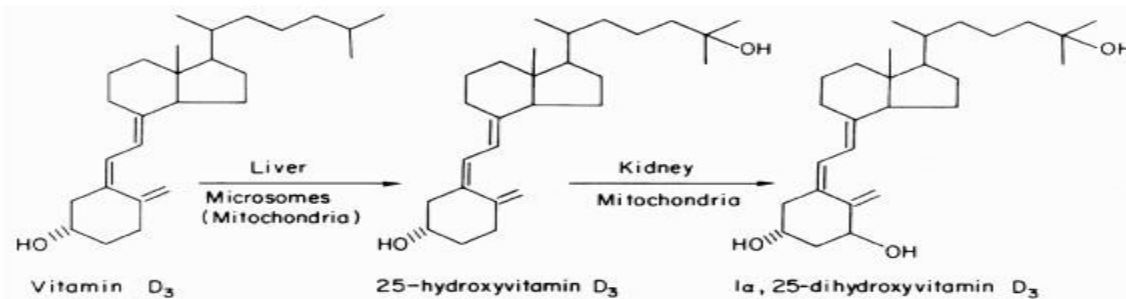


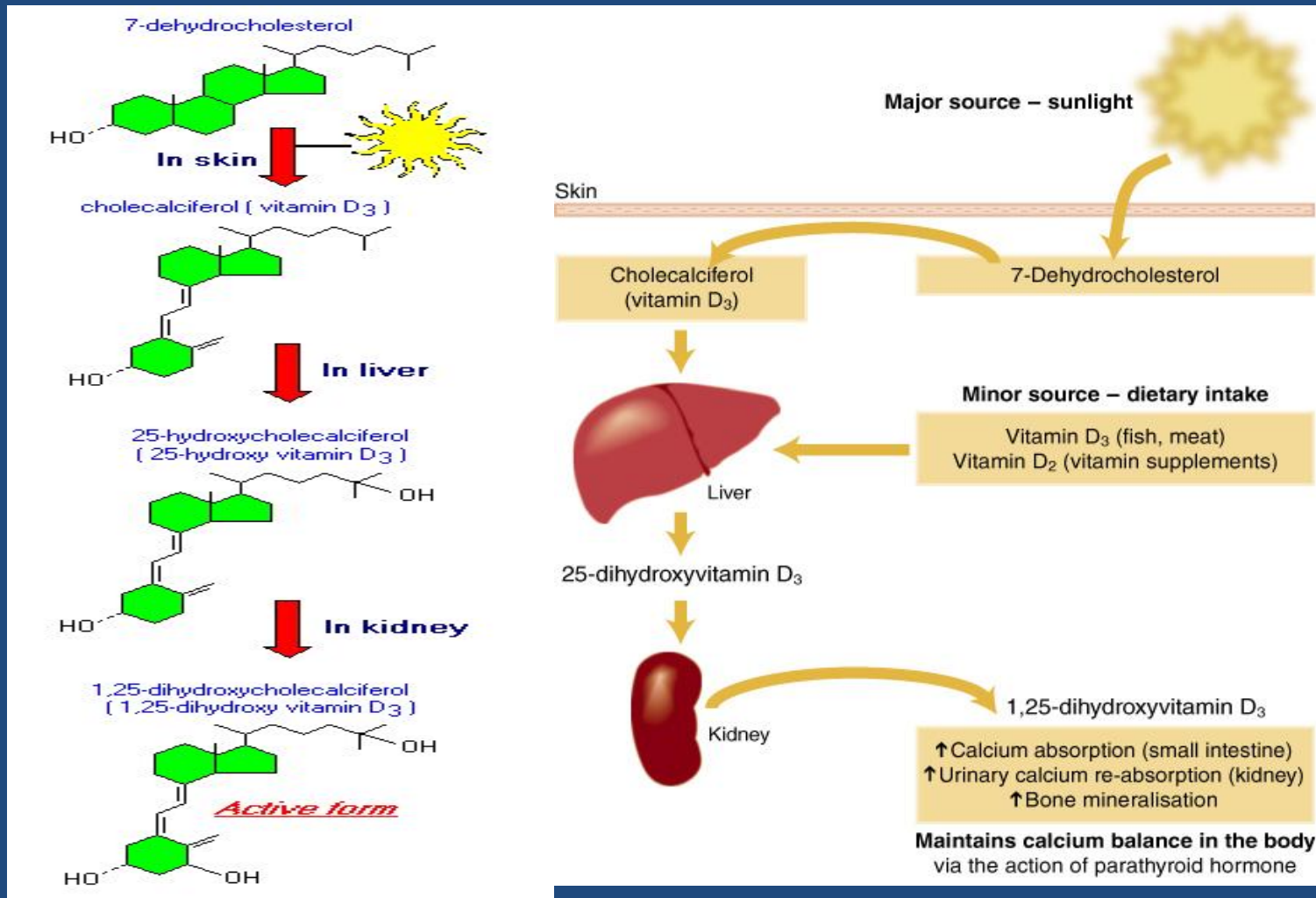
Vitamin D – The Sunshine Vitamin

- Vitamin D is a group of compounds containing sterol ring
- Mainly present in animals but also in plants and yeast
- Its mechanism of action is like hormone

- Ergosterol in plants $\longrightarrow$ Ergocalciferol D2
- 7- Dehydrocholesterol $\longrightarrow$ Cholecalciferol D3
(animals)



Synthesis of Vitamin D



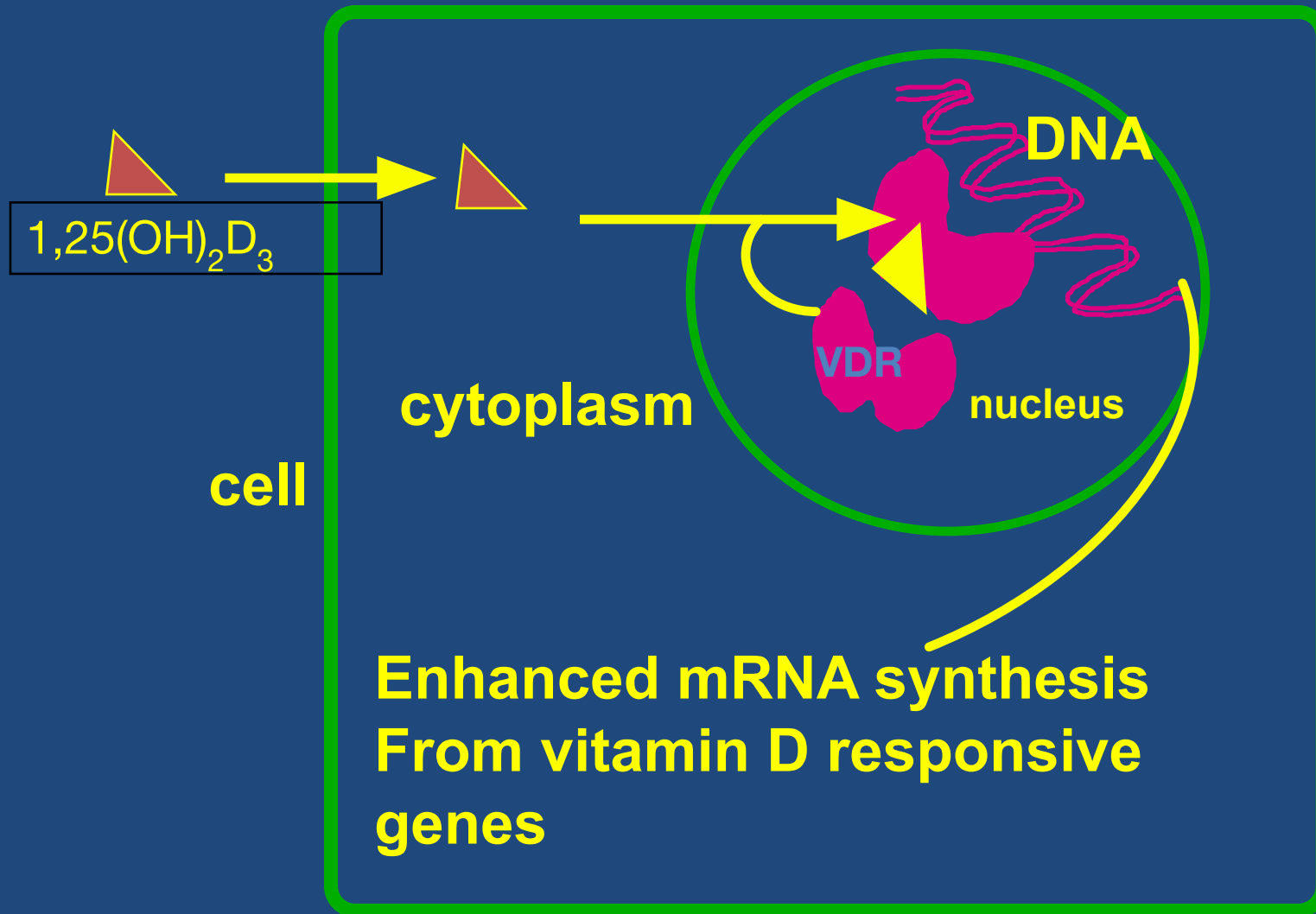
Functions

- Absorption of calcium from intestine
- Mineralization of bone
- Reabsorption of calcium and phosphorus from kidney

VITAMIN D - FUNCTIONS

- Action of calcitriol on the intestine
 - Increases the intestinal absorption of calcium and phosphate
 - By increasing synthesis of calcium binding protein - calbindin

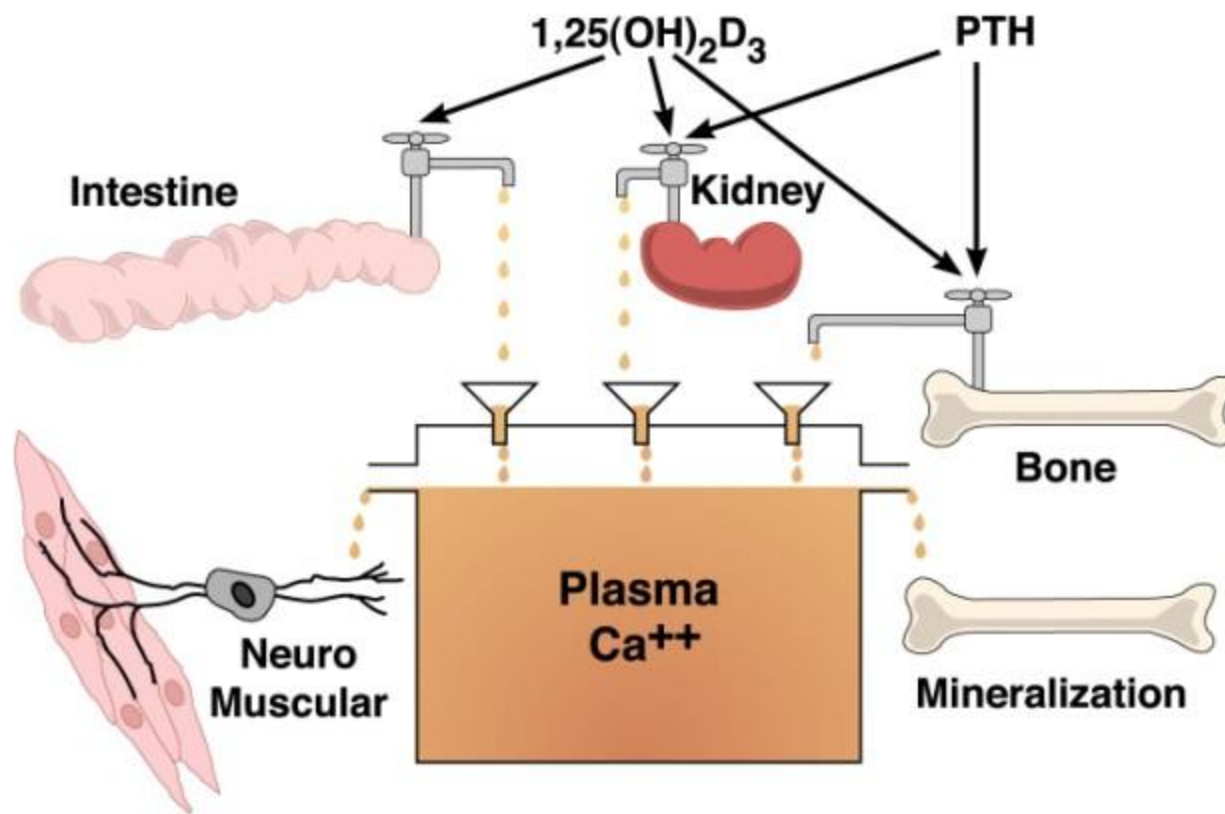
Mechanism of action vitamin D



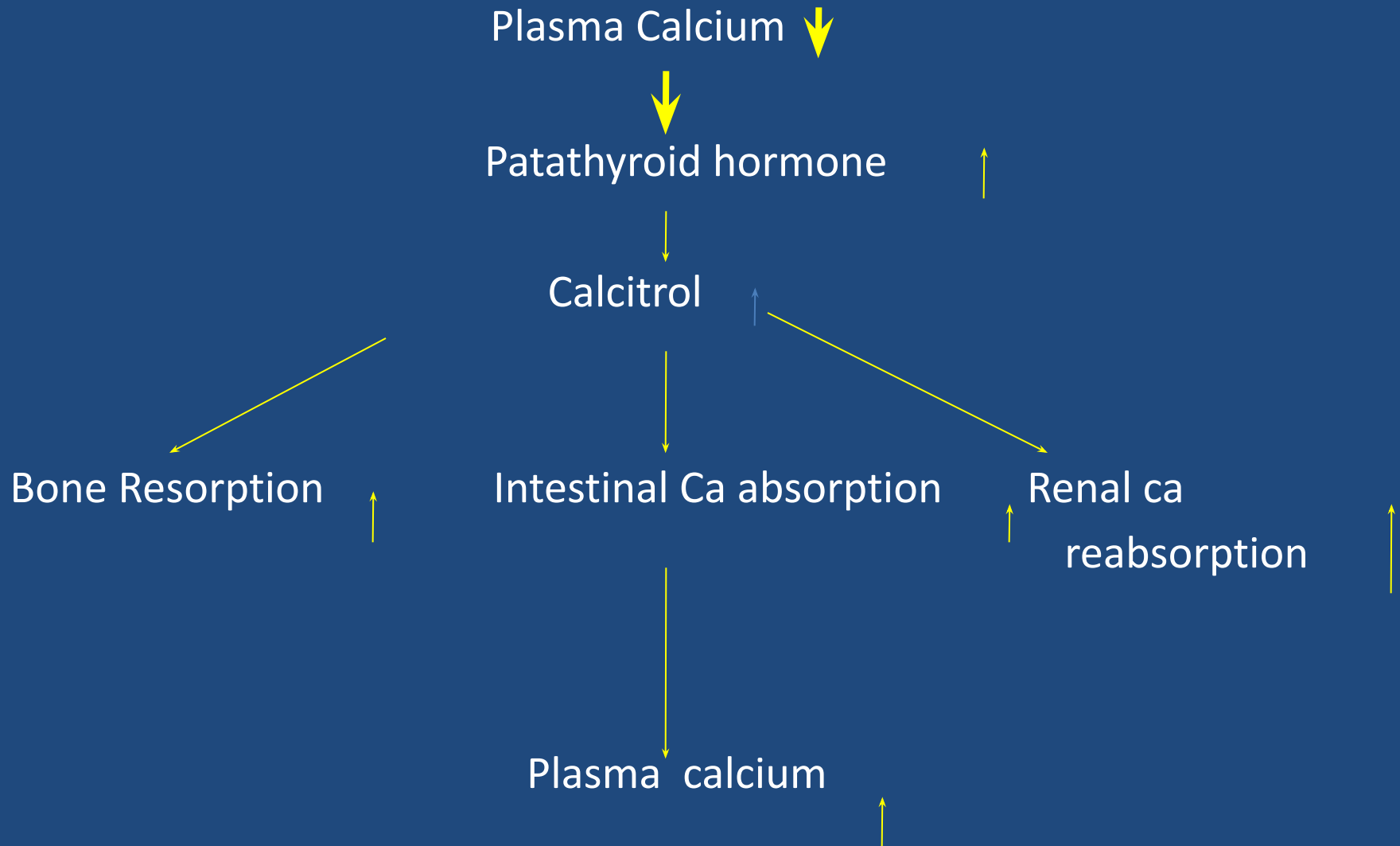
VITAMIN D - FUNCTIONS

- Action of calcitriol on the bone
 - Increases the activity of osteoblasts
 - In osteoblasts, it stimulates calcium uptake for deposition as a calcium phosphate
 - Causes Mineralization of bone
 - Mobilization of calcium from bone along with PTH when calcium level decreases

Plasma calcium homeostasis



Regulation of blood calcium level



VITAMIN D - DEFICIENCY

Causes

Inadequate supply, less exposure to sunlight

Impaired absorption- lack of lipid or bile salts , GIT disorders

Impaired production of 25hydroxy vitamin D₃ – Liver diseases

Impaired production of 1, 25 dihydroxy vitamin D₃ –Kidney Diseases

Resistant to the effects of 1, 25 dihydroxy vitamin D₃

Deficiency and toxicity

- Deficiency: Children = Rickets
- Adults = Osteomalacia
- ↓ Calcium absorption; ↓ Blood Calcium = bone deficiency
- Toxicity: 10x RDA
- ↑ Calcium absorption; ↑ Blood Calcium = Calcium deposits on soft tissue
e.g kidney stones

Rickets

- During growth, human bone is made and maintained by the interaction of **calcium**, **phosphorus**, and **vitamin D**. Calcium is deposited in immature bone (osteoid) in a process called calcification, which transforms immature bone into its mature and familiar form.
- In order to absorb and use the calcium available in food, the body needs vitamin D. In rickets, the lack of this important vitamin leads to low calcium, poor calcification, and deformed bones.

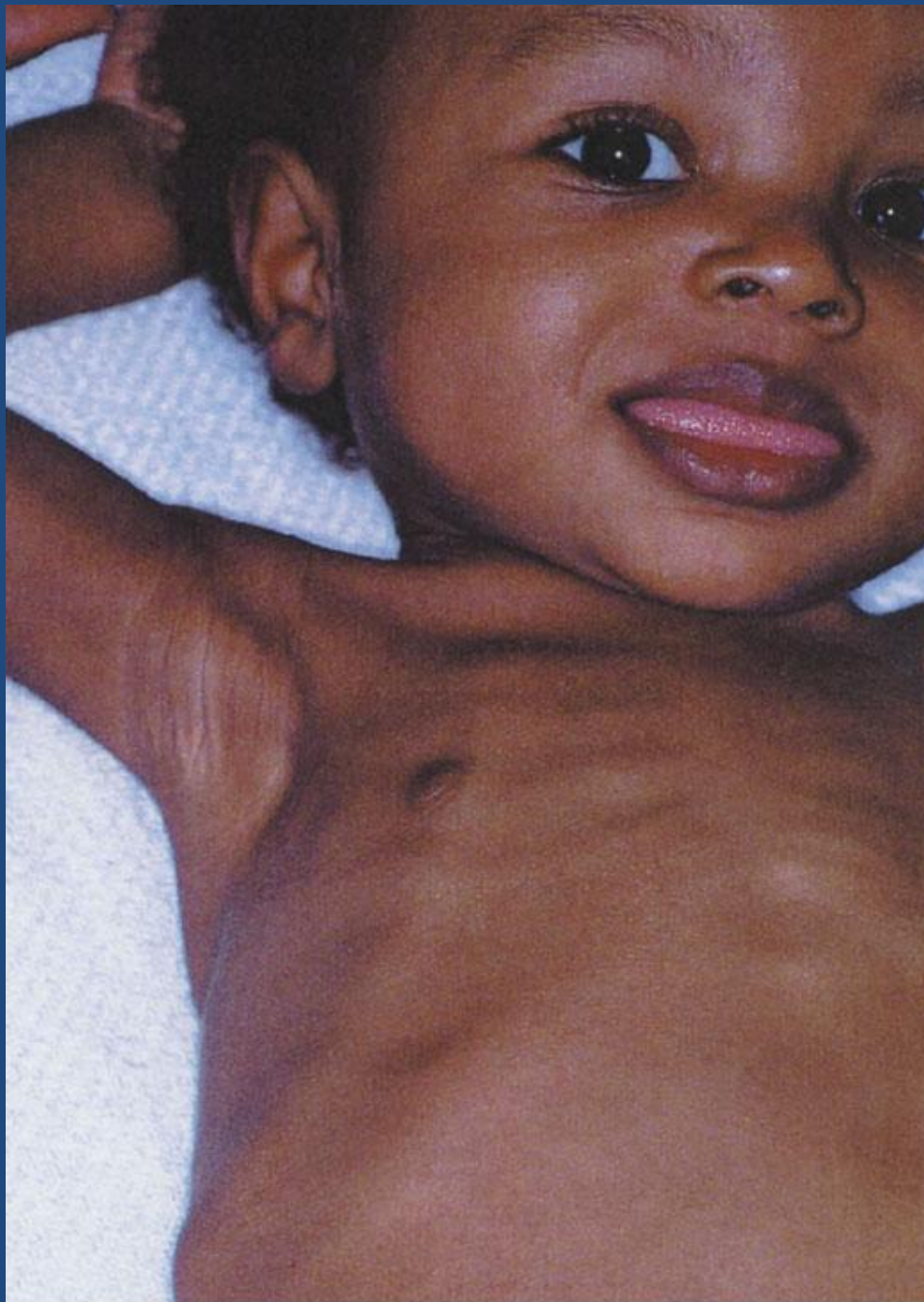
Types of Rickets

- Vitamin D Deficient Rickets(nutritional)
- Hypophosphatemic rickets
- Vitamin D Resistant Rickets
- Renal Rickets
- Hepatic Rickets

Bowed legs –
Characteristic
of rickets



Beaded ribs —
Characteristic
of rickets







OSTEOMALACIA



Figure 28.25

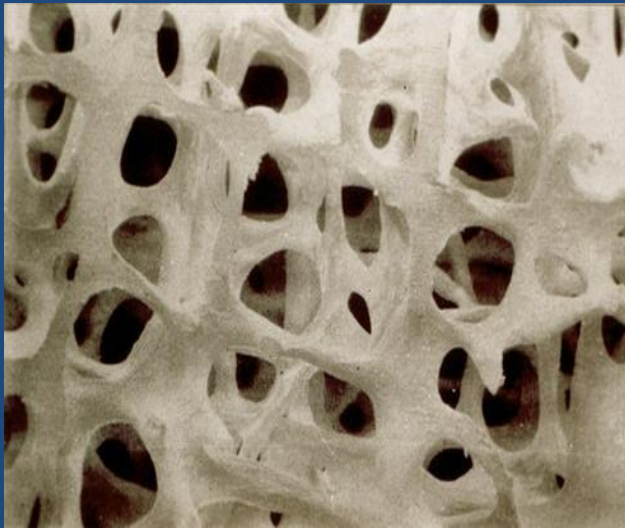
Bowed legs of middle-aged man with osteomalacia, a nutritional vitamin D deficiency which results in malformation of the skeleton.

in malformation of the skeleton.
vitamin D deficiency which results

Definition of Osteoporosis

A disease characterized by low bone mass and microarchitectural deterioration of bone tissue leading to enhanced bone fragility and a consequent increase in fracture risk.

World Health Organisation (WHO), 1993



Normal bone



Osteoporosis

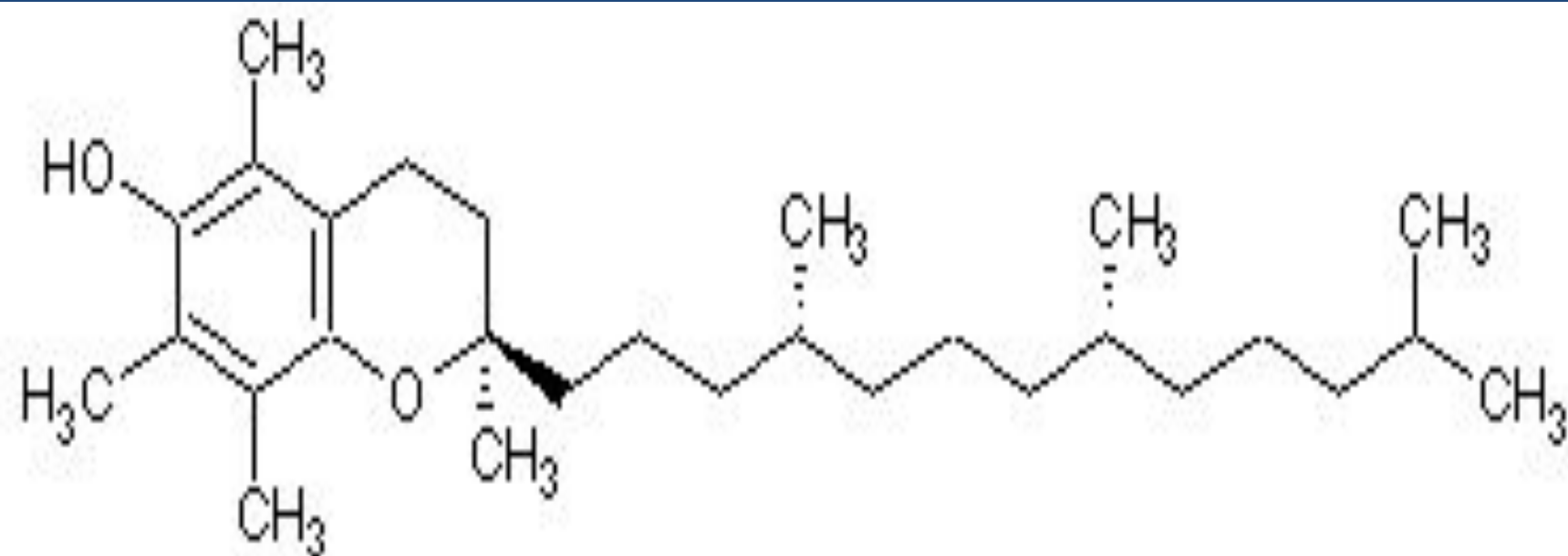
HYPERVITAMINOSIS D

- Doses above 1500 IU per day for very long period
- Anorexia, nausea & vomiting
- Constipation
- Hypertension
- Drowsiness, irritability & hypotonia
- Polyuria & polydipsia
- Renal damage
- Hyperkalaemia

Vitamin E –
Anti sterility
Vitamin

Chemistry

- Vitamin E is a fat-soluble vitamin
- • The compounds which have vitamin E activity known as tocopherols
- Toco-Child birth, Pherose- to bear ol- alcohol
- They contain 6- Hydroxy chromane ring with isoprenoid side chain
- Vitamin E as an antioxidant
- protects other substances from molecular oxygen and Free radicals



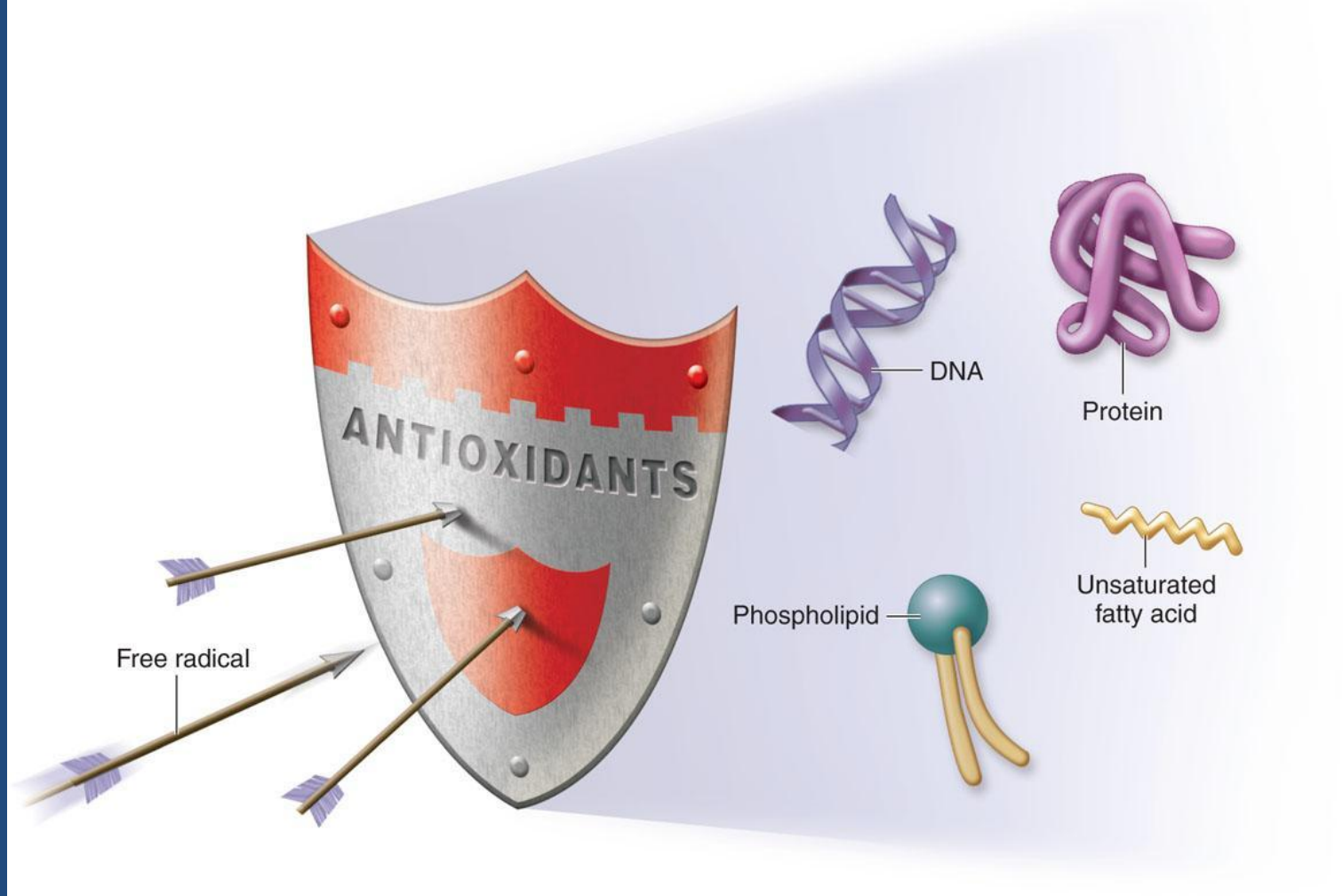
Vitamin E
Tocopherol

Biochemical functions

- Most of the functions of the vitamin E are related to its antioxidant property
- It prevents the non-enzymatic oxidations of various cell components by molecular oxygen and free radicals such as superoxide and hydrogen peroxide (H_2O_2)

Antioxidant Action

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- It protects the PUFA from peroxidation reactions
- Vitamin E is essential for membrane structure and integrity of the cell, hence it is membrane antioxidant
- It prevents the peroxidation of PUFA
- It protects the RBC from hemolysis by oxidizing agents (H_2O_2)

- -It is associated with reproductive function and prevents sterility
- It preserves and maintains germinal epithelium of gonads for proper reproductive function
- It increases the synthesis of heme by enhancing the activity of enzyme – δ aminolevulinic acid (ALA) synthase and ALA dehydratase
- It is required for cellular respiration –through ETC (Stabilize coenzyme Q)
- Vitamin E prevents the oxidation of Vitamin A and carotenes

It is required for proper storage of creatine in skeletal muscle

It protects the liver from toxic compounds such as carbontetrachloride

Vitamin E prevents oxidation of LDL

Oxidized LDL promotes heart diseases

Selenium: It is a component of glutathione peroxidase and function as antioxidant

It reduces the requirement of vitamin E in diet

Daily Requirement

- Males -10 mg/day
- Females - 8 mg/day
- Pregnancy - 10 mg/day
- Lactation - 12 mg/day
- 15 mg of vitamin E is equivalent to 33 IU
- Pharmacological dose is 200-400 IU/day
- Sources:
- Rich sources are vegetable oils
- Includes germ oil, sunflower oil, corn oil and margarine

Vitamin E deficiency

- When blood concentration of vitamin E falls below a critical level, the RBCs tend to break, open, spill their contents (hemolysis) due to increased fragility of the red blood cell membrane because of the peroxidation of their membrane PUFAs, this is known as erythrocyte hemolysis

Vitamin E toxicity

- Vitamin E toxicity effects are not serious as
- vitamin A or vitamin D toxicity.
- High dose of vitamin E interfere with blood clotting action of vitamin clotting K is enhancing the
- action of anti-coagulant medication leading to
- haemorrhage (blood fails to clot).