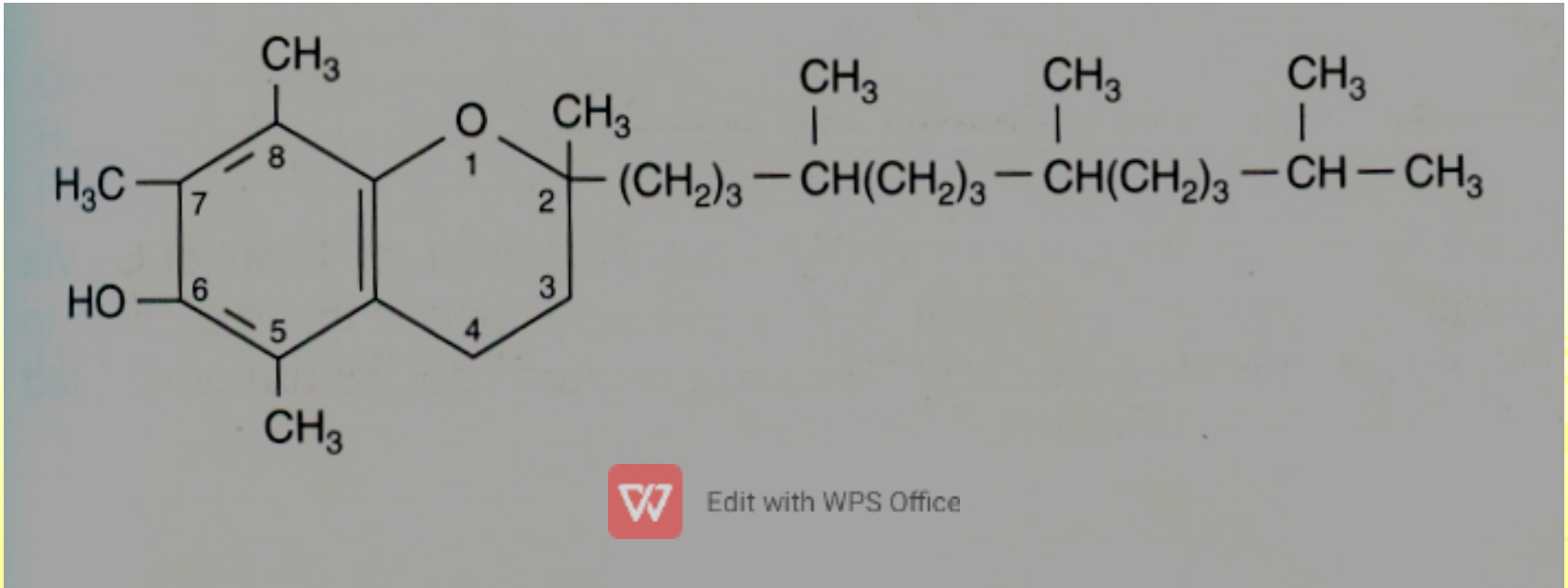
VITAMIN E - Chemistry

- anti – sterility factor
- Tocopherols
- Alpha tocopherol - biologically most potent



Absorption & Storage

- Along with fat absorption → chylomicrons

- Stored in adipose tissue

Sources of vitamin E

- Vegetable oils
  - wheat germ oil
  - Sunflower oil
  - Cotton seed oil
  - Safflower oil

RDA

- Males - 10 mg/day
- Females - 8 mg/day
- Pregnancy - 10 mg/day
- Lactation - 12 mg/day

Requirement ↑ with ↑ intake of PUFA

Biochemical role

1. Most important natural antioxidant

- First line of defense against ***peroxidation of PUFA*** present of membrane phospholipids.
- Protects structural integrity of cells & RBC (hence prevents hemolysis)

- Vit E causes breaking of free radical chain reaction
- By donating hydrogen to reduce free radical.

- Since vit E is fat soluble, it is the most imp antioxidant for membranes (lipids), whereas vit C antioxidant in plasma. (water soluble)

2. Antiatherogenic effect:

- Protects LDL from oxidation - ↓ risk of MI

3. Boosts immune response

Vitamin E & Selenium

- Vitamin E & Se act synergistically to ↓lipid peroxidation

- Glutathione peroxidase (Se integral component) – 2nd line of defense against hydroperoxides

- Se is required for digestion & absorption of lipids & vitamin E
- Vitamin E ↓ Se requirements by preventing loss of selenium from body
- mutual sparing effect for each other

VITAMIN K

Chemistry

- **naphthoquinone derivatives**

a. Phylloquinone –in green vegetables - vit K1

b. Menaquinones – synthesized by gut bacteria - vit K2

c. Menadione – synthetic form – vit K3

Sources

- *Green leafy vegetables*
- intestinal bacteria

Absorption & Storage

- Absorption in intestine along with CM (bile salts required)
- Stored in liver
- Transported in plasma along with VLDL

Biochemical Role

- Co-enzyme for

γ – carboxylation of glutamate residues in proteins

- post-translational modification.

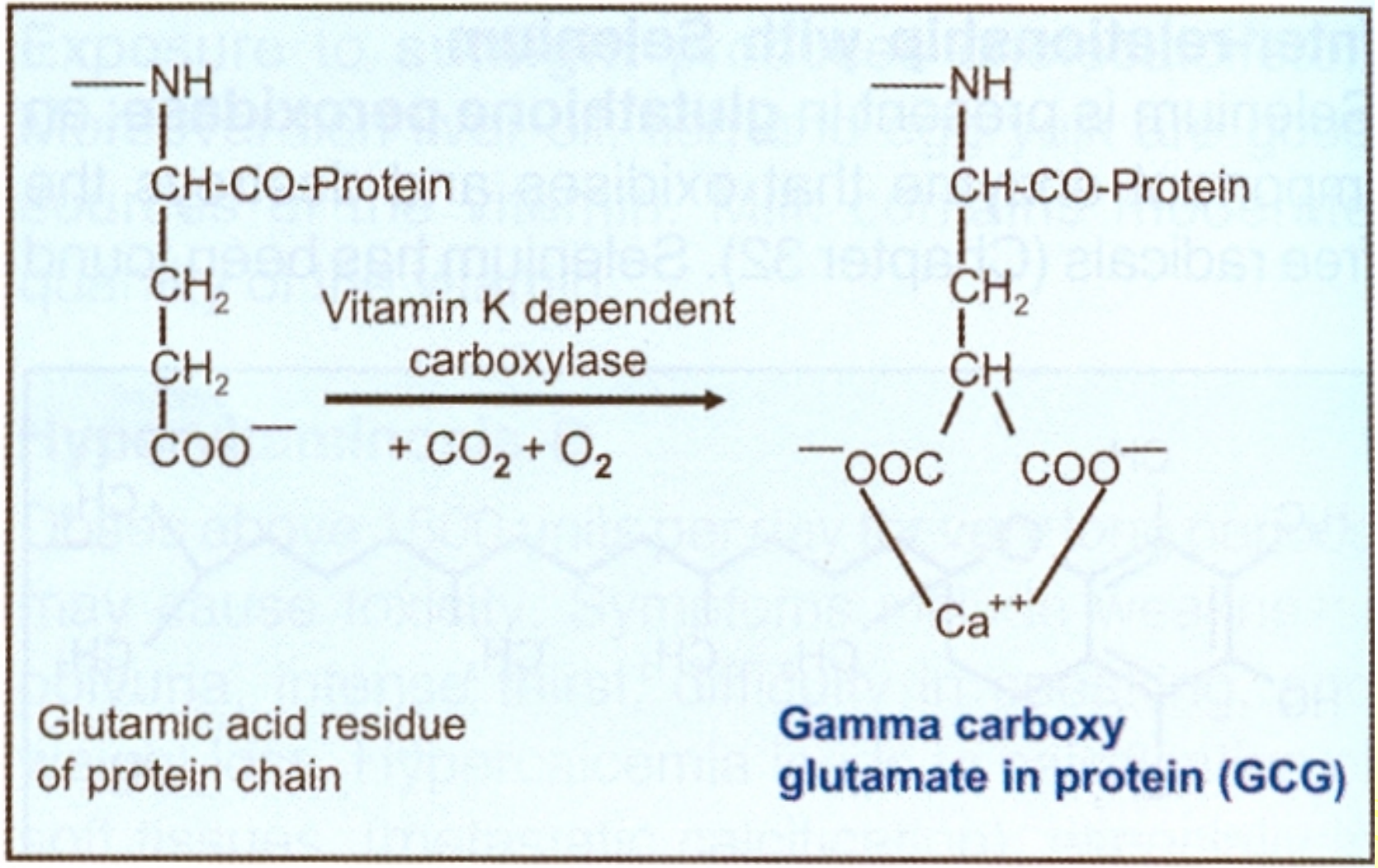


Fig. 26.16. Vitamin K as co-factor in GCG synthesis

Proteins requiring γ – carboxylation

1. ***Clotting factors*** –II, VII, IX & X

These factors are synthesized in liver as inactive zymogens

- Significance:

γ – carboxy Glutamate (GCG – negatively charged) is the binding site for Ca^{2+} ions.

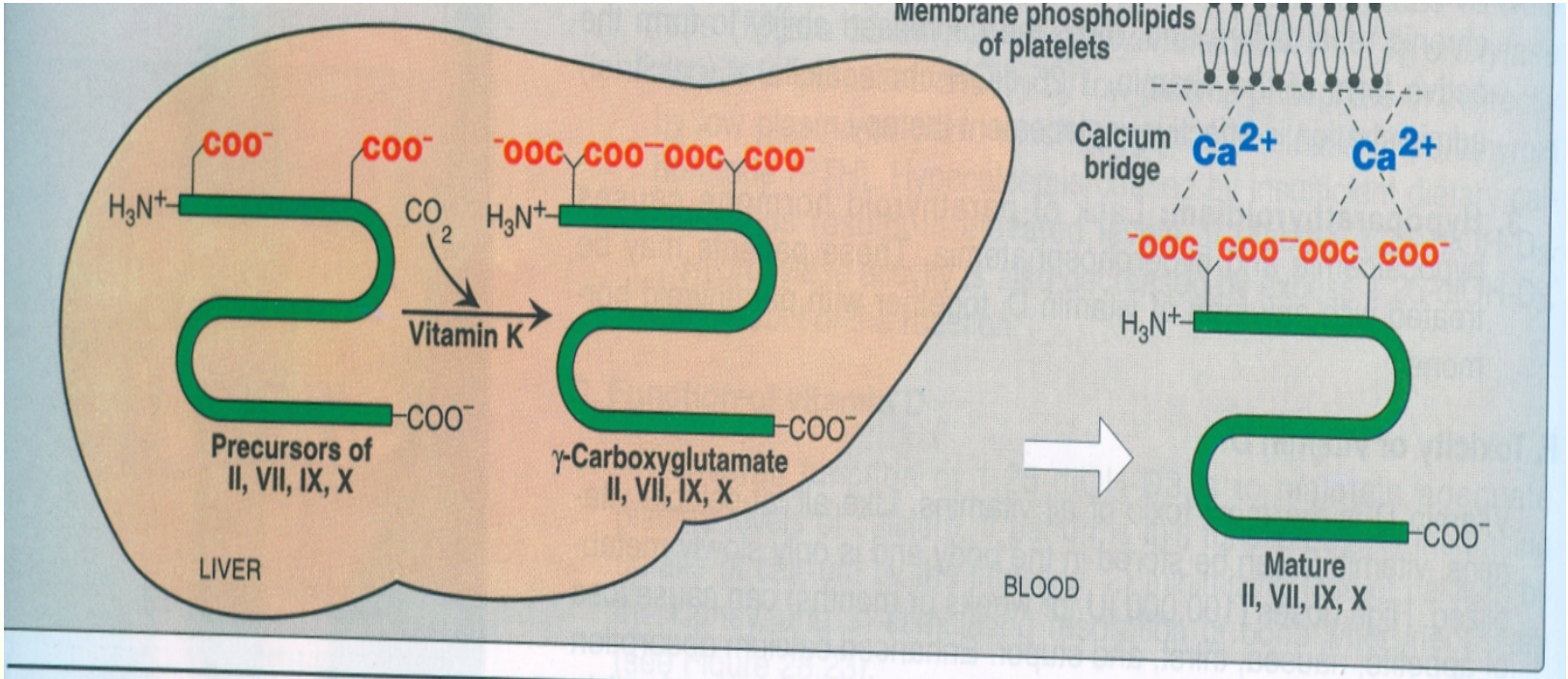


Figure 28.27
Role of vitamin K in blood coagulation.

- Factor II (prothrombin) – prothrombin-Ca+ complex binds to membranes of platelets where prothrombin is converted to thrombin

- Thrombin in turn catalyses proteolytic conversion of fibrinogen to fibrin clot.

- This is the reason menadione K3 is used as a therapeutic antihemorrhagic agent.

2. Osteocalcin

- synthesized by osteoblasts

- binds tightly to hydroxyapatite crystals of bone

- binding depends on the degree of γ –carboxylation

3.Structural proteins of kidney, lung & spleen

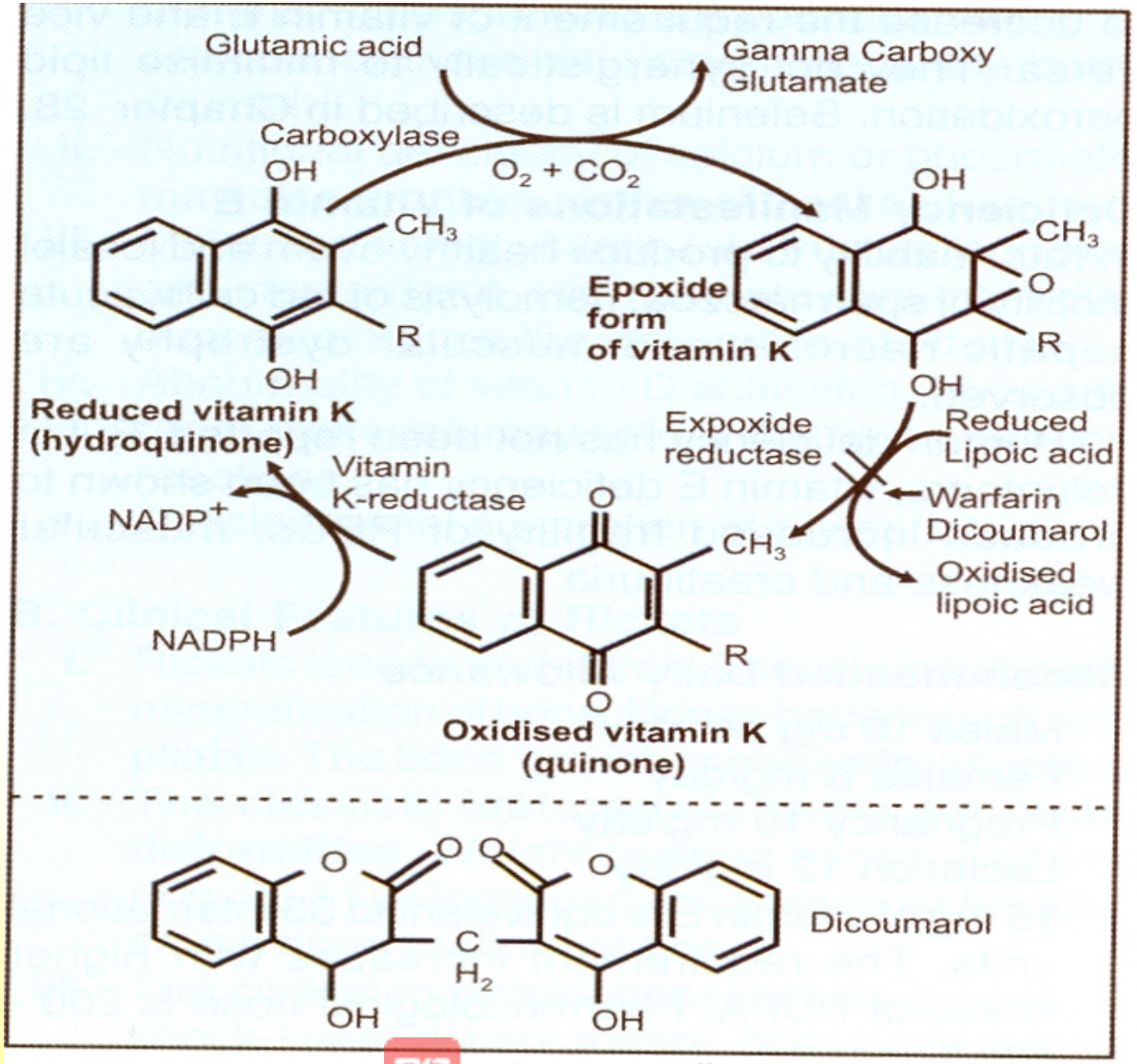


Fig. 26.14. Vitamin K cycle. Dicoumarol, a structural analogue inhibits vitamin K reductase

Warfarin & dicoumarol - used as anticoagulants for therapeutic purposes

Mechanism of action-

- structurally similar to vitamin K (epoxide form)
- Epoxide reductase is **competitively** inhibited
- Vit K epoxide is not reduced, accumulates & is excreted.

Deficiency

(seldom occurs in normal adults)

- **Causes**:

a. Fat malabsorption (obs. Jaundice, chronic pancreatitis, sprue)

b. Prolonged antibiotic therapy

c. Gastro-intestinal infections with diarrhea
(intestinal bacterial flora is destroyed)

Deficiency in newborns - Causes

- In premature newborns
- Placenta does not pass the vitamin
- Gut is sterile
- Low hepatic stores
- low breast milk levels of vit k

Vitamin K deficiency

- Clinical manifestations
  - Hemorrhagic disease of the newborn

  - In children & adults –

  - prothrombin time - prolonged
  - clotting time – delayed
  - Internal bleeding
  - Bruising tendency
  - mucus membrane hemorrhage