LECTURE-3

VITAMINS

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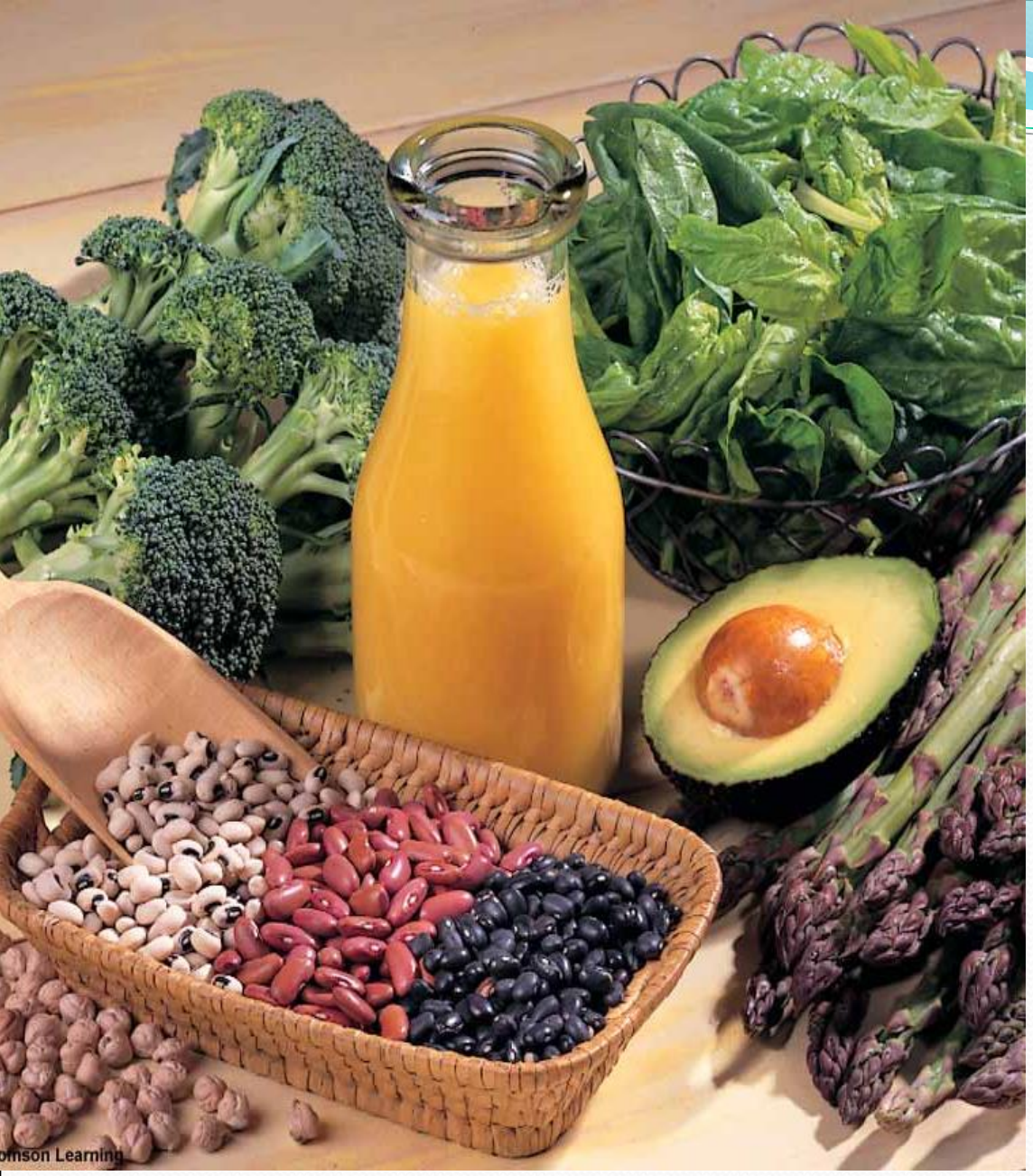


FOLATE or FOLIC ACID

FOLATE

- Other names
  - Folic acid
  - Folacin
  - Pteroylglutamic acid (PGA)
  - Vitamin B-9
  - Vitamin-M
- Contains : pteridine group linked with PABA, (pteroic acid)
- Attached to glutamic acid forming pteroyl glutamic acid or folic acid.

SOURCES

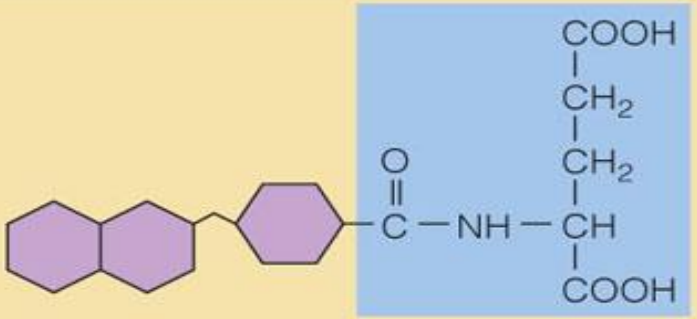
- Fortified Grains
- Leafy Green Vegetables
- Legumes, Seeds
- Liver

RDA

- ADULTS – 400 μg/day
- ADDITIONAL – 300 μg/day Pregnancy
  - AND – 400 μg/day Lactation

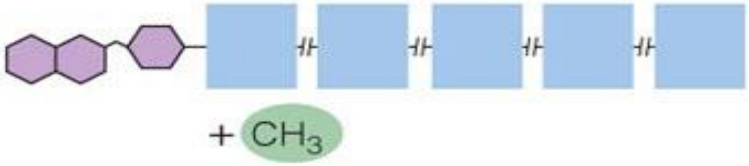
ABSORPTION & TRANSPORT

- **ABSORPTION**: SMALL INTESTINE
- **TRANSPORTED**: BY TWO BETA GLOBULINS
- **STORAGE**: CARRIED TO LIVER BUT NOT STORED (HELPS TO WORK AS COENZYME).
- **7,8 dihydrofolic acid** and **5,6,7,8 tetra hydro folic acid (THFA)** catalysed by folate reductase and requires NADPH



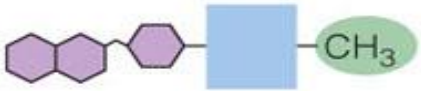
In foods, folate naturally occurs as polyglutamate. (Folate occurs as mono-glutamate in fortified foods and supplements.)

Spinach

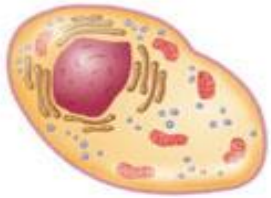


In the intestine, digestion breaks glutamates off . . . and adds a methyl group. Folate is absorbed and delivered to cells.

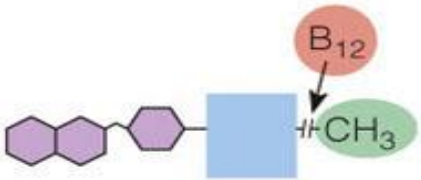
Intestine



In the cells, folate is trapped in its inactive form.



Cell



To activate folate, vitamin B_{12} removes and keeps the methyl group, which activates vitamin B_{12}.

Both the folate coenzyme and the vitamin B_{12} coenzyme are now active and available for DNA synthesis.

DNA

FUNCTIONS

- Coenzyme
- DNA synthesis
- Homocysteine metabolism
- Neurotransmitter formation
- THFA is the carrier of one carbon group (formyl, methyl, hydroxymethyl)

Folate and Homocysteine

- High homocysteine levels in blood associated with increased risk of CVD
- Folate deficiency → homocysteinemia ↓
- Folic acid appears to reduce the risk of stroke, which may be due to the role of folate in regulating homocysteine concentration
- Diets high in folate are associated with decreased risk of colorectal cancer
- There is a complex interaction between folic acid, vitamin B_{12} and iron. Deficiency of any one may be "masked" by excess of another so the three must always be in balance

DEFICIENCY CAUSES

- **PREGNANCY**- intake is less compared to requirement
- **DEFECTIVE ABSORPTION-** celiac disorder or GIT disorder
- **DRUGS** – anticonvulsant drugs (suppresses absorption)
- **HEMOLYTIC ANEMIA** – requirements are increased
- **DIETARY DEFICIENCY**- absence of green leafy vegetables for prolonged periods.

DEFICIENCY SYMPTOMS

- Similar signs and symptoms of vitamin B-12 deficiency
- Anemia
  - RBC grow, cannot divide (macrocytic-with FA deficiency)
  - Megaloblast: large, immature RBC

Neural Tube Defects

Malformation of the central nervous system that forms very early in the pregnancy (often even before woman realizes she is pregnant

Spina bifida- spine develops outside of the body

Anencephaly- entire brain and skull above the ears is missing

NEURAL TUBE DEFECTS

Spina Bifida

Anencephaly

- **Only known way to prevent these congenital malformations is adequate folacin intake *prior* to pregnancy**

- **Adequate folic acid intake can reduce the risk of NTD by up to 75%**

SYMPTOMS

- **Macrocytic anemia, also called megaloblastic anemia – large cell type**
- **Smooth, red tongue**
- **Mental confusion, weakness, fatigue, irritability and headaches**

- **Most vulnerable of all the vitamins to interactions with medications**
  - **Anticancer drugs**
  - **Antacids and aspirin**

ASSESSMENT

- **Normal blood level is 20 nanogram/ml, measured by Radio Immuno Assay (RIA)**
- **Histidine load test:**
- **AICAR excretion :**
- **AICAR-amino imidazole carboxamide ribosyl-5-PO4**

TOXICITY

- DOSES OVER 1 MG MAY CAUSE AGGRAVATION OF VIT-B12 AND MAY PRECIPITATE NERVE DAMAGE.

- FACT AS FA IS LESS SOLUBLE IS H2O LARGE DOSES CAN CAUSE CRYSTALLIZATION IN KIDNEY TUBULES LEADING TO RENAL DAMAGE.