

# **SELENIUM**

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# Nutritional intake

- **Main sources**
- bulbous vegetable
- brazil nuts
- viscera
- sea fish
- meat
- cereals
- legume
  
- **RDI:**      40 – 80  $\mu\text{g}$  /d  
(estimate of intake Czech rep. 20 – 40  $\mu\text{g}$  /d !)

# Forms of selenium in food and drugs

- **Organic Se (selenoMet)**
  - active resorption via channels
  - high retention in organism
  - antioxidative effects
  - low excretion
- **Anorganic Se ( $\text{Na}_2\text{SeO}_3$ )**
  - passive resorption by diffusion
  - low retention in organism
  - rather prooxidative effects?
  - high excretion

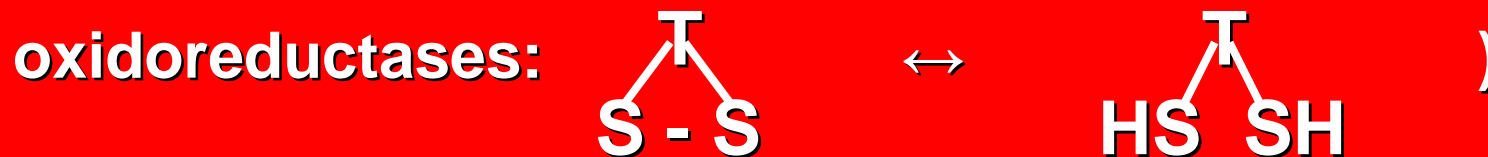
# Metabolism

- **Absorption**
- 76 - 100%; duodenum and jejunum
- **Transport and distribution in organism**
- binds albumin and then is built into **selenoproteins** as Se-Cys
- not stored in the liver → in inappropriate intake deficiency occurs quickly
- **Excretion**
- 50 – 60% urine
- faeces



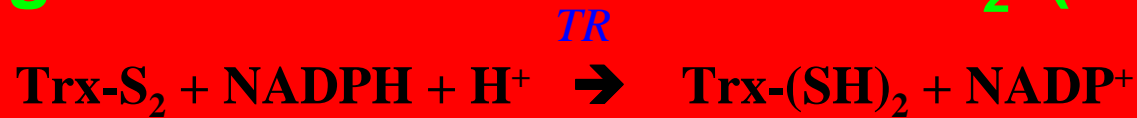
# Selenoproteins

- ***Selenoprotein P***
- **protects endothelial cells from peroxonitrite**
- ***Other selenoproteins with or without tissue specificity (a number of 10)***
- ***Thioredoxin reductase (TR)***
- ***(thioredoxins Trx – enzymes with disulphide bond, oxidoreductases:***



## *Thioredoxin reductase function*

- regeneration of thioredoxin-S<sub>2</sub> (Trx-S<sub>2</sub>)



- reduction of SeO<sub>3</sub><sup>2-</sup>



- reduction of hydroperoxides, selenodiglutathion, lipoic and dehydroascorbic acid, vit. K and alloxans
- e<sup>-</sup> donor for pGPx



# Importance of Se

- **Antioxidative protection (GPx; cardiovascular diseases, cancer, cognitive function )**
- **Synthesis of eicosanoids**
- **Affects immune reactions, ↓ viral expression**
- **Heavy metals (Hg, Cd, Tl, Pb, As) and organic carcinogenic substances deactivation**
- **Regulation of action of thyroid hormones (deiodinase)**
- **Necessary for reproduction (selenoproteins) and development**

# Deficiency

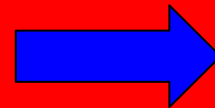
- ***Risk groups***
- **long-term parenteral nutrition**
- **cystic fibrosis , phenylketonuria**
- **sportsmen**
- **pregnant and breastfeeding women**
- **children**
- **seniors**

# Deficiency

- ***Clinical symptoms***
  - **Muscular weakness, pain and asthenopia**
  - **Depigmentation and other defects of hair, skin and nails**
  - **Macrocytosis**
- ***Oxidative stress***

# Deficiency

- **1. stage:** ↓ GPx, impairment of immune response; ↑ risk of cardiovascular diseases and malignities
- **2. stage:** hormonal metabolism changes, **epidemiologically significant diseases, death**



# Deficiency diseases

- ***Keshan disease***
- kardiomyopathy, muscular affection
- Keshan region in middle China, New Zealand
  
- ***Kashin-Beck disease***
- osteoarthropathy, China
  
- ***myxedematous kretenism***
- Zair

# Toxicity

- Se maximal safe daily intake: **400 – 600  $\mu\text{g}$  /d**
- unfavorable effect of Se: **about 1 500  $\mu\text{g}$  /d**
- DM ?
- selenosis - hair loss, nail defects, vesicular skin affections, enamel spots and pits, fatigue, breath odour (garlic ← dimethylselenide): **> 2 000  $\mu\text{g}$  /d**
- GIT, peripheral nerves affection: **> 15 000  $\mu\text{g}$  /d**

# Application

- **in deficiency**
- **antioxidative protection (cardiovascular diseases and malignities)**
- **reproduction, development and growth (fertility, pregnancy, breastfeeding)**