University of Fallujah
College of Medicine

Vitamin A

Lecture : 3

Stage : 2nd Stage

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Department: Chemistry and Biochemistry

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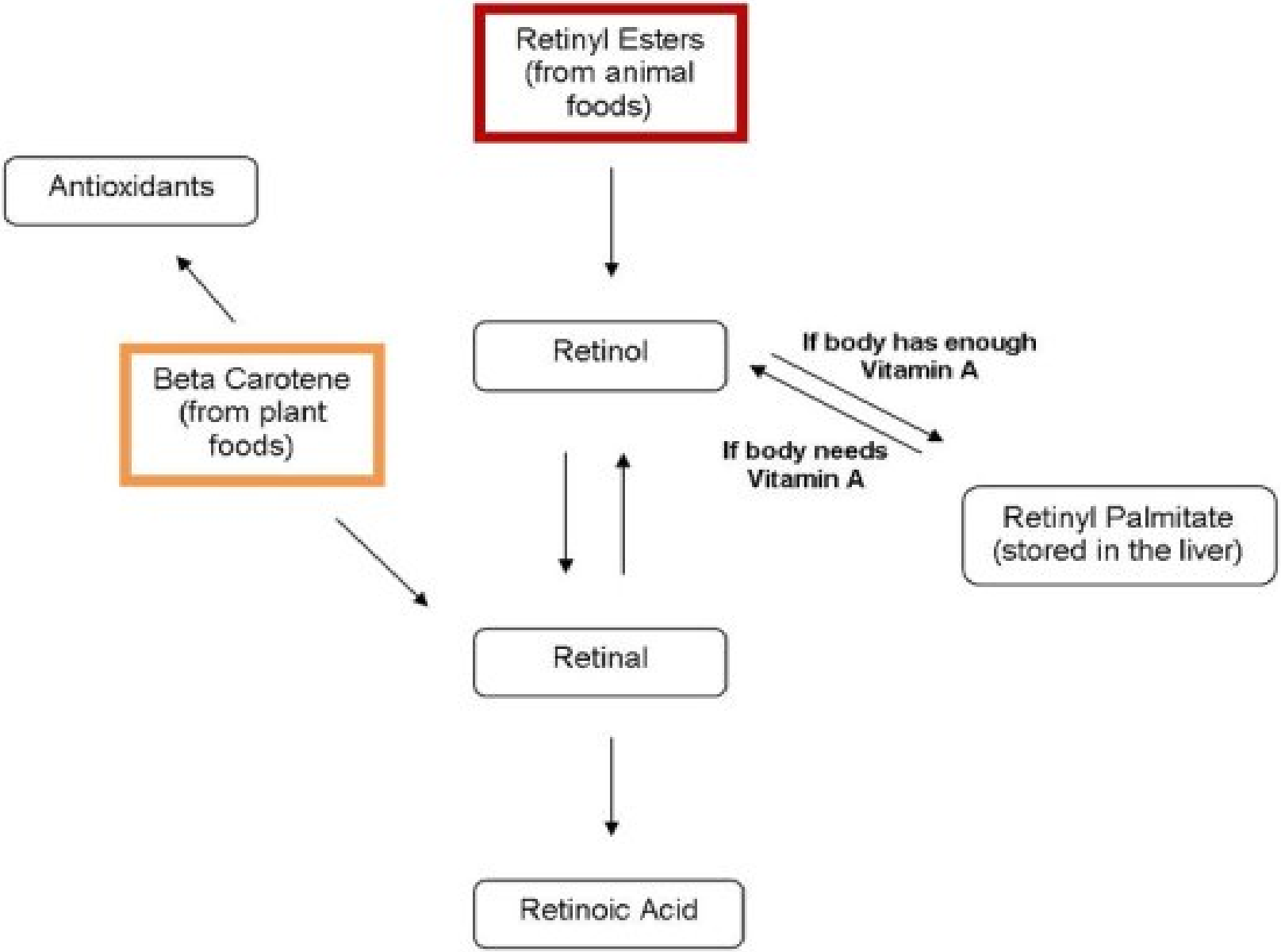
Learning Objectives

-Understand What is vit.A

-Understand the structures and action mechanism of vit. A

-Identify the clinical roles of vit. A

- **Vitamin A** is a **fat soluble vitamin**; **the active form** is **present only in animal tissue.**
- **The pro-vitamin, beta carotene is present in plant tissue**.
- **Retinol, retinal, retinoic acid, and related compounds are known as retinoid.**
- **Beta-carotene can be converted by the body into retinol are referred to as provitamin A (carotenoids)**.
- All forms of vitamin A have a **beta-ionone ring to which an isoprenoid chain is attached, called a retinyl group.**
- The orange pigment of carrots – beta-carotene – can be represented as two connected retinyl groups


Retinyl Esters (from animal foods)
Antioxidants
Retinol
If body has enough Vitamin A
If body needs Vitamin A
Beta Carotene (from plant foods)
Retinyl Palmitate (stored in the liver)
Retinal
Retinoic Acid

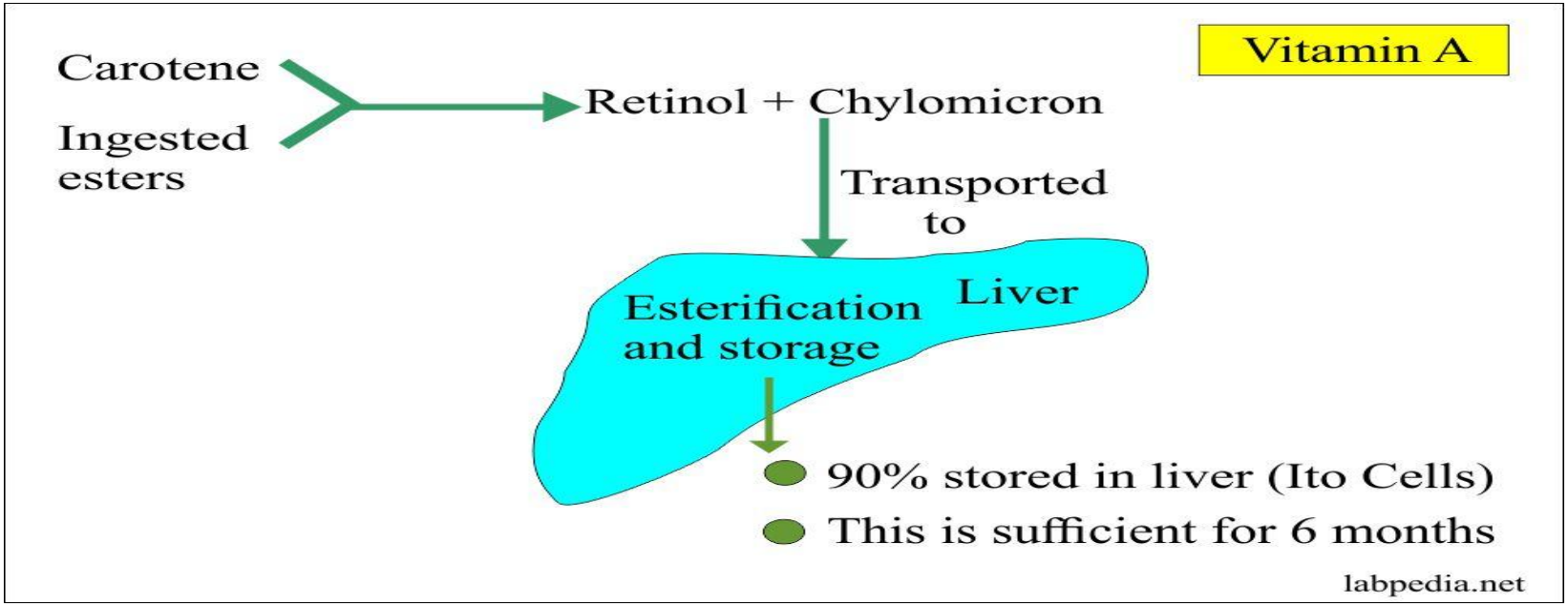
Vitamin A can be found in two principal forms in foods:

- ***Retinol**
- ***The carotenes alpha-carotene, beta-carotene, gamma-carotene**

Vit. A exists in three forms:

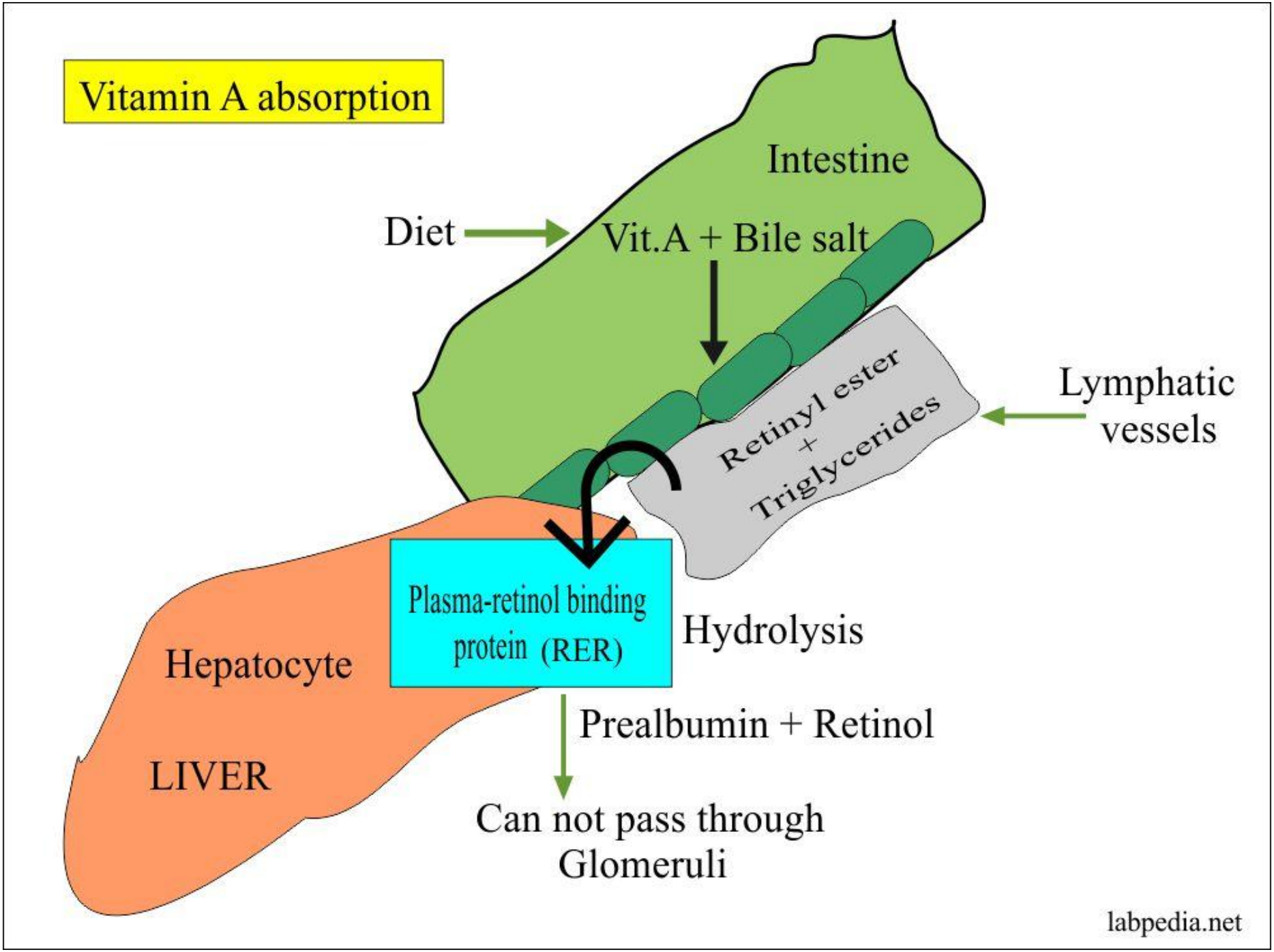
1- Retinol (A1) is the most important form of Vit.A. This is the **transport form** as the Retinol ester and also **storage form .** This is oxidized to aldehyde retinal which is used in visual pigments.Also oxidized to retinoic acid.

2- Retinal. & **3-Retinoic acid.**



Metabolism •

- **Absorption**
- 70% of vitamin **A from the diet is absorbed in the intestine**.
- **Absorption of vitamin A** is very **rapid**, with maximum absorption occurring **two to six hours after digestion.**
- **Beta carotene is cleaved by a di-oxygenase,to form retinal** .
- The **retinal** is reduced **to retinol** by an **NADH or NADPH dependent retinal reductase** present in the intestinal mucosa.
- **Intestine is the major site of absorption**


Vitamin A absorption
Intestine
Diet
Vit.A + Bile salt
Retinyl ester
+
Triglycerides
Lymphatic
vessels
Plasma-retinol binding
protein (RER)
Hydrolysis
Hepatocyte
LIVER
Prealbumin + Retinol
Can not pass through
Glomeruli
labpedia.net

• Transport

- **1-**After leaving the enterocytes **chylomicron,** which **carry retinyl esters, carotenoids, and unesterfired retinol along with triglycerides**, are circulated first through the lymphatic system and then through the general circulation.
- **2-** Upon arriving at extra-hepatic cells **chylomicron release triglycerides, however vitamin A remains within the chylomicron**.
- **3-**The **vitamin A is then incorporated into a chylomicron remnant**.
- **4-The chylomicron remnant** then travels back to the **liver** where it is taken up and further **metabolized or stored**.
- When **needed retinol** is mobilized from the **liver** and requires the use of a **carrier for transport** through the blood. **Retinol-binding protein (RBP)** is the specific **carrier used to transport all-trans retinol in the plasma**.

Functions

Vitamin A helps, form, and maintain healthy skin, teeth, skeletal and soft tissue, mucous membranes, and skin.

1- It is needed for good vision.

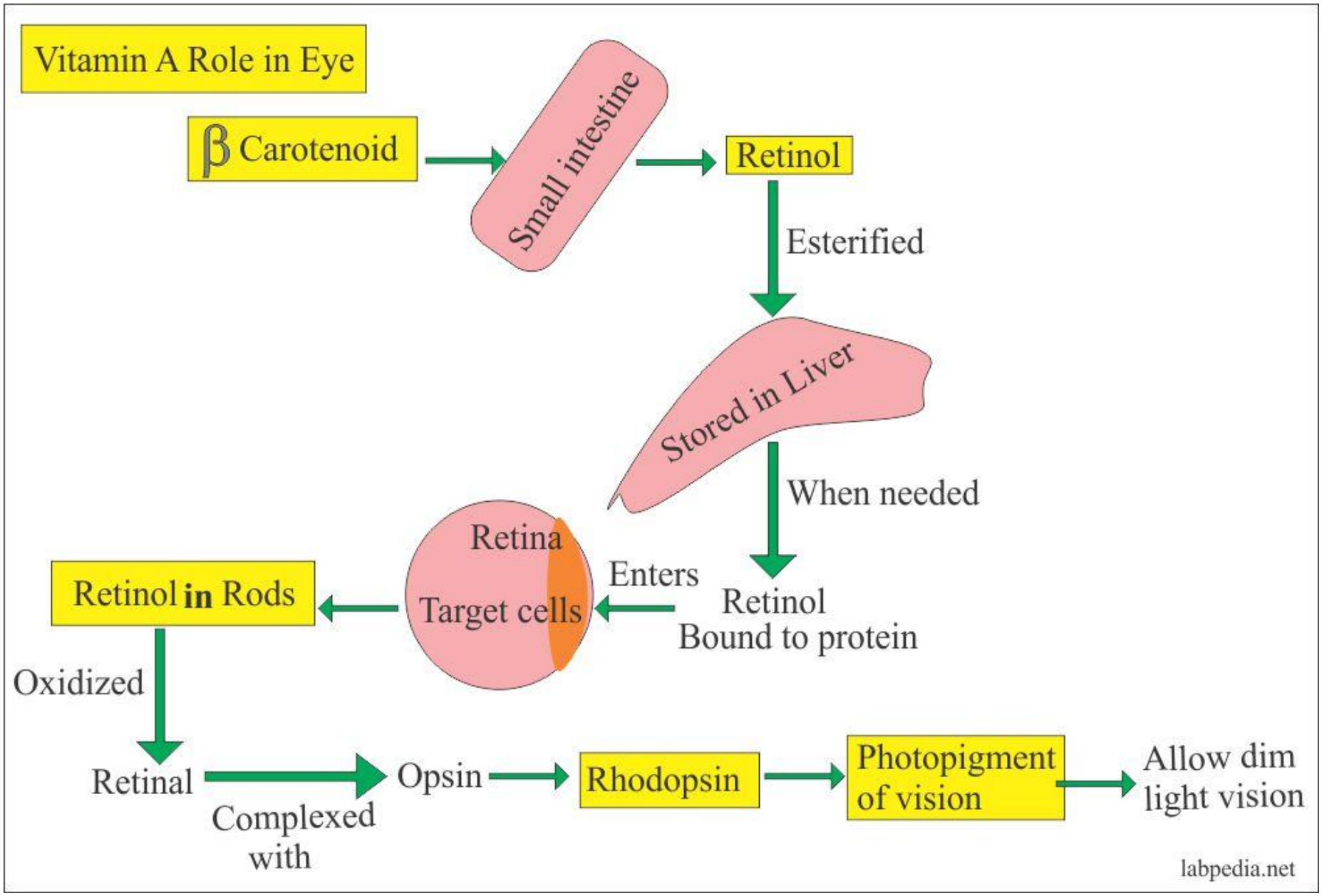
2- Needed for the growth of fetus and embryo (reproduction and growth).

3- It has a role in the immune system.

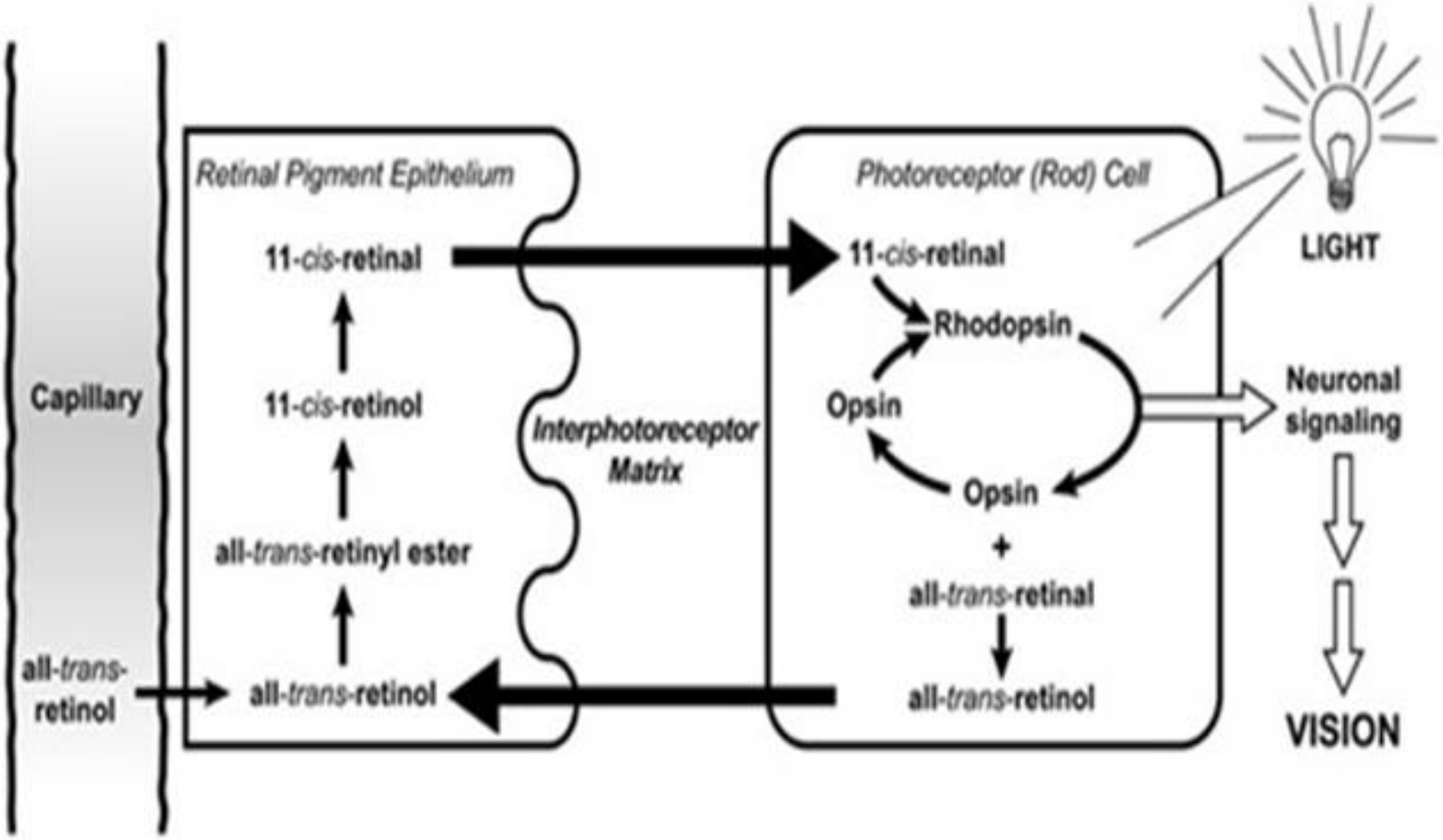
4- It helps in wound healing.

5-It helps in the reproductive system.

Role of Vitamin A in the eye



- **The Visual Cycle**



Deficiency:

Vitamin A deficiency can occur as either a **primary or a secondary deficiency.**

Primary vitamin A deficiency occurs among children and adults who **do not consume an adequate intake of provitamin A.**

Secondary vitamin A deficiency is associated with chronic malabsorption of lipids, impaired bile production and release, and chronic exposure to oxidants, such as cigarette smoke, and chronic alcoholism.

Zinc deficiency can also **impair absorption, transport, and metabolism of vitamin A** because it is essential for the synthesis of the vitamin A transport proteins and as the cofactor in conversion of retinol to retinal.

Causes for vitamin A deficiency

1-Decreased intake.

2-Obstructive jaundice causing defective absorption.

3-Cirrhosis of liver leading to reduced synthesis of RBP.

4-Severe malnutrition, where amino acids are not available for RBP synthesis.

5-Chronic nephrosis