

Department of Morphology
and General Pathology

ARTERIAL HYPERTENSION

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Our plan

1. WHY WE STUDY HYPERTENSION

2. CLASSIFICATION OF HYPERTENSION

3. END ORGANS

4. PRIMARY HYPERTENSION

5. SECONDARY HYPERTENSION

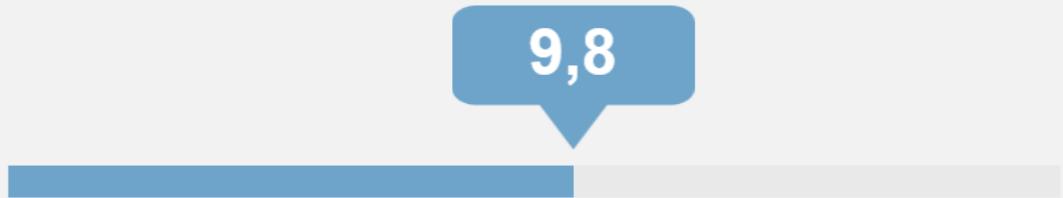
Mortality and global health



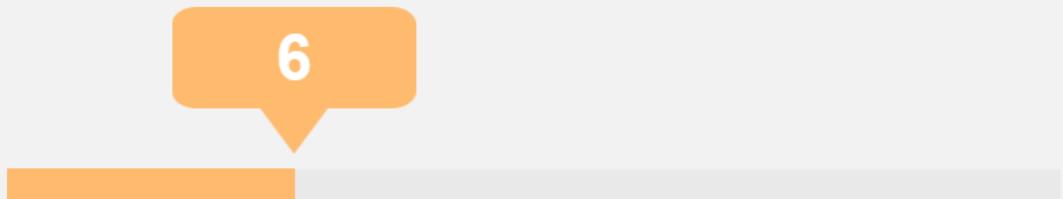
Cardiovascular disorders
millions per year



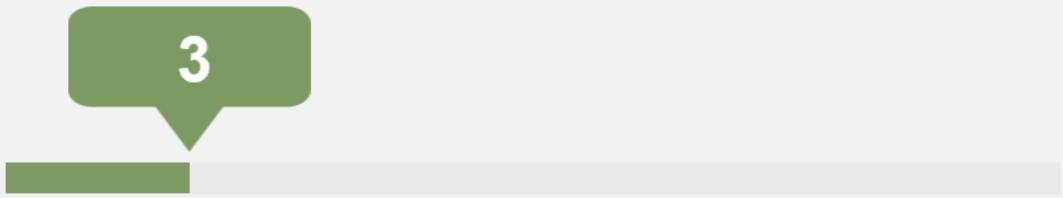
Tumors
millions per year



Lung disorders
millions per year



COVID-SARS
millions per year



total vascular resistance

ejection fraction

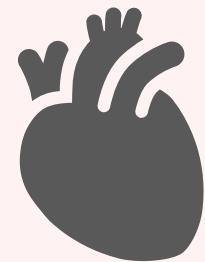
total blood volume

heart rate

vessels diameter

vessels elasticity

blood viscosity



blood pressure

Hypertension is defined as office SBP values ≥ 140 mmHg and/or diastolic BP (DBP) values ≥ 90 mmHg



**primary
hypertension**



**secondary
(symptomatic
)**



≥ 2 RULE

For diagnosis establishing

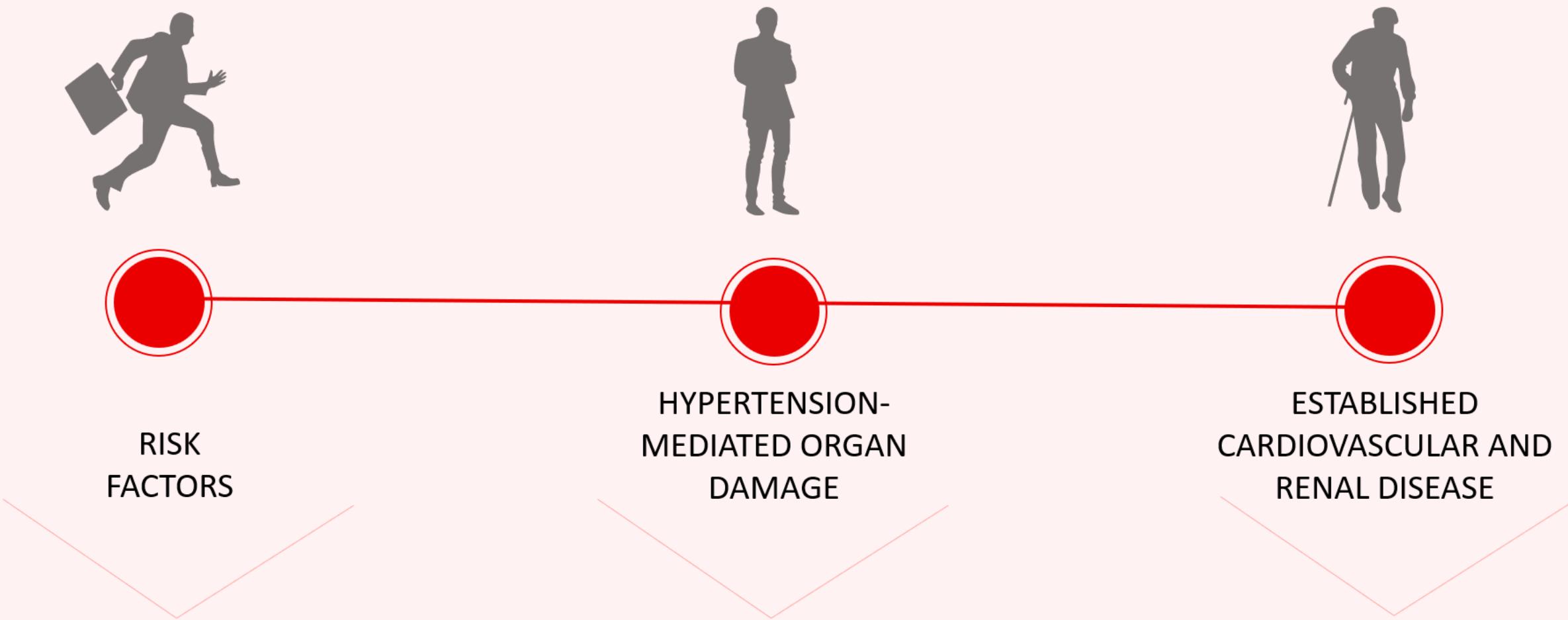
- » ≥ 2 readings
- » ≥ 2 visits



FACTORS INFLUENCING CARDIOVASCULAR RISK



cardiovascular continuum in case of uncontrolled arterial hypertension





RISK
FACTORS



HYPERTENSION-
MEDIATED ORGAN
DAMAGE



ESTABLISHED
CARDIOVASCULAR AND
RENAL DISEASE



normal heart



left ventricle
hypertrophy



angina pectoris,
myocardial infarction,
heart failure



HYPERTENSION-MEDIATED ORGAN DAMAGE

asymptomatic



→ left ventricle hypertrophy (Echo or ECG verified)



arterial stiffening:
→ Pulse pressure ≥ 60
→ Carotid-femoral pulse wave velocity $\geq 10\text{m/c}$



→ albuminuria 30-300 mg/24h;
→ CKD 1-3a stage



ankle-brachial index $< 0,9$



HYPERTENSION-MEDIATED ORGAN DAMAGE (2)

asymptomatic



advanced
retinopathy:
haemorrhages or
exudates,
papilloedema



No criteria



ESTABLISHED CARDIOVASCULAR OR RENAL DISEASE

myocardial infarction, angina, myocardial revascularization, chronic heart failure



ischaemic stroke, cerebral haemorrhage, TIA



advanced CKD
GFR $\leq 30 \text{ ml/h}^* \text{m}^2$



peripheral artery disease





ESTABLISHED CARDIOVASCULAR OR RENAL DISEASE (2)

aa.retinalis
thrombosis



presence of
atheromatous
plaque on imaging

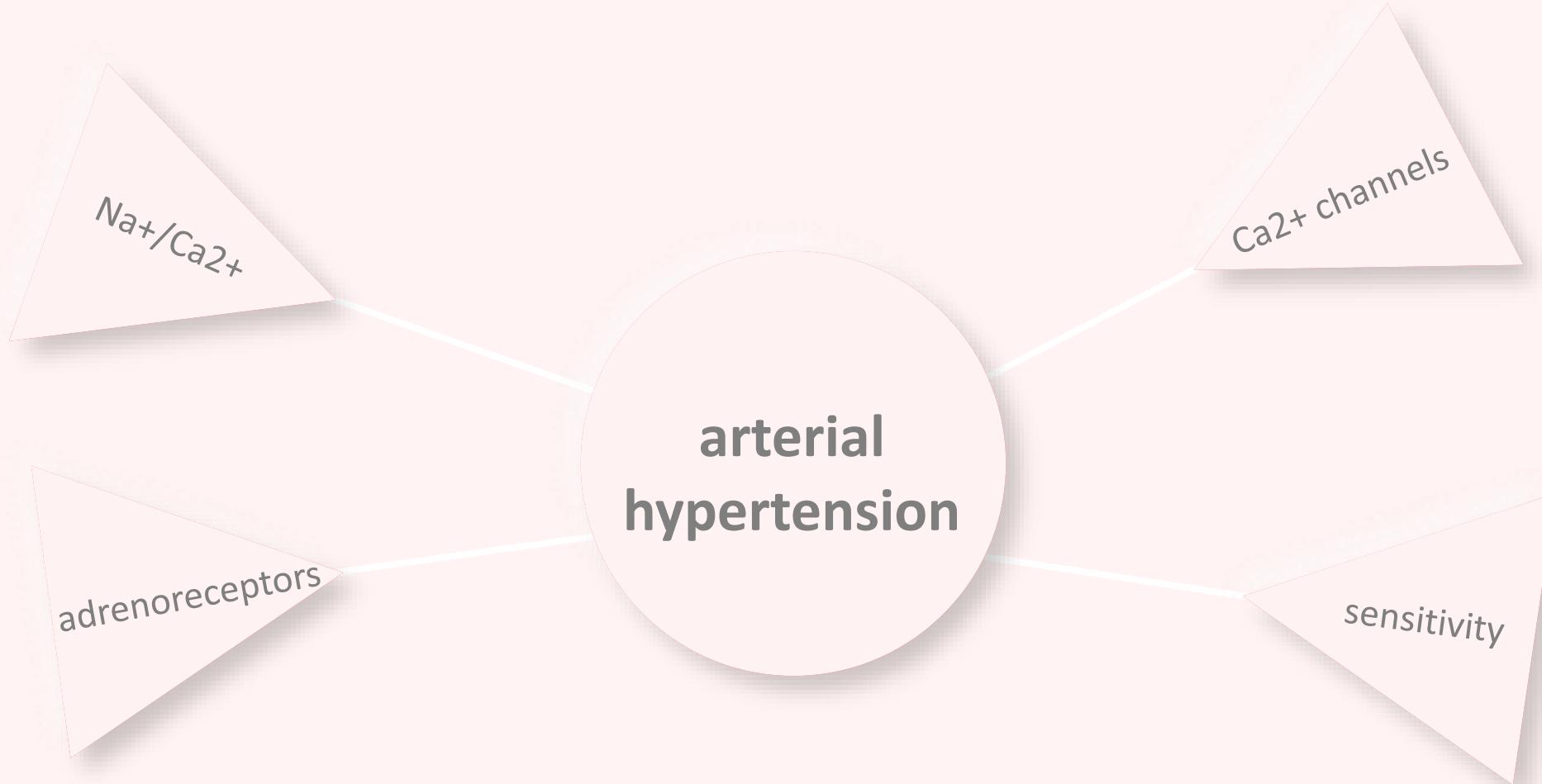


Hypertension disease staging	Other risk factors, HMOD, or disease	BP (mmHg) grading			
		High normal SBP 130-139 DBP 85-89	Grade 1 SBP 140-159 DBP 90-99	Grade 2 SBP 160-179 DBP 100-109	Grade 3 SBP \geq 180 or DBP \geq 110
Stage 1 (uncomplicated)	No other risk factors	Low risk	Low risk	Moderate risk	High risk
	1 or 2 risk factors	Low risk	Moderate risk	Moderate to high risk	High risk
	\geq 3 risk factors	Low to Moderate risk	Moderate to high risk	High Risk	High risk
Stage 2 (asymptomatic disease)	HMOD, CKD grade 3, or diabetes mellitus without organ damage	Moderate to high risk	High risk	High risk	High to very high risk
Stage 3 (established disease)	Established CVD, CKD grade \geq 4, or diabetes mellitus with organ damage	Very high risk	Very high risk	Very high risk	Very high risk



primary arterial hypertension

PRIMARY HYPERTENSION – POLYGENIC CONDITION



ROBERT M. SAPOLSKY

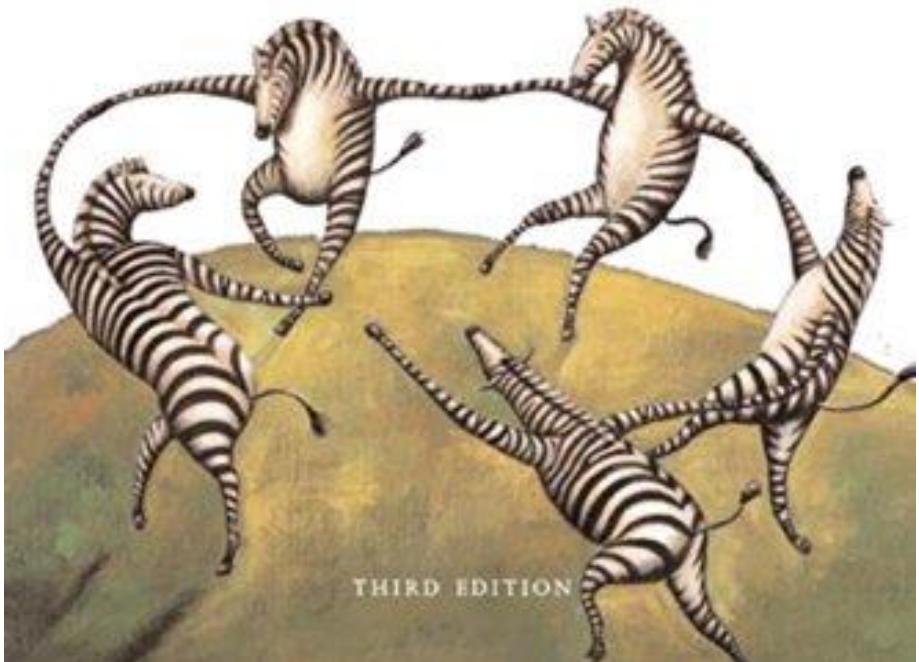
Author of A Primate's Memoir

WHY ZEBRAS DON'T GET ULCERS

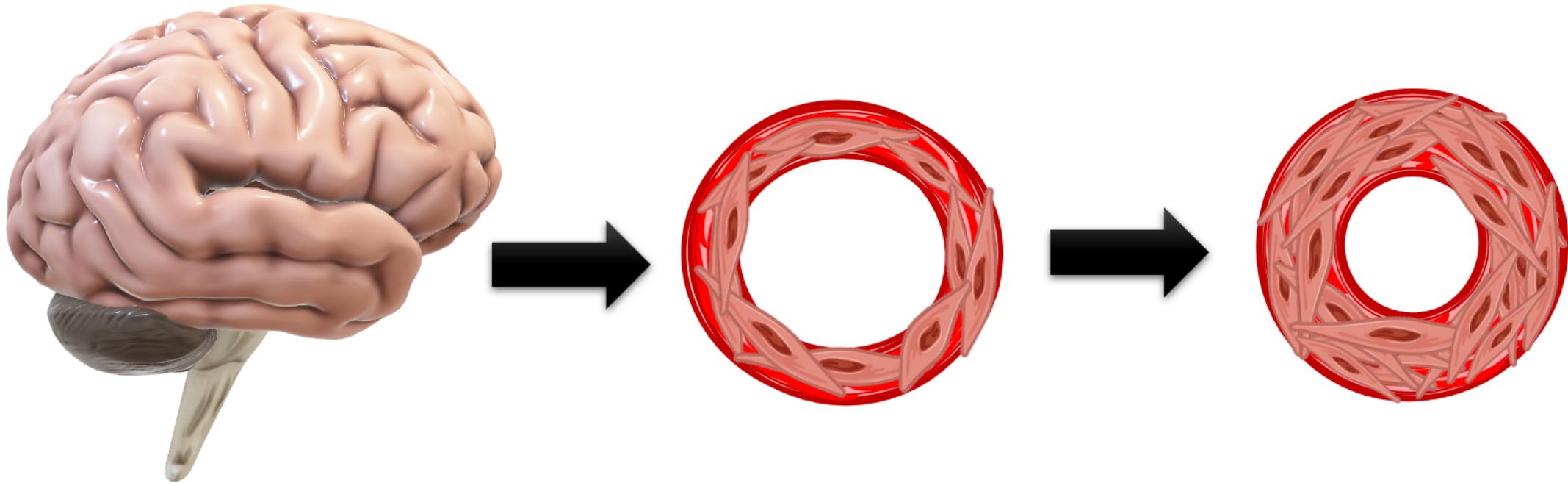
The Acclaimed Guide to Stress, Stress-Related
Diseases, and Coping—Now Revised and Updated

"One of the best science writers of our time."

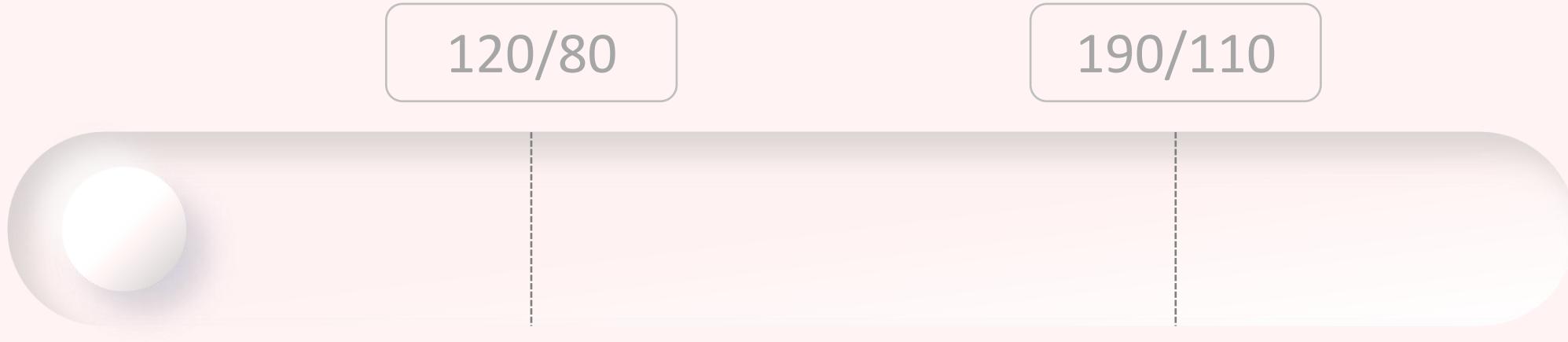
—Oliver Sacks



THIRD EDITION



ALTERED BLOOD PRESSURE CONTROL



normal
set-point

new set-point

Mechanism of changed set-point

- » vessels remodeling
- » baroreceptors resetting
- » increased activity of blood regulatory systems

secondary arterial hypertension

secondary arterial hypertension

1. NEPHROGENIC

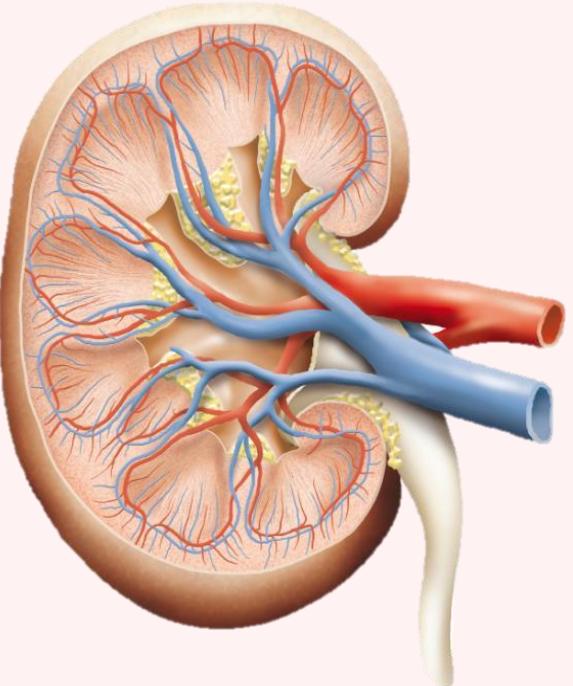
2. ENDOCRINE

3. NEUROGENIC

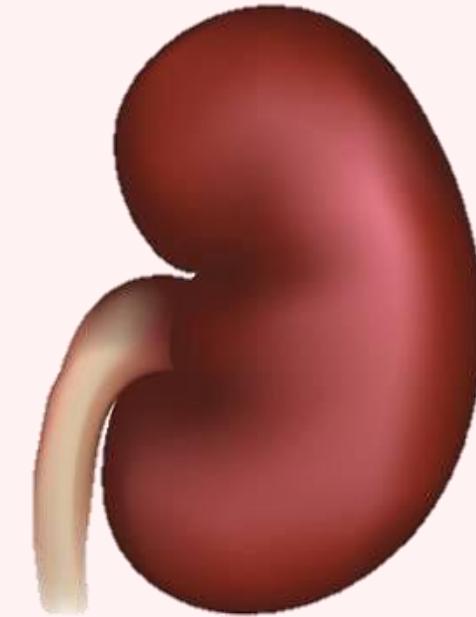
4. DRUG INDUCED

5. OTHERS

nephrogenic arterial hypertension



vasorenal



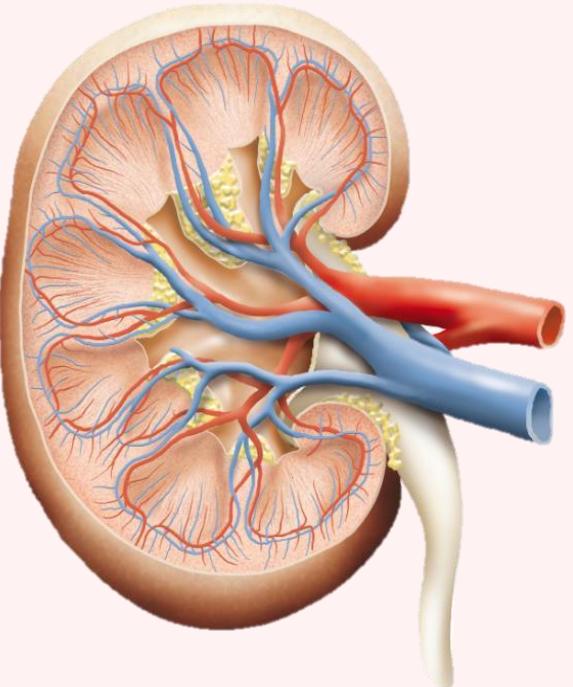
renoparenchymal

renoparenchymal hypertension

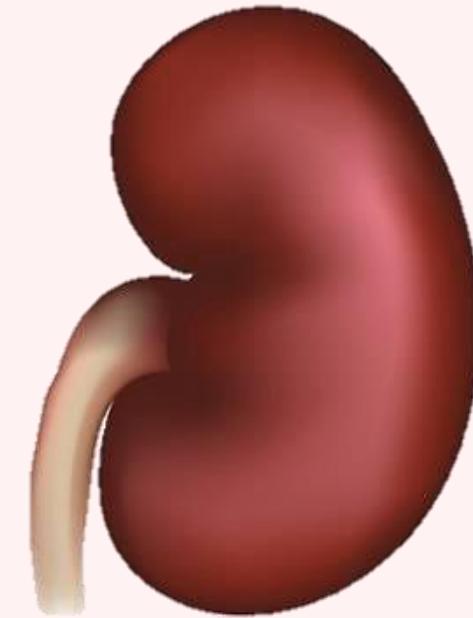


- » Decreased PG production
- » Decreased aminopeptidase synthesis which cleaves angiotensin II
- » Increased blood volume

nephrogenic arterial hypertension

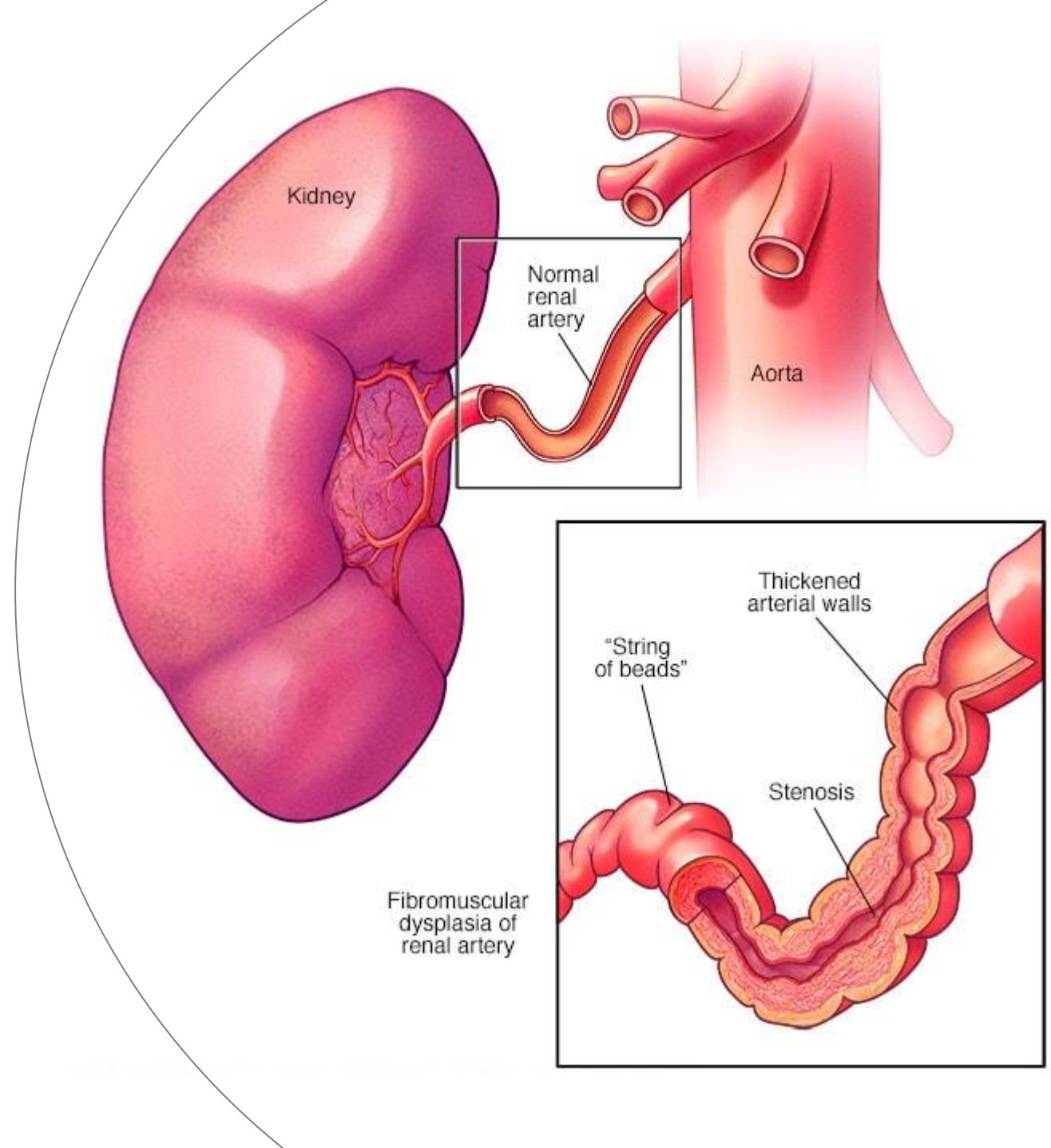


vasorenal



renoparenchymal

Fibromuscular dysplasia



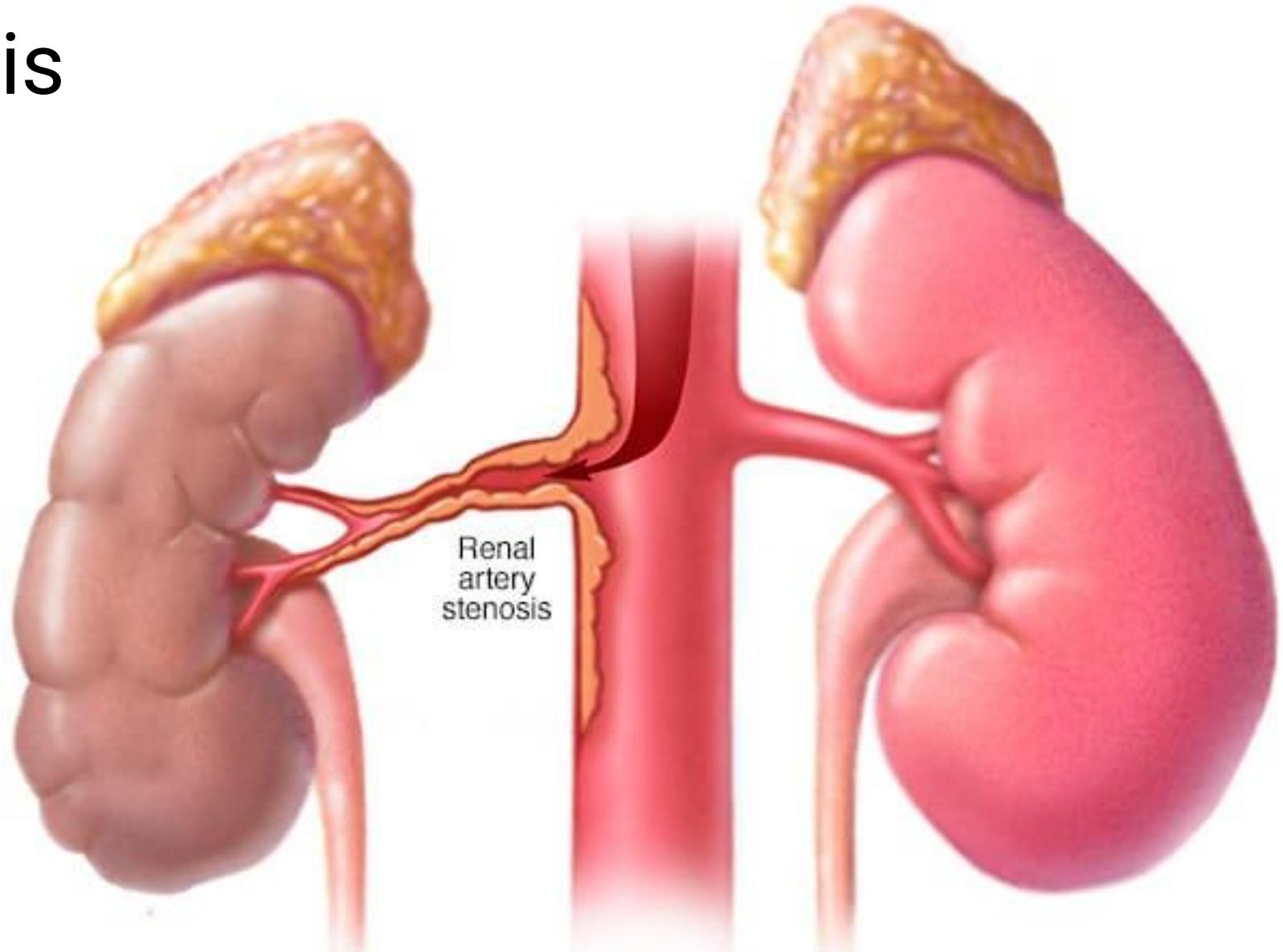
Urography
lying position



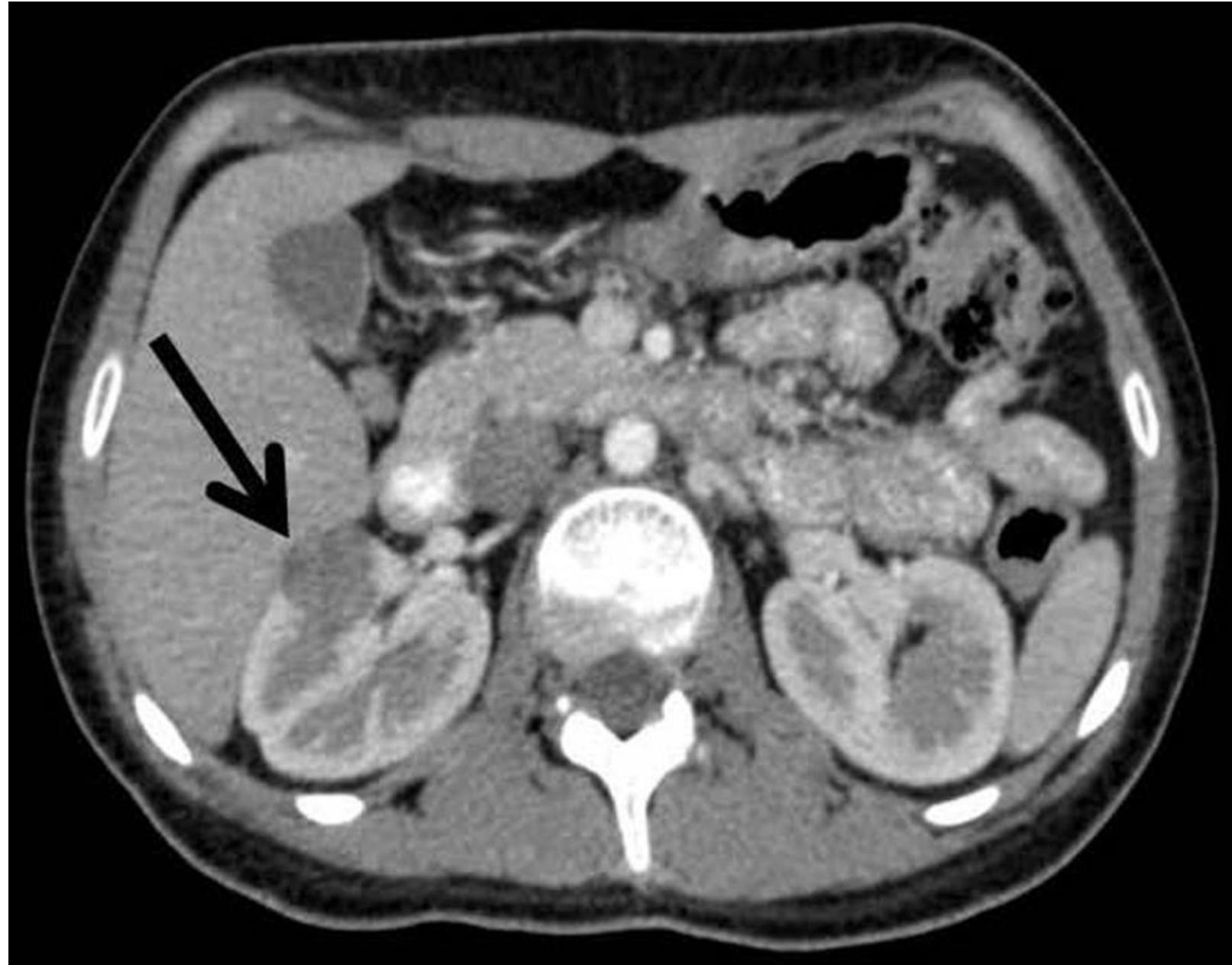
Urography
standing position



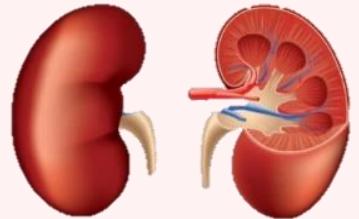
a.renalis
atherosclerosis



Reninoma



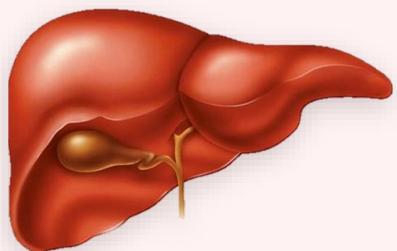
RAAS protagonists:



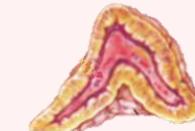
RENIN



ACE

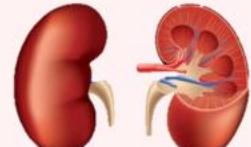


ANGIOTENSINOGEN

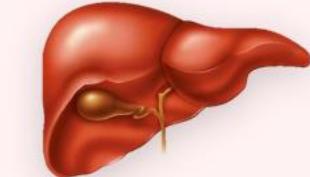


ALDOSTERONE

HYPOTENSION
HYponatremia
SNS ACTIVATION



RENIN



ANGIOTENSINOGEN



ALDOSTERONE

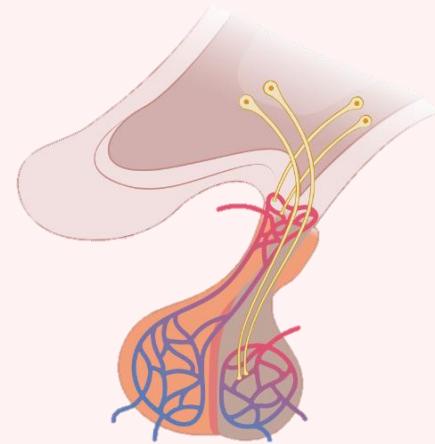
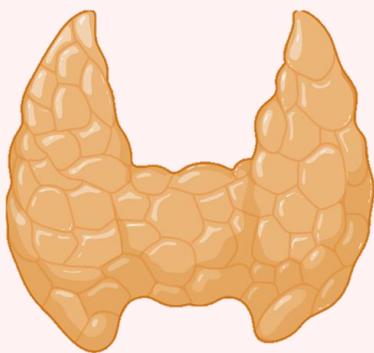
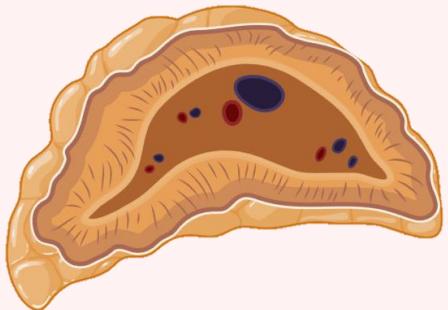
ANGIOTENSIN I

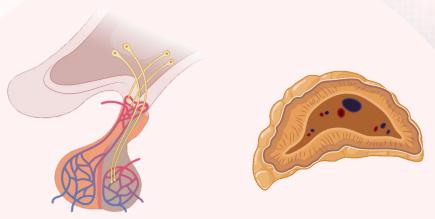
ACE



ANGIOTENSIN II

endocrine arterial hypertension





hypercortisolism

ejection fraction

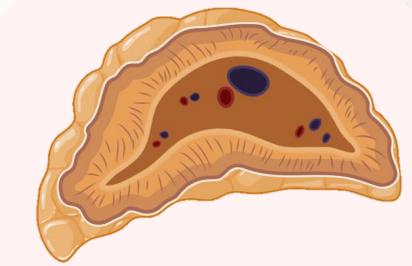
increased blood volume

tachycardia

vasoconstriction

high vessel stiffness

high blood viscosity



hyperaldosteronism

ejection fraction

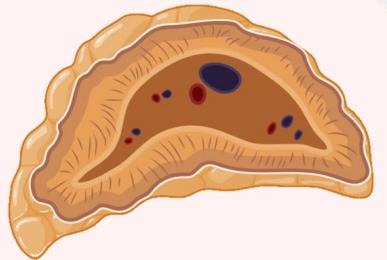
increased blood volume

tachycardia

vasoconstriction

high vessel stiffness

high blood viscosity



pheochromocytoma

ejection fraction

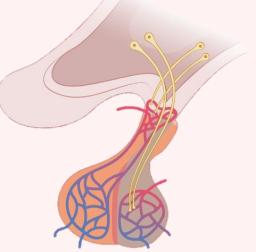
increased blood volume

tachycardia

vasoconstriction

high vessel stiffness

high blood viscosity



**inappropriate
antidiuretic hormone
secretion**

ejection fraction

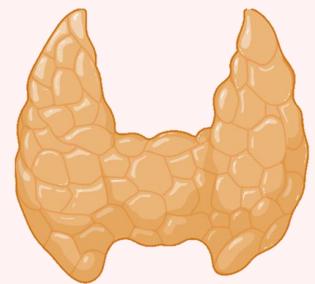
increased blood volume

tachycardia

vasoconstriction

high vessel stiffness

high blood viscosity



hyperthyroidism

ejection fraction

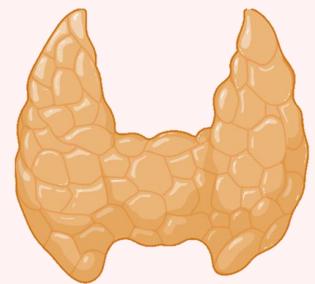
increased blood volume

tachycardia

vasoconstriction

high vessel stiffness

high blood viscosity



hypothyroidism

ejection fraction

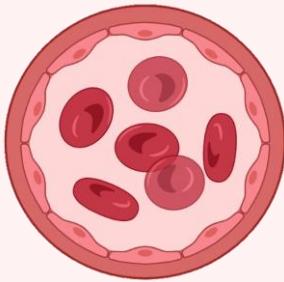
increased blood volume

tachycardia

vasoconstriction

high vessel stiffness

high blood viscosity



primary erythrocytosis

ejection fraction

increased blood volume

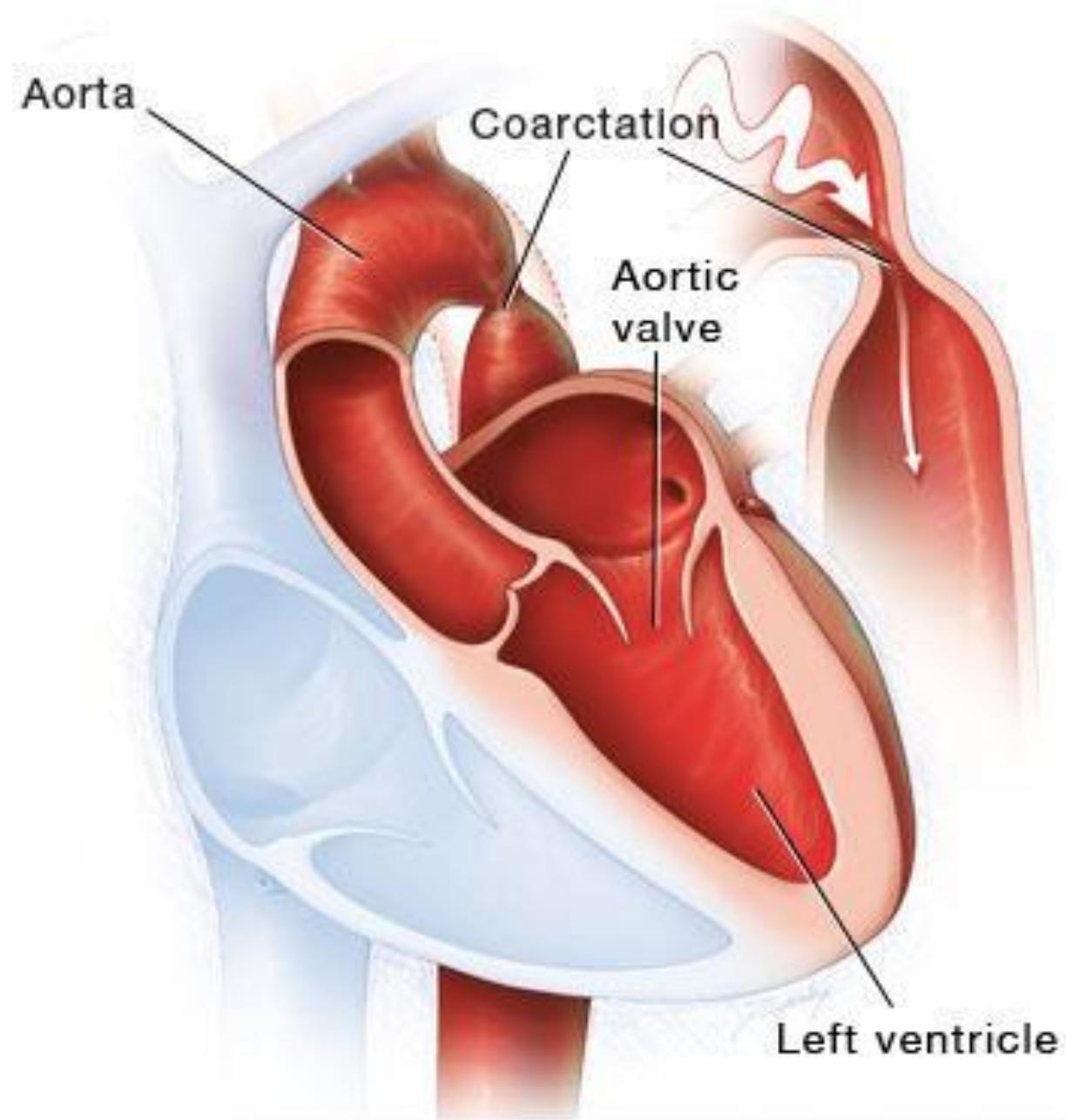
tachycardia

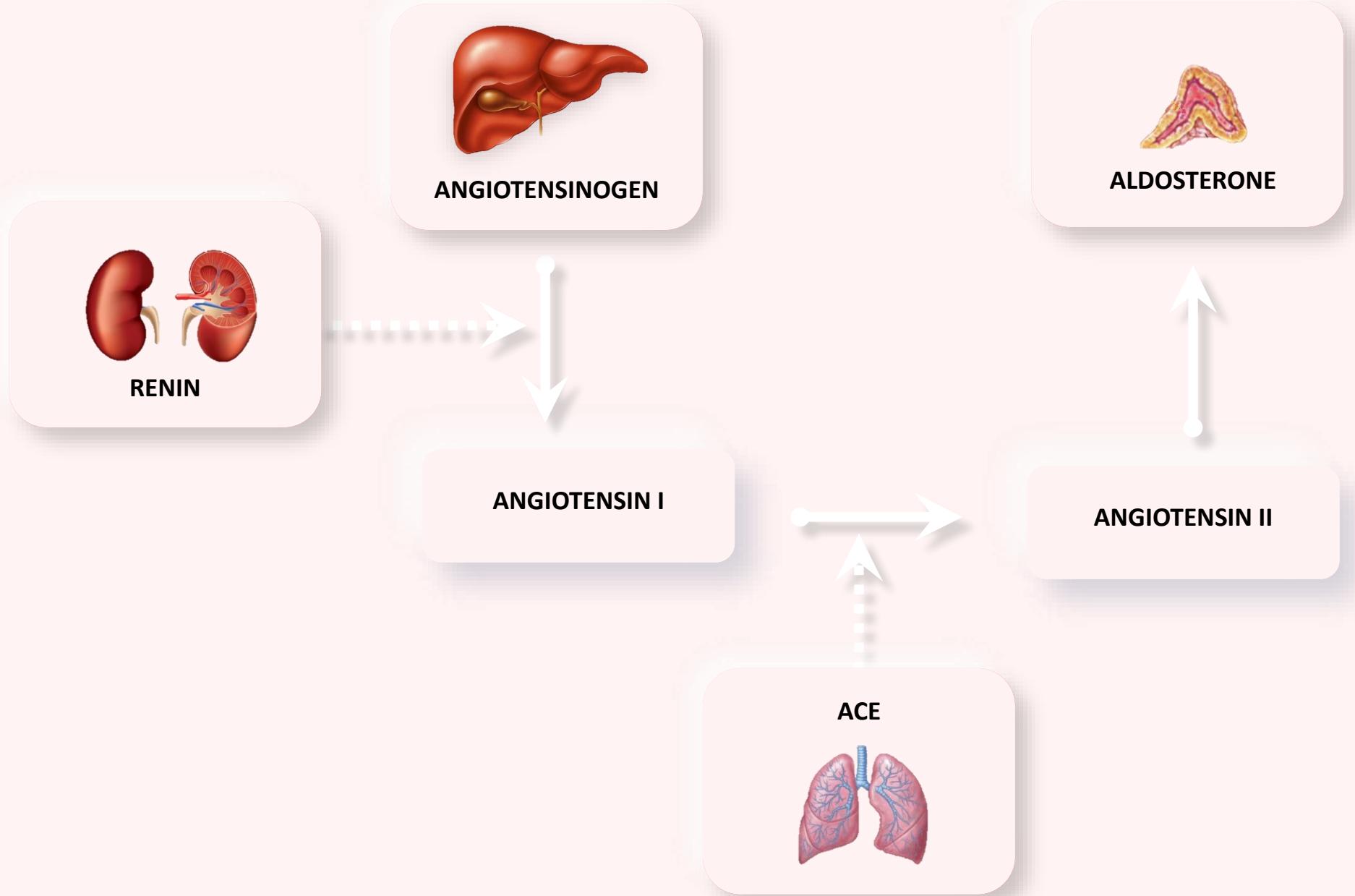
vasoconstriction

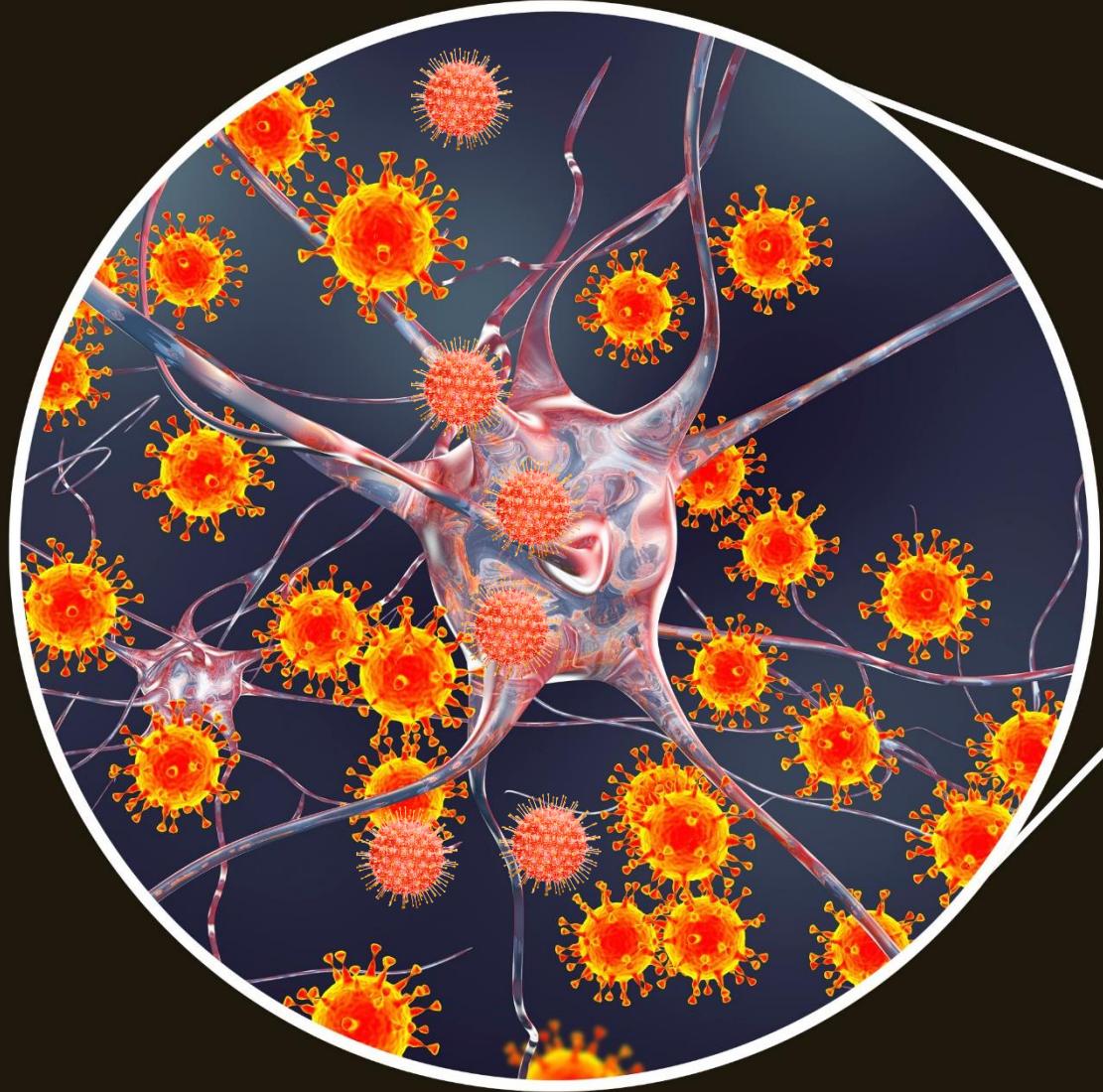
high vessel stiffness

high blood viscosity

Aorta coarctation



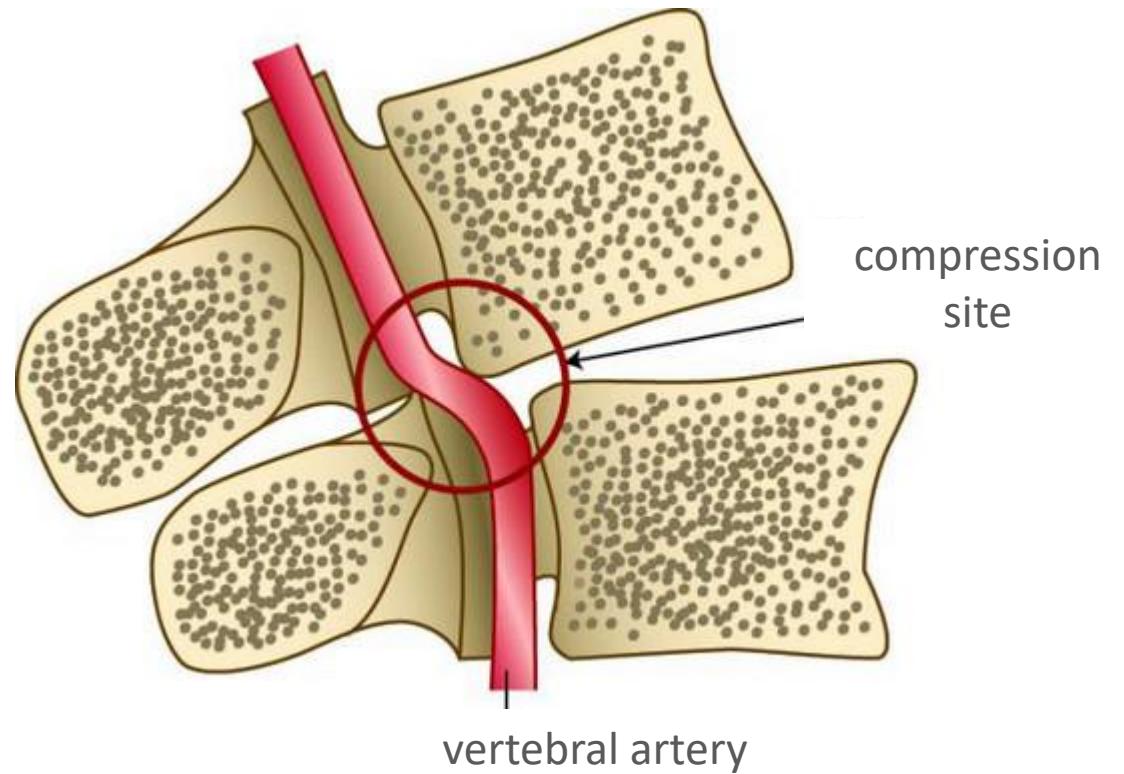




**Neurogenic arterial
hypertension**



Neurogenic arterial hypertension



A close-up photograph of a doctor's torso and hands. The doctor is wearing a white lab coat over a black collared shirt. A stethoscope hangs around their neck, and they are holding it with both hands, the tips of the tubes pointing towards each other. The background is dark.

White-coat hypertension

Drug-induced hypertension

Tricyclic antidepressants

Adrenomimetics

Cocaine, amphetamine

NSAID's

Glucocorticosteroids

Testosteron