Schemes and animations prepared by

Servisní středisko pro e-learning na MU
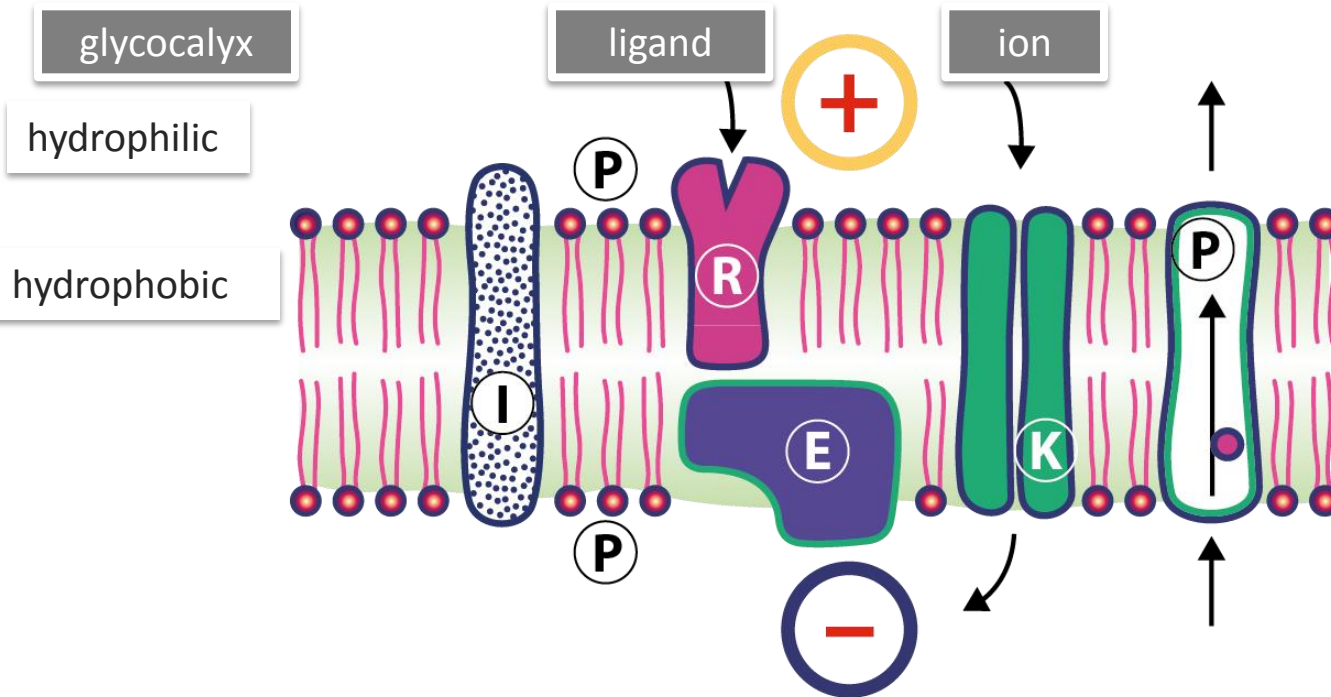
http://is.muni.cz/stech/

PLASMATIC MEMBRANE

glycocalyx

hydrophilic

ligand

ion

hydrophobic

+

P

R

P

P

I

E

K
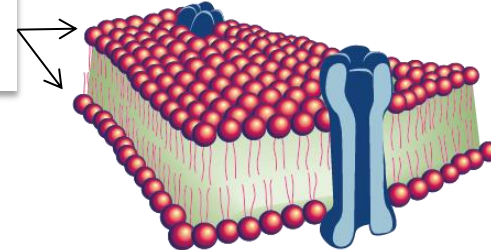
P

−

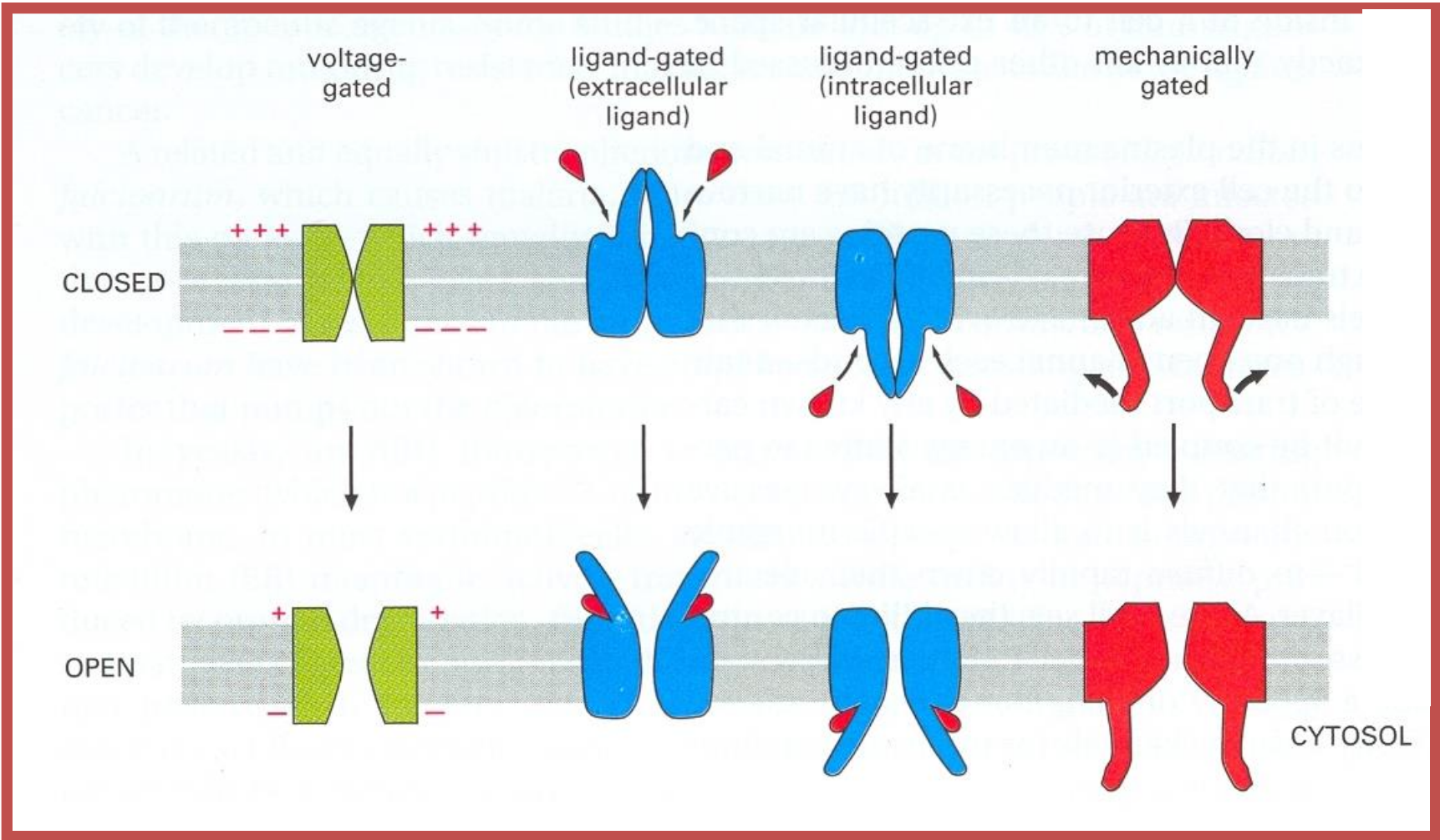I – integral protein
R – receptor
E – enzyme
K – channel
P – pump (ATP-ase)

Membrane molecules

Protein molecules

„GATING“

Molecular biology of the cell. B. Alberts et al., Garland Science2002
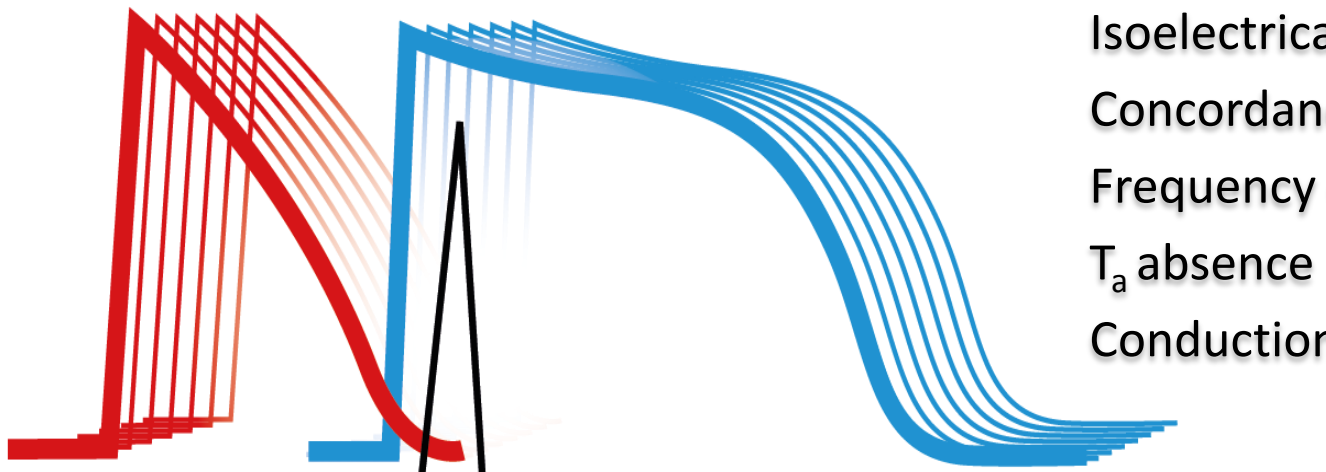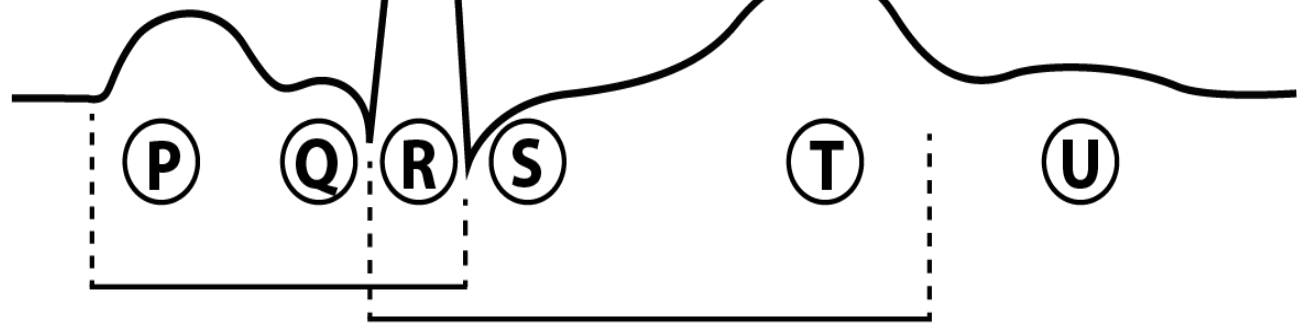
Isoelectric segments
Concordance of T wave
Frequency dependence
T_a absence
Conduction system

P Q R S T U

PQ interv.   QRS   QT
0,16   0,1   0,3
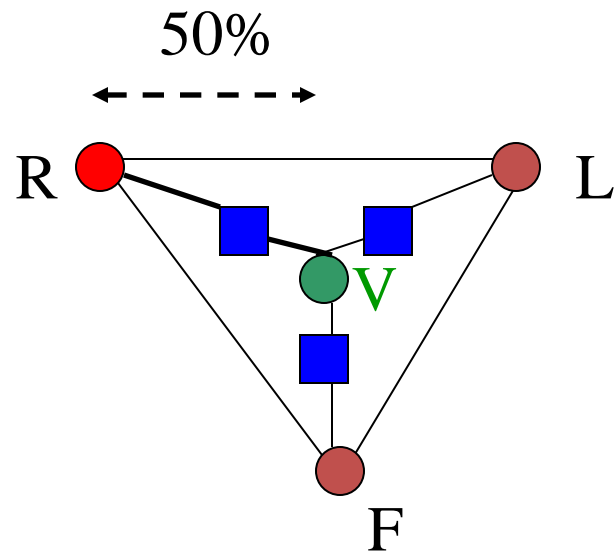
HR – dependent

Atrial depol.   Ventricular complex

(depol.)   (repol.)

100%

R ———— L

F
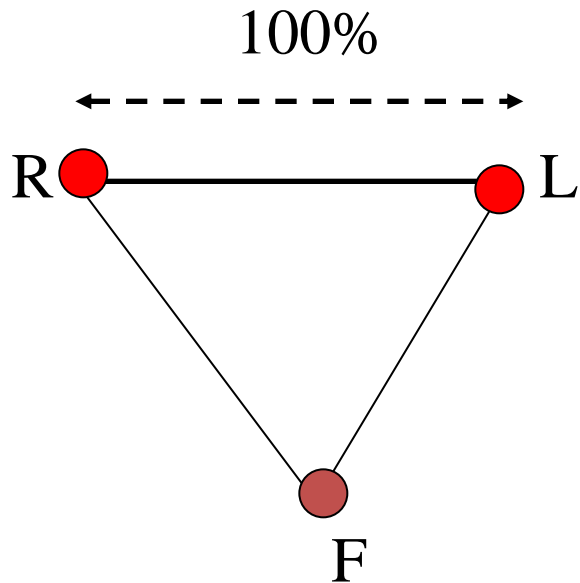
Einthoven, 1913

I, II, III

50%

R L

V

F

Wilson, 1934, VR, VL, VF

87%

R L

V'

F
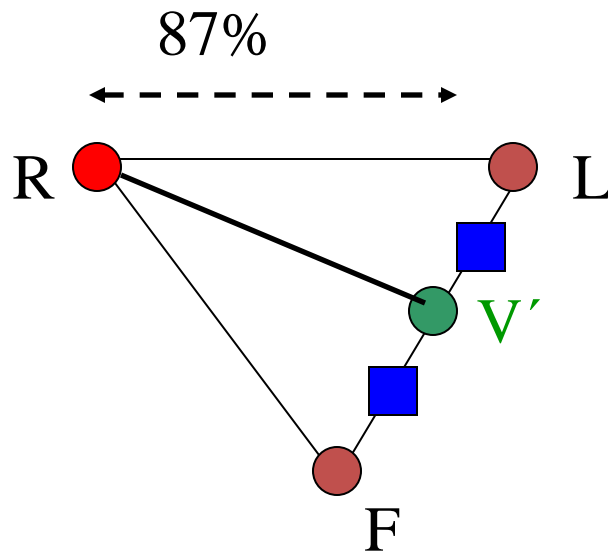
Goldberger, 1947, aVR, aVL, aVF

ELECTRICAL AXIS – in frontal plane

(R–Q–S) in lead I., II., III.

-90°
(270°)

left prepondeance
(deviation)

180°

0°

Normal range

90°

right prepondeance
(deviation)
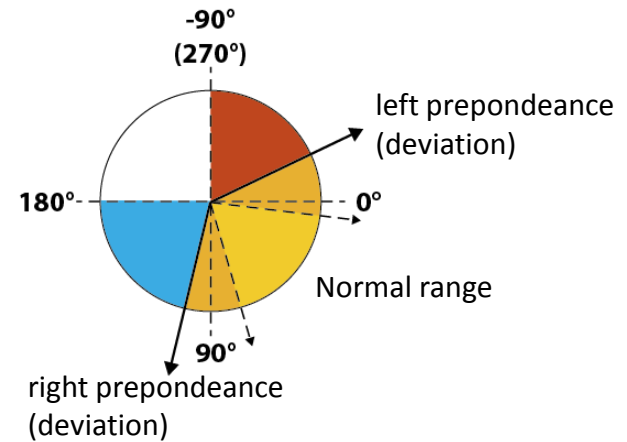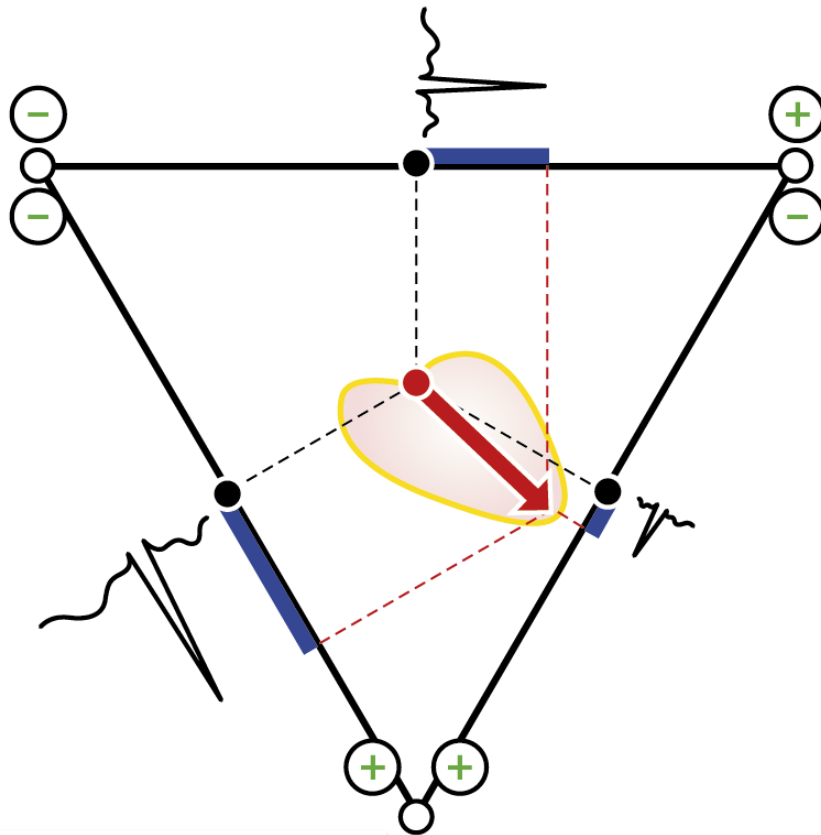
• **Eqilateral**
Einthoven
triangle

Terminology ⟶

QS   RS
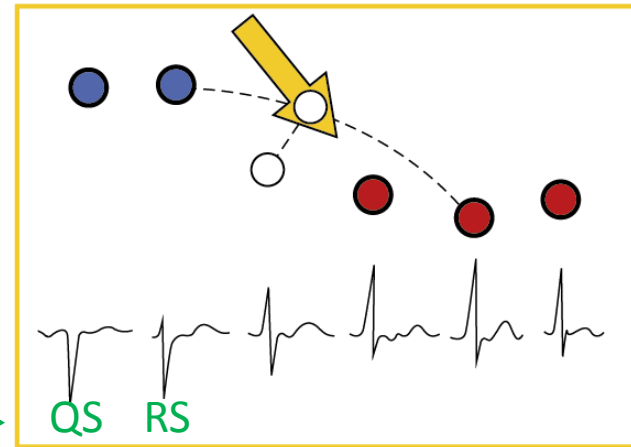
ELECTRICAL AXIS OF THE HEART

Summary of all momentary vectors, which form ventricular depolarisation loop. Expresses the direction of ventricular activation. Reflects asymmetry in ventricular wall thickness and the position of the heart in the chest.

PROJECTION PLANES OF CARDIAC VECTOR AND ECG LEADS
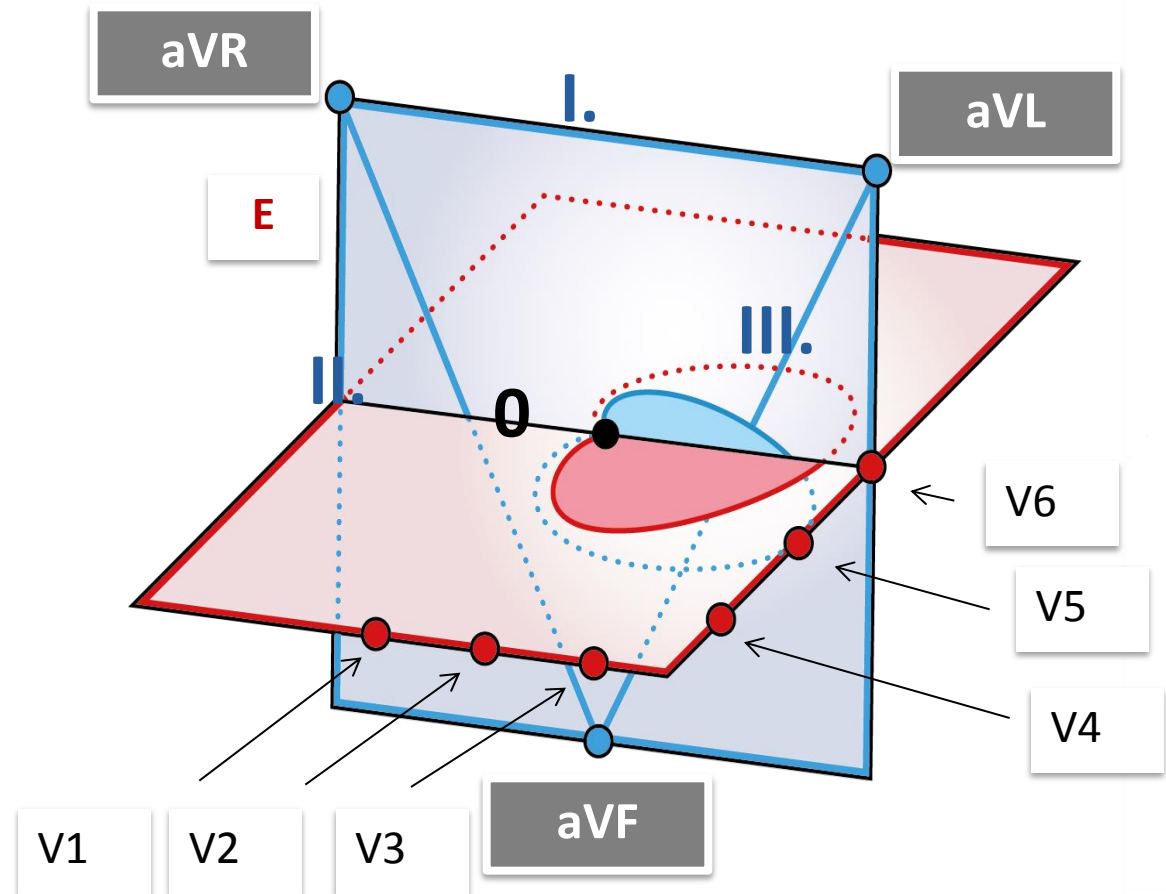
Frontal plane
limb leads
I., II., III., aVR, aVL, aVF

Horizontal plane
V1 – V6

Both planes are shifted into the level
of electrical centre of the heart
(0)

E – Einthoven triangle

aVR

I.

aVL

E

III.

II.

0

V6

V5

V4

V1   V2   V3

aVF

CARDIAC CYCLE

$P = \underline{T} \cdot 2h \cdot \underline{r^{-1}}$ **Diastole:** r and T rise, P first drops down, then rises up (relationship length/tension)

$\underline{P} = \underline{T} \cdot 2h \cdot r^{-1}$ **Isovolumic contraction**: T rises up, valves closed – increase in P

$\underline{P} = T \cdot 2\underline{h} \cdot r^{-1}$ **Ejection**: r drops down, h rises, thus P increases even at the same T

$\underline{P} = \mathbf{T} \cdot 2h \cdot r^{-1}$ **Isovolumic relaxation**: T decreases, valves closed – decrease in P

| **CARDIAC RESERVE** = maximal CO / resting CO | **4 - 7** |

CORONARY RESERVE = maximal CF / resting CF   **3.5**

CHRONOTROPIC (FREQUENCY) RESERVE = maximal HR / resting HR   **3 - 5**

VOLUME RESERVE = maximal SV / resting SV   **1.5**

CO = cardiac output
CF = coronary flow
HR = heart rate
SV = stroke volume