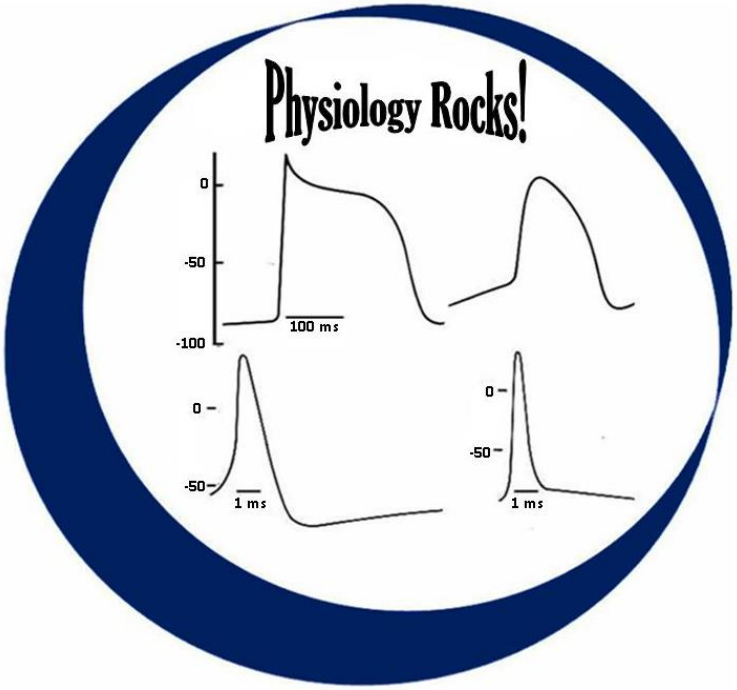
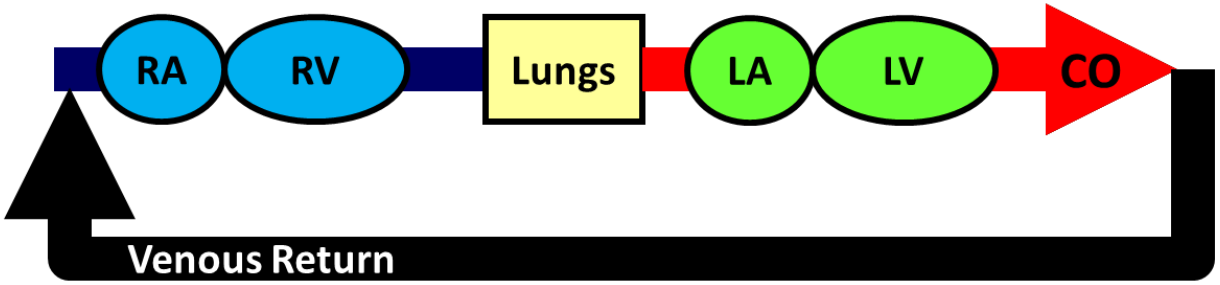
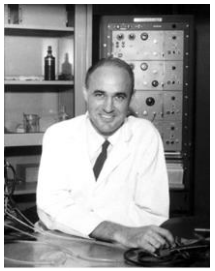
Lecture 15
Cardio-Vascular Interactions



HN Mayrovitz PhD
mayrovit@nova.edu
drmayrovitz.com

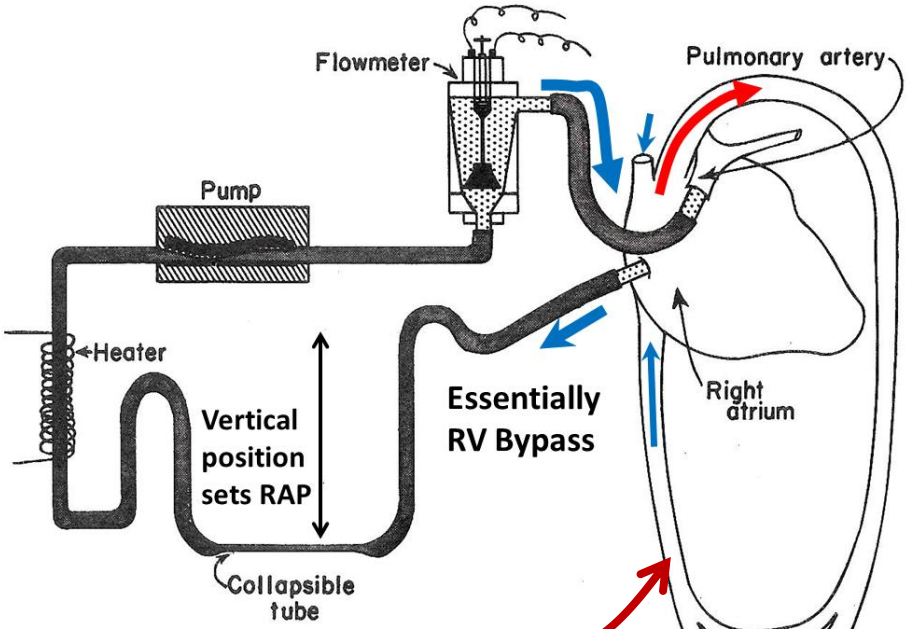
Dependence of Venous Return on RAP



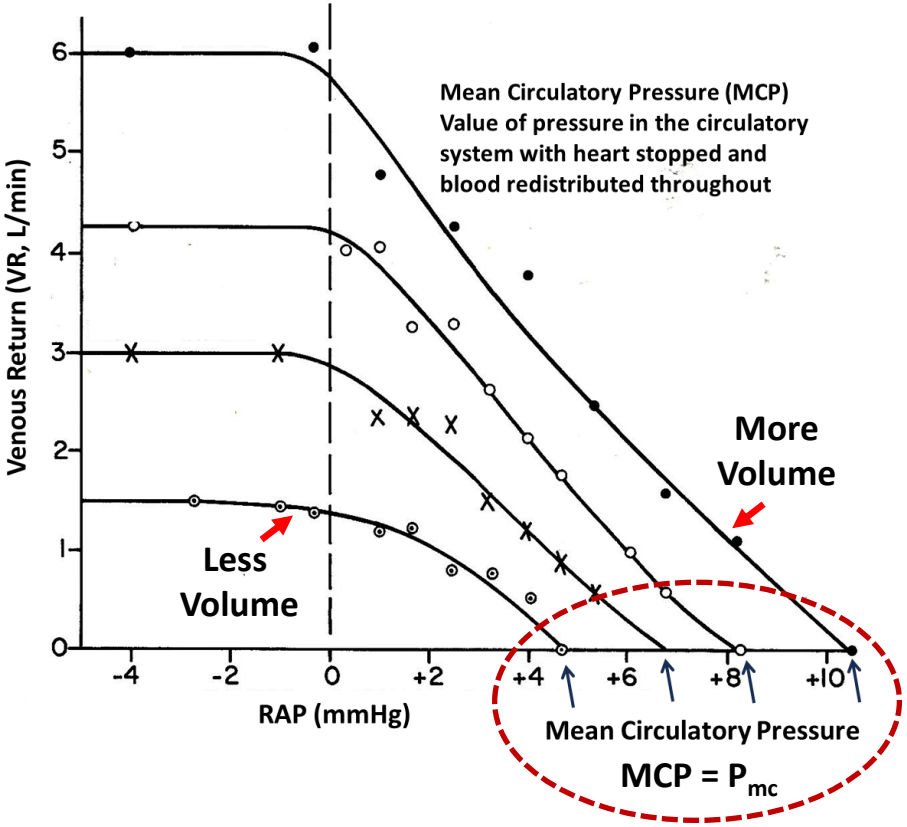


Arthur Guyton
1919-2003 (April 3)

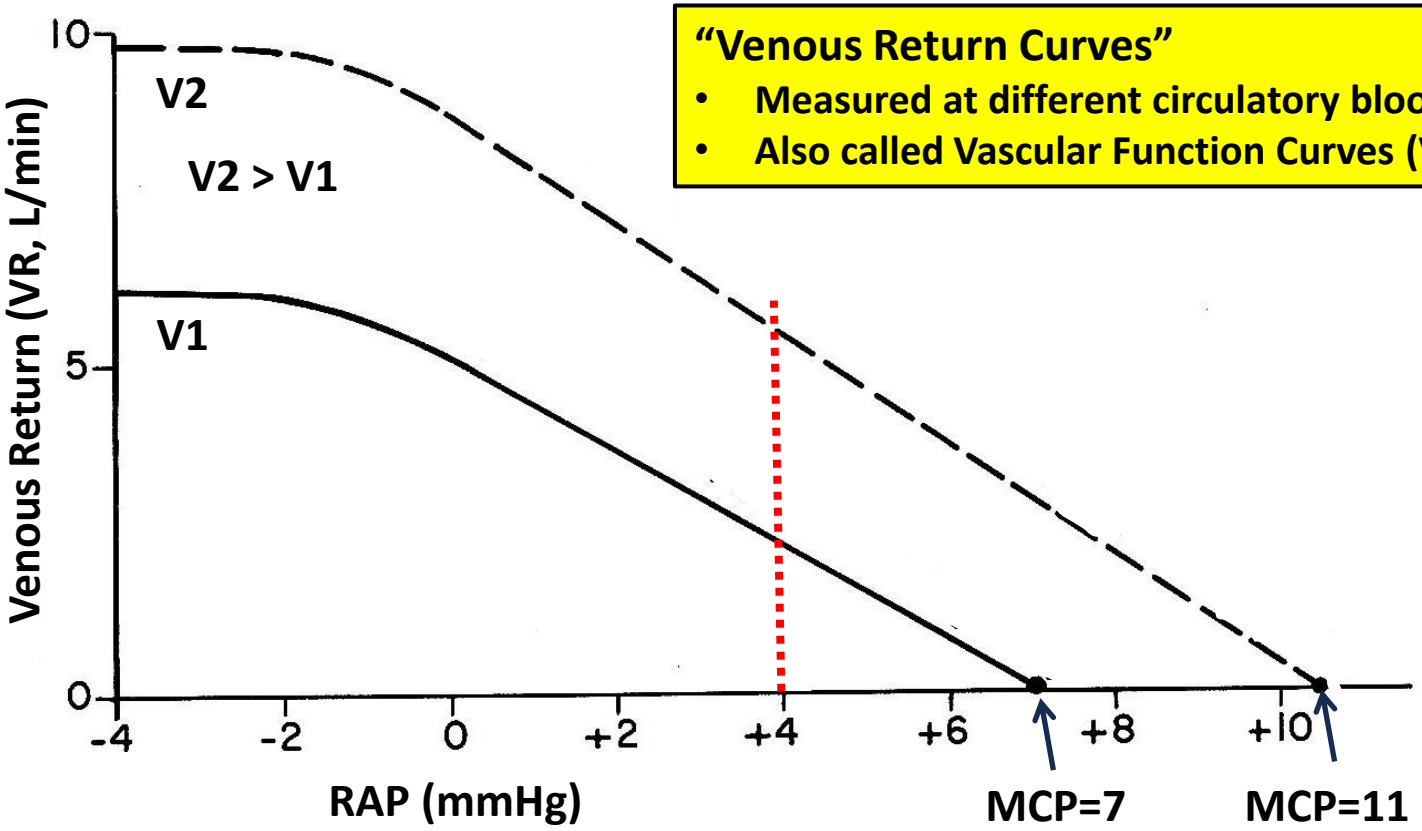
Arthur C. Guyton, MD | Circulation (ahajournals.org)



Increase blood volume in steps and for each volume, vary RAP



"Pressure Gradient for Venous Return" (PGVR)



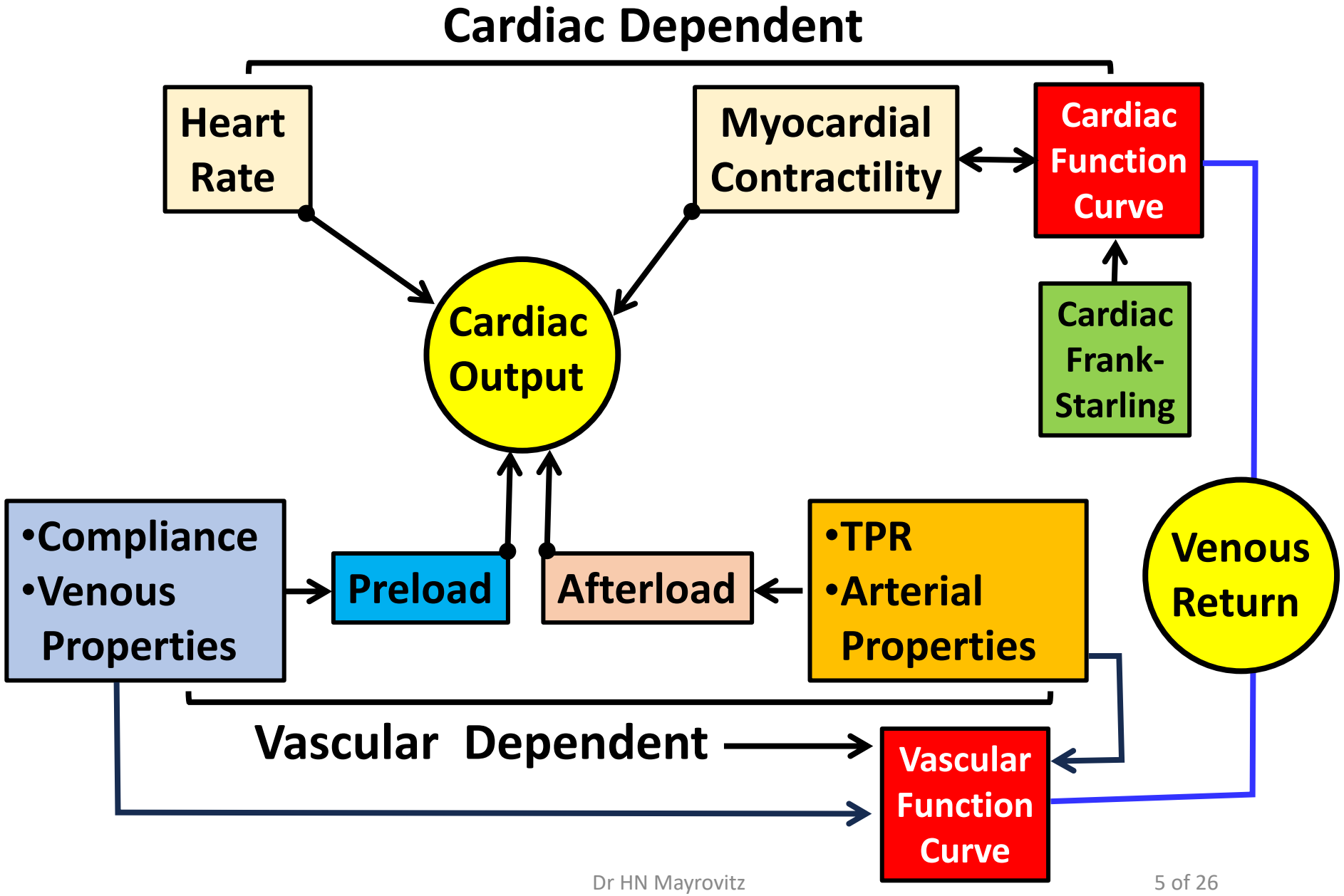
"Venous Return Curves"
- Measured at different circulatory blood volumes
- Also called Vascular Function Curves (VFC)

PGVR = MCP - RAP

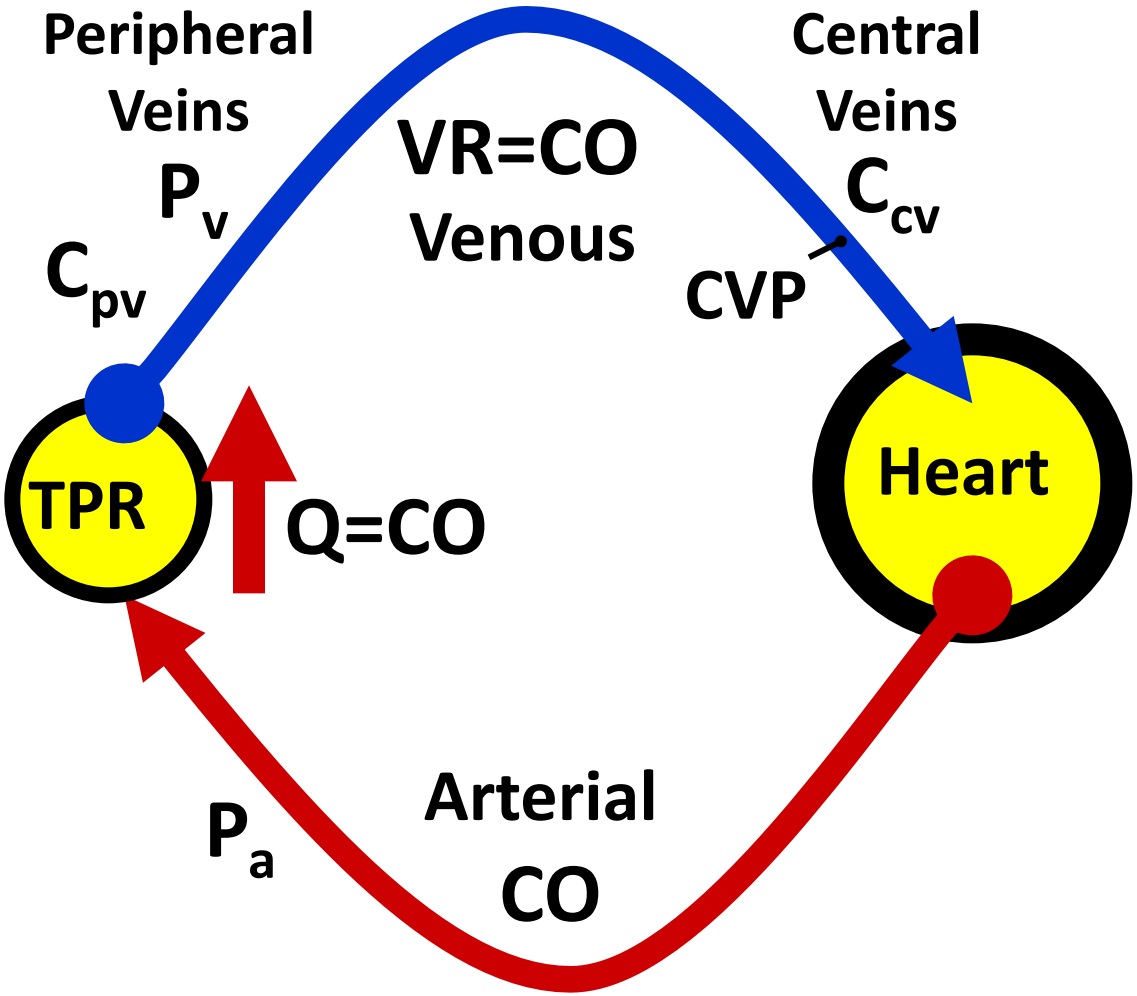
@ RAP = 4 mmHg
PGVR = 7-4 = 3 mmHg for V1
PGVR = 11-4 = 7 mmHg for V2
Consistent with the increased VR at V2

The Cardiovascular Representation

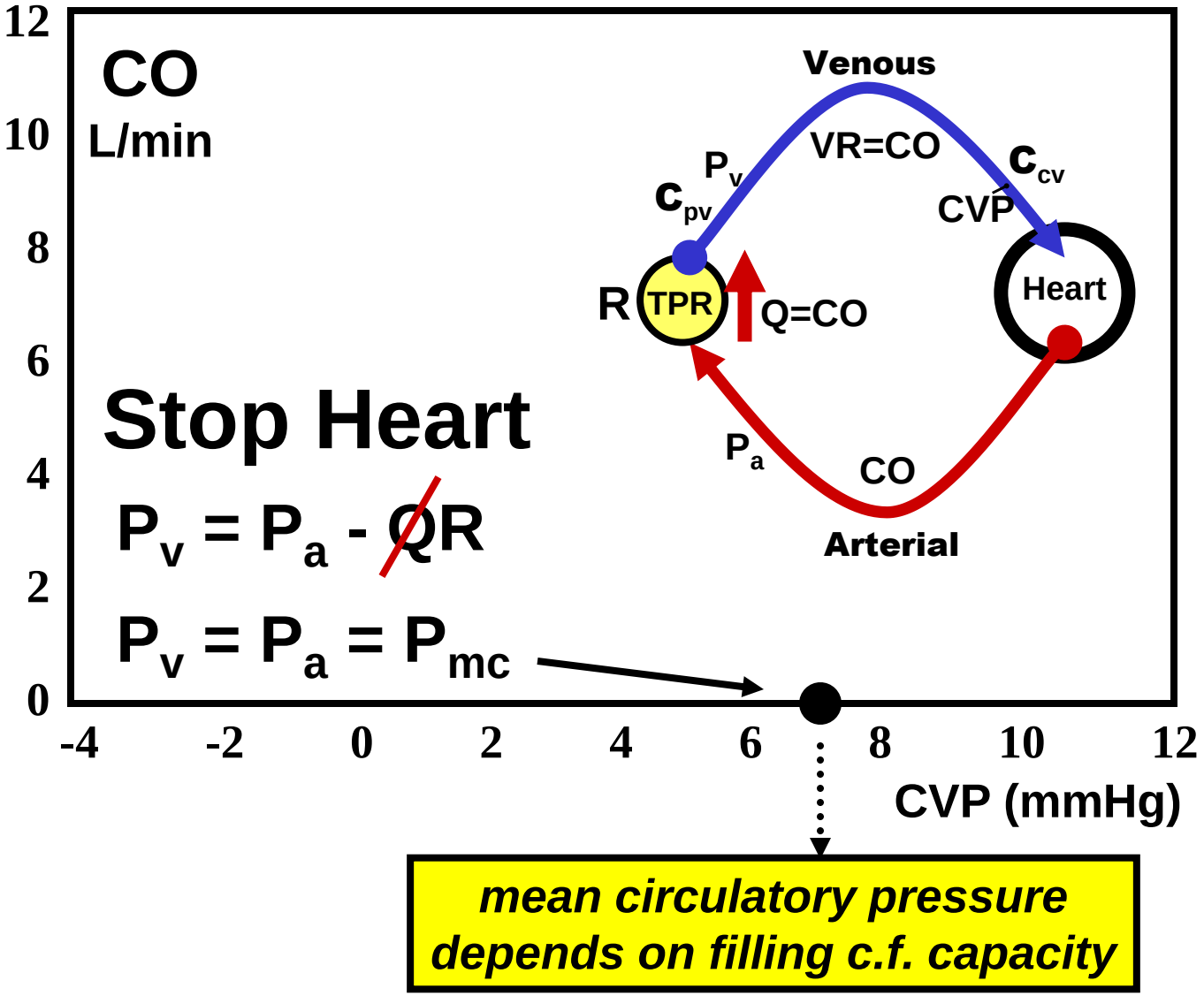
Cardiac Output Major Determinants



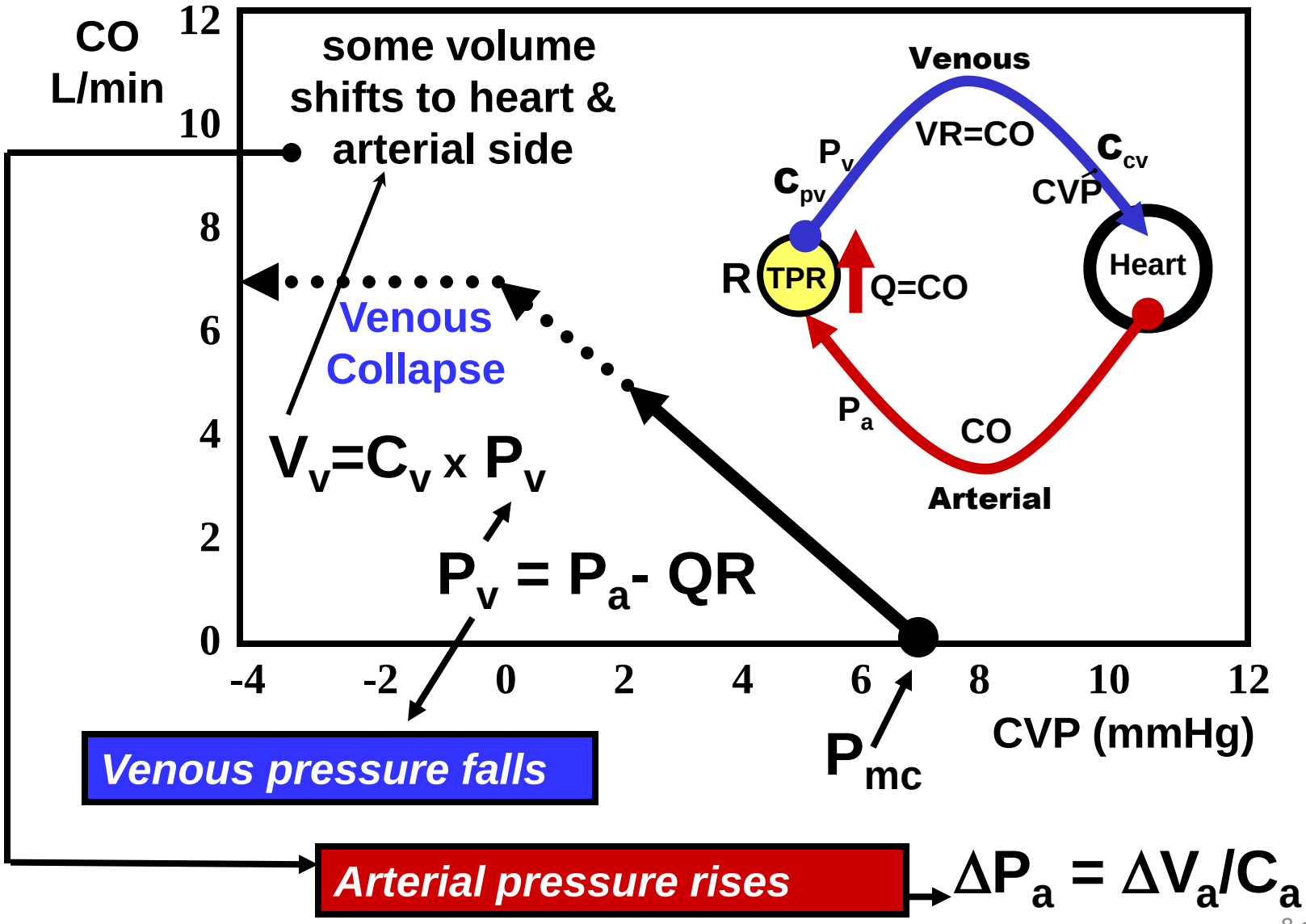
Basic Circulatory Representation



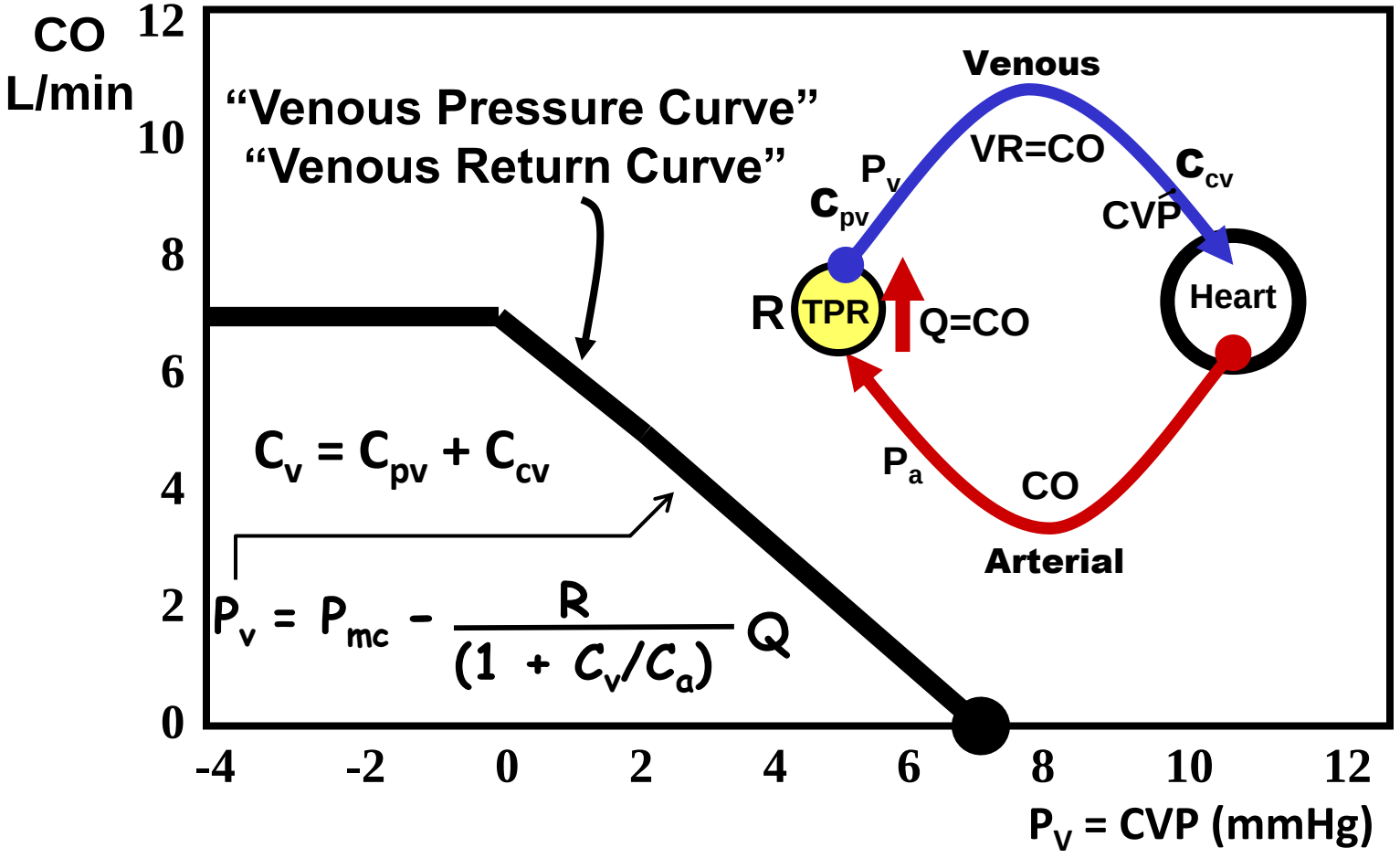
Vascular Function Curve – Heart Stopped



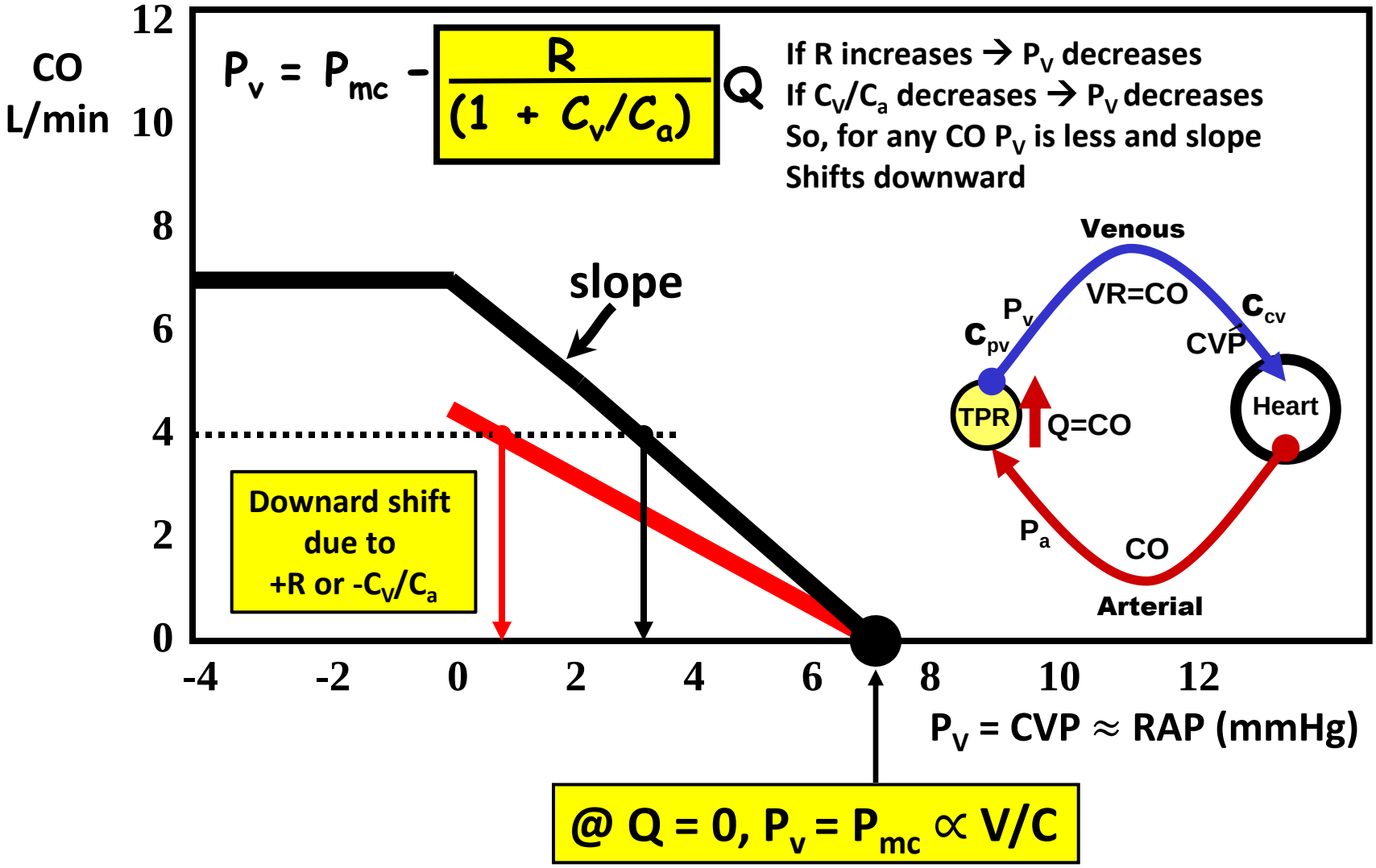
Restart Heart – Start Pumping



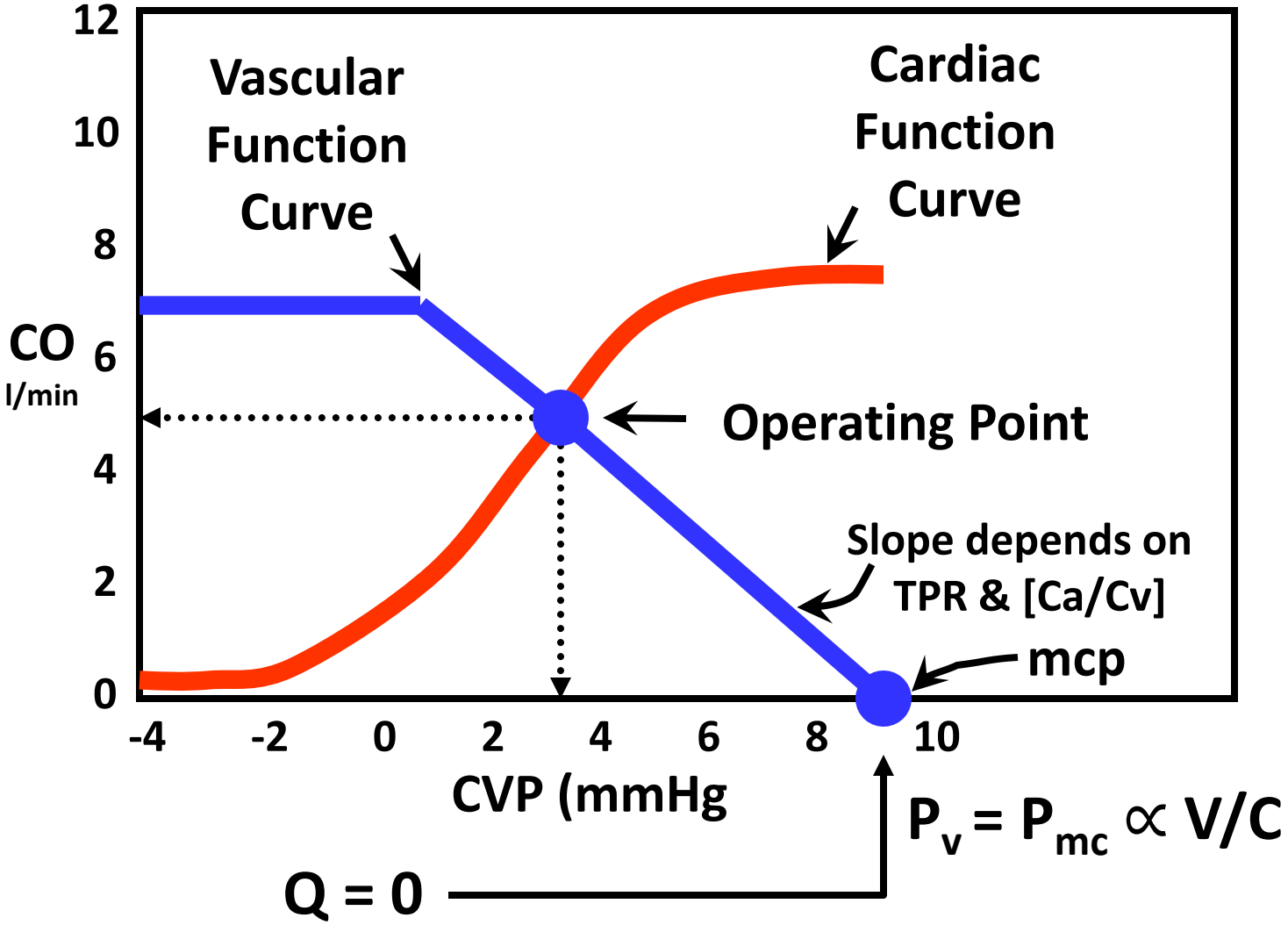
Vascular Function Curve (VFC) – Heart Pumping



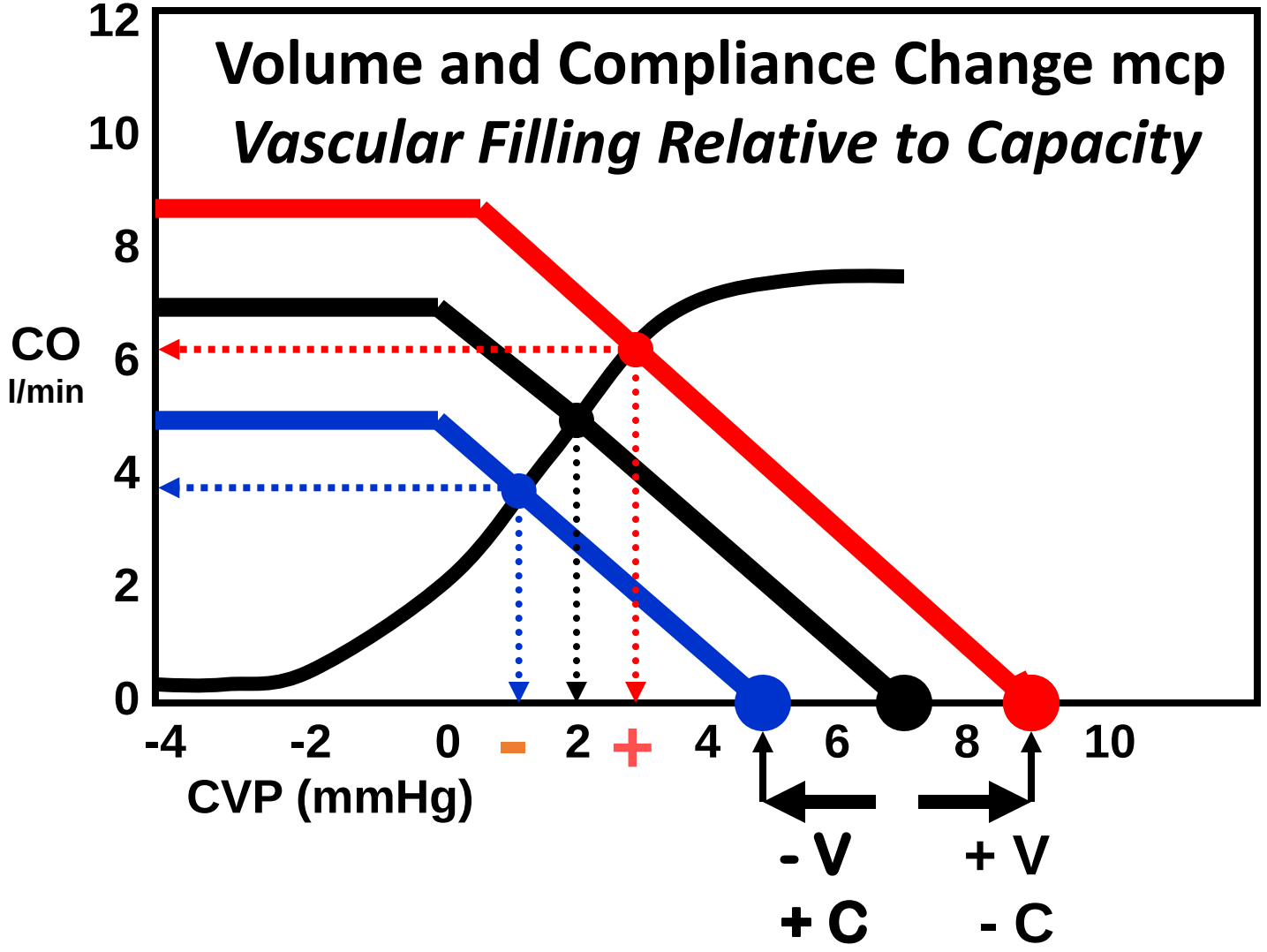
Vascular Function Curve (VFC): Slope Change



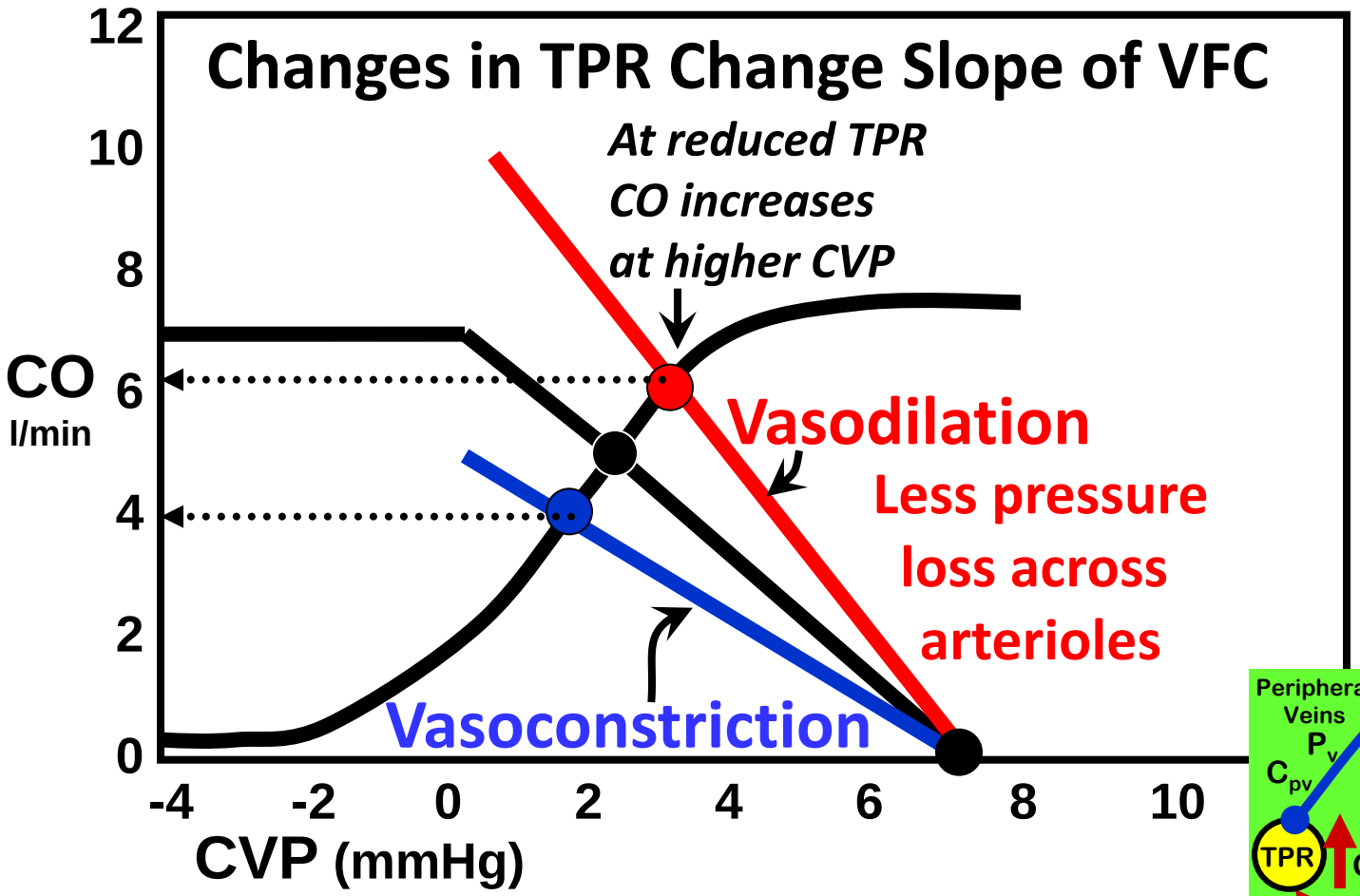
Vascular and Cardiac Function Curves Intersect

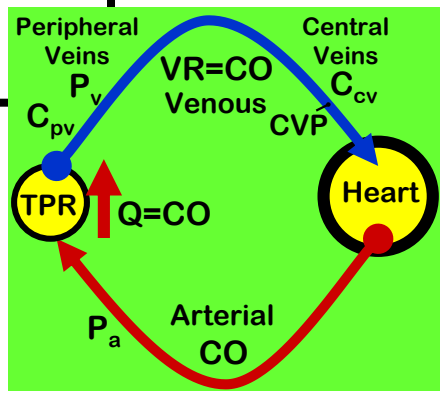


Mean Circulatory Pressure Changes

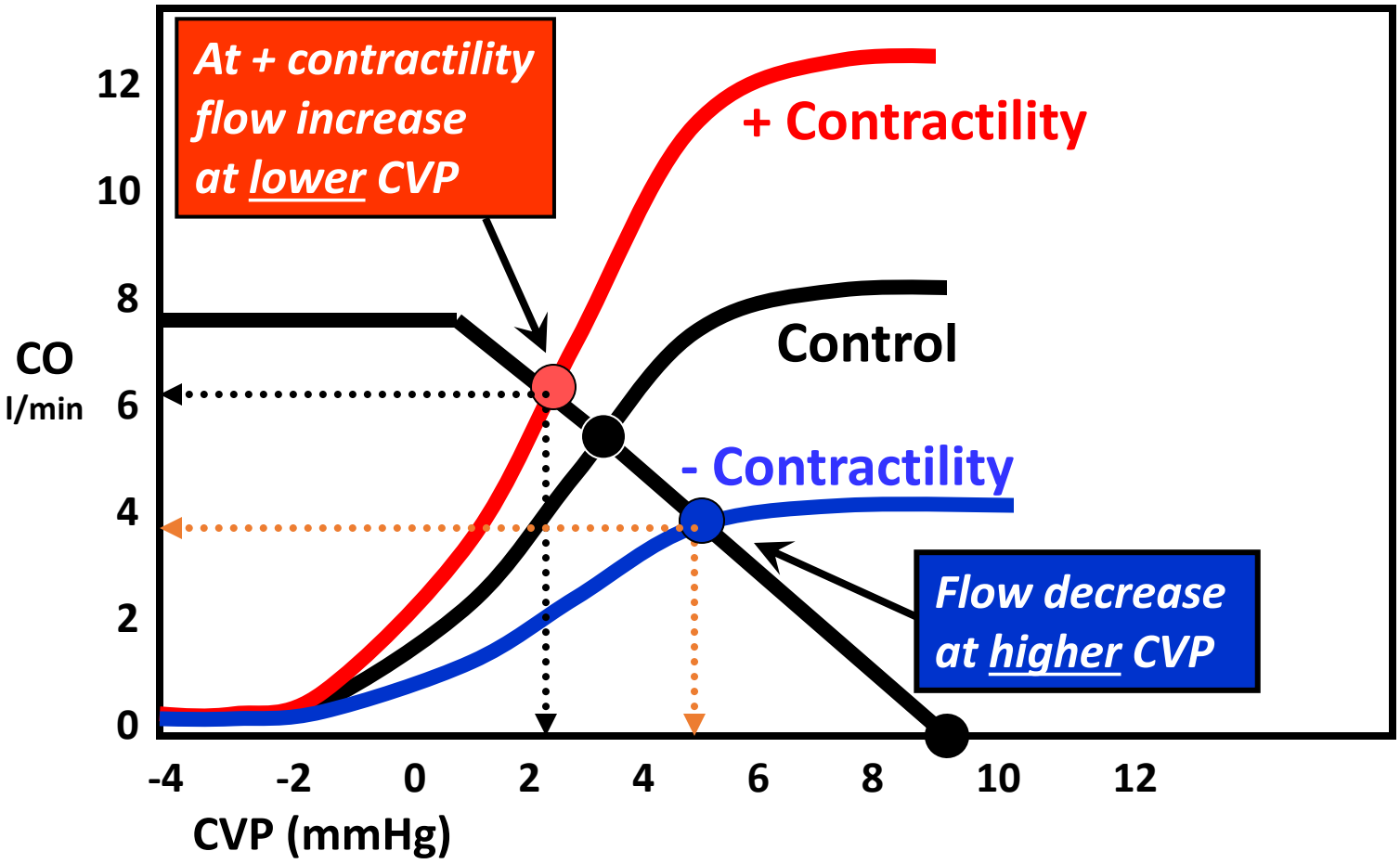


Vascular Function: Slope Changes

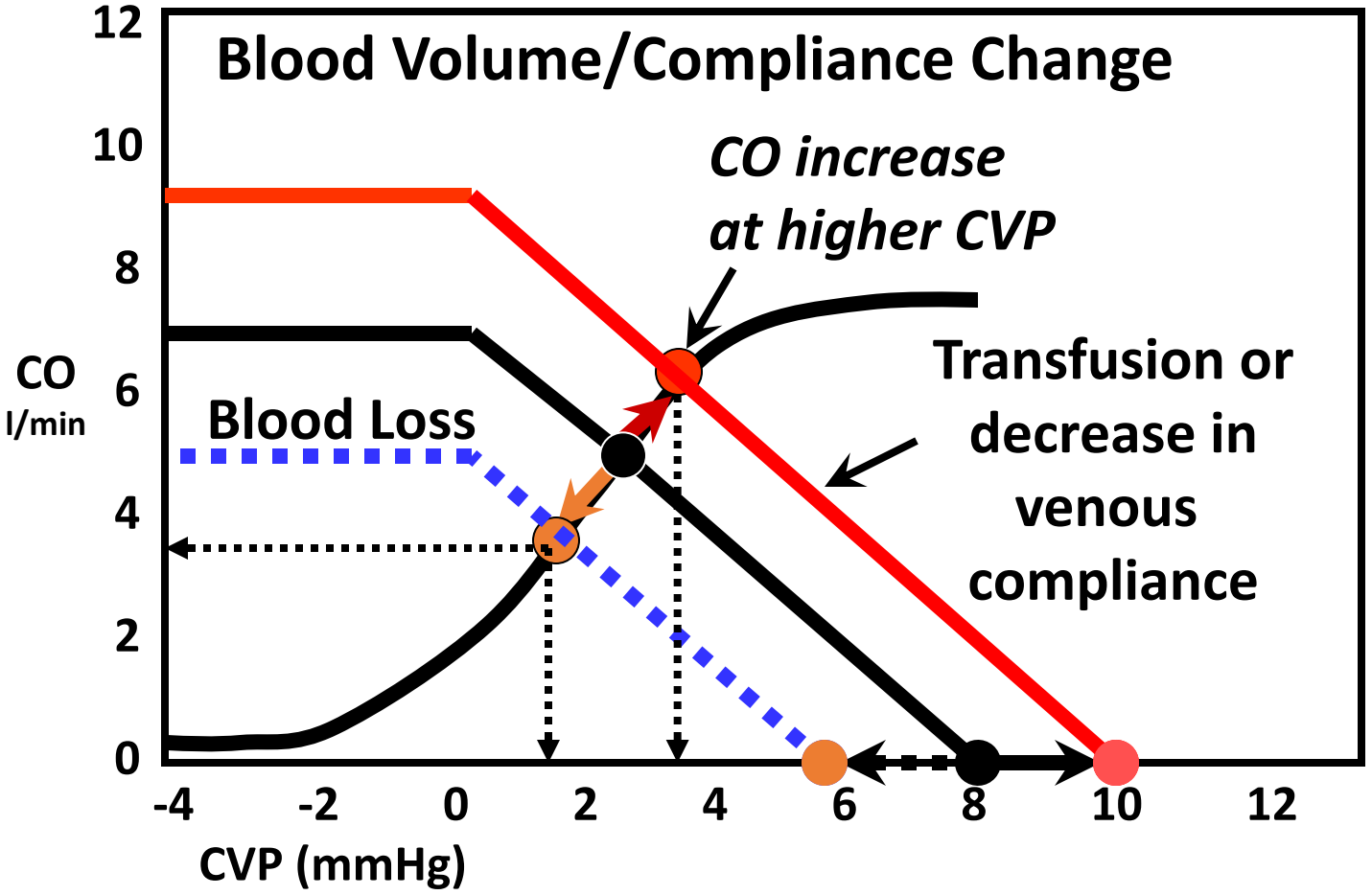




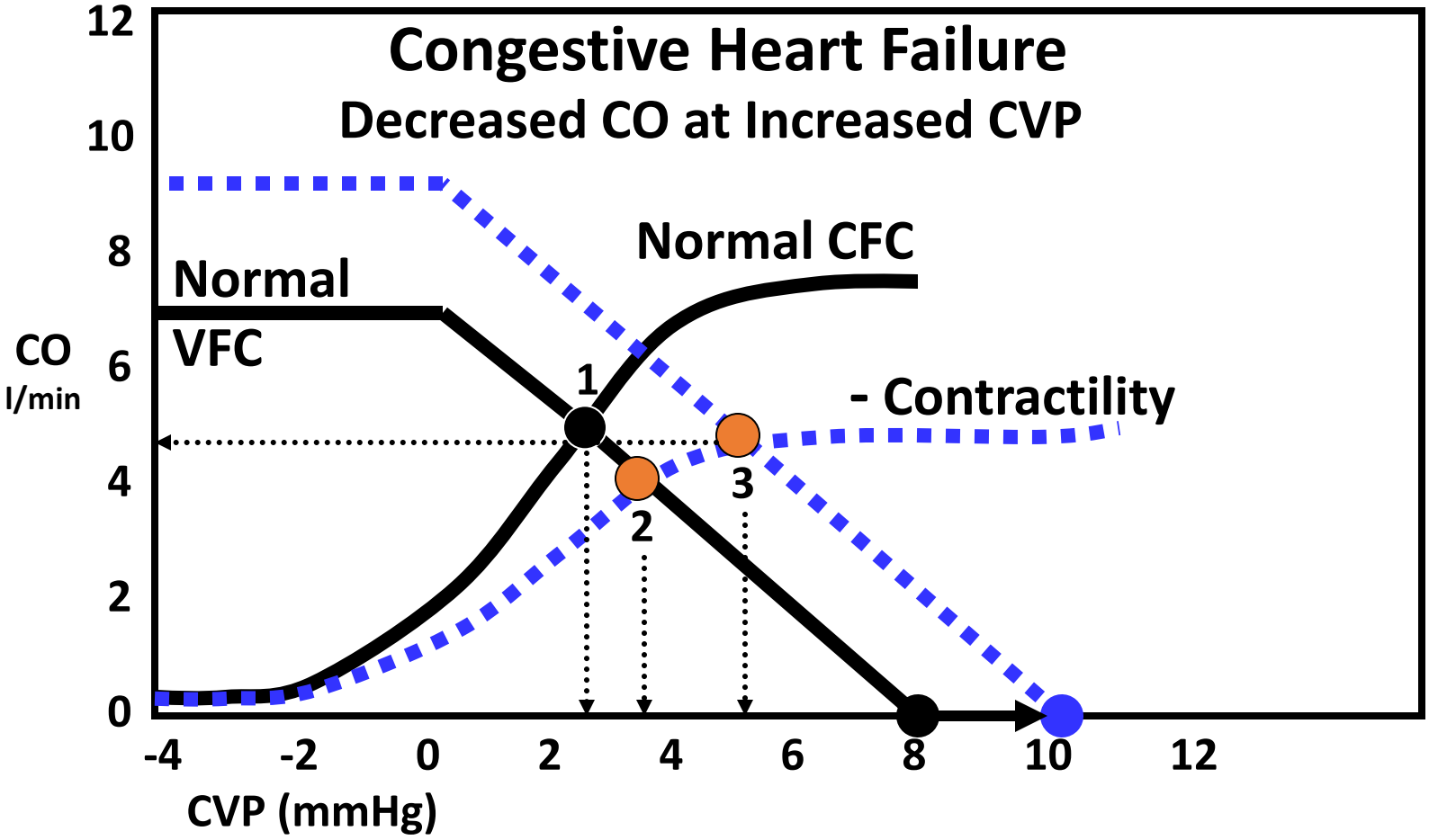
Contractility Effects



Shifts in VFC

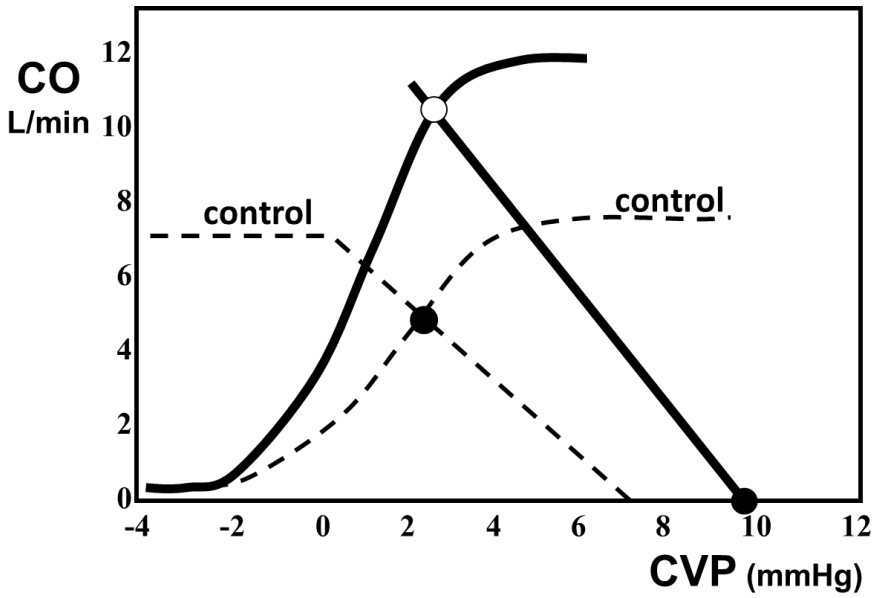


Decreased Contractility



Interactive Question

The figure shows a hypothetical patient's cardiac and vascular function curves before a change (control dashed line) and the change that occurred due to some event (solid lines). CO and CVP are cardiac output and central venous pressure respectively. What best describes the change that occurred?



A. Contractility and TPR increased

B. Contractility and TPR decreased

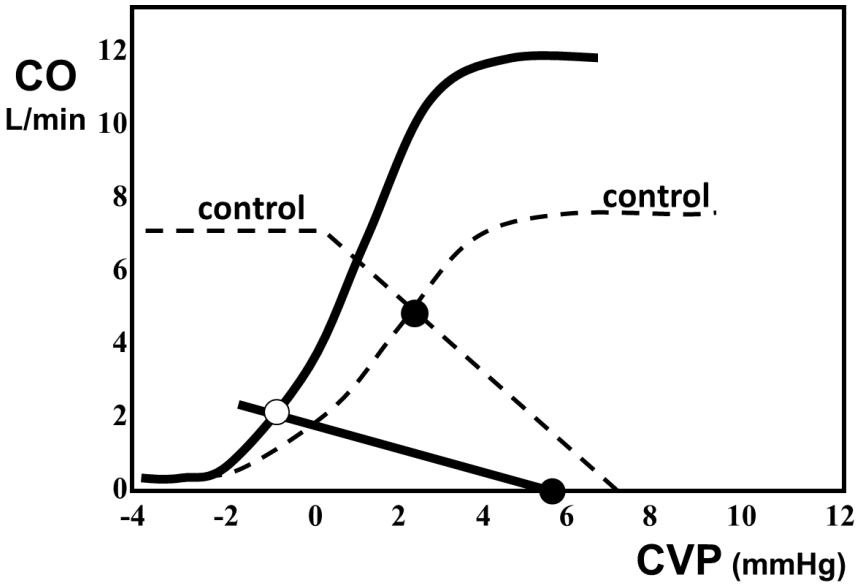
C. Contractility and blood volume increased

D. TPR and blood volume increased

E. TPR increased and contractility decreased

Interactive Question

The figure shows a hypothetical patient's cardiac and vascular function curves before a change (control dashed line) and the change that occurred due to some event (solid lines). CO and CVP are cardiac output and central venous pressure respectively. What best describes the change that occurred?



A. Contractility and TPR increased

B. Contractility and TPR decreased

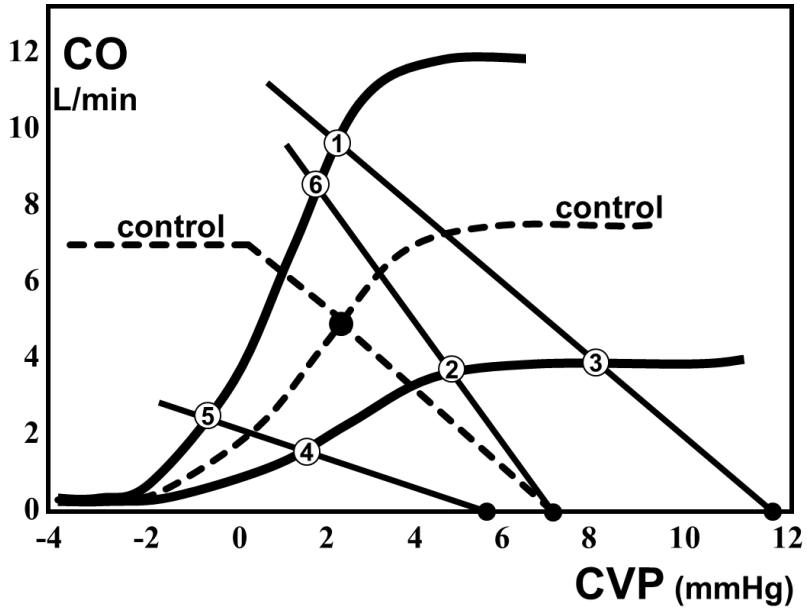
C. Contractility and blood volume increased

D. TPR and blood volume increased

E. TPR increased and contractility decreased

Interactive Question

The figure shows a hypothetical patient's cardiac and vascular function curves before a change (control dashed line) and the change that occurred due to some event (solid lines). CO and CVP are cardiac output and central venous pressure respectively. What best describes the change that occurred?



If the intervening event is **increased sympathetic activation of heart and arterioles**, what is the new operating point?

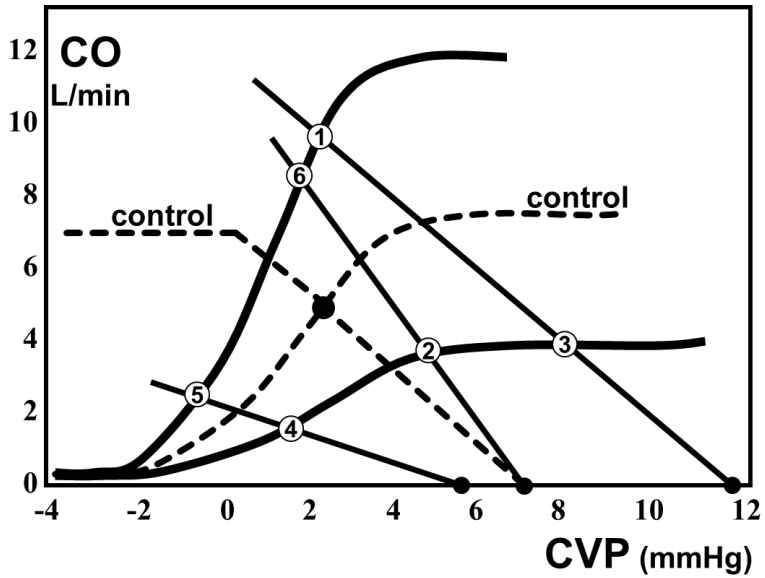
A. 2
B. 3
C. 4
D. 5
E. 6

Interactive Question

The figure shows a hypothetical patient's cardiac and vascular function curves before a change (control dashed line) and the change that occurred due to some event (solid lines). CO and CVP are cardiac output and central venous pressure respectively. What best describes the change that occurred?

If the intervening event is **increased sympathetic activation of heart and veins**, what is the new operating point?

A. 1
B. 3
C. 4
D. 5
E. 6

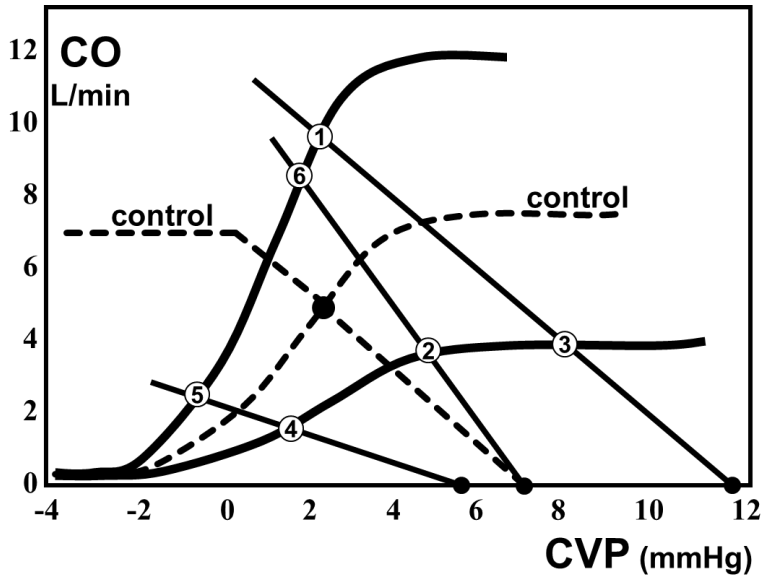


Interactive Question

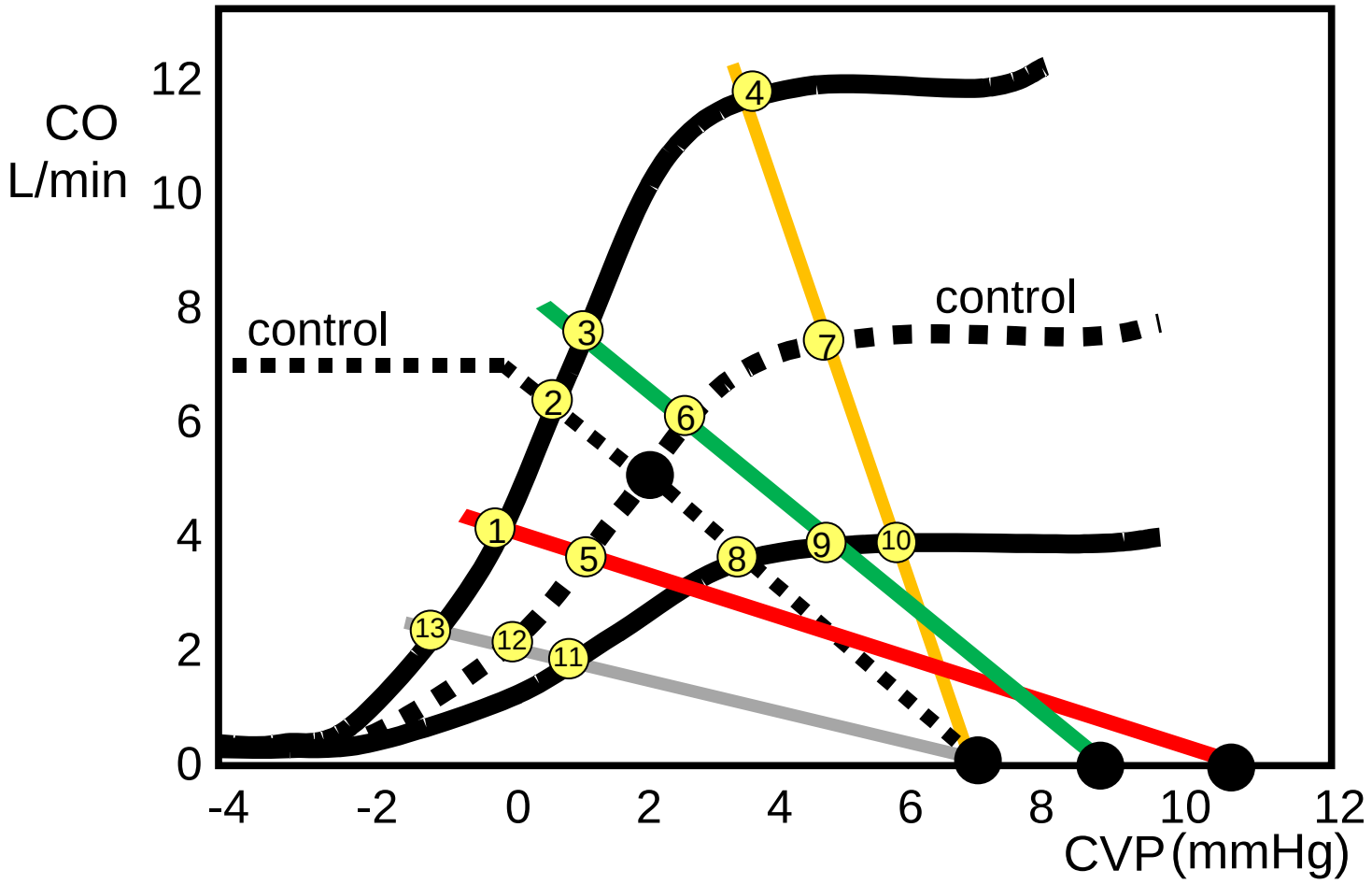
The figure shows a hypothetical patient's cardiac and vascular function curves before a change (control dashed line) and the change that occurred due to some event (solid lines). CO and CVP are cardiac output and central venous pressure respectively. What best describes the change that occurred?

If the intervening event is **administration of a vascular dilator and a positive inotropic drug**, what is the new operating point?

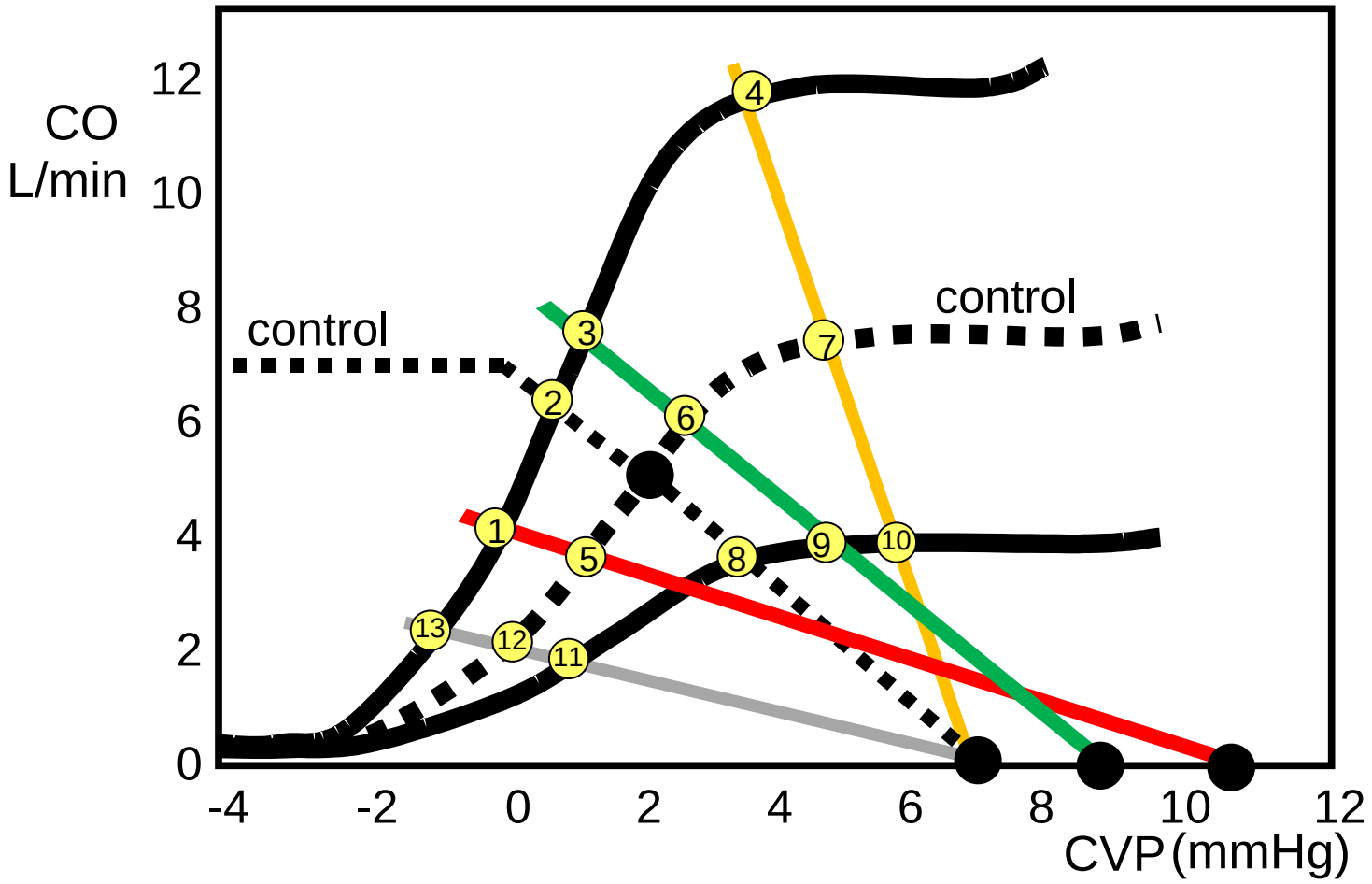
A. 1
B. 3
C. 4
D. 5
E. 6



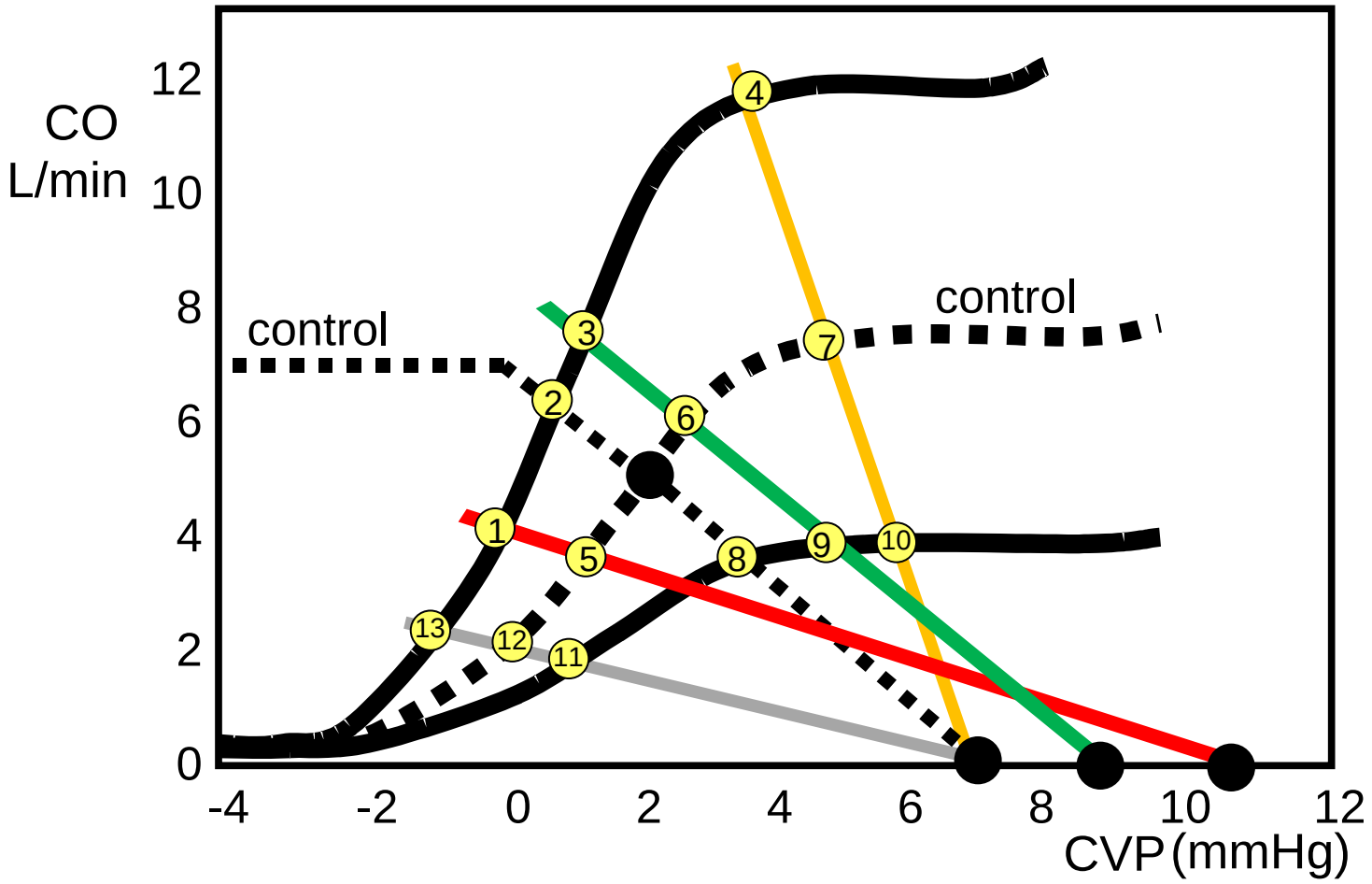
What is new intersection if sympathetic impulses increase only to veins?



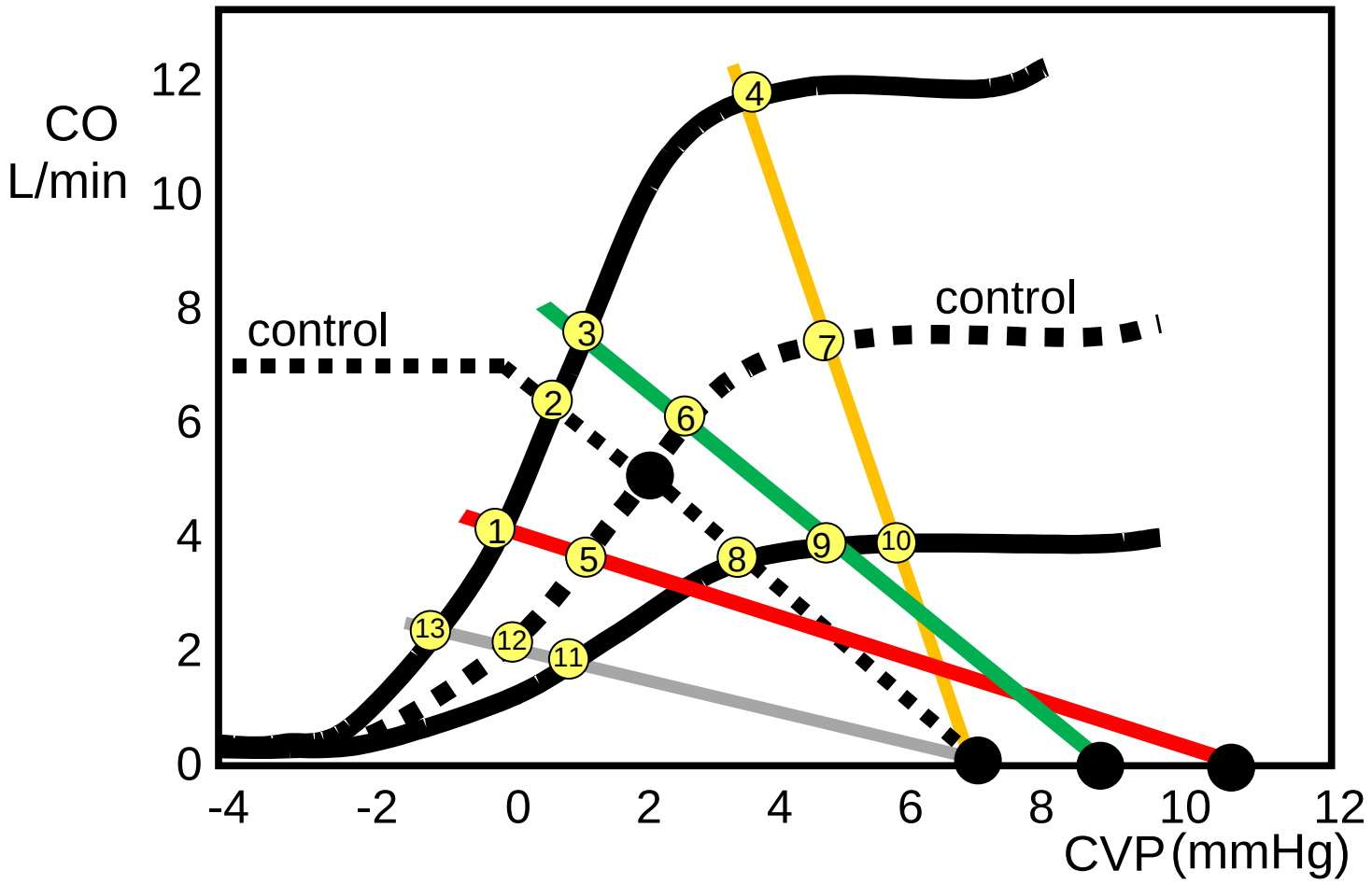
What is new intersection if sympathetic impulses increase only to arterioles? (neglect effect on arterial compliance)



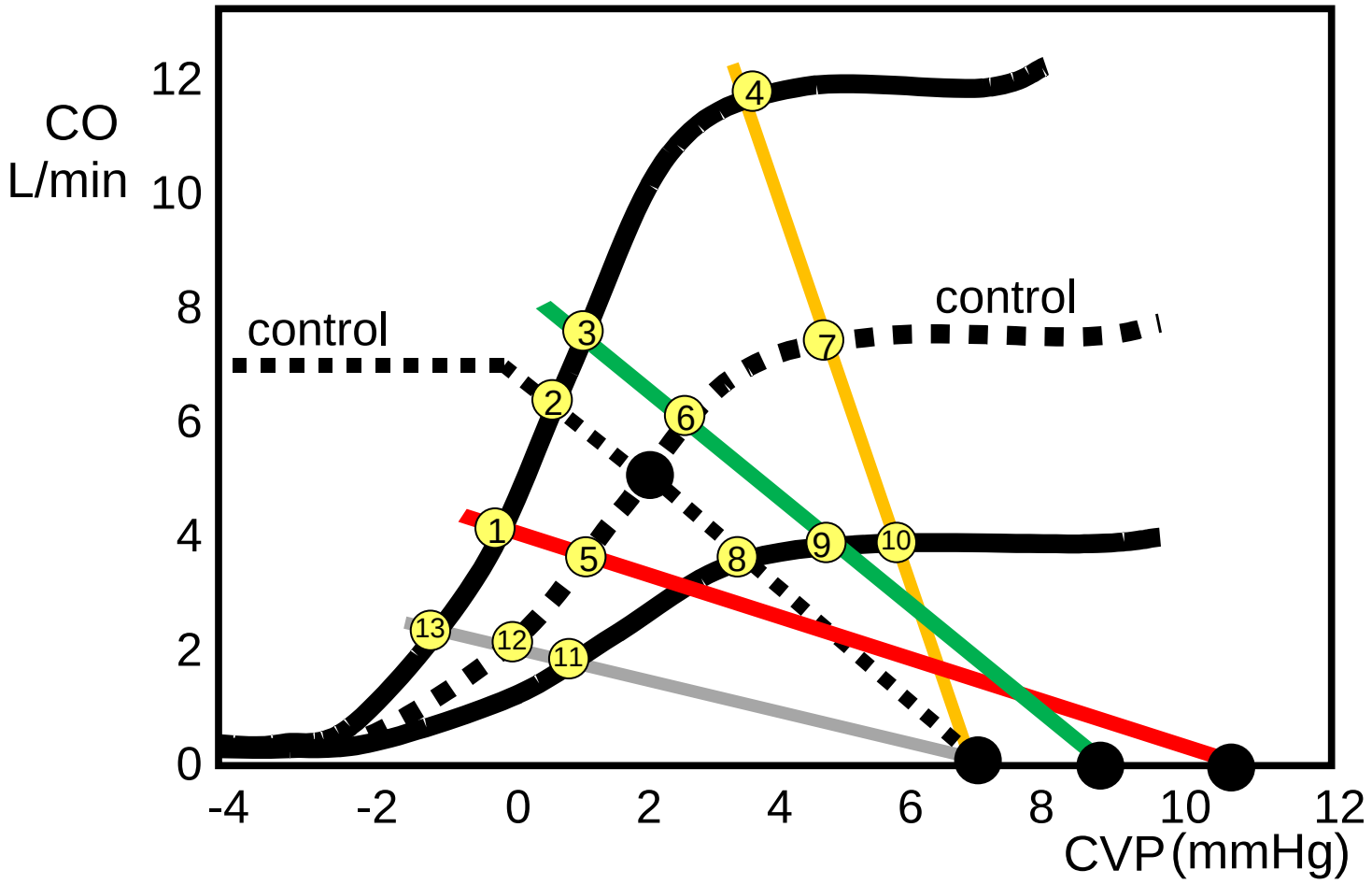
What is new intersection if sympathetic impulses increase to LV myocardium and to systemic arterioles? (neglect compliance changes)



What is the new intersection if sympathetic impulses to veins and LV myocardium both increase?



What is the new intersection if sympathetic impulses to arterioles and to the LV myocardium both decrease? (Neglect compliance effects).



End CV Physiology Lecture 15

Dr HN Mayrovitz