

Non-invasive methods of blood pressure measurement

Arterial blood pressure curve

Blood pressure (BP): pressure on the vascular wall (a continual variable)

Mean arterial pressure (MAP) : mean value of blood pressure in the inter-beat interval (IBI)

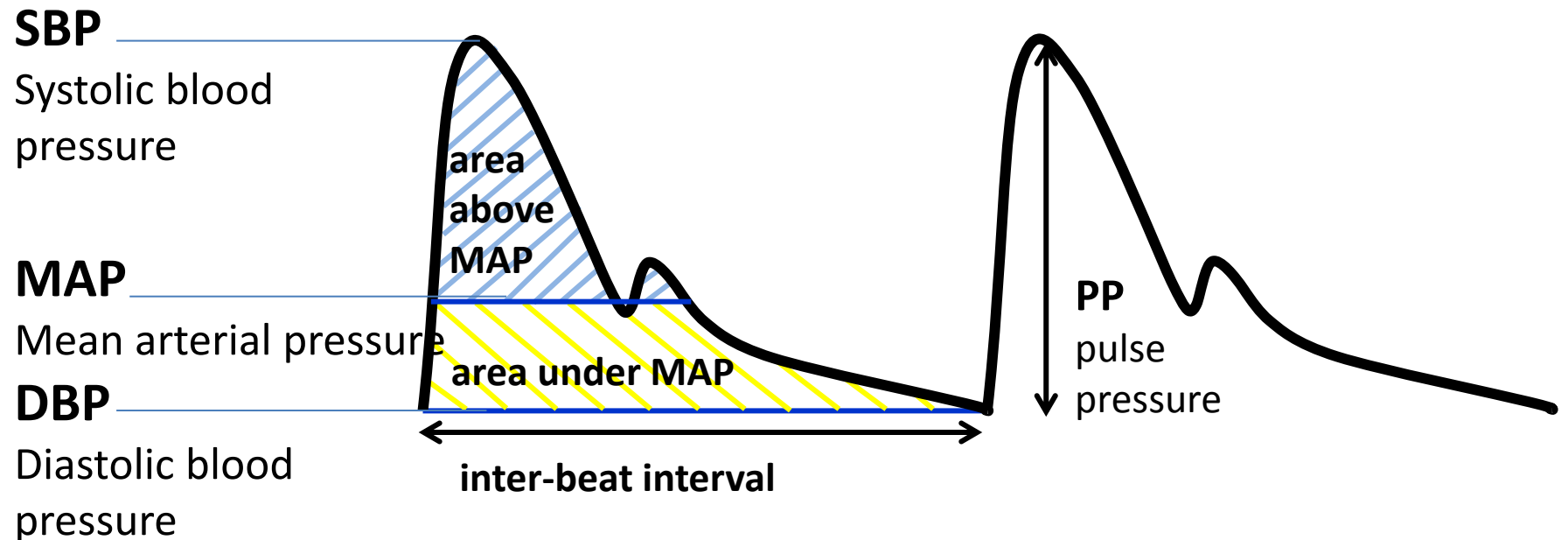
- area under MAP = area above MAP
- approximation: $MAP \approx DBP + 1/3 PP$ ($PP = SBP - DBP$)

Definition:

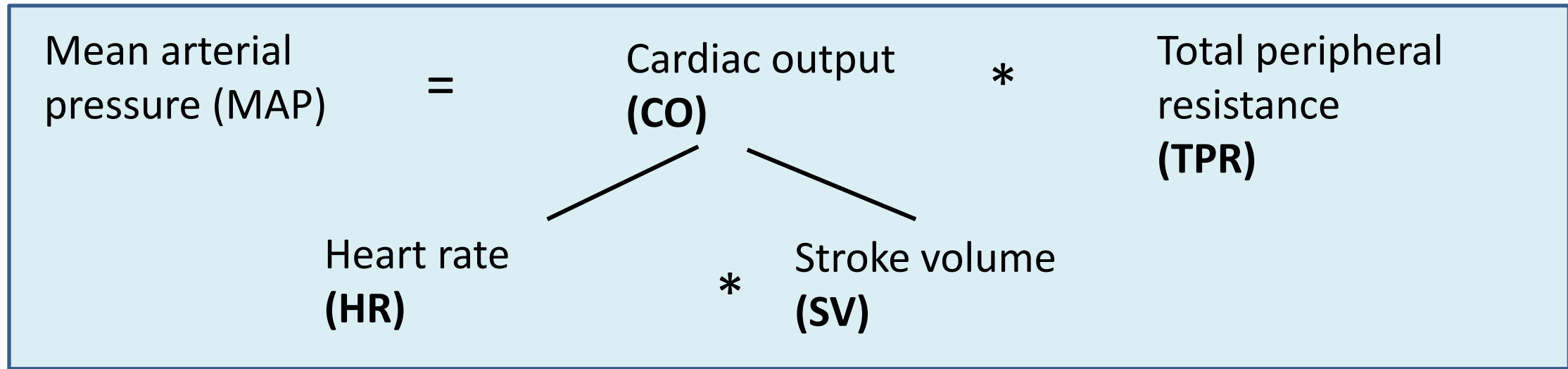
SBP - maximum of BP in the inter-beat interval

DBP – minimum of BP in the inter-beat interval

Attention: Values of SBP and DBP varies in different parts of cardiovascular system!



MAP is a function of cardiac output and total peripheral resistance



- SBP is given mainly by CO
- DBP is given mainly by TPR

Methods of the arterial blood pressure measurement

Palpatory
(sphygmomanometer)



Auscultatory
(sphygmomanometer,
stethoscope)



Oscillometric



24-hour blood pressure
monitoring



Photoplethysmographic
(volume-clamp method, Peñáz)



Laminar / turbulent flow, Korotkoff sounds

$$Re = \frac{v \cdot S \cdot \rho}{\eta}$$

laminar flow $Re < 2000$

turbulent flow $Re > 3000$

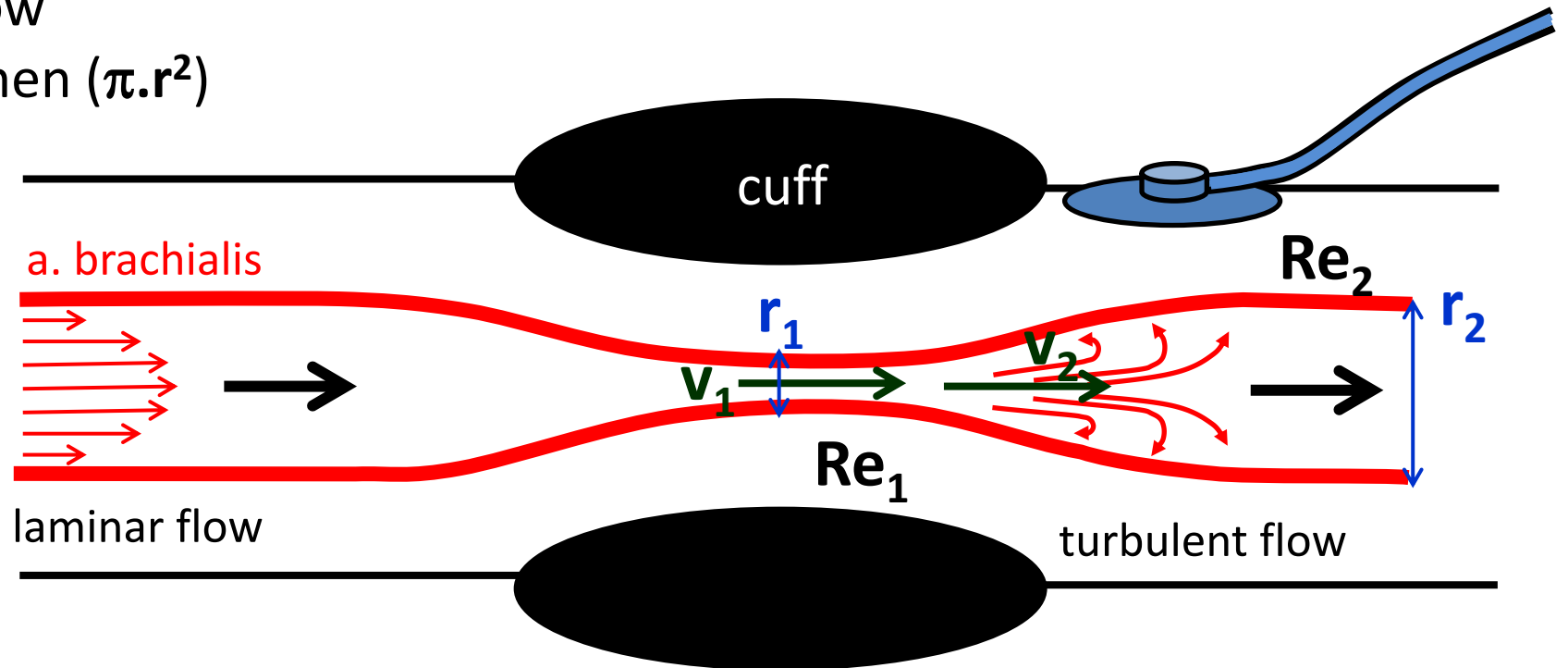
Reynolds number Re : predicts the transition from laminar to turbulent flow

v : velocity of blood flow

S : area of vascular lumen ($\pi \cdot r^2$)

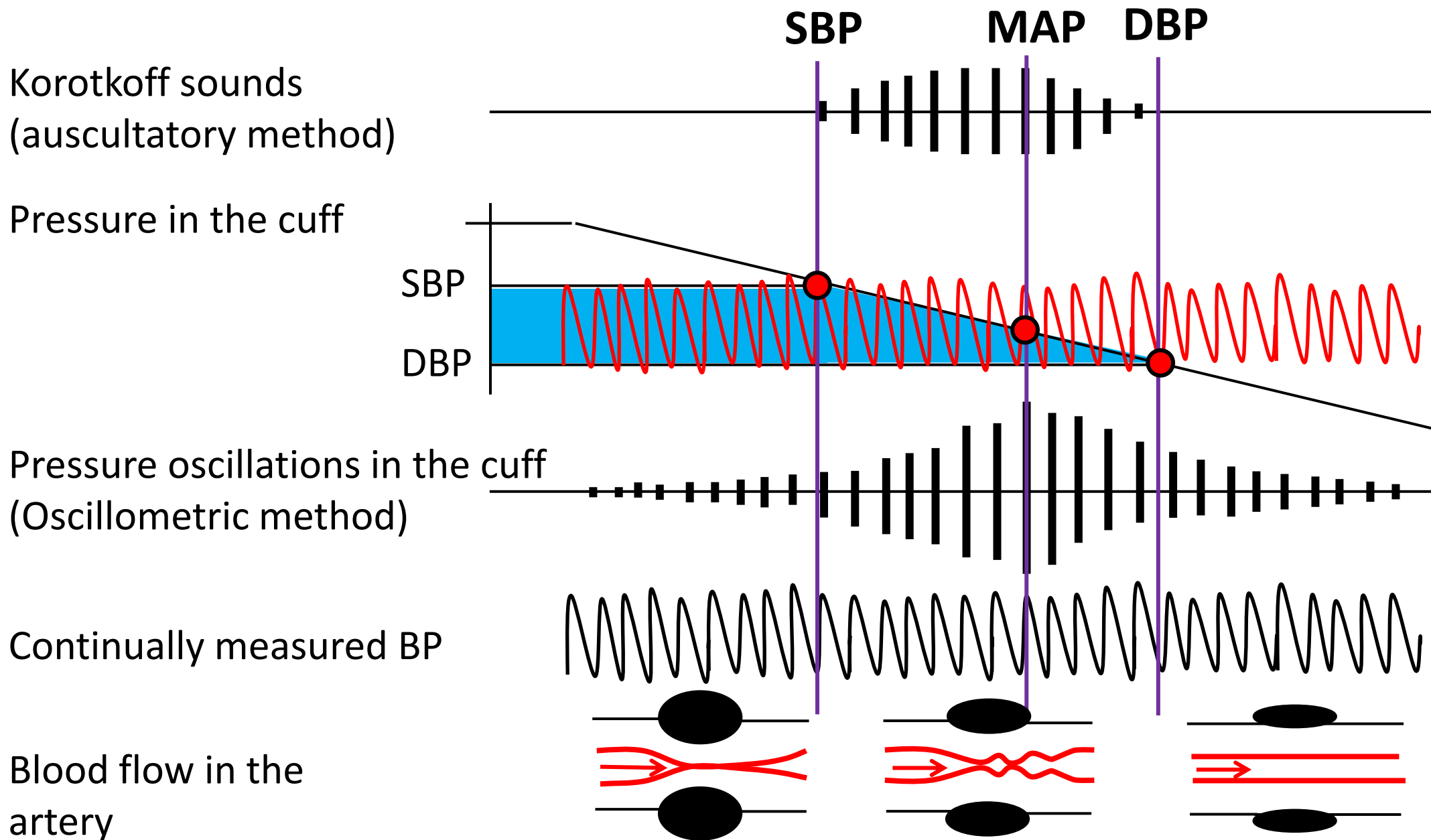
ρ : density of blood

η : viscosity of blood
(lower in anemias)



right behind the narrowing of the artery: $S_1 < S_2$, $v_1 \approx v_2 \rightarrow Re_1 < Re_2 \rightarrow$ turbulent flow

Principles of blood pressure measurement

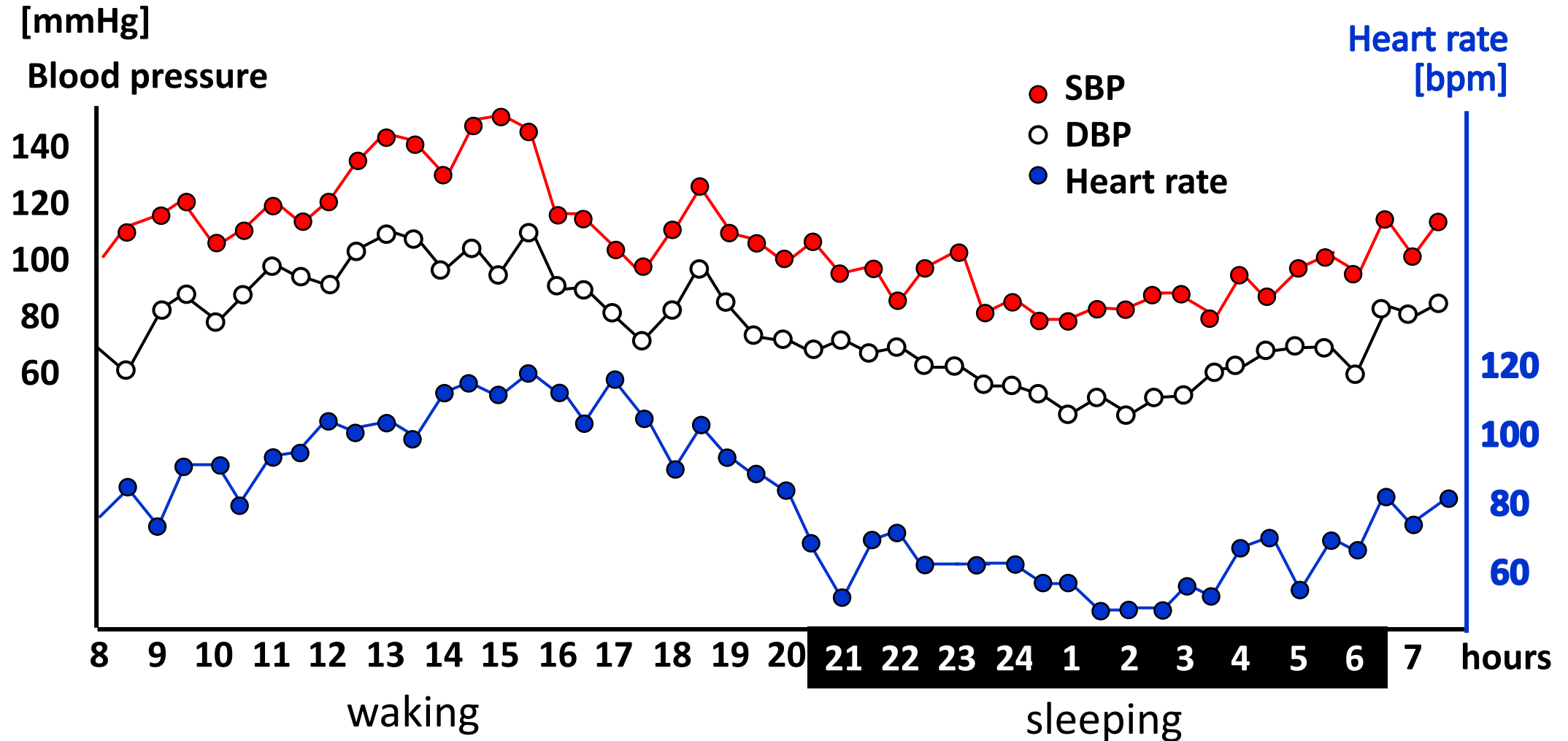


During BP measurement, following rules must be observed:

- Patient is sitting and resting for a few minutes before the measurement.
- Only validated measuring equipment must be used.
- At least two measurements have to be performed, in the course of 1–2 minutes.
- Use cuff of standard size (12–13 cm width and 35 cm length); smaller and bigger cuffs must however be available for patients with smaller or bigger arms, respectively.
- Cuff must always be at the level of heart of examined person.
- Pressure in the cuff must be decreased slowly: 2mmHg/s.

24-hour blood pressure monitoring

BP decrease during night: 10 - 15%

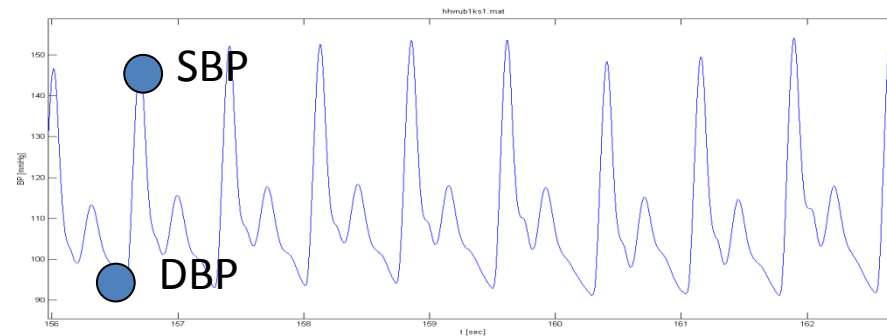
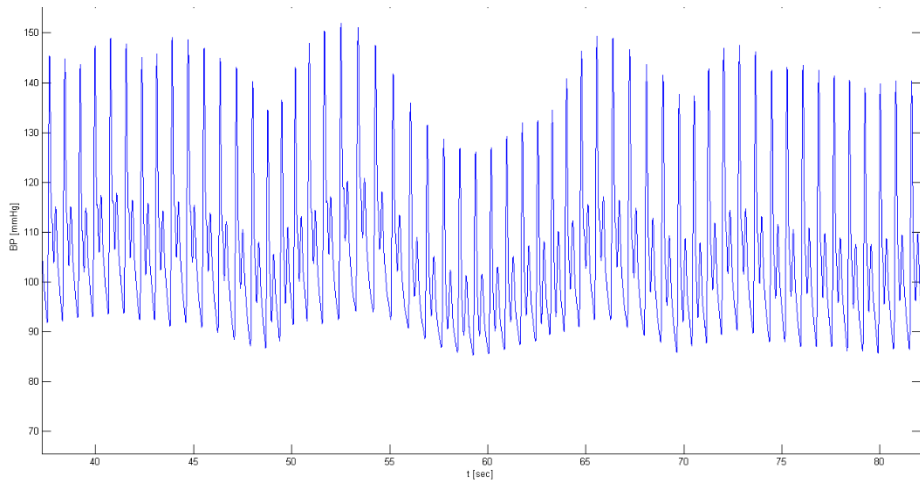
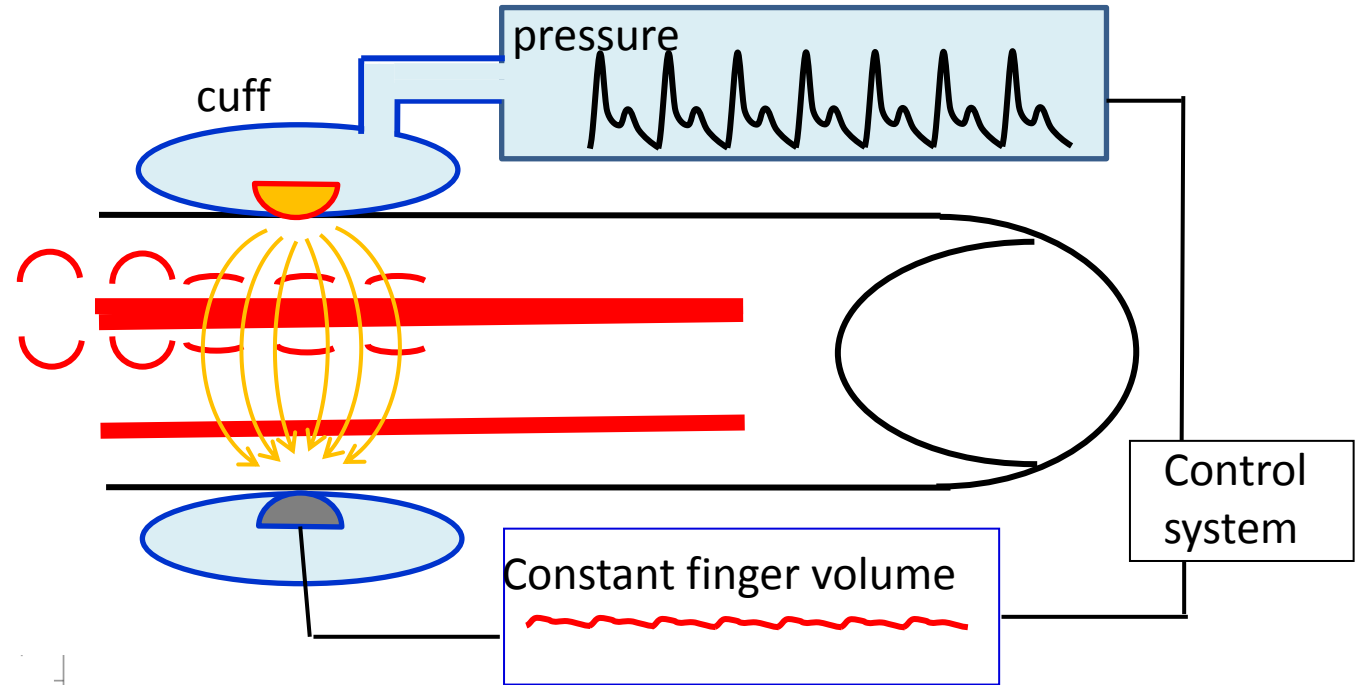


Photoplethysmography

Control system:

Correction of the pressure in the finger cuff according to the arterial lumen changes.

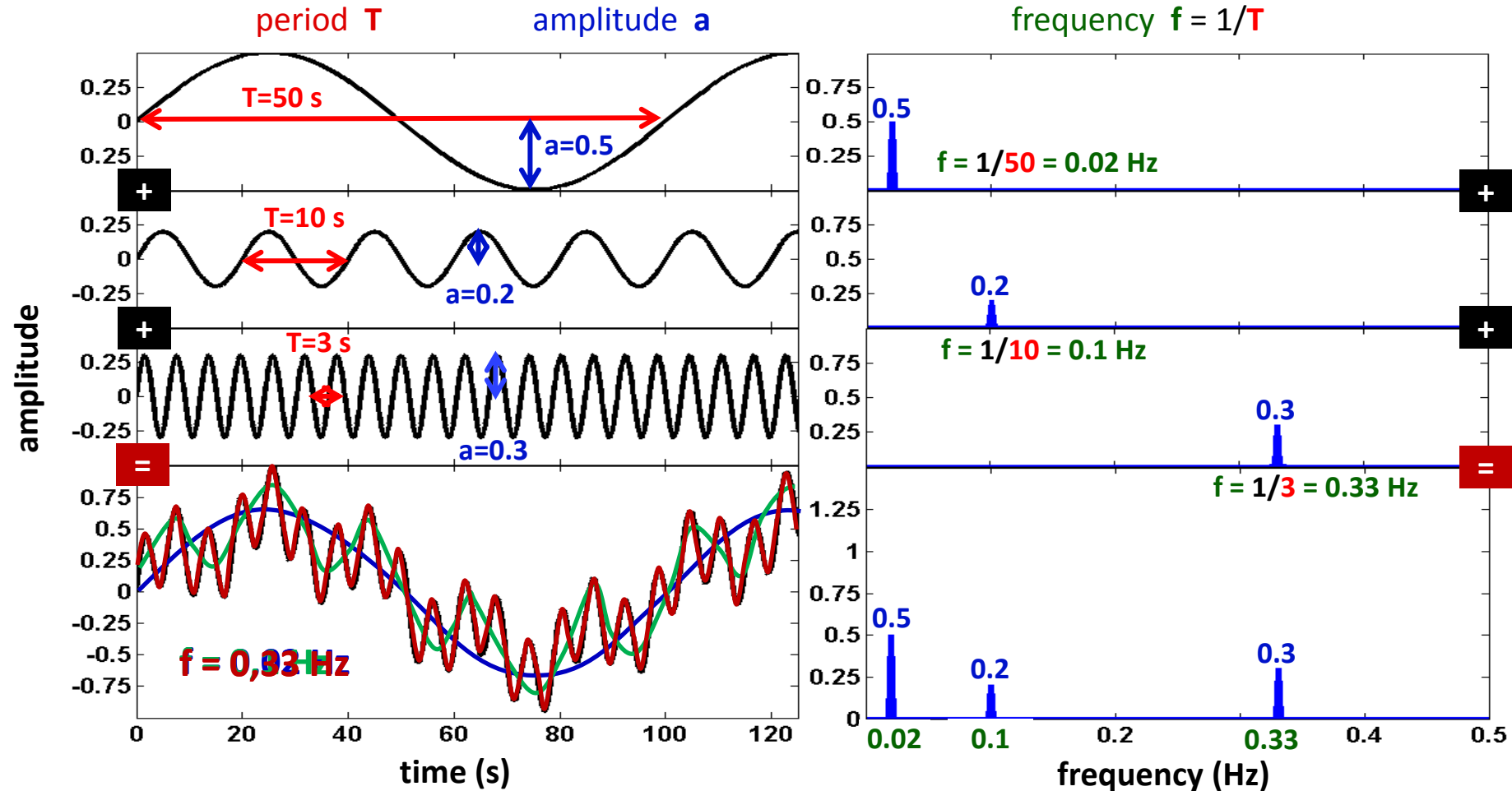
Aim: maintaining of constant arterial lumen through pressure changes in the cuff.



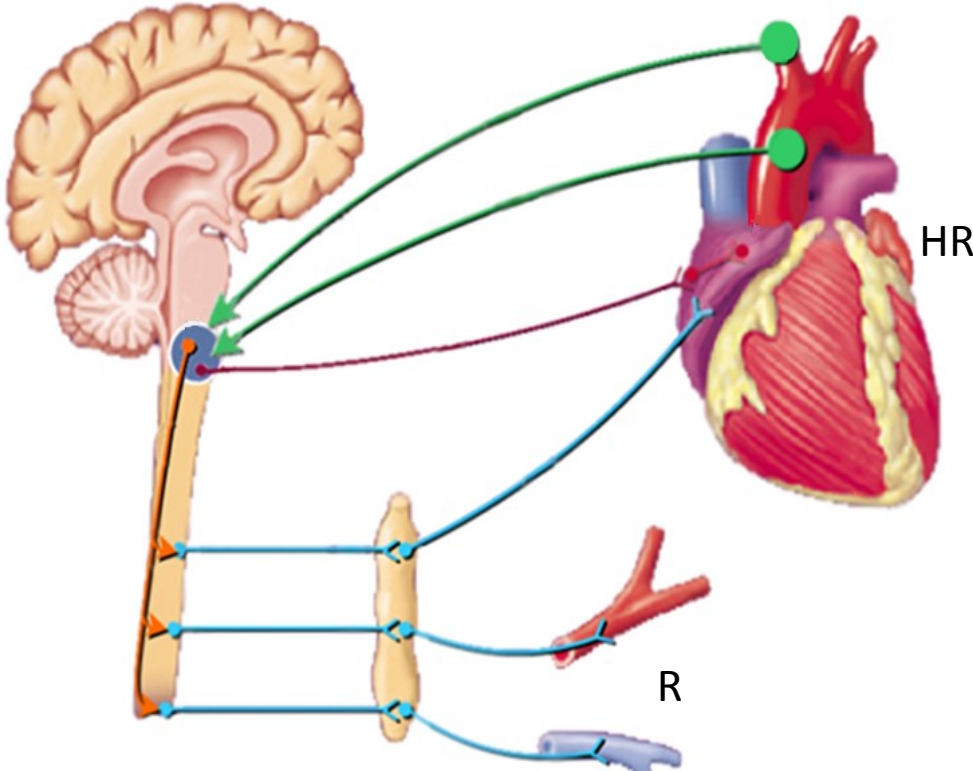
Variability of circulatory parameters

Time domain

Spectrum
Frequency domain



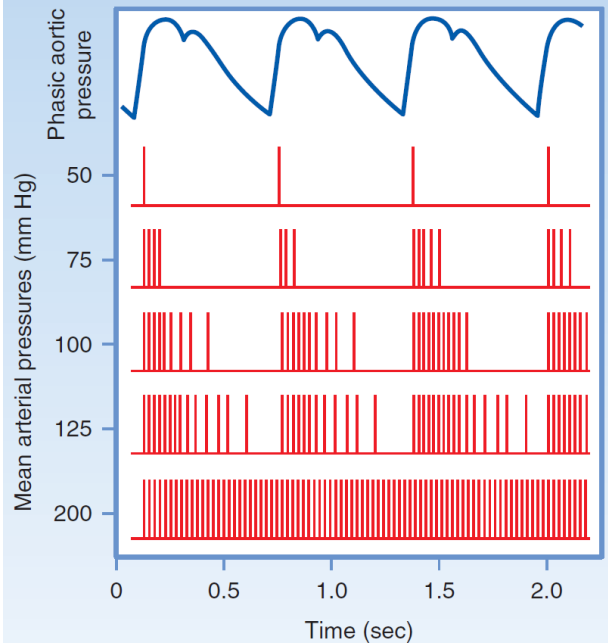
Baroreflex



█ Aferent pathway
█ Parasympathetic pathway
█ Sympathetic pathway

$BP = HR \times SV \times R$

- Inotropic
 - Chronotropic
 - Dromotropic
 - Batmotropic
- } effect



$BP = HR \times SV \times R$

Valsalva maneuver

