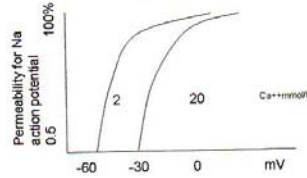


Calcium + phosphate

HOMEOSTASIS OF CALCIUM ROLE OF Ca^{++}

- Nerve function
- Enzymatic reactions
- excitation-contraction coupling
- excitation-secretion coupling
- Blood clotting mechanism, coagulation – taking blood (first hypocalcemic tetany)
- cAMP dependent functions (activity of adenylcyclase), 2nd messengers
- permeability of membranes
- Growth and development

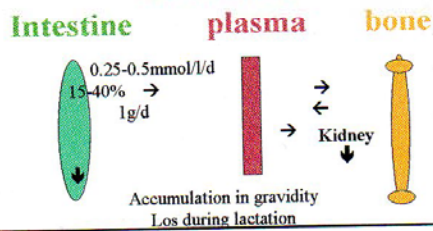
Stabilisation of membrane potential hypocalcemic TETANY



CONTENT OF CALCIUM IN THE BODY

2% of body weight = 5. element in the body,
99% in bones

Ca balance



Calcium in plasma

TOTAL

2.3 - 2.7 mmol/l (9.2-10.8 mg%)

stable nondiffusible → exchangeable

bound to proteins 40% (1.14 mmol/l) Ca^{++} , complexed to anions (citrate) 10% (0.15 mmol/l)

Ionisation of proteins ↑
at ↑ pH → ↑ binding of Ca^{++}

HYPERVENTILATION → ↓ conc. H^+
→ tendency to TETANY

PHOSPHATE

85-90% in skeleton

ATP, cAMP, phosphorylated proteins, inorganic phosphate

TOTAL in plasma
(12mg%)

2/3 organic compounds 1/3 inorganic anions

Plasma concentration of Ca^{++} and phosphate

Blood is nearly saturated solution
CONST. product: $Ca^{++} \times$ phosphate
P in plasma 0.8 - 1.4 mmol/l

Example: infusion of phosphate
.... Ca into bones
→ hypocalcaemia

BONES

dynamic balance between formation and reabsorption

- **OSTEOBLASTS**
Secrete COLLAGEN
→ MATRIX
Alkaline phosphatase
hydrolysis of ester P
product solubility of Ca⁺⁺
and P is exceeded
PRECIPITATION
+ estrogens, STH
- parathormon, vit D
In older people osteoporosis
- **OSTEOCLASTS**
Polynuclear cells erode by
Acidic phosphatase
(Hydroxyprolin released)
+ parathormon
- estrogens, calcitonin

PARATHYROID HORMON - PTH

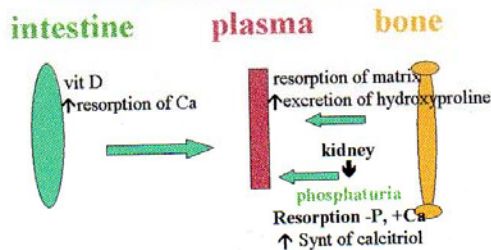
4 glands embedded in Th. G.
during STRUMECTOMY minimally
1 P. G.



CHIEF CELLS (PTH)
chemoreceptor and effector

- ↑ level of Ca⁺⁺ in plasma
- ... ↑ secretion of pre-pro-hormone
- ... proteolysis
- ... biol effective peptide 34 AMA
(RIA determines all together)
- bb. oxyphytic (fca ?)

PTH increases calcaemia



HYPOPARATHYROIDISM

- PTH essential for life

1. after parathyroidectomy (during thyroid surgery -1 Parath. gl.)
- symptoms after 2-3 days (or later)
2. Idiopathic – exceptionally

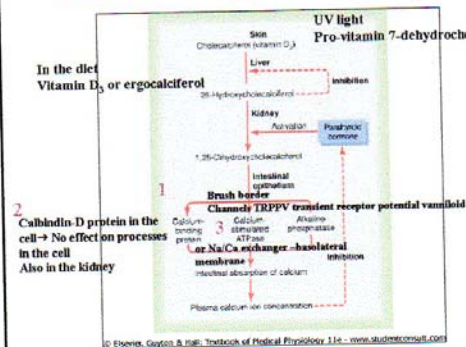
TETANY

1. Chvostek's sign – tapping over the facial nerve
 2. Trousseau's sign – spasm of upper extremity after occluding the circulation for some min.
- DEATH LARYNGOSPASM**

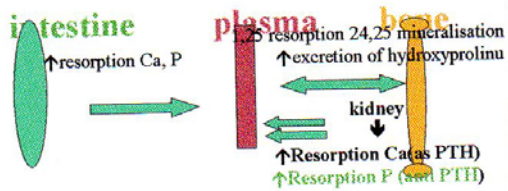
HYPERPARATHYROIDISM

1. PRIMARY = hypercalcaemic adenoma
Demineralization of bones – multiple cysts = „osteitis cystica generalisata“ = RECKLINGHAUSEN'S DISEASE
Broken bones, nephrolithiasis →
Calcaemia over 4 mmol/l
„calcaemic death“ = stop of the heart in systole
Dg. ↑ excretion of hydroxyprolin in urine
1. SEC. = normocalcemic hyperplasia and hyperfunction –during ↓ calcitriol, nephropathy (compensation of loss of calcium)

Vitamin D – synthesis of D hormone



D hormone = 1,25-(OH)₂ cholecalciferol
Stimulates expression of genes involved in synthesis and transport proteins



Deficiency - children rickets ↓sun -th. Vit.D (insufficient mineralization, weakness and bowing of weight bearing bones), type I vit.D-resistant r: 11-α hydroxylase, th. Calcitriol type II vit.D-resistant r: receptors for calcitriol (rare, resistant to th. - adults osteomalacia demineralization of bones

Calcitonin

- Secretion – parafolikular cells in Th. Gl.
- Plasma level is low, role is uncertain
- bones -↓resorption of Ca⁺⁺
- kidney - ↑excretion of Ca and Ph
- Secretion is activated by CCK – protect against postprandial hypercalcaemia ... decreased calcemia supports resorption of Ca⁺⁺... may be - in young skelct development