of SM during vigorous Ex
- Heart tissue extracts max amount of O2 during rest
- Limited anaerobic glycolysis in the heart, so the only way to ↑ E is by ↑ BF

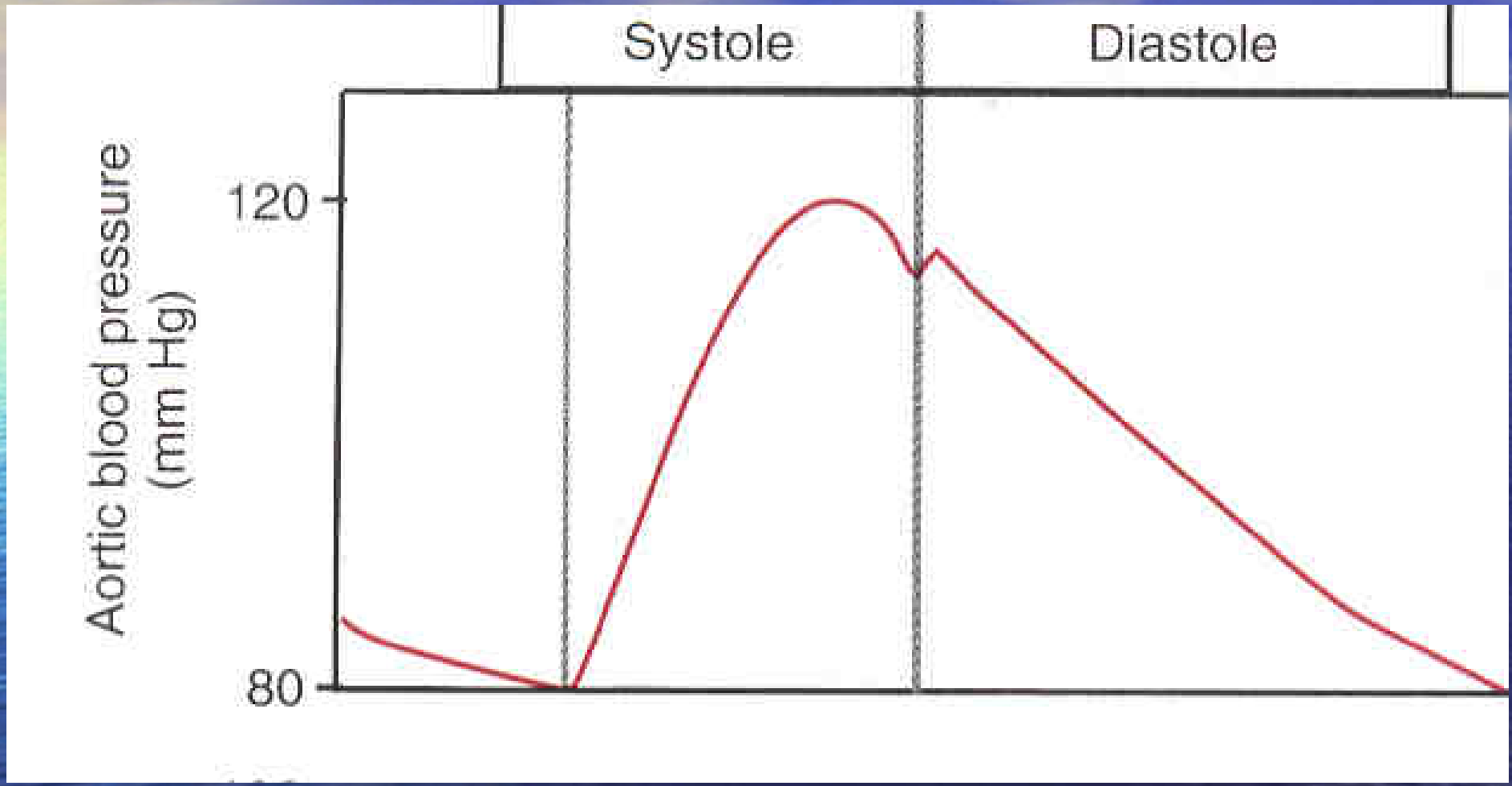

Brachiocephalic artery
Superior vena cava
Right pulmonary artery
Ascending aorta
Pulmonary trunk
Right pulmonary veins
Right atrium
Right coronary artery (in right atrioventricular groove)
Anterior cardiac vein
Right ventricle
Marginal artery
Small cardiac vein
Inferior vena cava
Left common carotid artery
Left subclavian artery
Aortic arch
Ligamentum arteriosum
Left pulmonary artery
Left pulmonary veins
Left atrium
Auricle
Circumflex artery
Left coronary artery (in left atrioventricular groove)
Left ventricle
Great cardiac vein
Anterior interventricular artery (in anterior interventricular sulcus)
Apex


Aorta
Left pulmonary artery
Left pulmonary veins
Auricle of left atrium
Left atrium
Great cardiac vein
Posterior vein of left ventricle
Left ventricle
Apex
(d)
Superior vena cava
Right pulmonary artery
Right pulmonary veins
Right atrium
Inferior vena cava
Right coronary artery (in right atrioventricular groove)
Coronary sinus
Posterior interventricular artery (in posterior interventricular sulcus)
Middle cardiac vein
Right ventricle

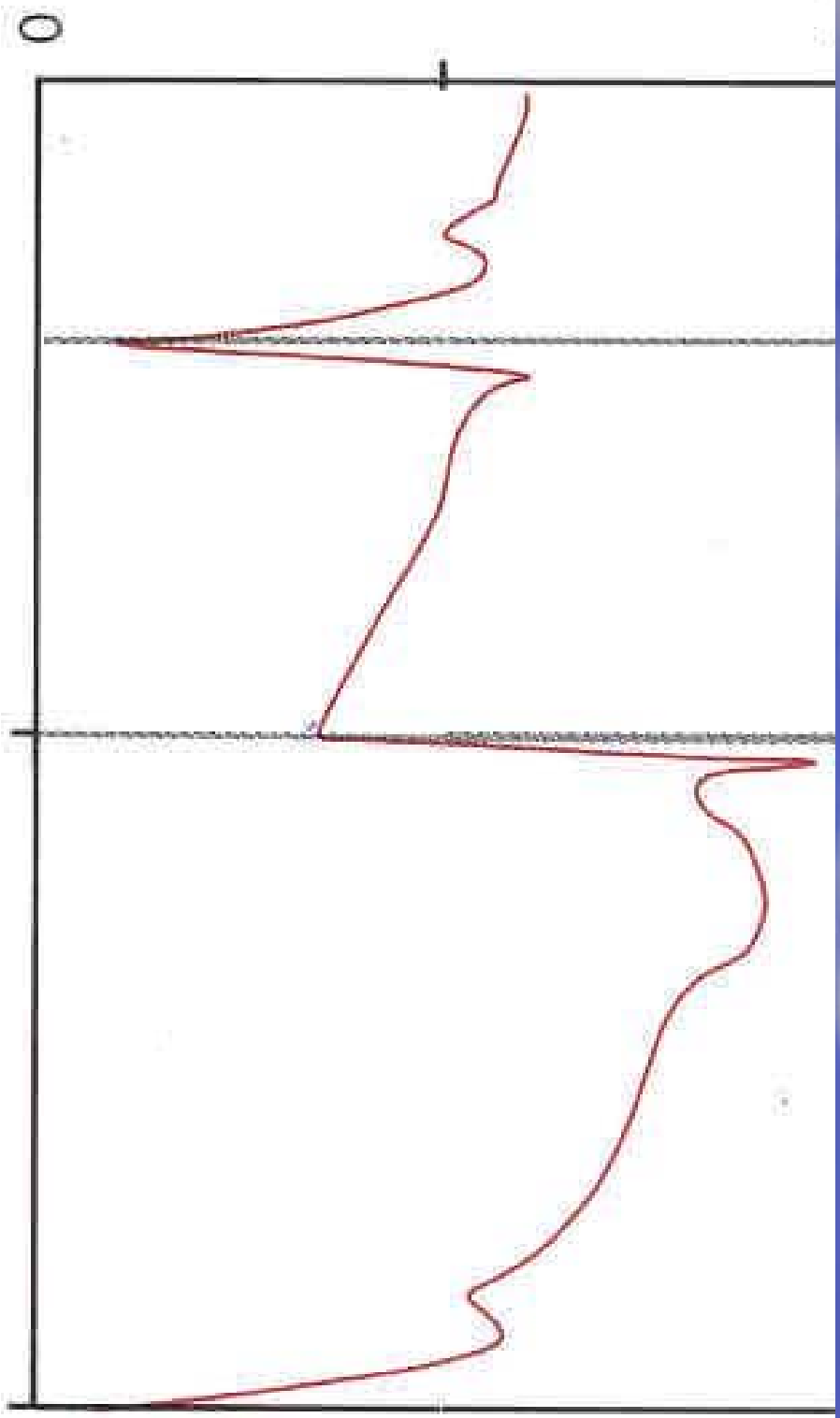
CORONARY CIRCULATION

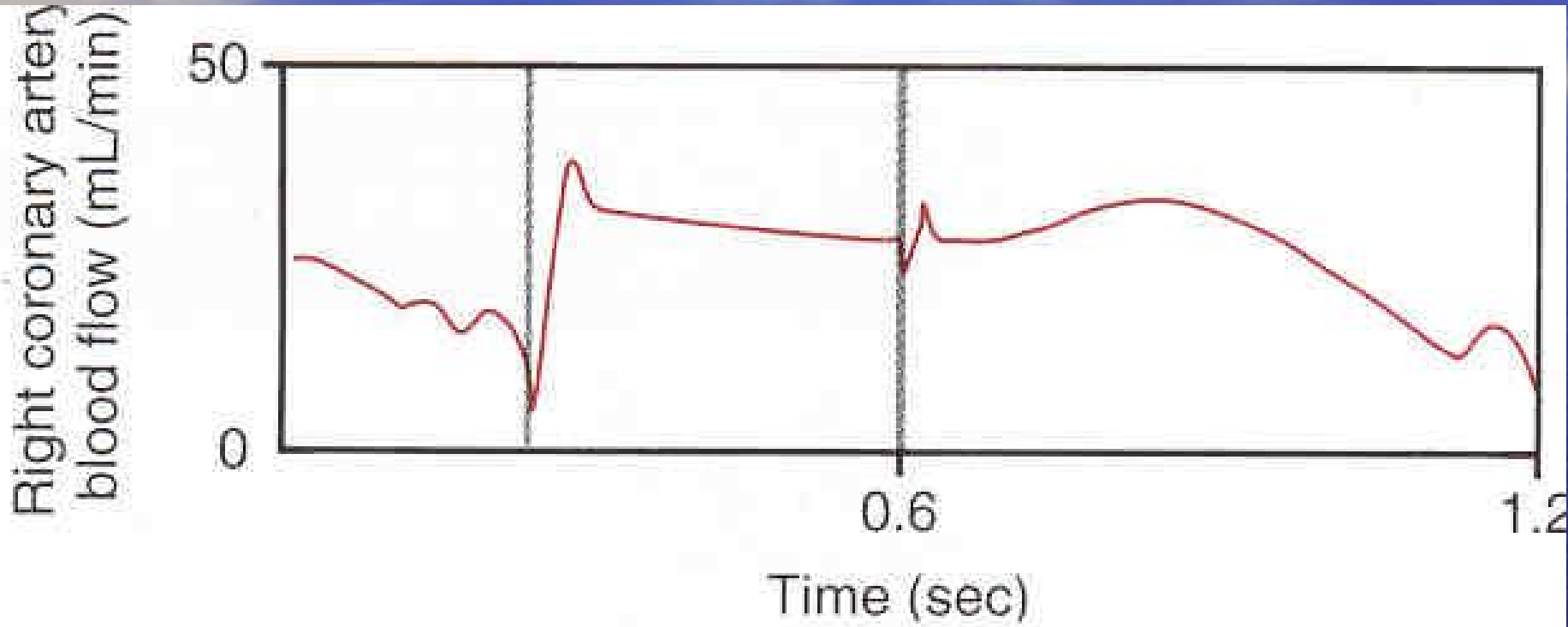
- Perfusion of cardiac muscle from epicardium – endocardium
- Cardiac systole →

  CBF is 10-30% of that during Cardiac diastole
- Systolic compression on RV is minimum
- Systolic compression has more effect on BF in the endocardial layer


Systole
Diastole
Aortic blood pressure
(mm Hg)
120
80

Left coronary artery
blood flow (mL/min)




Right coronary artery blood flow (mL/min)
50
0
0.6
1.2
Time (sec)

Coronary Vascular Resistance

- 75 % of CVR occurs in vessels with diameter ≤ 200 um (small arteries and arterioles)

Mechanisms for Controlling Blood Flow

- Local Control:
  - Autoregulation

    e.g., increase or decrease arterial pressure
  - Active hyperemia

    BF to an organ is proportional to its metabolic activities
  - Reactive hyperemia

    an increase in BF in response to a previous reduction in BF to certain organ

Hypothesis explains the local control of BF

- Myogenic hypothesis

  explains autoregulation: ↑ vascular smooth m. stretching → constriction → ↑ resistance

- Metabolic hypothesis

  The O2 delivery to the tissue can be matched the O2 consumption by changing the Resistance

CORONARY CIRCULATION

- Factors affecting CBF:

➢ Chemical factors:

1. - ↑ cardiac metabolism → ↑ Adenosine
2. NO
3. H
4. CO_2
5. ↓ O_2

CORONARY CIRCULATION

- Sympathetic innervation
- Constrictor mechanism is important in equalizing BF thru the layers than ↓ BF
- $\alpha 1$ (in CA and large arterioles) makes constriction
- $\beta 2$ (in small arterioles) makes vasodilation
- $\beta 1$ activation → heart rate

CORONARY CIRCULATION

- Sympathetic innervation
- Partial vasoconstriction of CA limits the retrograde BF during ventricular systole
- Prevents part of decreased flow in deep layers
- ↓ coronary vascular resistance (CVR)