
بسم الله الرحمن الرحيم
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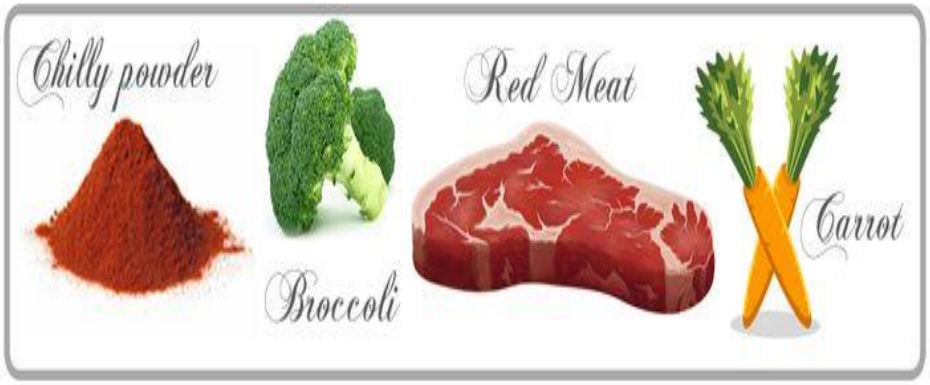
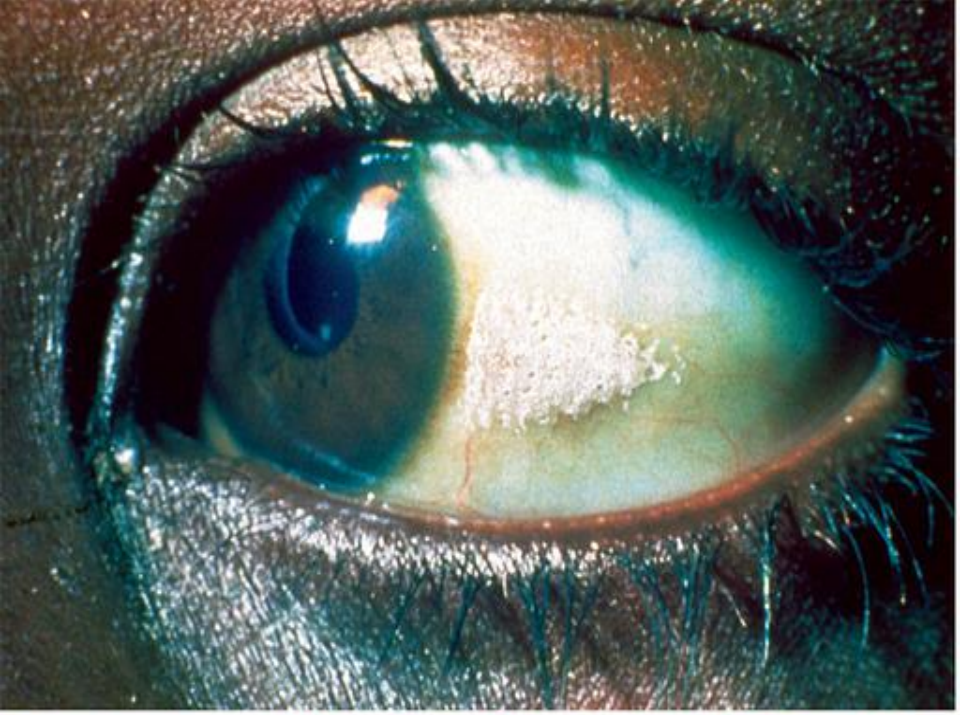
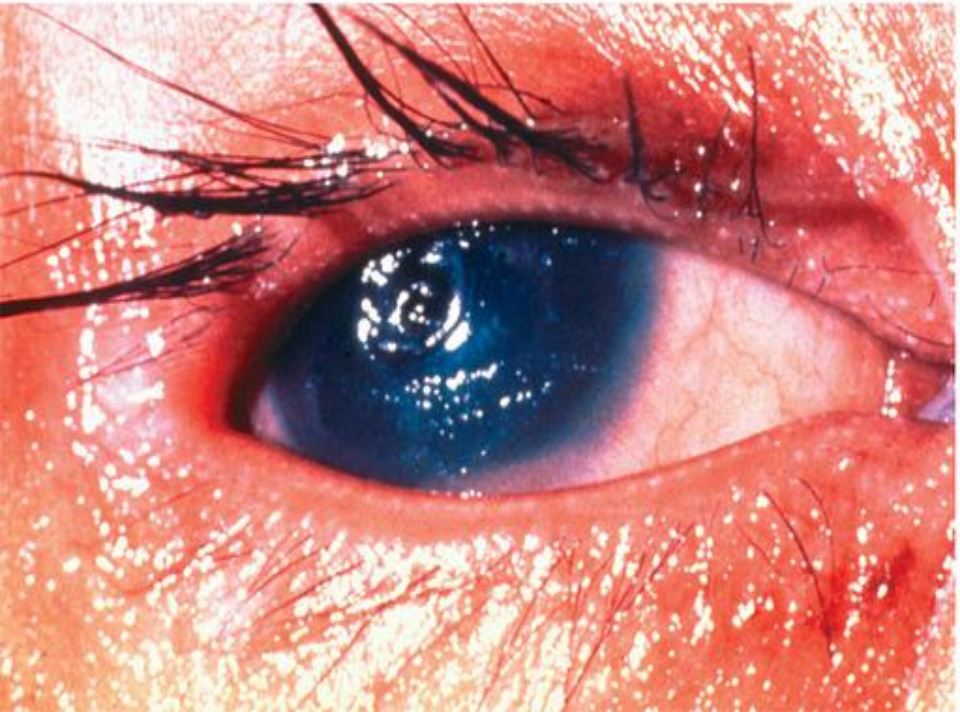
Apricot
Peppers
Mango
Cheese


Fish
Eggs
Lettuce


Chilly powder
Broccoli
Red Meat
Carrot







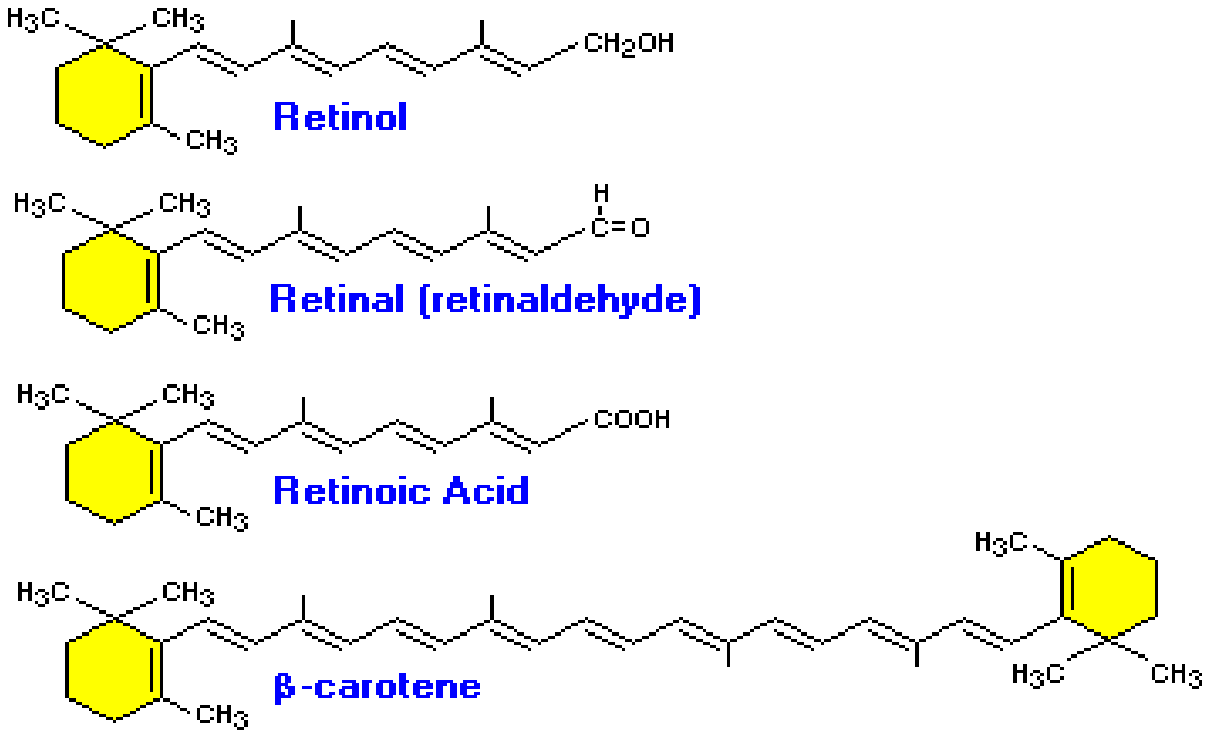
A

Objectives

- Chemical structure of vitamin A.
- Vitamin A sources and Types
- Absorption and transport
- Biochemical functions,
- Deficiency manifestations
- Therapeutic uses

CHEMICAL STRUCTURE

All the natural and synthetic forms collectively called Retinoids.
All forms consist of beta ionone ring with isoprenoid side chain.
Retinol present in animal tissue as retinyl ester.
Oxidation of retinol produce retinal,
while retinoic acid is produced by oxidation of retinal.



Forms of vitamin A

- Pro vitamin A
- These are the substances which are converted to vitamins in the body.
- The most abundant pro vitamin A is β carotene, comes from a group of compounds called the carotenoids (give yellow and red color to foods). One need to eat six time as much β carotene to get same amount of vitamin A.

- Active vitamin A
- Obtained directly from foods.

sources of vitamin A

- Animal sources

  Cod fish liver oil, butter, milk, cheese, egg yolk.

- Plant sources

  In plants it is in the form of pro vitamin.

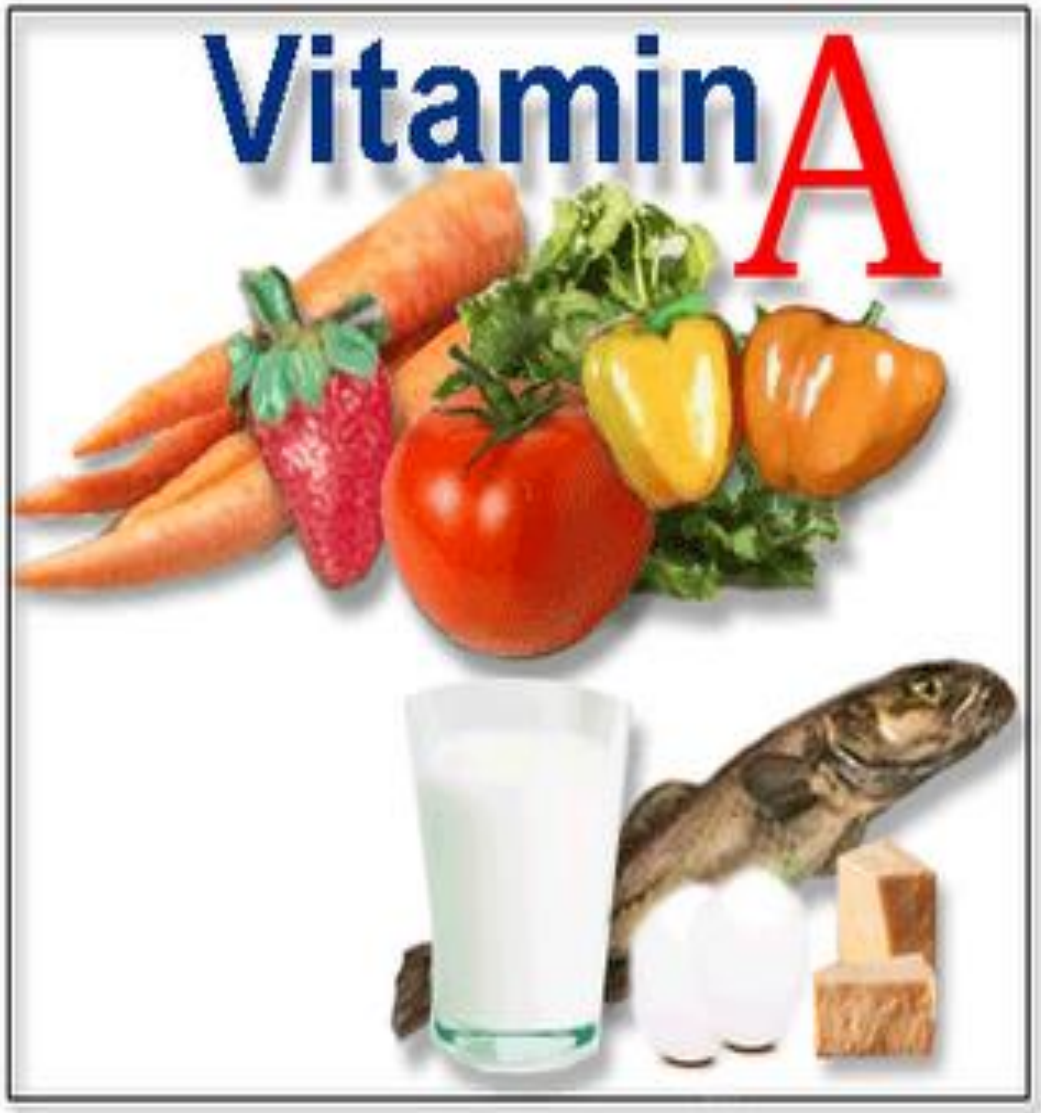
- Carotene

  Tomatoes, carrot, green yellow vegetables, spinach and fruits such as mango, papaya and corn, sweet potatoes.

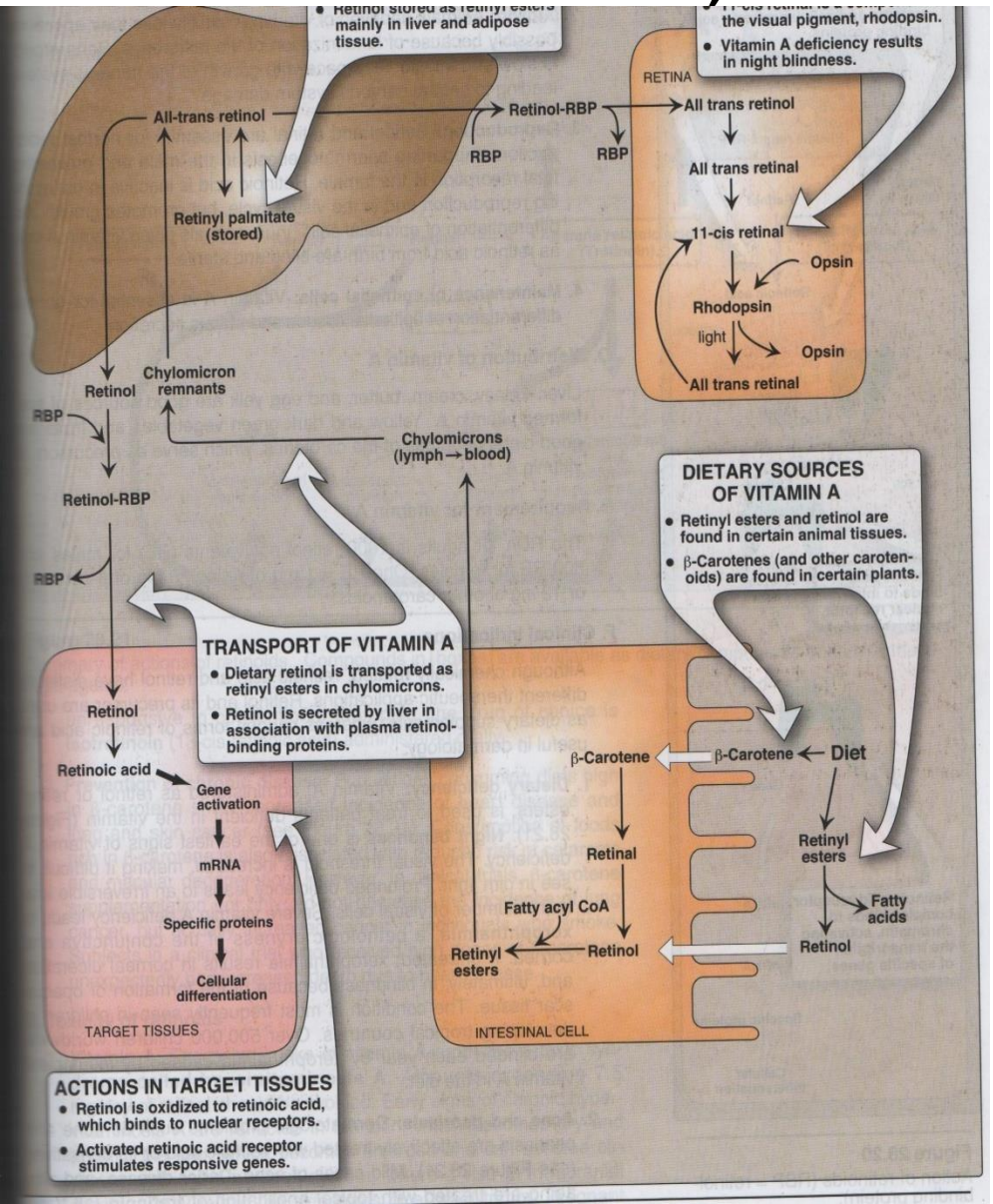
DAILY REQUIRMENT

Daily requirement.

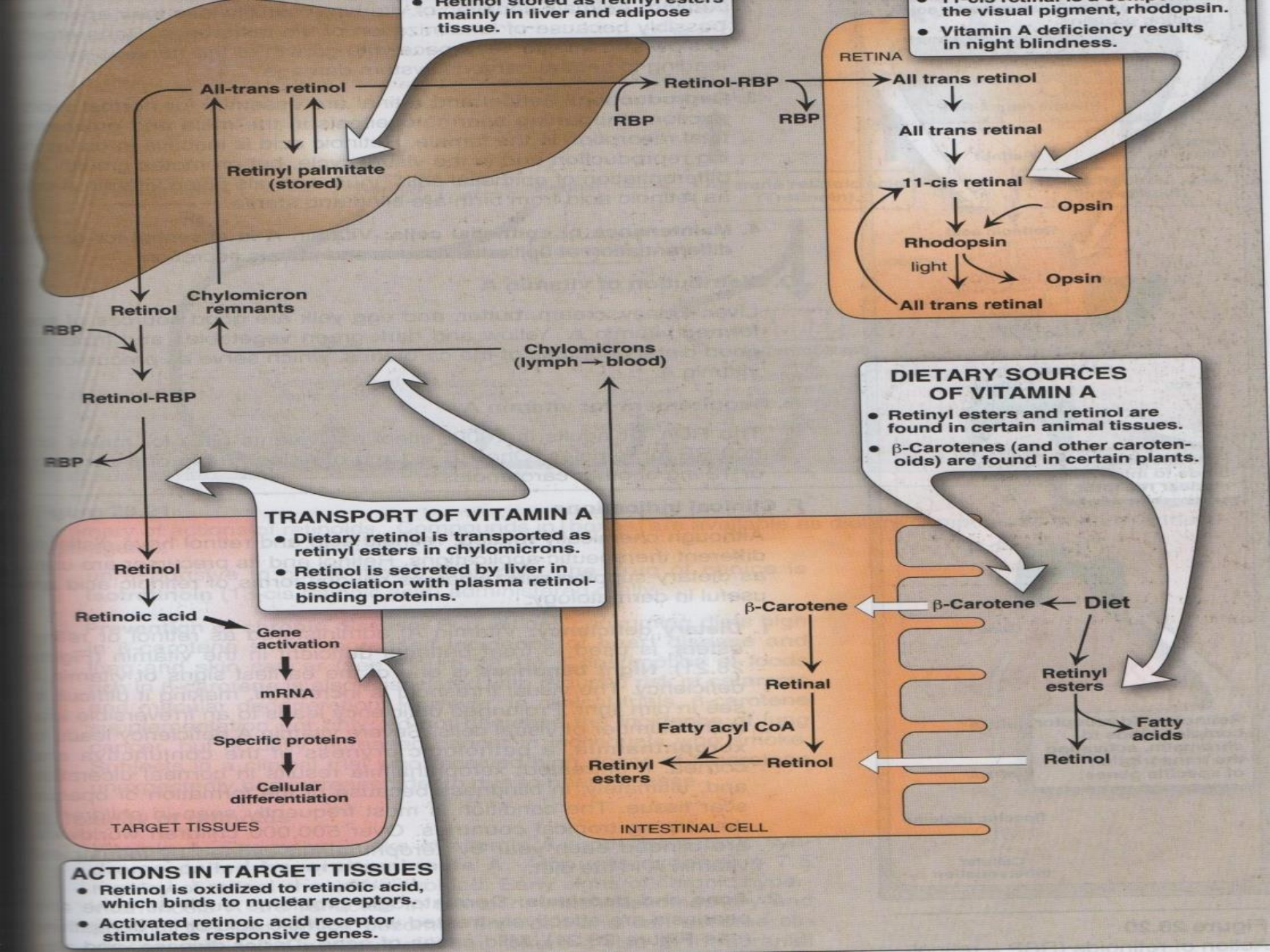
- Infants_ 400-600 IU /day.
- Children_400-900 IU/day.
- Male_900-3000 IU /day.
- Female_700-2500 IU /day.
- RDA….. 5000 IU/ day



ABSORPTION ,STORAGE AND TRANSPORT



- Absorbed in small intestine. Dietary vitamin A is in ester form.
- Hydrolyzed by cholesterol esterase.
- β-carotene di-oxygenase cleave β-carotene to two molecules of retinaldehyde .
- Stored in body as retinyl palmitate in liver
  (10-20mg/100 gm of liver).
- Transported in blood by retinol binding proteins.


• Retinol stored as retinyl esters mainly in liver and adipose tissue.
All-trans retinol
Retinyl palmitate (stored)
Retinol-RBP
RBP
RBP
• 11-cis retinal is a component of the visual pigment, rhodopsin.
• Vitamin A deficiency results in night blindness.
RETINA
All trans retinol
All trans retinal
11-cis retinal
Opsin
Rhodopsin
light
Opsin
All trans retinal
Retinol
RBP
Chylomicron remnants
Chylomicrons (lymph → blood)
Retinol-RBP
RBP
DIETARY SOURCES OF VITAMIN A
• Retinyl esters and retinol are found in certain animal tissues.
• β-Carotenes (and other carotenoids) are found in certain plants.
TRANSPORT OF VITAMIN A
• Dietary retinol is transported as retinyl esters in chylomicrons.
• Retinol is secreted by liver in association with plasma retinol-binding proteins.
Retinol
Retinoic acid
Gene activation
mRNA
Specific proteins
Cellular differentiation
TARGET TISSUES
β-Carotene
β-Carotene
Diet
Retinal
Retinyl esters
Fatty acids
Fatty acyl CoA
Retinyl esters
Retinol
Retinol
INTESTINAL CELL
ACTIONS IN TARGET TISSUES
• Retinol is oxidized to retinoic acid, which binds to nuclear receptors.
• Activated retinoic acid receptor stimulates responsive genes.

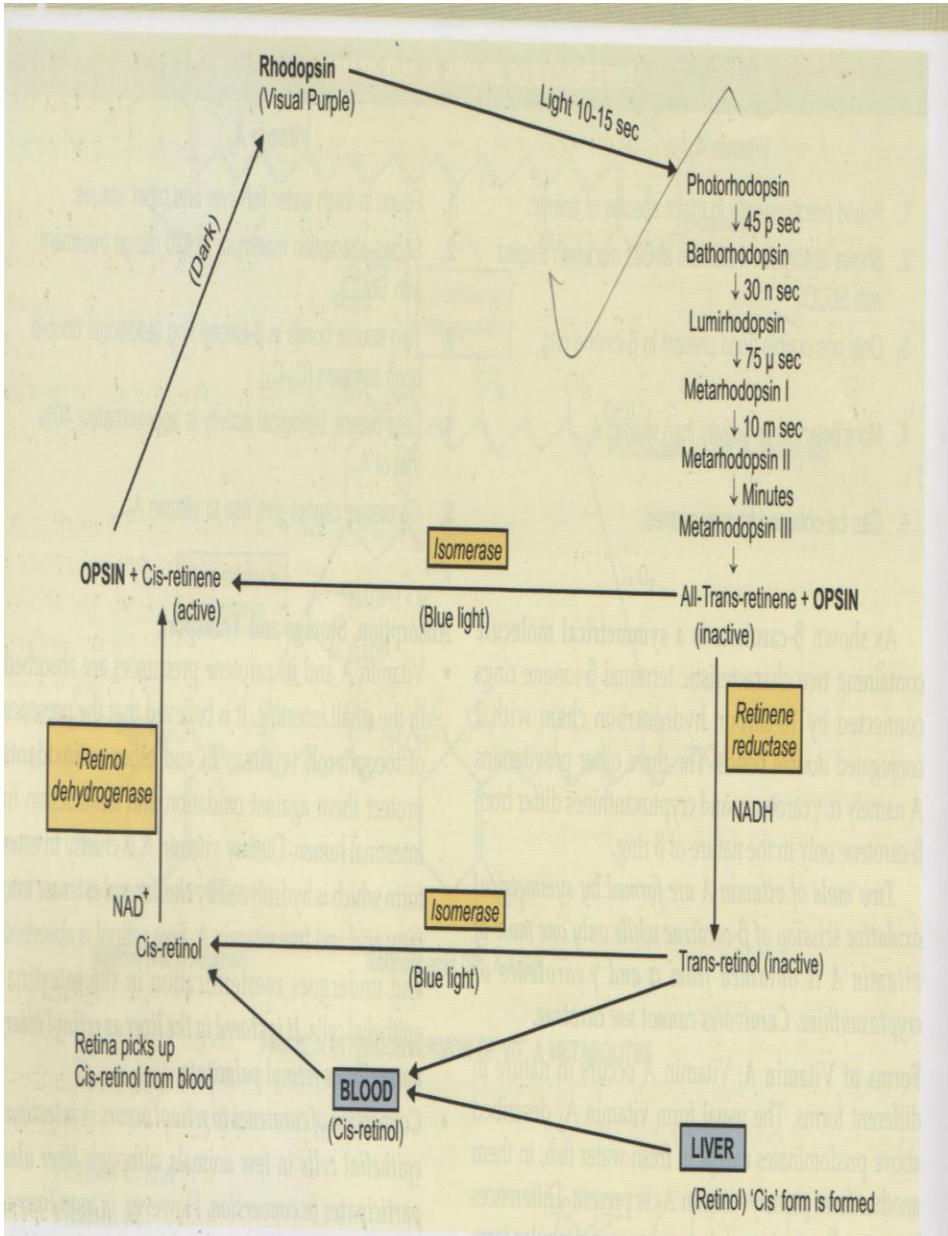
VITAMIN A FUNCTIONS

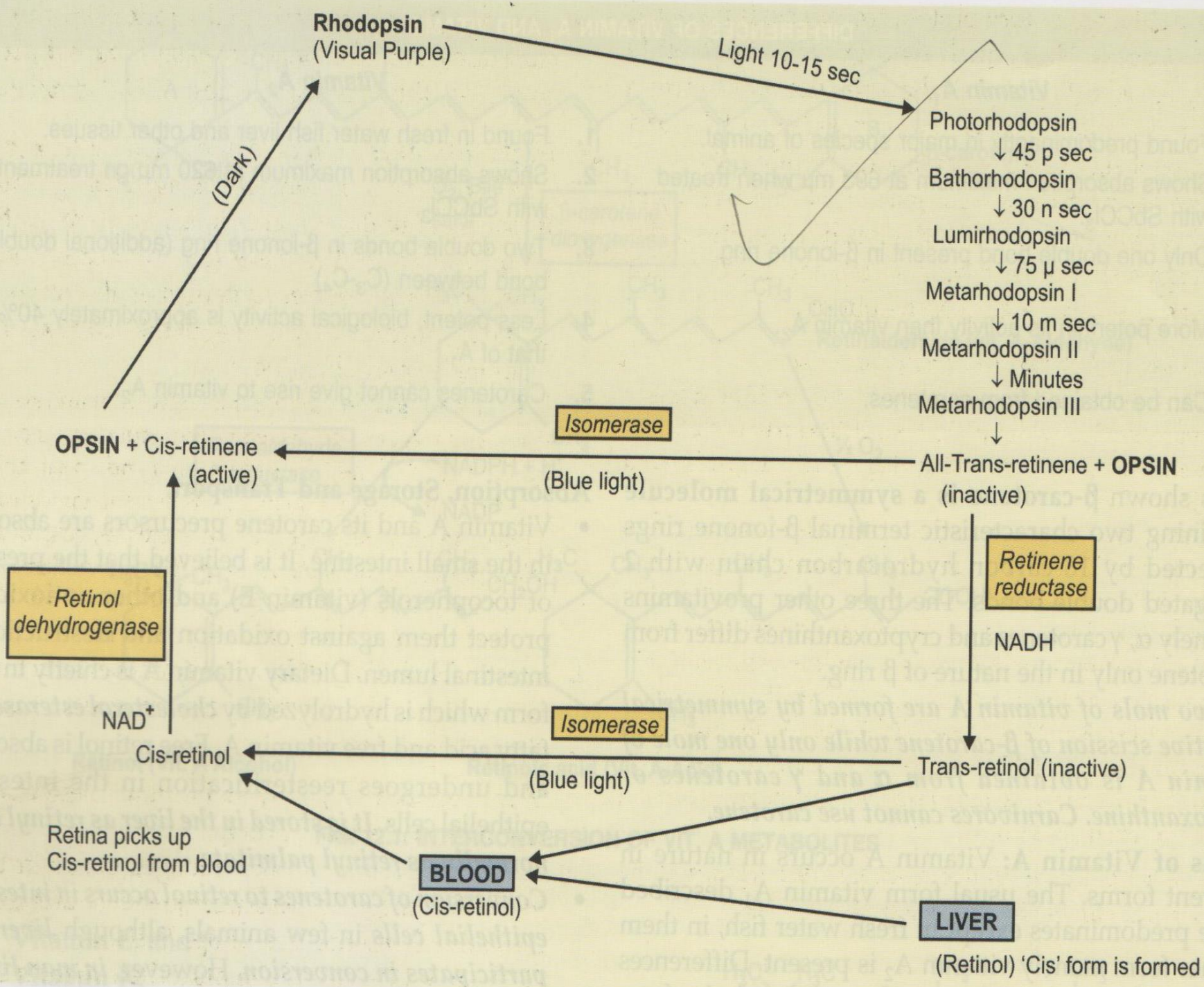
Fats soluble essential for

- Vision
- Reproduction
- Growth and
- Maintenance of epithelial tissues.

METABOLIC FUNCTIONS

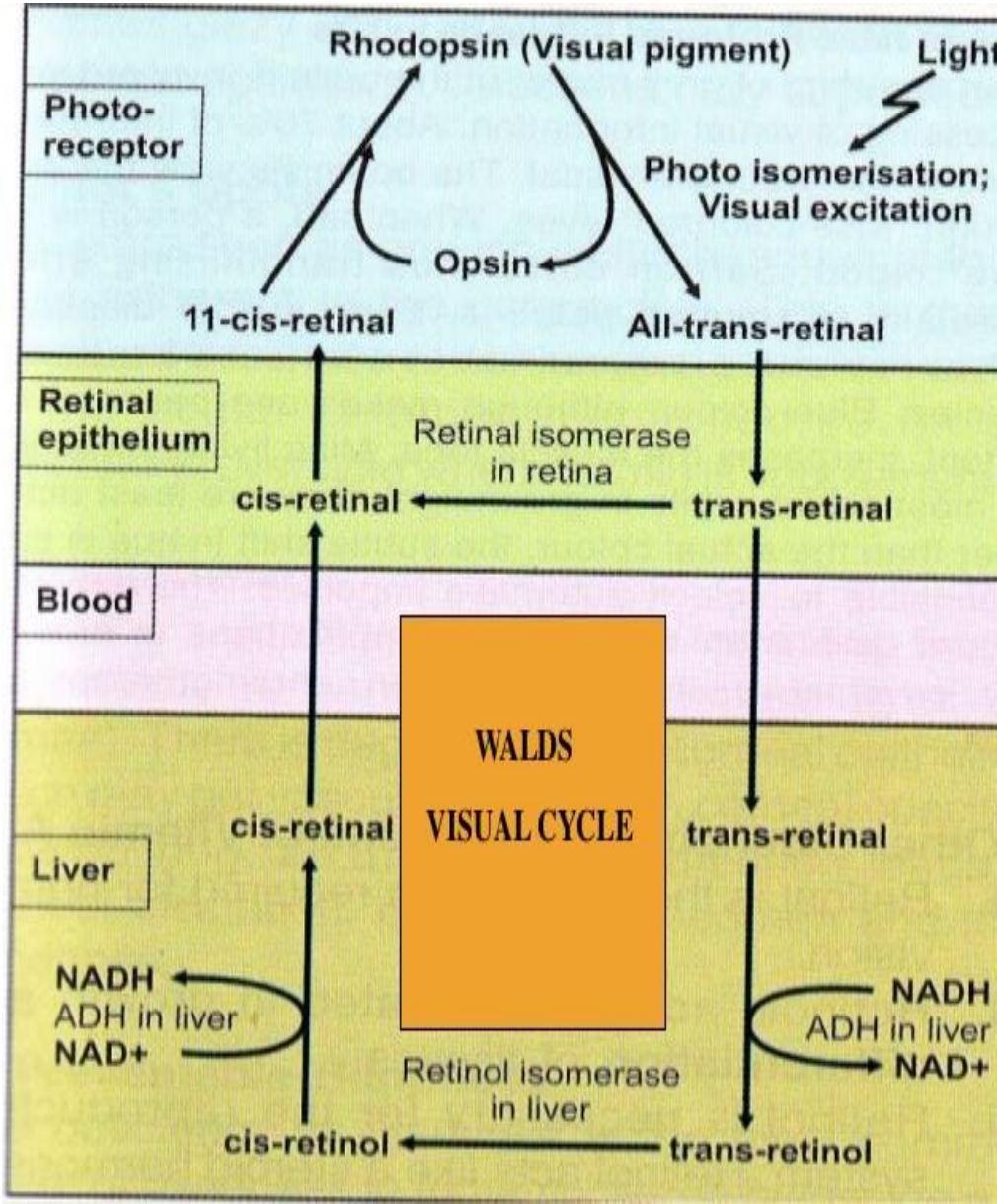
- Vision
- Wald's visual cycle (Rhodopsin cycle)
- When light falls on rhodopsin it splits into opsin and all-trans-retinal.
- All-trans-retinal is isomerizes to its 11-cis-isomer .



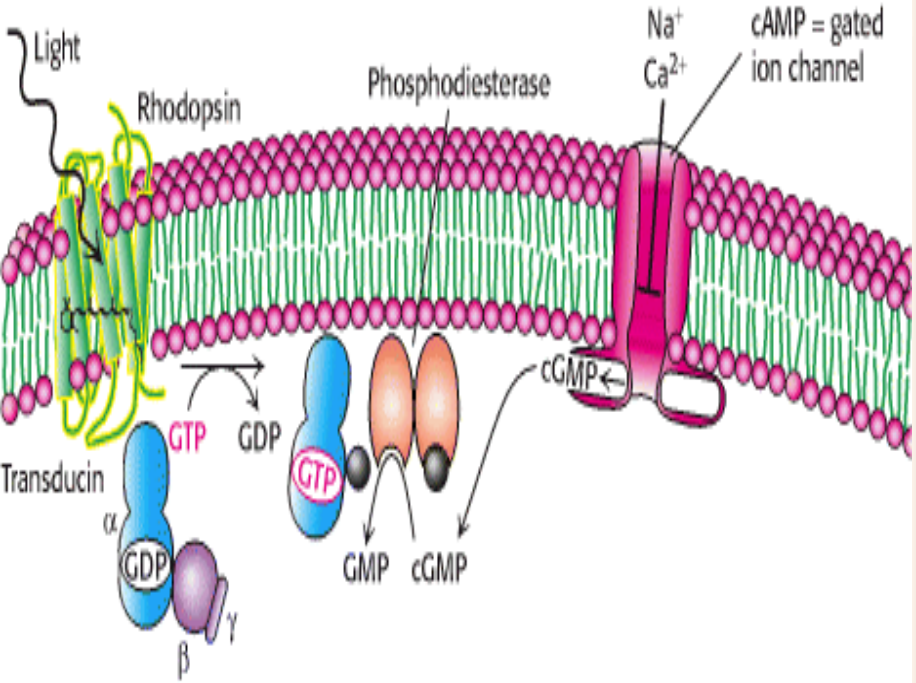

Rhodopsin
(Visual Purple)
Light 10-15 sec
Photorhodopsin
↓ 45 p sec
Bathorhodopsin
↓ 30 n sec
Lumirhodopsin
↓ 75 μ sec
Metarhodopsin I
↓ 10 m sec
Metarhodopsin II
↓ Minutes
Metarhodopsin III
↓
(Dark)
OPSIN + Cis-retinene
(active)
Isomerase
(Blue light)
All-Trans-retinene + OPSIN
(inactive)
Retinol dehydrogenase
Retinene reductase
NADH
NAD+
Isomerase
Cis-retinol
(Blue light)
Trans-retinol (inactive)
Retina picks up
Cis-retinol from blood
BLOOD
(Cis-retinol)
LIVER
(Retinol) 'Cis' form is formed

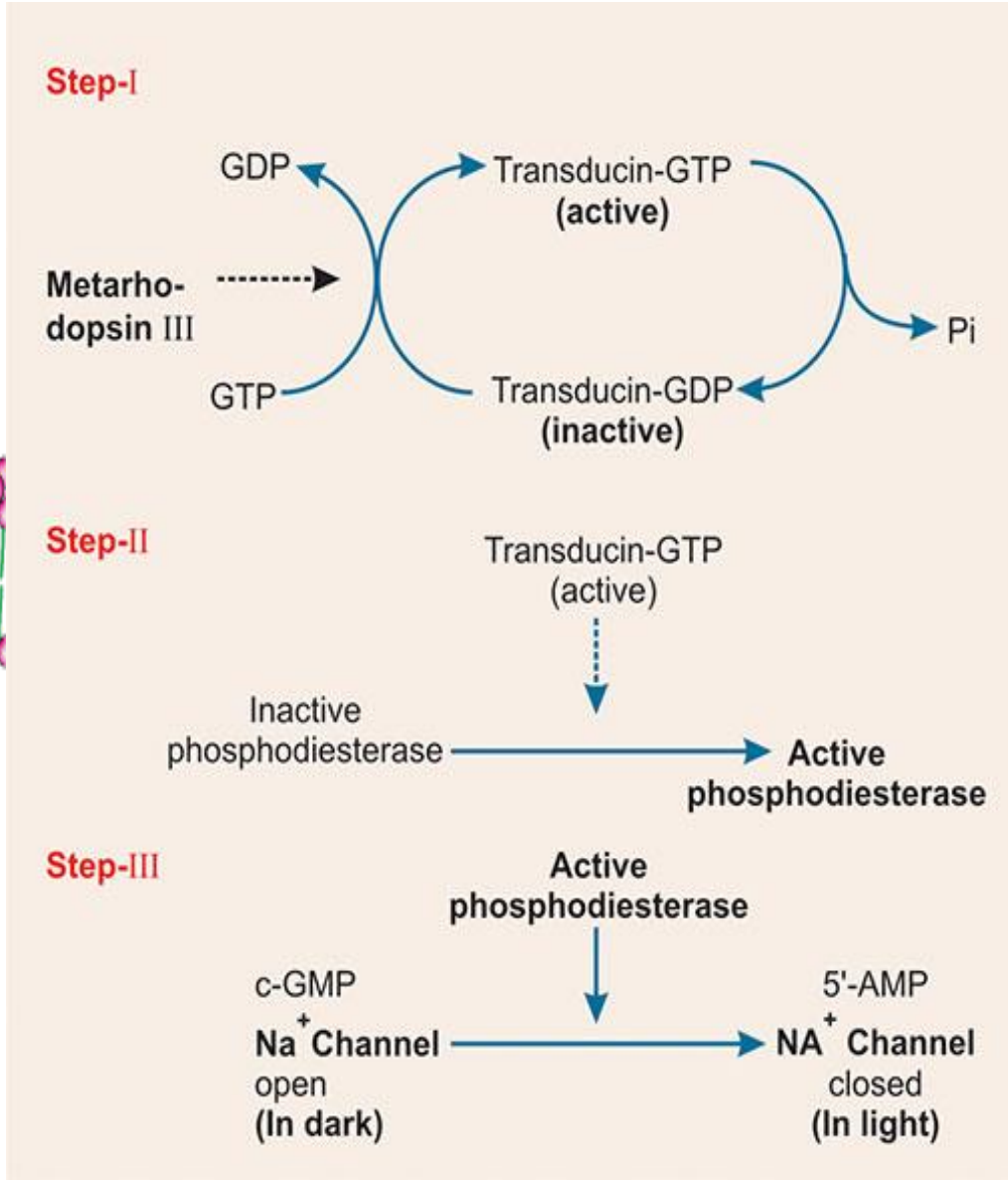
wald's visual cycle

- All-trans-retinal can be converted to all-trans-retinol by retinene reductase.
- All –trans-retinol is first isomerizes to 11-cis-retinol
- 11-cis-retinol then be converted to 11-cis-retinal by retinol dehydrogenase.
- 11-cis-retinal combines with opsin to form rhodopsin.



Role of cyclic GMP in light and dark adaptation





- 2) Binds to transcription regulatory proteins and causes gene expression and tissue differentiation.

- 3) Enhance the activity of Immune system.

- 4) Embryonic development and reproduction. Involve in cell differentiation + cell division

5) Bone metabolism- osteoblasts and osteoclasts depend on vitamin A. deficiency results in growth retardation.

6) Haematopoeisis-synthesis of transferrin. has a role in iron absorption.

7) Skin health- controls biosynthesis of membrane glycoproteins and glycosaminoglycans necessary for mucous secretions to prevent keratin synthesis.

8) Antioxidant and anticancer activity (β-carotene).

9)Sperm production in male, reproductive cycle in female require vitamin A.

Causes of Deficiency

Primary

- Nutritional

Secondary

- Impaired absorption--celiac disease
- lack of lipase--pancreatitis
- Impaired storage--liver disease
- Failure to convert β-carotene to retinol
- Zinc deficiency inhibits retinol mobilization from liver
- Alcohol interfere conversion of retinol to retinaldehyde.

DEFICIENCY

1) NIGHT BLINDNESS:

- Vitamin A deficiency depresses the re synthesis of rhodopsin and interfere with the function of rods resulting in night blindness.

2) XEROPHTHALIMIA:

- Dryness of conjunctiva and cornea.
- white opaque dots on either side in each eye(bitot's spots.

Deficiency

3) Keratomalacia

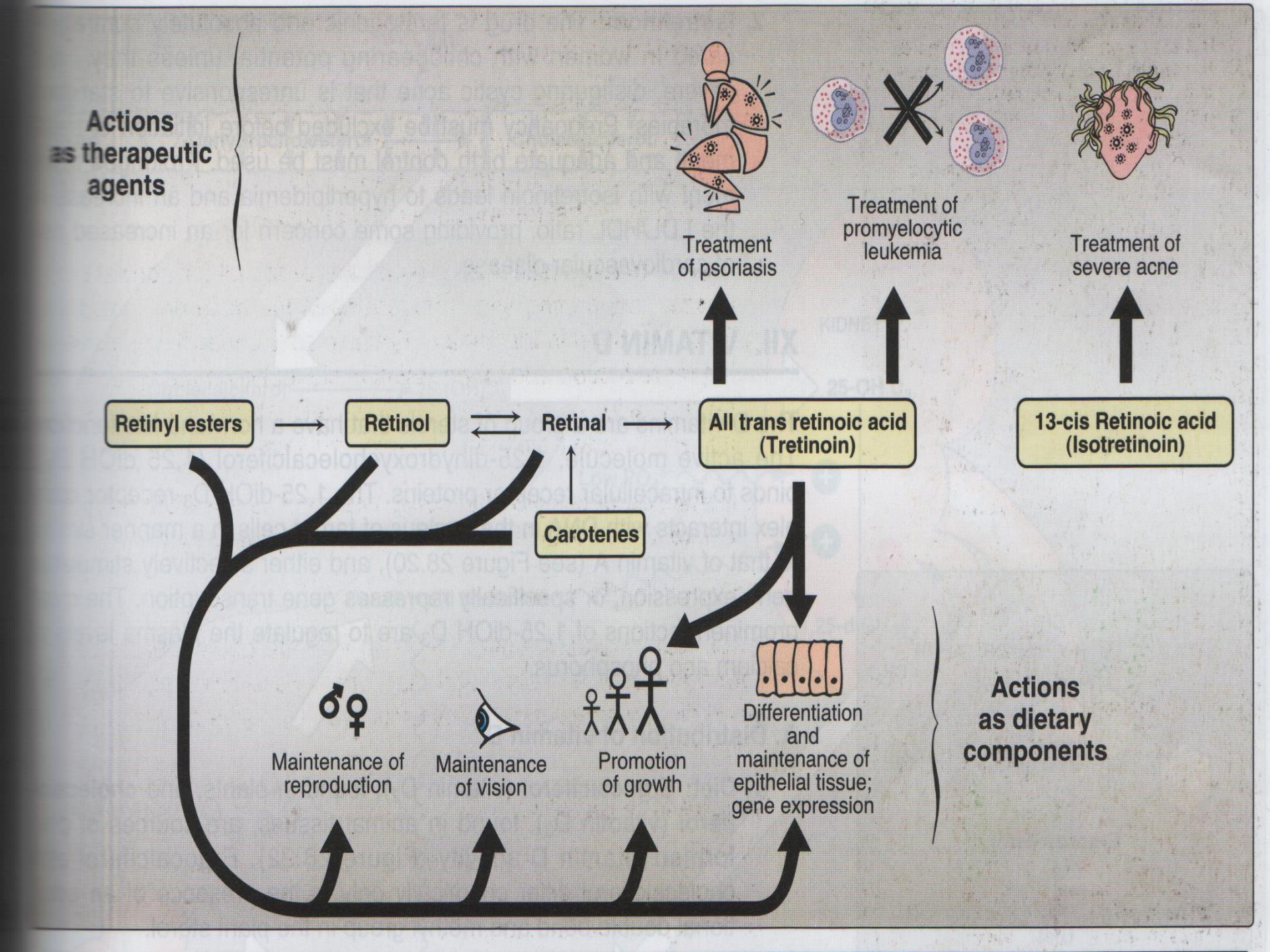
keratinisation , softening and ulceration of corneal epithelium,keratomalcia and loss of vision.

4) Skin become dry, scaly and rough.

Keratinization of respiratory epithelium leads to infection and low resistance to disease. UTI and calculi formation.

CLINICAL USES

- For treatment of acne and psoriasis.
- Retinyl palmitate used in skin creams.
- Tretinoin (all trans retinoic acid) used for topical application.
- Used in oral leukoplakia.
- Beta carotenes decreases incidence of heart and lung disease and skin cancer.


Actions as therapeutic agents
Treatment of psoriasis
Treatment of promyelocytic leukemia
Treatment of severe acne
Retinyl esters
Retinol
Retinal
All trans retinoic acid (Tretinoin)
13-cis Retinoic acid (Isotretinoin)
Carotenes
Maintenance of reproduction
Maintenance of vision
Promotion of growth
Differentiation and maintenance of epithelial tissue; gene expression
Actions as dietary components

HYPERVITAMINOSIS ‘A’

- Nausea, jaundice, irritability, anorexia, vomiting, blurring of vision, headache, hair loss, muscle and abdominal pain and weakness, drowsiness and altered mental status.

- In chronic cases hair loss, dry skin, fever, insomnia, weight loss, bone fractures, anemia and diarrhea.

- Congenital malformations in growing fetus.

References

- Chatterjea
- Jaypee
- Satyanaryn


Thank you!