VASOCONSTRICTION = ↑resistance = ↓blood flow

MAP = 1/3 systolic pressure + 2/3 diastolic pressure
= Diastolic pressure + 1/3 pulse pressure
Pulse pressure = systolic pressure – diastolic pressure
(Only in the arterial side of the circulation)

CO = MAP/TPR

F = $\Delta P/R$

F = AV

$V \propto 1/A$
F is constant
Area: capillaries (2500 cm diameter) > venae cavae (8) > aorta (2)
Velocity: aorta > venae cavae > capillaries

Laminar flow = parabolic flow profile = blood layers away from the vessel wall flow faster with the centermost layer as the fastest

Reynold's number: indicator of turbulence (Eddy currents)
$Re = v * d * \rho / \mu$
If Re < 400 then the flow is laminar.

If Re > 1000 then the flow is turbulent.

If Re is between 400 and 1000 the flow MAY become turbulent with constriction or sharp turn.

Critical velocity is the velocity that is high enough for the blood flow to become turbulent. After the critical velocity the velocity will increase in a slower manner as the pressure increases. (Pressure-Flow diagram)

Poiseuille's Law:

F = $\pi \Delta P r^4 / 8\mu L$

F = $\Delta P / R$

So,

R = $8\mu L / \pi r^4$

Thus; the <u>radius</u> has the <u>highest effect on the resistance</u> of the vessel + viscosity too but not as much as r

Factors affecting viscosity

HAEMATOCRIT ***main factor طردي***
PLASMA PROTEINS ***main factor طردي***
TEMPERATURE عكسي
DIAMETER ***not really عكسي***

Series vascular circuits

R(total) = R1 + R2 + R3 + R4 …

The total resistance in series is <u>bigger</u> than every contributing resistance.

Parallel vascular circuits

1 / R(total) = 1/R1 + 1/R2 + 1/R3 + 1/R4 …

The total resistance in parallel is <u>smaller</u> than every contributing resistance.

Conductance = 1/Resistance

Just like resistance, conductance is <u>mainly influenced</u> by the <u>radius</u>.

Critical closing pressure: the BP at which the blood starts to flow. (Start button)
Any measure below the critical closing pressure means that the flow is stopped
We can find what is the closing pressure of a blood vessel if we know the diameter of that vessel and the tension developed in its wall:

Tension = pressure x radius

Distensibility: delta in volume with respect to the original volume with delta pressure
Distensibility = increase in volume / (increase in pressure x original volume)
(Pulmonary arteries > systemic arteries)
(Veins >>>>>> arteries)

Compliance = Capacitance: delta volume with respect to delta pressure
Compliance = increase in volume / increase in pressure
Thus;
Compliance = Distensibility x original volume

Volume-Pressure relationship:
When compliance is held constant (we're just talking about the arteries or veins) the change in volume is proportional to the change in pressure.

Velocity and Compliance: بربيش وسليندر حديد
The compliant vessel can accommodate high volumes of blood, then this blood won't be pushed immediately to the next segment of the vessel, and the next segment won't expand immediately after the first segment, this will make the pulse wave in the arterial wall to move slowly.
High compliance = low velocity بربيش
Low compliance = high velocity سليندر حديد

Pulse pressure = systolic pressure – diastolic pressure
Pulse pressure = SV / atrerial Compliance

Damping of pulse pressures in peripheral arteries = less difference between the systolic and diastolic pressure (less pulse pressure)
The degree of damping is proportional to the resistance of small vessels and arterioles and the compliance of the larger vessels.

More damping = ↑resistance, ↑compliance, ↓pressure
Basically in arterioles

Abnormal pulse pressure

ARTERIOSCLEROSIS high pulse pressure
PATENT DUCTUS ARTERIOSUS high pulse pressure
AORTIC REGURGITATION high pulse pressure