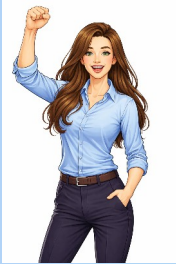


Arrhythmias

By Inga Borchgrevink

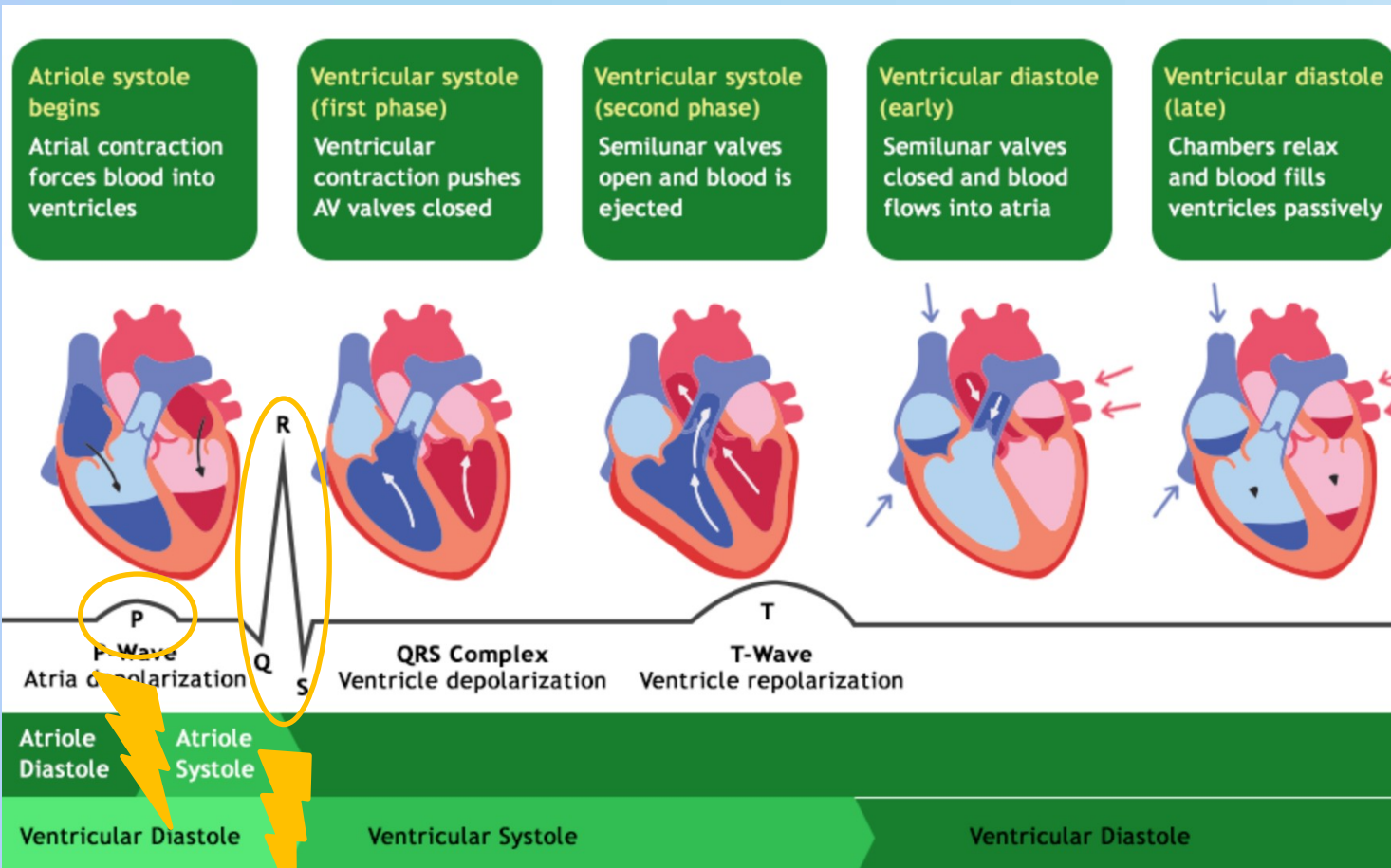
Atrial pump



Ventricular pump

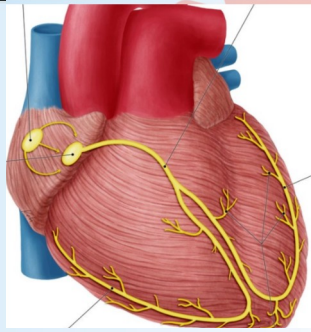


Physiological cardiac cycle



Rythm starts only
in sinus node =
SINUS RYTHM

Cardiac conduction system



- **Sinus node (SAN)**
 - Right atrium
- **Atrioventricular node (AVN)**
 - Between atrias & ventricles
 - Delays signal
- **His bundle**
 - Left & right bundle branch
- **Purkinje fibers**
 - In ventricular sub-endocardium

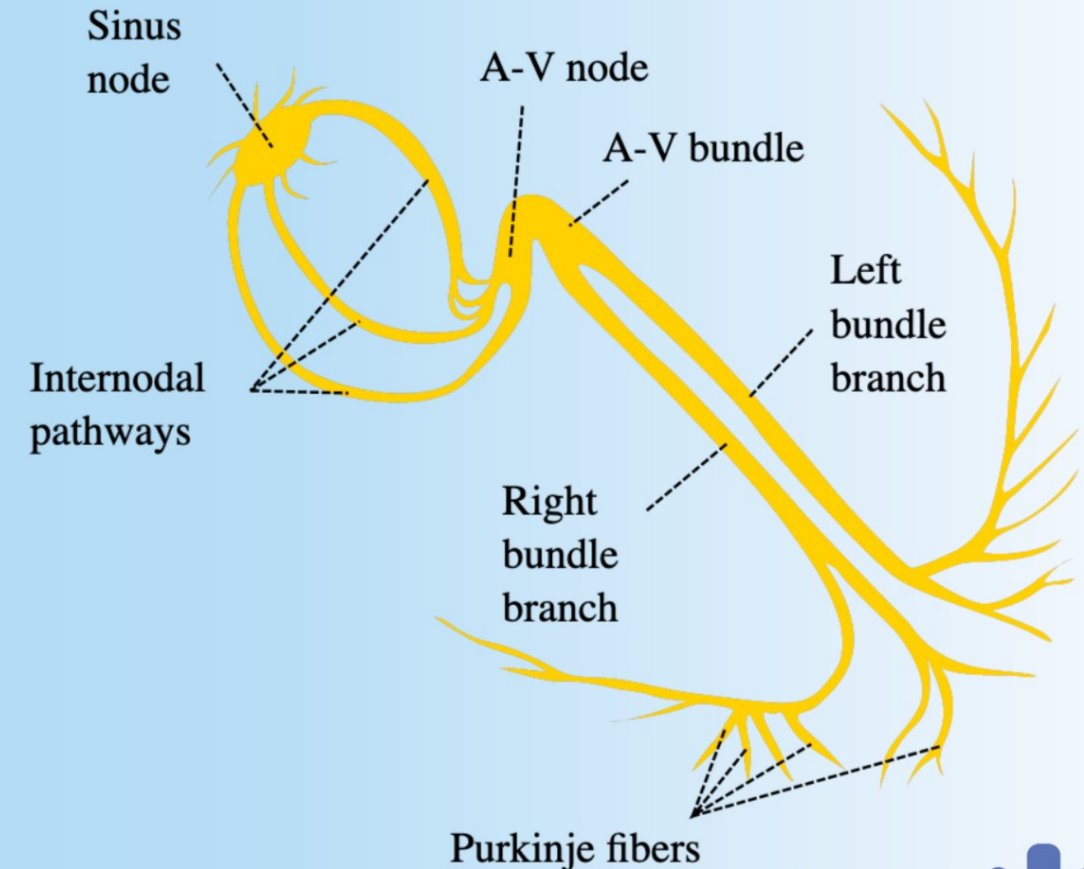
Spontaneous depolarization rate

60-100 BPM

40-60 BPM

40-45 BPM

20-40 BPM



Bradyarrhythmias

Brady = slow



Bradyarrhythmias

Altered impulse formation

Decreased SAN automaticity

Sinus bradycardia

Sick sinus syndrome

Escape rhythms

Ventricular escape rhythms

Junctional escape rhythms

Altered impulse conduction

AV block

1st° AV block

2nd° AV block

3rd° AV block

Mobitz I

Mobitz II

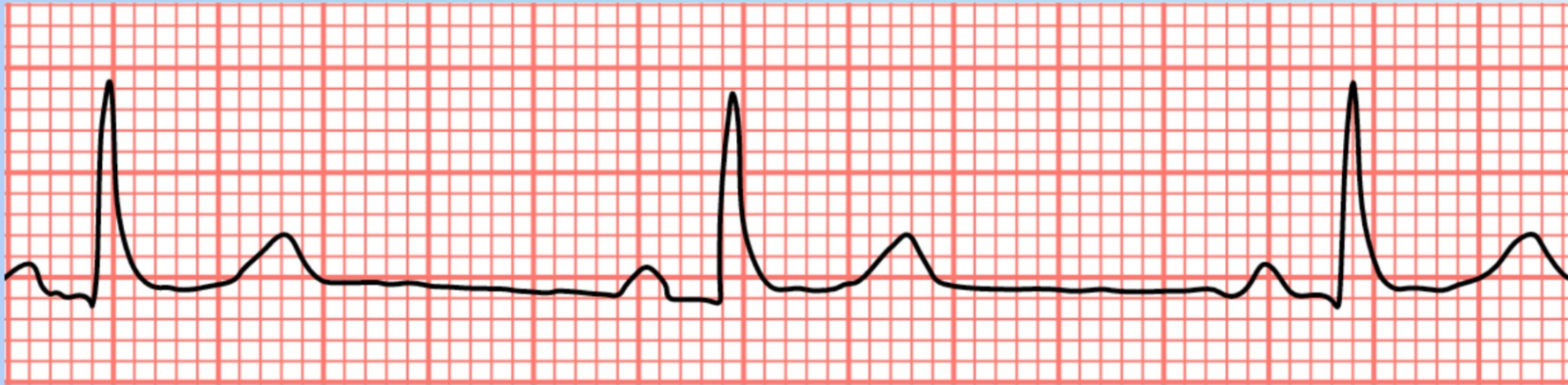
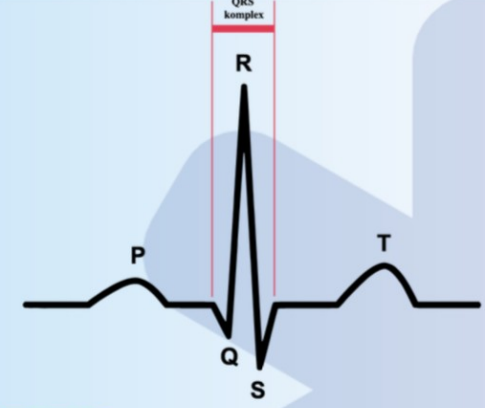
Atrial pump



Ventricular pump



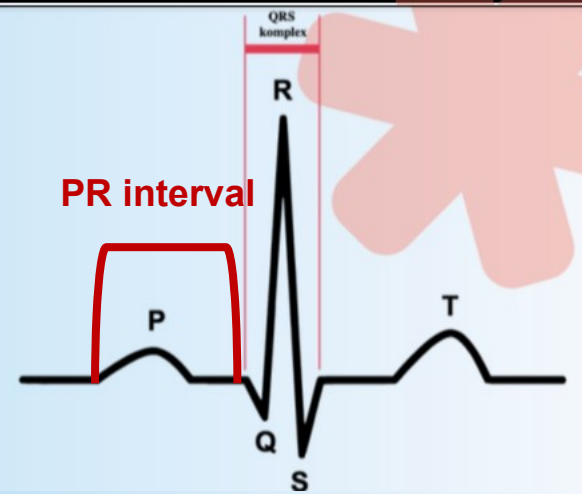
Sinus bradycardia



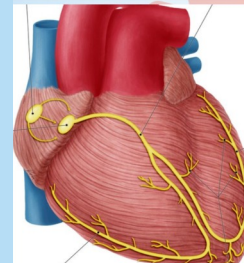
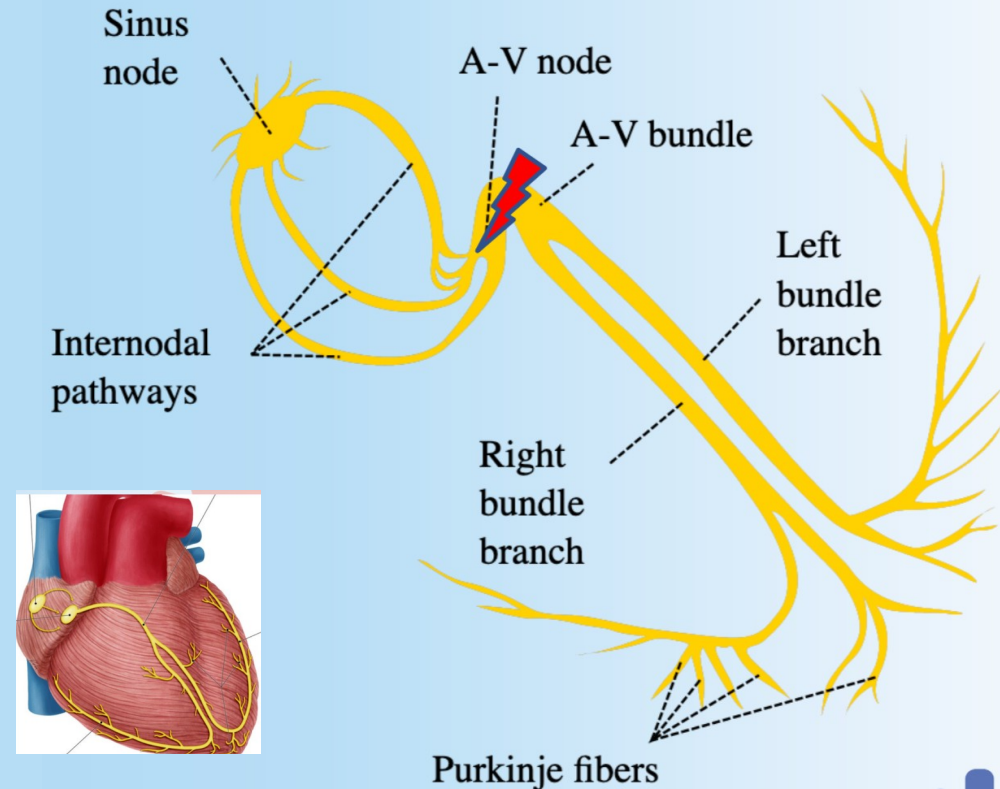
- $HR = 300 / \text{number of large squares between R waves}$
- Bradycardia = $HR < 60 \text{ BPM}$
- Only treated when symptomatic:
 - Lightheadedness, fatigue, syncope

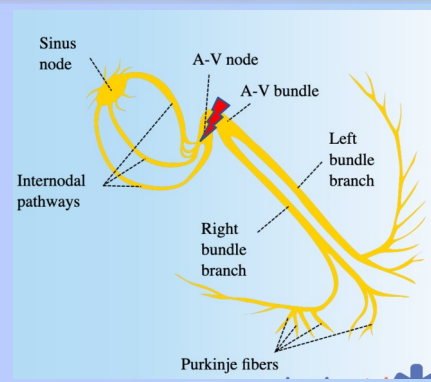
AV- blocks

*Conduction through AV node
=
PR interval on ECG*



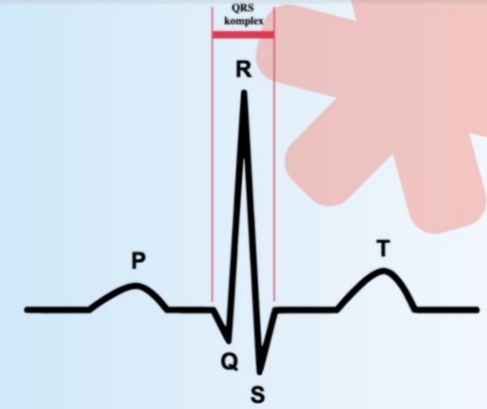
- Impaired conduction of electrical impulses from Atria → Ventricles
- Bc of:
 - Fibroses (age) or ischemia (MI) **around AV node**
 - Medications (beta- blockers++)
 - Increased vagal tone (athletes)
 - Infections
 - Surgical trauma
- AV-block
 - 1st degree AV-block
 - 2nd degree AV-block
 - Mobitz I/Wenckebach
 - Mobitz II
 - 3rd degree AV-block





Conduction block

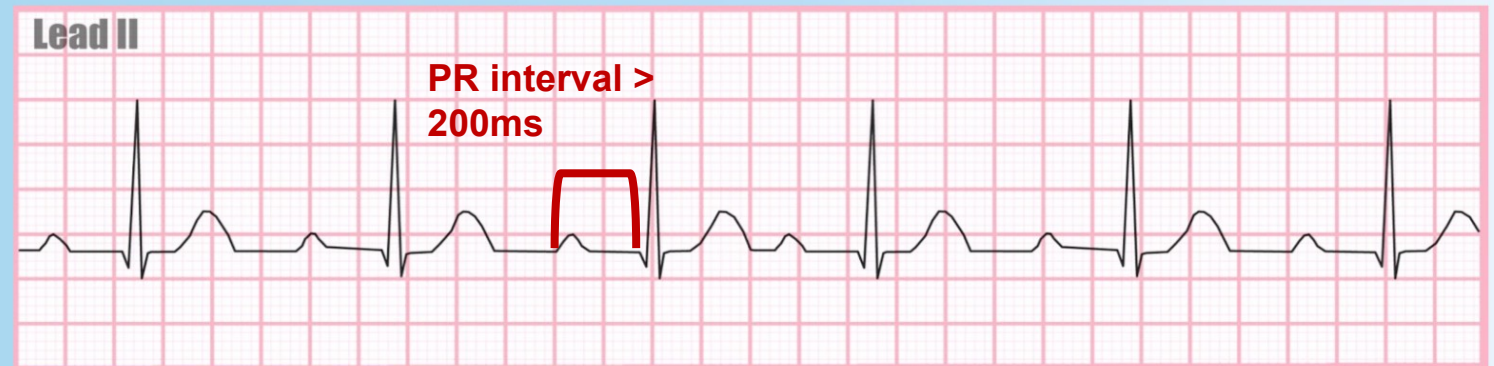
1st degree AV-block



- PR interval longer than normal ($>200\text{ms}$)
- Common in older patients. Clinically insignificant.

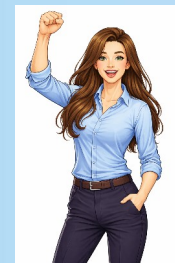
Etiology:

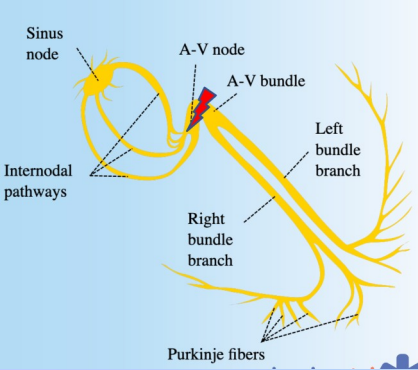
- AV nodal fibrosis
- High vagal tone
- B-blockers
- Hypokalemia



Atrial pump

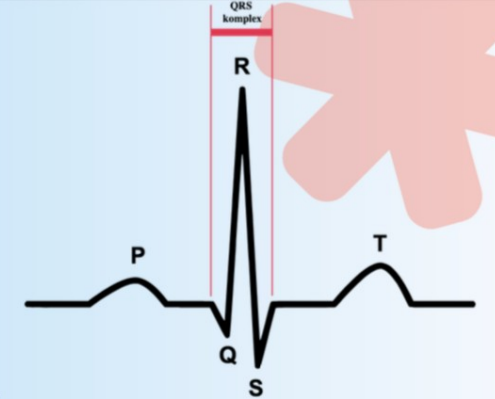
Ventricular pump



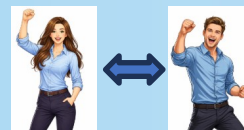
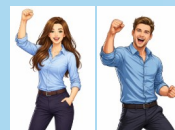
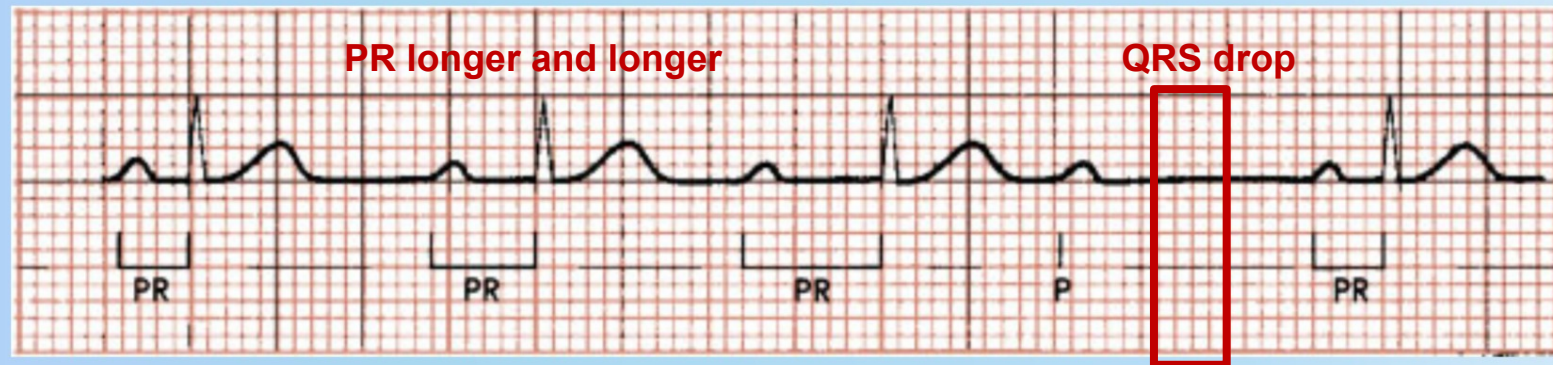


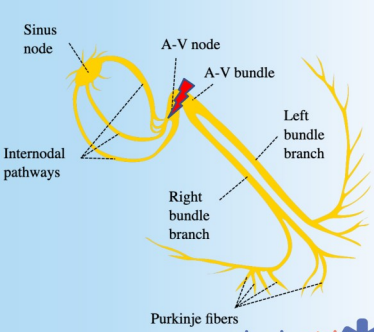
Conduction block

2nd degree AV-block, Mobitz I/Wenckebach



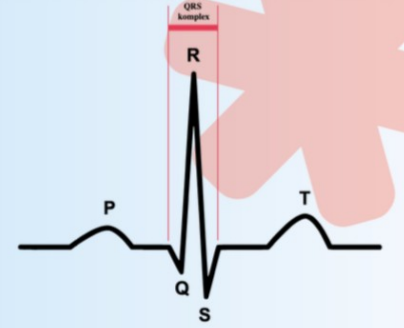
- Gradual prolongation of PR interval until a P wave is not conducted through AV-node → *missed beat*
- PP interval is constant, PR interval is variable
- Only treated when symptomatic



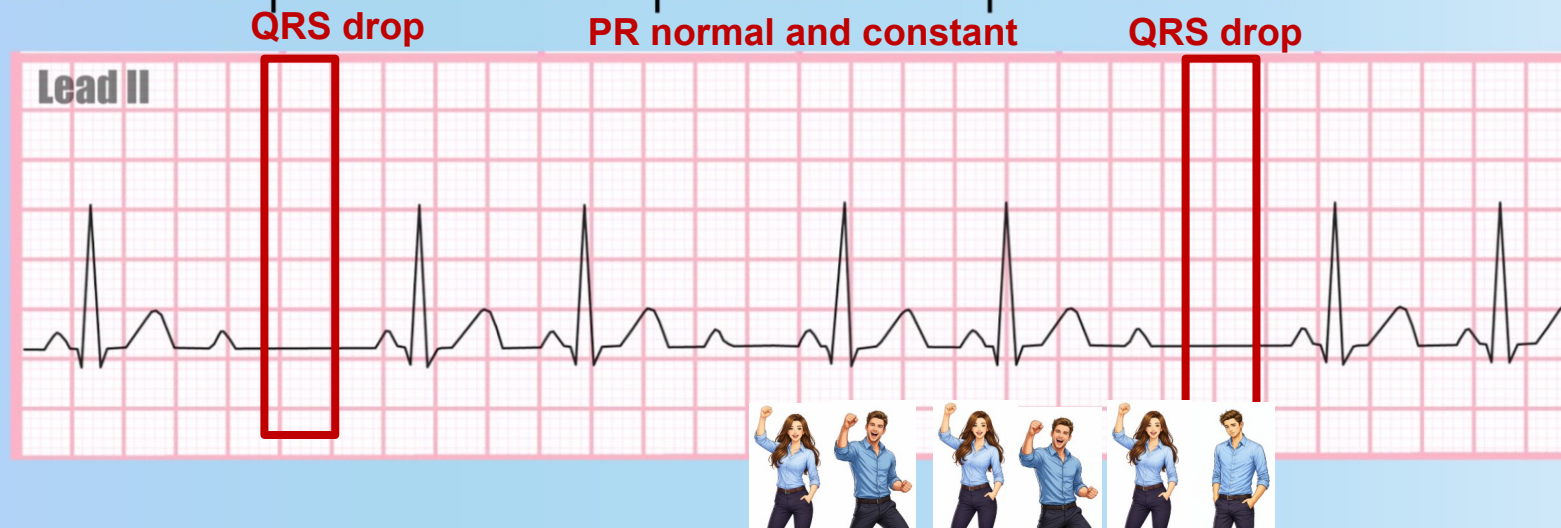


Conduction block

2nd degree AV-block, Mobitz II



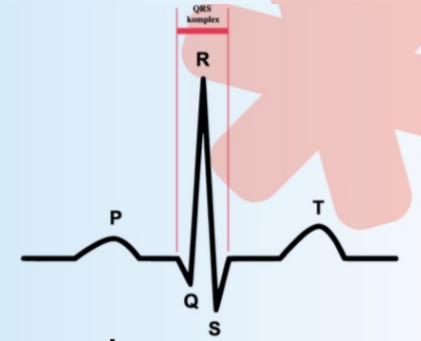
- Constant PR duration, but some P waves are not conducted through AV-node → *missed beat*
- PP interval is constant & PR interval is constant
- Associated with:
 - progression to 3rd degree AV-block, cardiogenic shock and sudden cardiac death
- Treated with implantation of permanent pacemaker



Rhythm originates from
BOTH sinus node (P) and
ventricles (QRS)

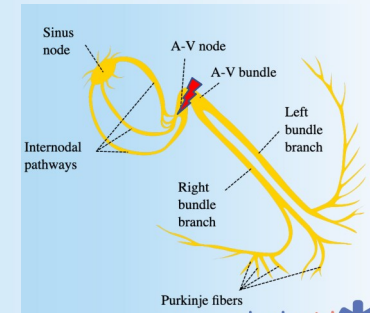
Conduction block

3rd degree AV-block

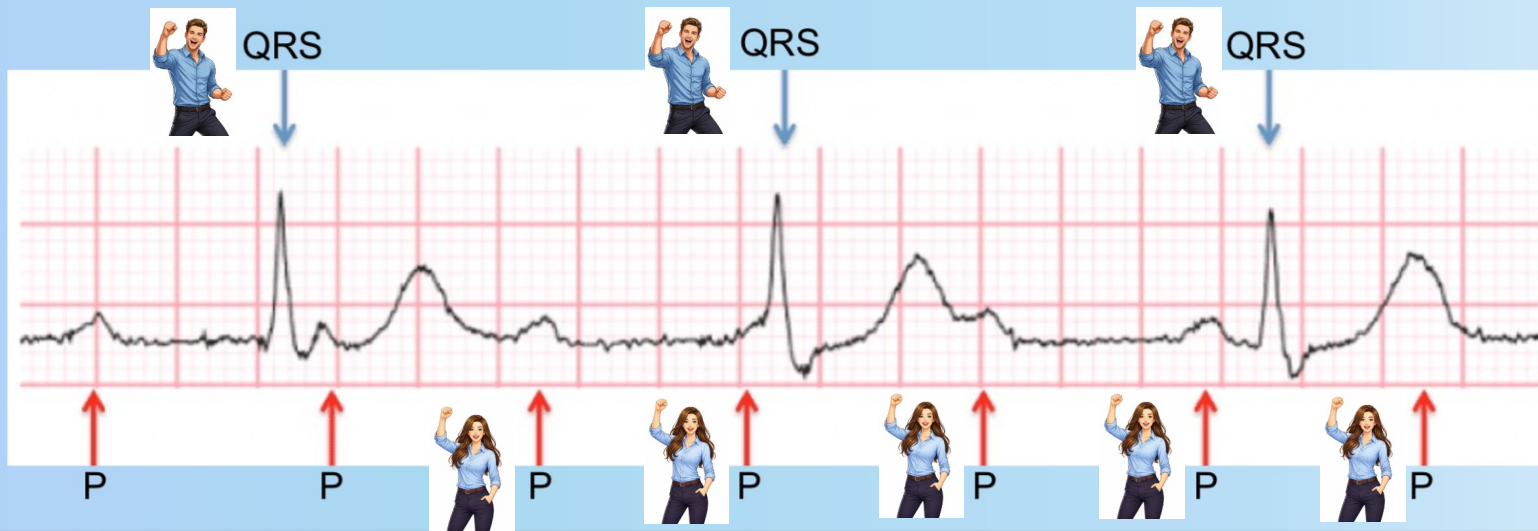


No conduction between atria & ventricles → P & QRS are independent

- QRS complexes may arise from AV junction → *normal width*
- QRS complexes arise from His-purkinje system → *wide QRS*



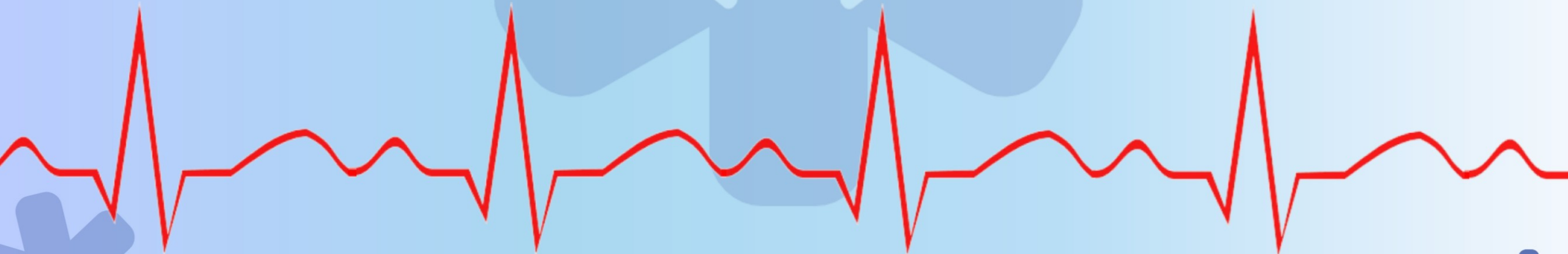
- HR: 40-60 BPM
- High risk of sudden cardiac death
- Treated by contemporary pacing until implantation of pacemaker



QRS - QRS constant

Tachyarrhythmias

Tachy = fast



Tachyarrhythmias

Altered impulse formation

Enhanced SAN automaticity

Sinus tachycardia

Enhanced latent pacemaker automaticity

Ventricular extrasystole

Atrial extrasystole

Ventricular trigeminy

Ventricular bigeminy

Ventricular fibrillation

Ventricular tachycardia

Altered impulse conduction

Re-entry tachycardia

AVNRT

Wolff-Parkinson-White syndrome

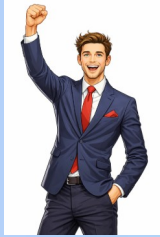
Atrial flutter

Atrial fibrillation

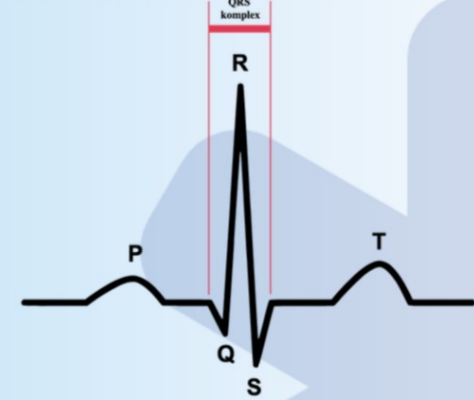
Atrial pump



Ventricular pump



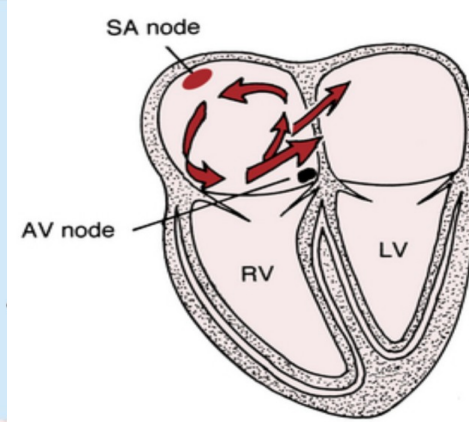
Sinus tachycardia



- Defined as HR 100-160 BPM with no other ECG changes
- May be symptom of other pathology (sepsis, hypovolemia, hypoxia)

Rhythm originates from conduction cells inside atriums, NOT sinus node!!

Atrial flutter

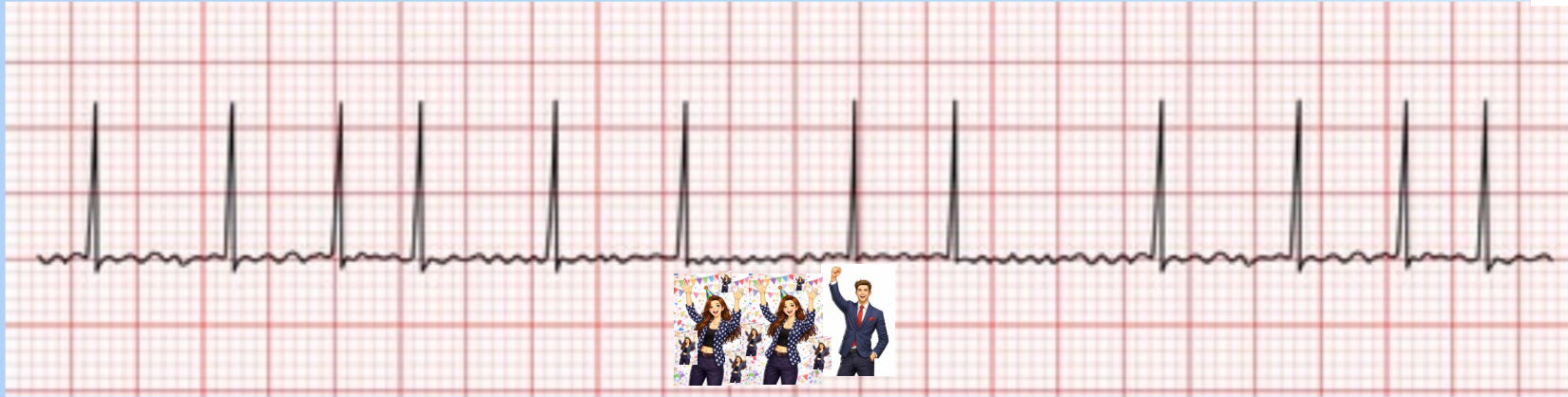
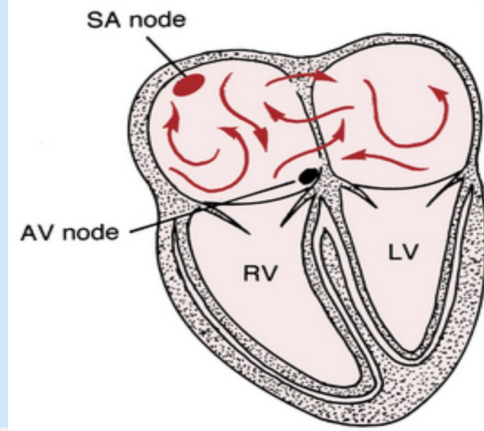


Regular 180-350 BPM

- P-waves (flutter waves) are regular with a high frequency; «sawtooth appearance»
- QRS-complexes are regular with normal morphology, but may be fast Regular 80-180 BPM

Rhythm originates from conduction cells inside atriums, NOT sinus node!!

Atrial fibrillation



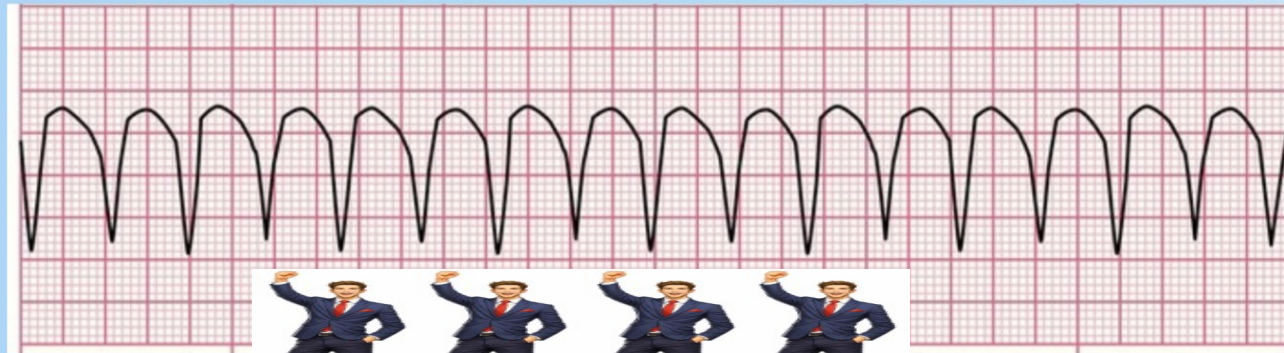
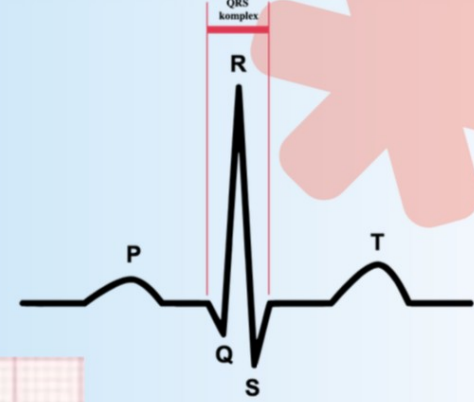
- P-waves are barely visible Irregular 350-600 BPM
- Irregular and fast QRS-complexes with normal morphology Irregular 160 BPM
- Predisposes for blood clot formation in atria ➡ Emboli stroke

Start patient on blood thinner medication

Rhythm originates from the ventricular myocardium or the Purkinje fibers



Ventricular tachycardia



- Broad, continuously repeating QRS complexes
- HR: 110-250 BPM

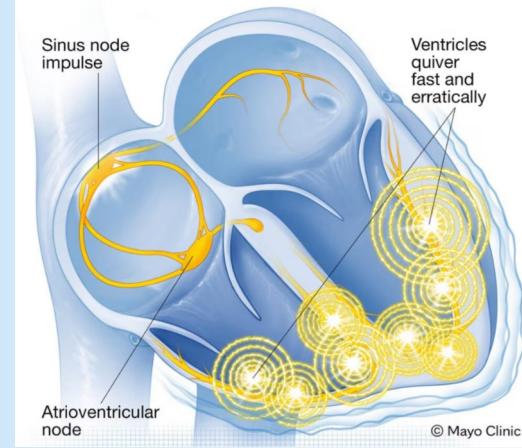
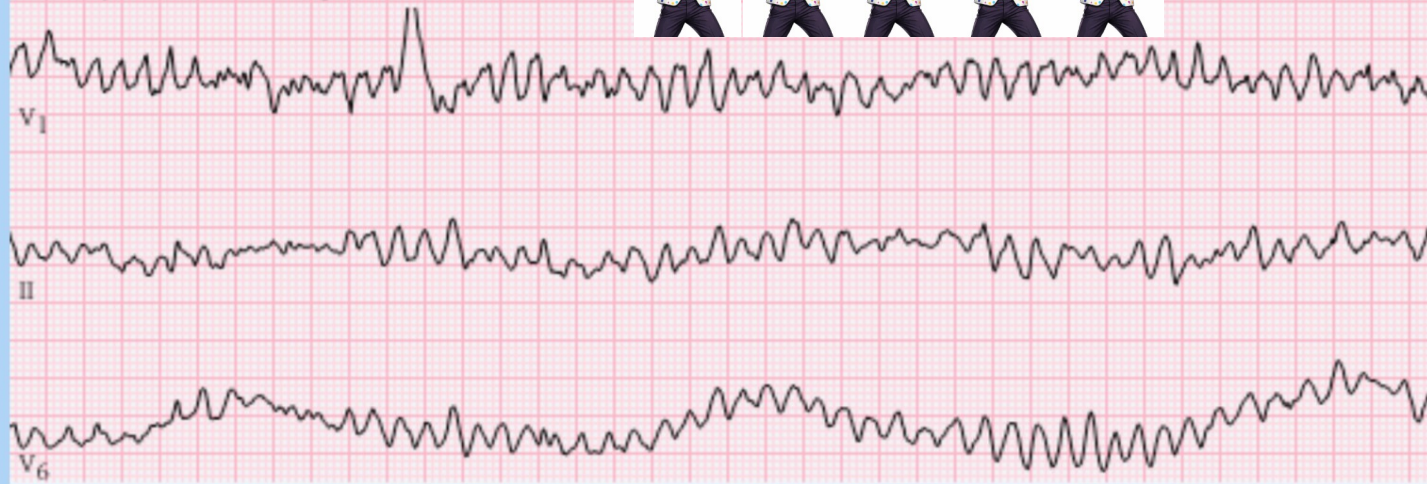
Rythm originates from the ventricular myocardium or the Purkinje fibers



Can occur during an ongoing MI or after

Ventricular fibrillation

Courtesy of Jason E. Roediger, CCT, CRAT



- No distinguishable features visible on ECG
- Heart rate 150-500 BPM Chaotic ventricular Rythm
- Mortality rate 90-95%
- Heart «vibrating» — **no blood is pumped**



WOOCCLAP
😊