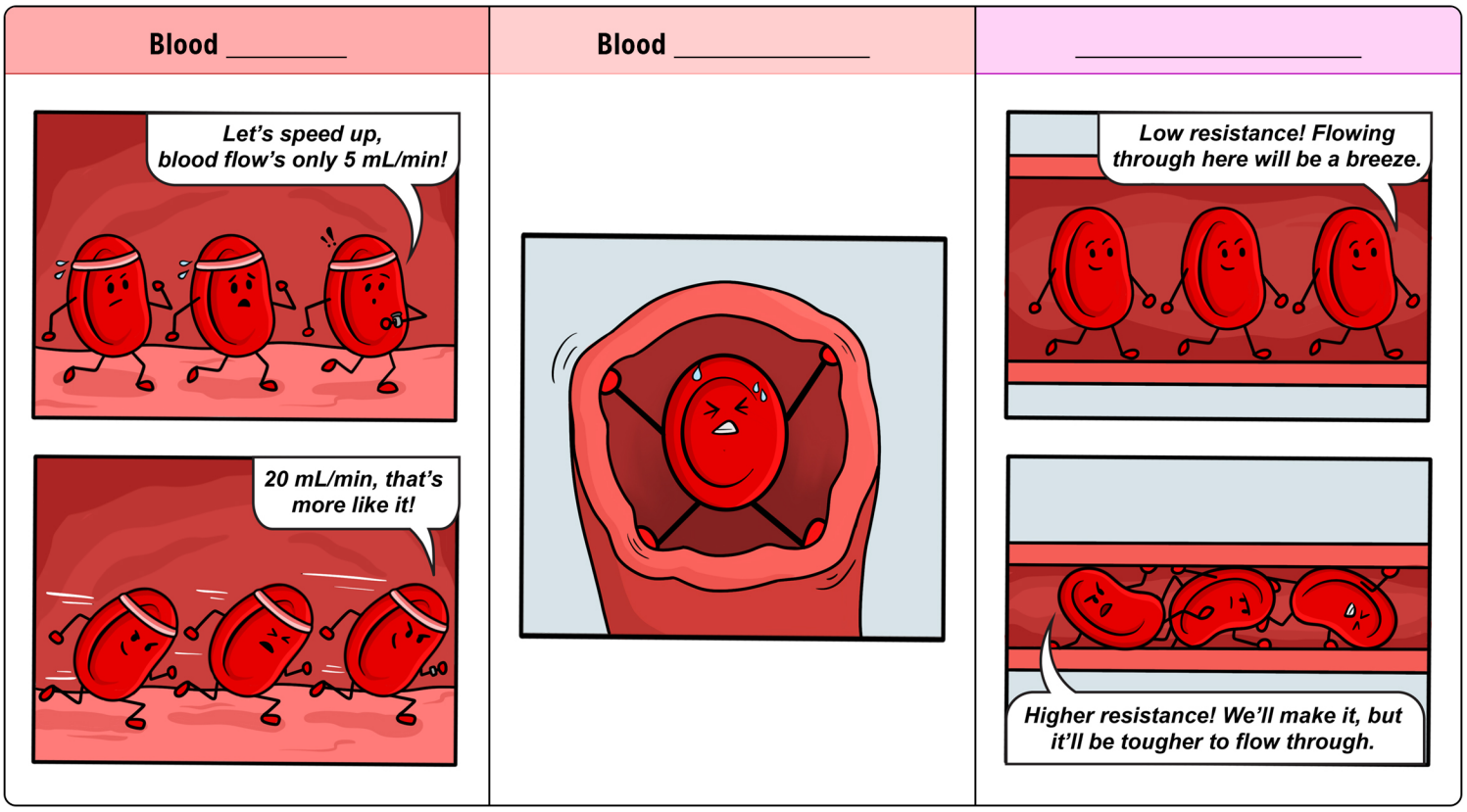
TOPIC: INTRODUCTION TO HEMODYNAMICS

Introduction to Hemodynamics

- **Hemodynamics:** the physical principles of blood _____.
  - **Blood Flow:** _____ of blood flowing through a particular point in a given time period (mL/min).
  - **Blood Pressure:** the _____ that blood exerts on the walls of the vessel (mmHg).
  - **Resistance:** any _____ to blood flow - measures amount of *friction* blood encounters.



EXAMPLE

Which of the following is an appropriate analogy for increasing resistance to blood flow in blood vessels?

a) Lubricating a garden hose so that water can flow through it faster.

b) Cutting the end of a garden hose so that water has a shorter distance to travel.

c) Cutting a hole in the side of a garden hose so that some water leaks out as it flows through.

d) Squeezing a garden hose, thereby slowing down the water flowing through it.

TOPIC: INTRODUCTION TO HEMODYNAMICS

PRACTICE

Arteries tend to have thicker walls than veins. Which of the following is a reason for this?

a) Arteries need to provide less resistance to blood flow than veins, and a thinner wall provides resistance.

b) Veins need to provide more resistance to blood flow than arteries, and a thinner wall provides resistance.

c) Arteries need to withstand higher blood pressure than veins.

d) Veins need to withstand higher blood pressure than arteries.

Relationship Between Blood Flow, Pressure, & Resistance

- Blood **F**low (____) is directly driven by a **P**ressure *gradient* (_____) but is also affected by **R**esistance (____).
  - The greater the **ΔP**, the _____ the **F**.
  - The greater the **R**, the _____ the **F**.

F = Blood **F**low

ΔP = Difference in **P**ressure

R = Total **R**esistance

$$F = \frac{\Delta P}{R}$$

TOPIC: INTRODUCTION TO HEMODYNAMICS

EXAMPLE

Blood is flowing from point A to point B at a constant rate. Then, a physiological change causes the resistance to blood flow between the two points to decrease. What will happen to the rate of blood flow?

a) It will increase. b) It will decrease. c) It will remain the same.

PRACTICE

The pressure at point A in the circulatory system is 15 mmHg, & the pressure at point B is 8 mmHg. Blood is flowing from point A to point B, then a physiological change causes the pressure at point B to increase to 10 mmHg. What will happen to the rate of blood flow?

a) It will increase. b) It will decrease. c) It will remain the same.

PRACTICE

Which of the following physiological changes would likely occur in someone's blood vessels when they begin an intense exercise session?

a) Rate of blood flow needs to increase, so the ΔP will increase & the resistance will increase.

b) Rate of blood flow needs to decrease, so the ΔP will decrease & the resistance will decrease.

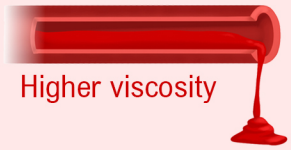
c) Rate of blood flow needs to increase, so the ΔP will increase & the resistance will decrease.

d) Rate of blood flow needs to decrease, so the ΔP will increase & the resistance will decrease.

TOPIC: INTRODUCTION TO HEMODYNAMICS

Altering Resistance in Blood Vessels

- _____ important factors affect resistance:
  1. **Blood** _____: Greater viscosity = _____ resistance.
  2. **Blood Vessel** _____: *Longer* vessel = _____ resistance.
  3. **Blood Vessel** _____ (*easily altered): *Larger* diameter = _____ resistance.

	1 Viscosity	2 Vessel Length	3 Vessel Diameter
_____ **Resistance**	 Lower viscosity	 Shorter vessel	 Larger diameter
_____ **Resistance**	 Higher viscosity	 Longer vessel	 Smaller diameter

EXAMPLE

Imagine two individuals sharing a thick/viscous milkshake. One drinks from a *broader*, *shorter straw* and the other drinks from a *thinner*, *taller straw*. Which individual encounters more resistance drinking the milkshake?

TOPIC: INTRODUCTION TO HEMODYNAMICS

PRACTICE

Assuming each of these blood vessels have the same difference in pressure along their length, which would have the lowest resistance and therefore, the greatest rate of blood flow?

a) 

b) 

c) 

d) 

PRACTICE

Blood vessels primarily impact resistance to bloodflow by:

a) Altering their length.

b) Altering their diameter.

c) Altering their wall thickness.

d) Altering the viscosity of blood.