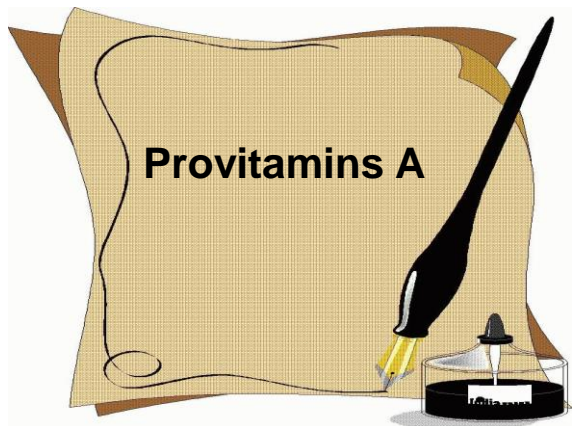
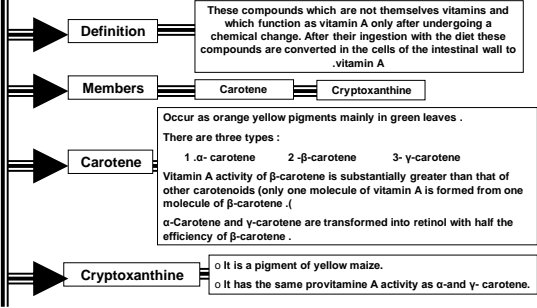


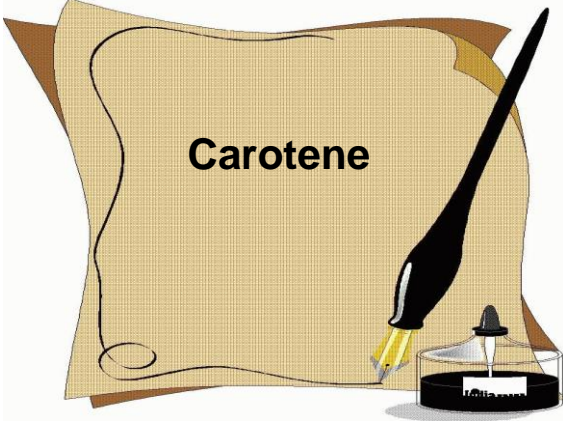
Form of vitamin A.	
Vitamin A1	<ul style="list-style-type: none"> <input type="checkbox"/> Other names: retinol <input type="checkbox"/> What is the meaning by retinol? <input type="checkbox"/> Retinal: is an unsaturated 20-carbon cyclic alcohol. <input type="checkbox"/> It consists of β-ionone (trimethylcyclohexene) nucleus and an unsaturated side chain. <input type="checkbox"/> Five conjugated double bonds are present in the retinol molecule, including the double bond in the β-ionone ring which is in conjugation with those in side chain. <input type="checkbox"/> Retinol = alcohol form of vitamin A and when alcohol group Replaced by aldehyde group Retinal is formed and alcohol group Replaced by acid group retinic acid is formed.
Vitamin A2	<ul style="list-style-type: none"> <input type="checkbox"/> It has an additional double bond between C-3 and C-4 of the ring. <input type="checkbox"/> It is found in the fresh-water fish. <input type="checkbox"/> It has less activity in mammals and birds than retinol.



Provitamin A.

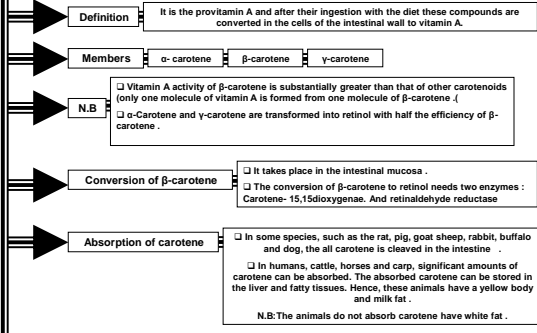


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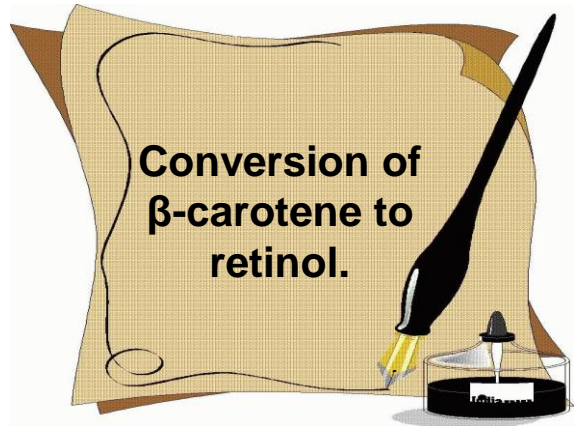


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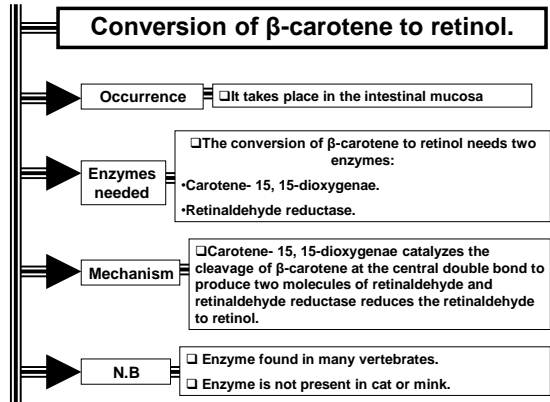
Carotene



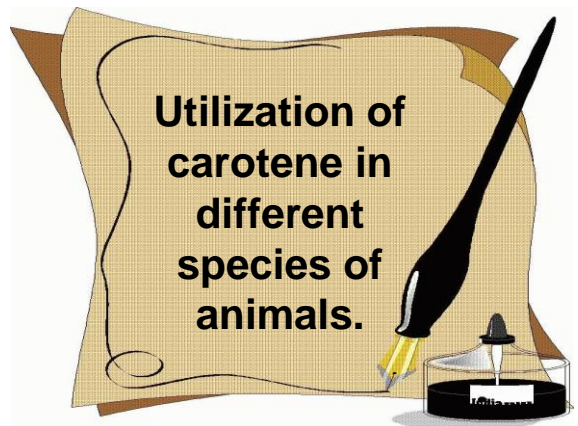
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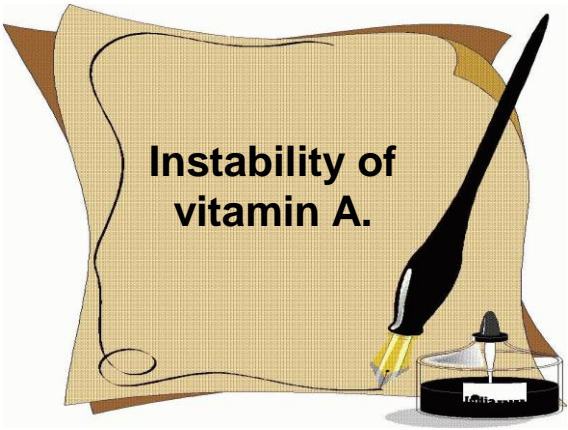
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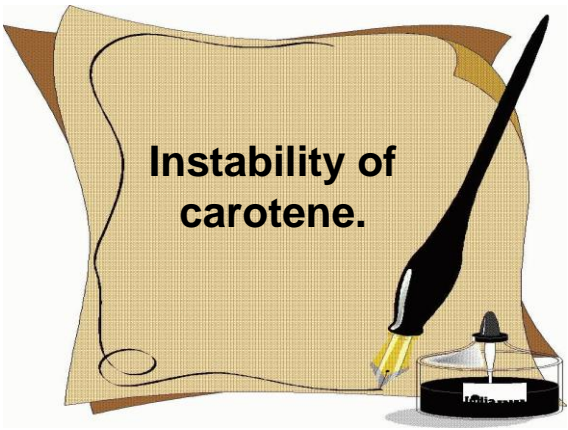


Instability of vitamin A.

- Retinal is readily oxidizable owing to the presence of the conjugated double bond system .
- Retinol is particularly unstable on exposure to light or heat, especially in the presence of heavy metal ions and water .
- Esterified vitamin A is more stable than retinol .
- Trace metals present in feed mixtures and hydroperoxides of fatty acids present in the lipid fraction of animal feeds have a deleterious effect on vitamin A stability, the unsaturated easily oxidized fats being the most destructive .

N.B :

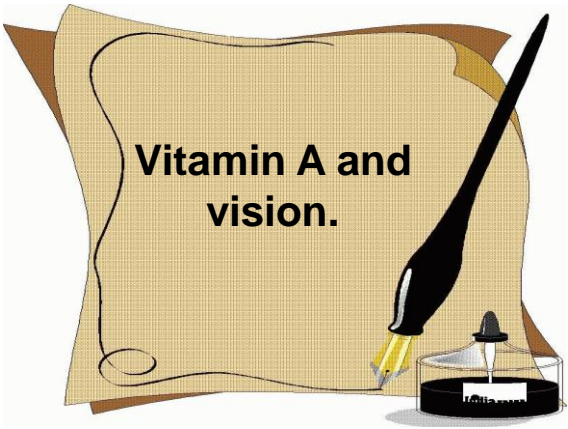
- A stable preparation of vitamin A intensively used in animal feeding involves coating.
- In this process the vit. A is embedded, together with an antioxidant such as ethoxyquine or BHT, in a gelatin-carbohydrate matrix to form a beadle.
- In the gastrointestinal tract the beadle softens disintegrates as the matrix is digested and releases the vitamin A which is thus fully biologically available .
- This form of vitamin A preparation when added to feed mixtures, results in less than 3-4% loss of vitamin A per month on storage of animal feeds under low moisture conditions .
- Pelletting feeds destabilizes the gelatin beadle some what and results in greater loss of vitamin A on storage .



Instability of carotene.

- ❑ Carotene is readily oxidizable owing to the presence of the conjugated double bond system .
- ❑ Carotenoids in plant material are subject to enzymatic oxidation through the lipoxygenase system, and to non-enzymatic processes accelerated by direct sunlight.
- ❑ Slow drying of forages in the sun-for hay preparation may cause an up to 80% destruction of carotene.
- ❑ High-temperature short-term heat treatment (artificial dehydration of green crops) deactivates the lipoxygenase and enables conservation of the carotene.
- ❑ Carotene is usually well preserved in silage, with total losses of about 10% typical of ensiling processes. Wilting prior to ensiling causes greater carotene losses of up to 30%.

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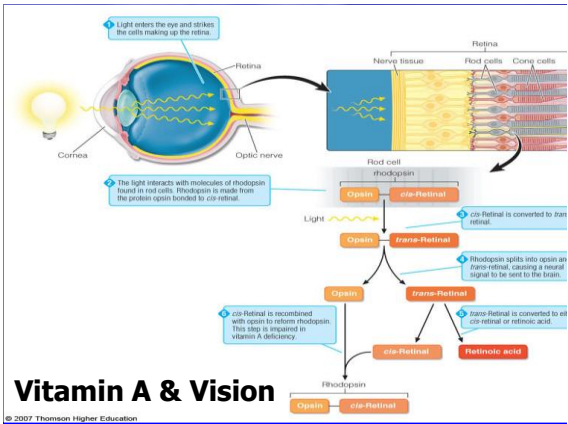


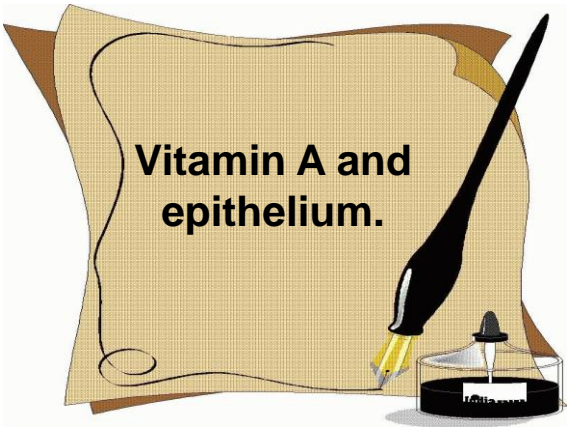
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Vitamin A and vision.

Function	<ul style="list-style-type: none"> ❑ Rhodopsin formation which is essential for transmission of light stimuli to the brain . ❑ It is essential for healthy of the epithelium of the eye.
Mechanisms	<p><u>Formation of rhodopsin and transmission of light stimuli to the brain.</u></p> <ul style="list-style-type: none"> ❑ 11-Cis-Retinal is combined with the protein opsin in both rods and cones in the light sensitive pigments. ❑ This pigment is then bleached by light isomerizing the cis-retinal to trans-retinal which is bound less strongly to the visual pigment, and trans-retinal is accordingly released. ❑ The isomerization of cis-retinal triggers a never impulse, and the energy derived from this reaction is transferred to the brain via the optic nerve and the seeing of color is registered. ❑ In the dark, the pigment is regenerated; this requires that transretinal is isomerized to the cis form, which occurs following reduction to retinol. <p><u>healthy of the epithelium of the eye</u></p> <ul style="list-style-type: none"> ❑ It prevent keratinization of corneal epithelium.

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Vitamin A and epithelium.

Function

- Vitamin A is required form maintenance of epithelial cells lining of all those canals and cavities of the body which communicate with the external air such as the alimentary, respiratory and the genitor-urinary treat as well as the corneal epithelium and the soft tissues around the eyes.
- It is essential for differentiation of mucus secreting cells.

Mechanisms

Stabilizing the membrane

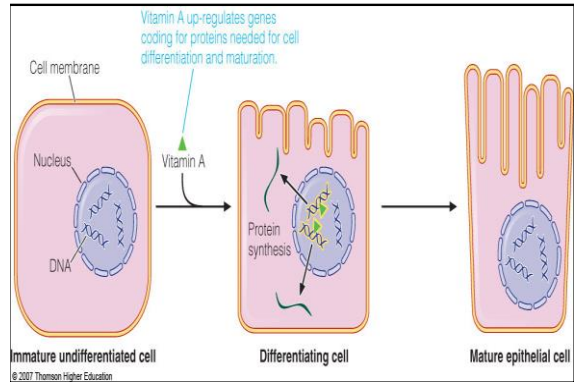
- Vitamin A penetrates lipoprotein membranes and at optimum levels, may act as a cross-linkage agent between lipid and protein, thus stabilizing the membrane.

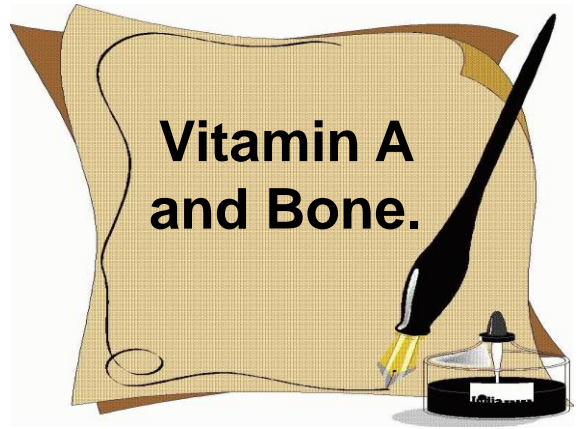
differentiation of mucus secreting cells

- Maintaining cell differentiation for mucus-secretion through two possible mechanisms:
 - Action of the cell nucleus, by altering expression of genetic information.
 - Extranuclear process, for example, the synthesis of cell surface glycoprotein.

Vitamin A is necessary for the formation of large molecules containing glucosamine. These are the mucopolysaccharides occurring in almost all tissues of mammal organisms but principally in the mucus-secreting epithelial and in the extra cellular matrix of cartilage, mainly as chondroitin sulfate.

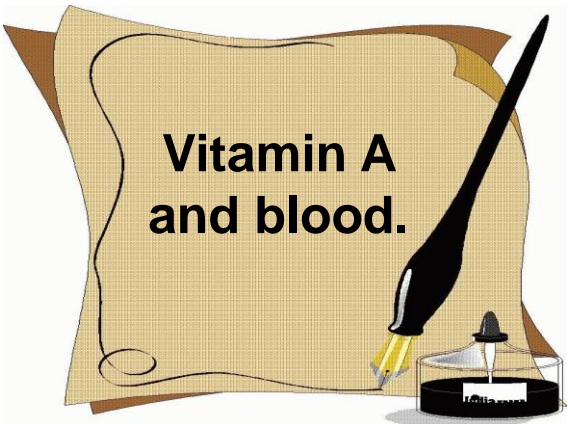
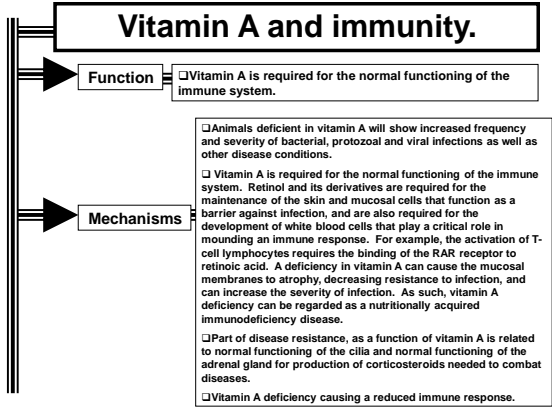
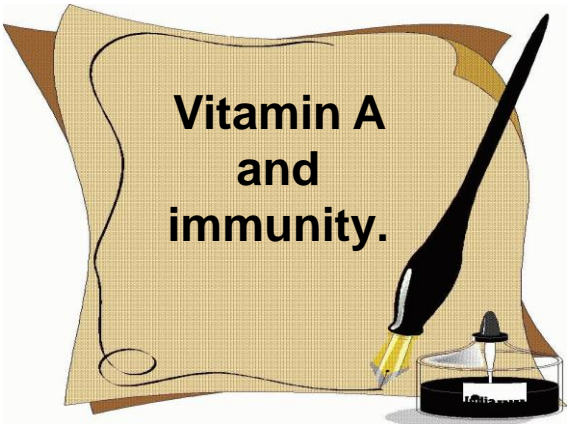
Vitamin A & Cell Differentiation





Vitamin A and bone.

- ➔ **Function** = Vitamin A has a role in the normal development of bone .
- ➔ **Mechanisms** = Vitamin A control exercised over the activity of osteoclasts and osteoblasts of the epithelial cartilage.
 Vitamin A has a role on the biosynthesis of mucopolysaccharides (glycoproteins) which are major constituents of organic matter in bones.



Vitamin A and blood.

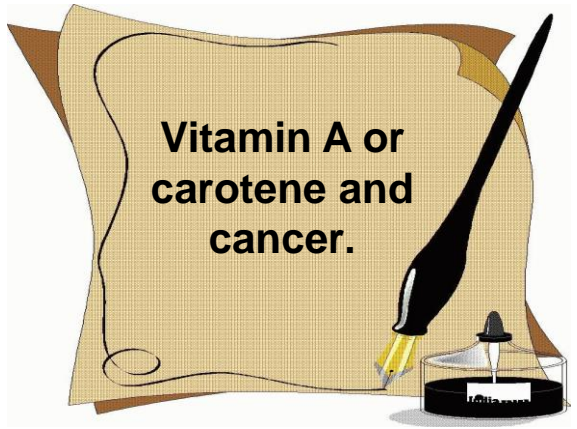
Function

□ Vitamin A has a role in the production of red blood cells and function of Hb.

Mechanisms

□ Vitamin A is also involved in the production of red blood cells, which are derived from stem cells that are dependent upon retinoids for their proper differentiation.

□ Vitamin A appears to facilitate the mobilisation of iron stores to developing red blood cells, where it is incorporated into the oxygen carrier haemoglobin).



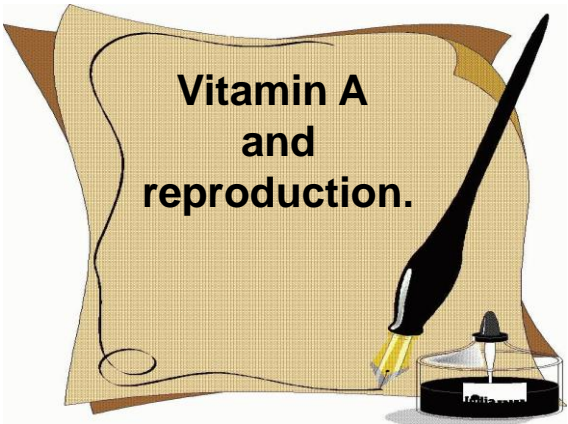
Vitamin A or carotene and cancer.

Function

□ Vitamin A intake has a complex relationship with cancer prevention.

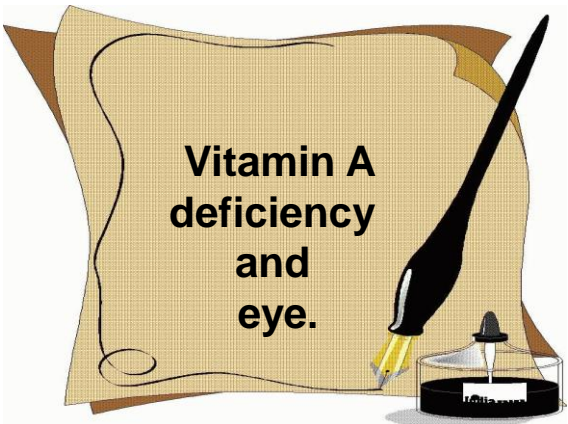
Mechanisms

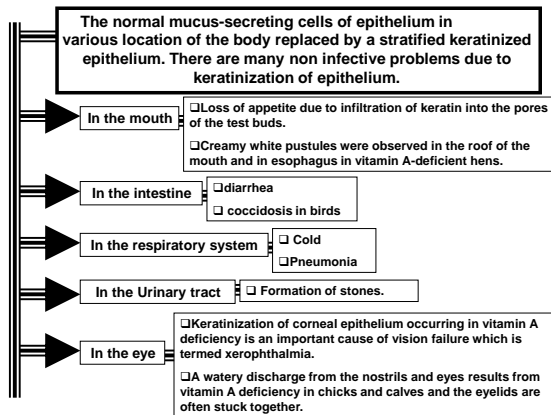
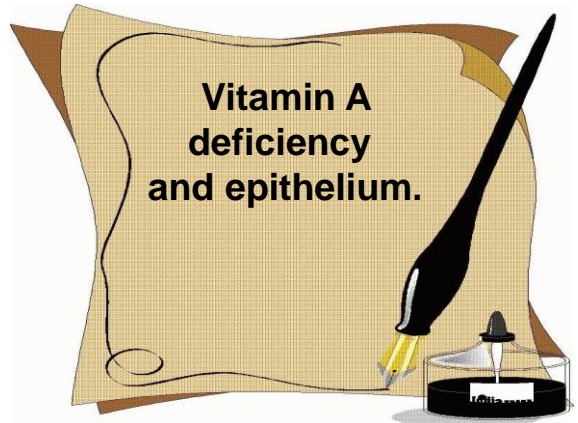
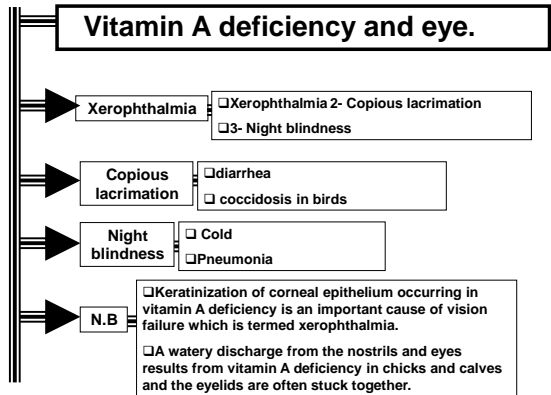
□ Vitamin A intake has a complex relationship with cancer prevention: while small doses of vitamin A or beta-carotene appear to help prevent cancer, higher doses seem to have the reverse effect. The anti-cancer effects of beta-carotene appear to stem from its anti-oxidative ability to scavenge for reactive oxygen species, as well as through its conversion to vitamin A, which can improve immune function in addition to eliciting an anti-proliferative effect through the RAR and RXR receptors, thereby acting to block certain carcinogenic processes and inhibit tumour cell growth. However, an excessive intake of beta-carotene appears to have carcinogen effects, possibly through its promotion of the eccentric (or asymmetric) pathway of beta-carotene cleavage, which produces breakdown products that might lead to the destruction of retinoic acid through the activation of the P450 enzyme, which in turn could decrease retinoid signalling leading to enhanced cell proliferation. Therefore dosage seems to be an important factor in beta-carotene action.

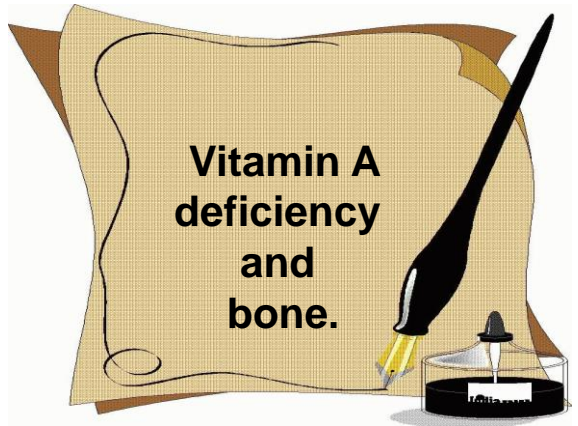


Vitamin A and reproduction.

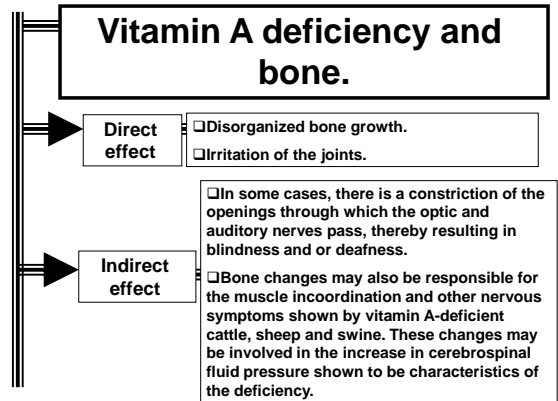
- Function**
 - ❑ In most livestock, the absence of vitamin A in the ration will dramatically reduce reproductive ability.
- Mechanisms**
 - ❑ Vitamin A is required for maintenance of epithelial cells lining of the genitor-urinary tract.
 - ❑ It prevents keratinization of the mucus membrane of the reproductive system in male and female.



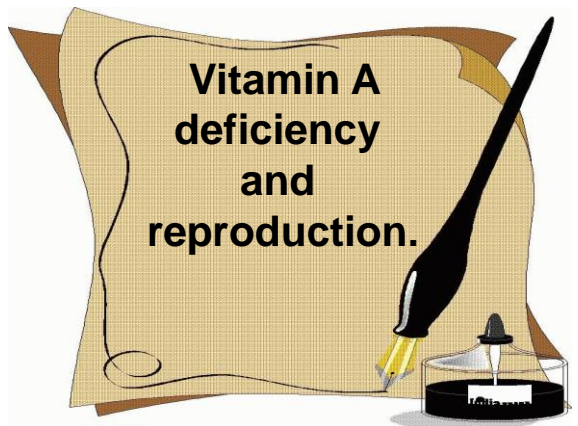




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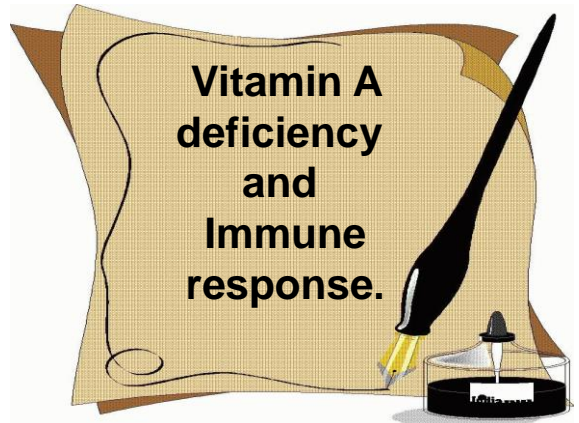


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Vitamin A deficiency and reproduction.

- In male**
 - Vitamin A deficiency in the male results in a decline in sexual activity and failure of spermatogenesis.
- In female**
 - The resorption of the fetus.
 - Abortion.
 - Birth of dead offspring.
 - Retained placenta may be a characteristic of vitamin A deficiency in some species
- In rats**
 - Degeneration of germinal epithelium and seminiferous tubules.
 - Cessation of spermatogenesis in vitamin A-deficient rats is not prevented by retinoic acid.
- In rabbits**
 - Reduction in fertility and an increased incidence of abortion in pregnant does.

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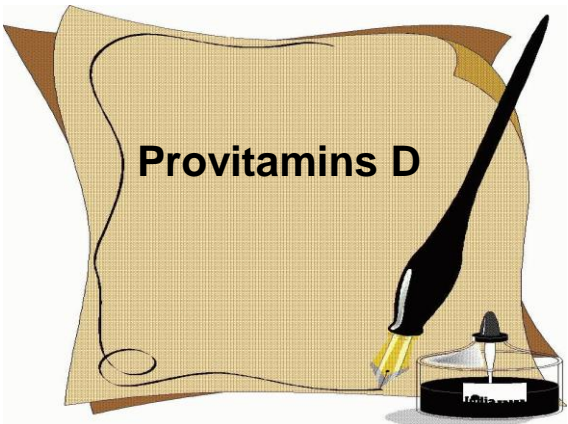
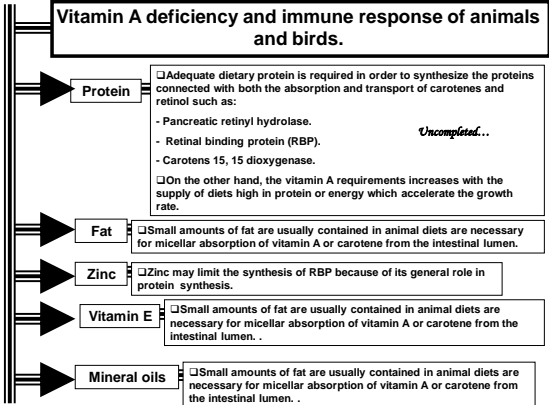
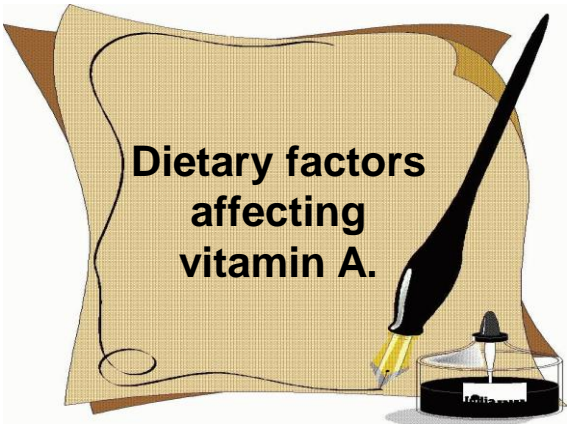


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Vitamin A deficiency and immune response of animals and birds.

- Effect**
 - Vitamin A deficiency causing a reduced immune response.
- Examples**
 - Animals deficient in vitamin A will show increased frequency and severity of bacterial, protozoal and viral infections as well as other disease conditions.
 - Part of disease resistance, as a function of vitamin A is related to maintenance of mucus membranes and normal functioning of the adrenal gland for production of corticosteroids needed to combat diseases.
 - N.B:**
 - Vitamin A-deficient chicks showed rapid loss of lymphocytes.
 - Vit A-deficient rats showed atrophy of the thymus and spleen and reduced response to diphtheria and tetanus toxoids.
 - Vitamin A is instrumental in curing ring worm infestation in cattle.
 - Supplementation with vitamin A improved the health of animals infected with round worms.

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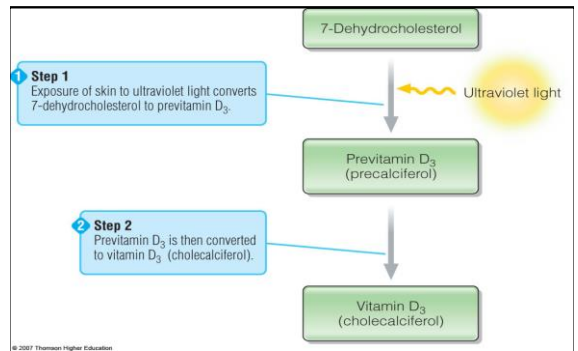


Provitamin D

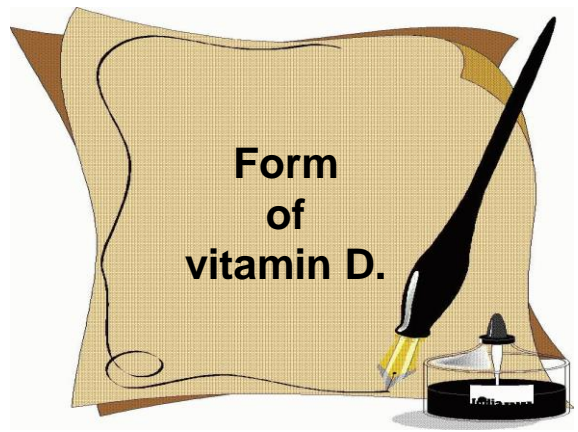
- ➔ **Definition** ➔ These compounds which are not themselves vitamins and which function as vitamin D only after undergoing a chemical change. The precursors have no biological activity until the β-ring is opened between the 9-and 10- . . . position of the steroids
- ➔ **Members** ➔ Ergosterol ➔ 7-Dehydrocholesterol
- ➔ **Ergosterol** ➔
 - ☐ Provitamin D2, occurs commonly in plants and is transformed into vitamin D2 during sun-drying of harvested forages.
 - ☐ 1 Kg of hay contains between 800 and 1700 IU.
 - ☐ Yeast is rich in ergosterol and its irradiation results in a potent source of vitamin D.
- ➔ **7-dehydrocholesterol-** ➔
 - ☐ Irradiated 7-dehydrocholesterol is used as a feed additive for poultry diets
 - ☐ D3 are formed by ultraviolet irradiation

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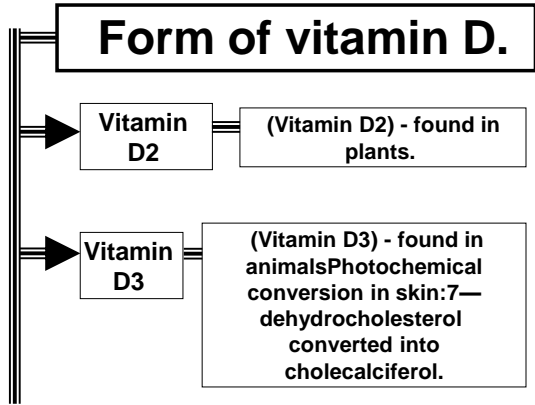
Synthesis of Vitamin D



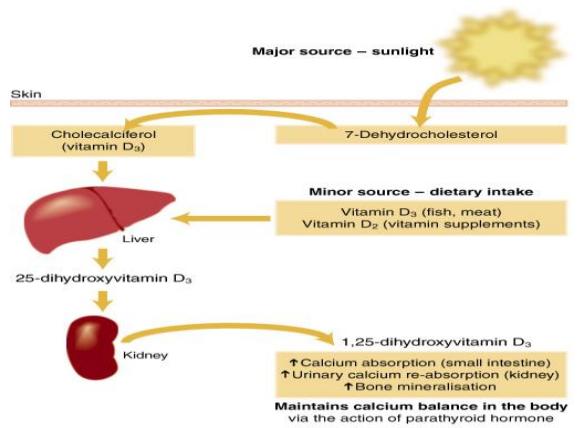
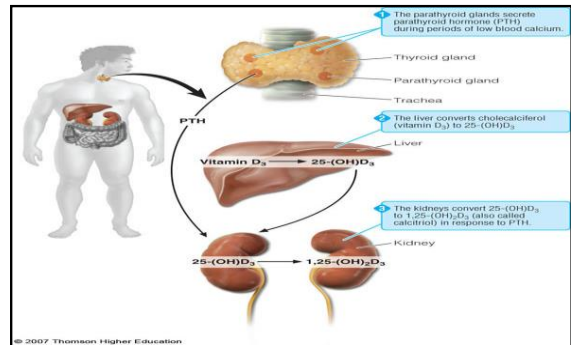
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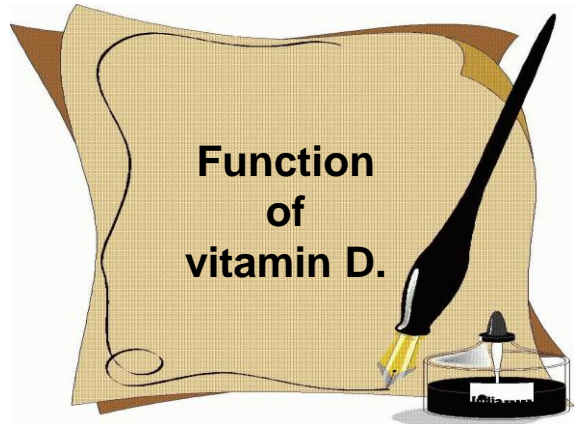


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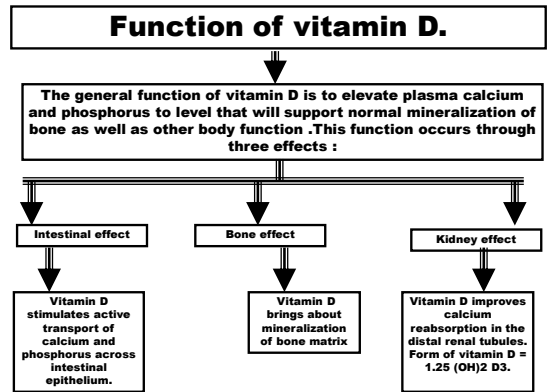


Activation of Vitamin D

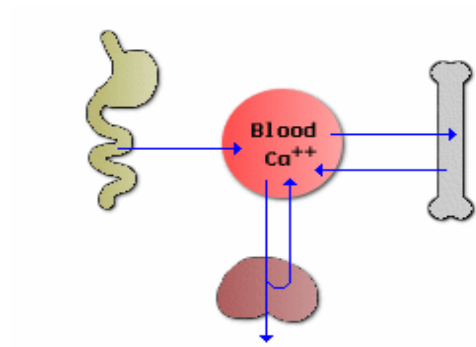




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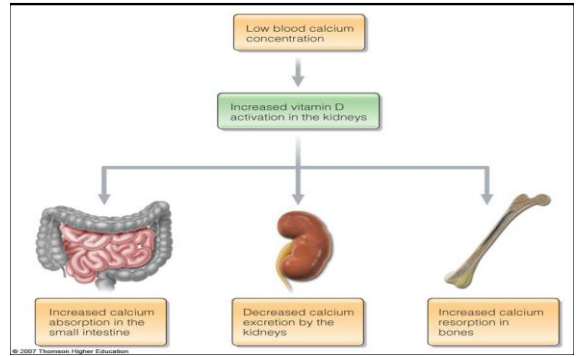


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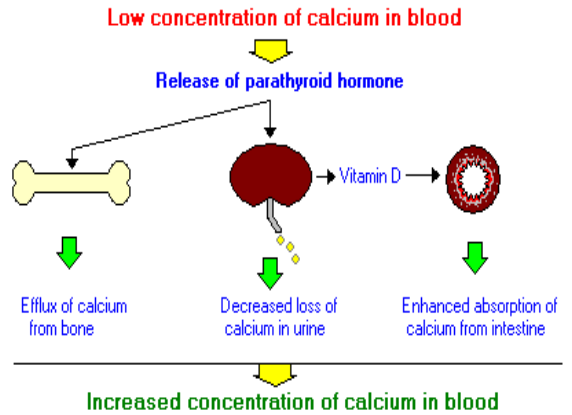


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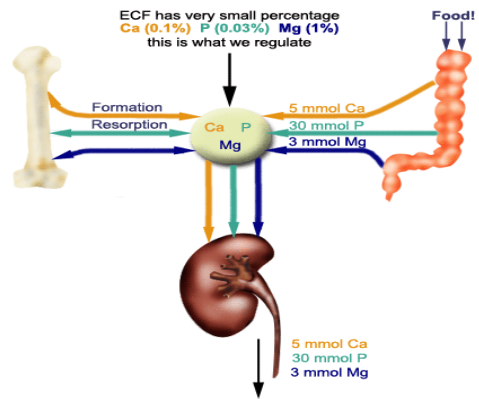
Vitamin D & Calcium Homeostasis



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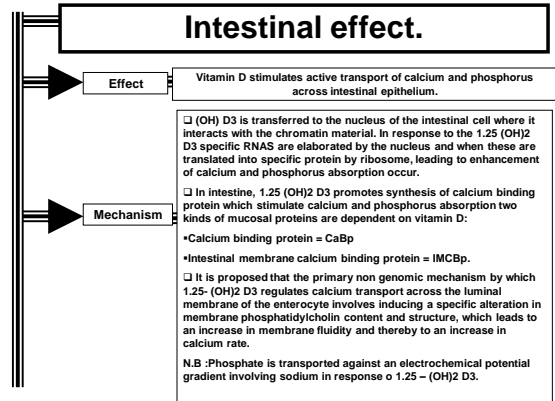
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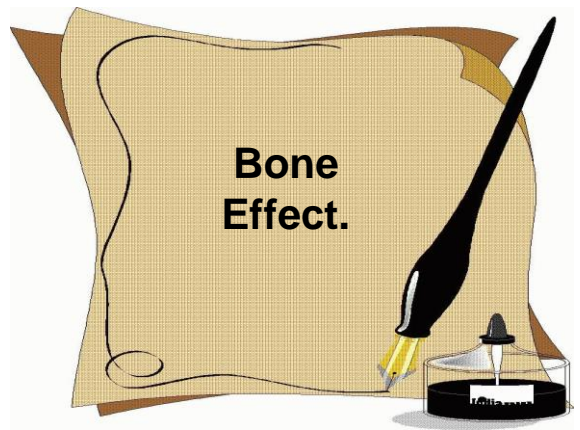
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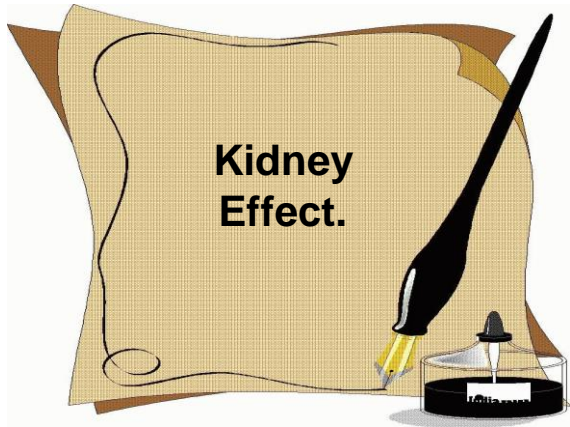
Bone effect.

Effect : Vitamin D brings about mineralization of bone matrix.

Mechanism :

- (OH)₂ brings about mineralization of bone matrix.
- 1,25 (OH)₂ D₃ is localized in the nuclei of bone cells. Also there is some indication that 24, 25- (OH)₂ D₃ and possibly 25-oH D₃ may have unique actions on bone.
- The 24, 25 (OH)₂ D₃ appears to be accumulated in bone, where it promotes normal development.
- Vitamin D plays another role in bone, that is, in mobilization of calcium from bone to the extracellular fluid compartment this function is shared by PTH.
- Vitamin D has a role in the biosynthesis of collagen in preparation for mineralization.

N.B: A vitamin D deficiency causes inadequate cross-linking of collagen as a result of low lysyl oxidase activity, which is involved in a condensation reaction for the collagen cross-linking. This may be a direct effect of vitamin D or a result of mineral changes in blood, it is not considered a major function of vitamin D.



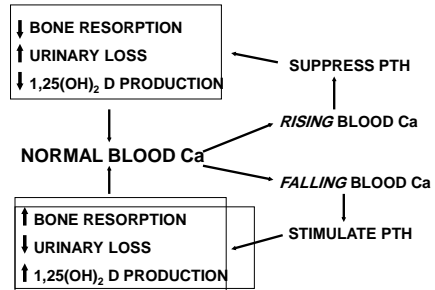
Kidney effect.

Effect : Vitamin D improves calcium reabsorption in the distal renal tubules.

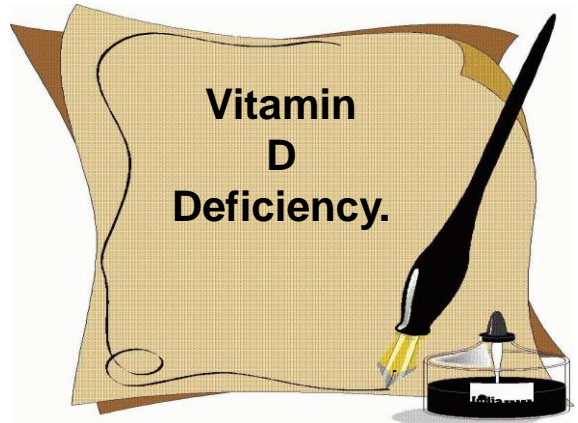
Mechanism :

- 25-hydroxy-vit D₃ converted into 1, 25-dihydroxy-vit D₃ which improves calcium reabsorption in the distal renal tubules .

LOOPS CALCIUM, PTH, AND VITAMIN D FEEDBACK



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Vitamin D deficiency.

→ The typical signs of vitamin D deficiency are

→ clinical symptoms differ in different species

- ☐ Rickets in young animals.
- ☐ Osteomalacia in adult animals.

☐ In calves as swelling occurs in the metacarpal and metatarsal bones. Bending of the forelegs.

☐ Arching of the forelegs arching of the back.

☐ In chicks the joints become enlarged and the beak becomes soft and rubbery and can be easily bent (plate in atlas).

☐ The most characteristic internal signs of vitamin D deficiency in chicks are:

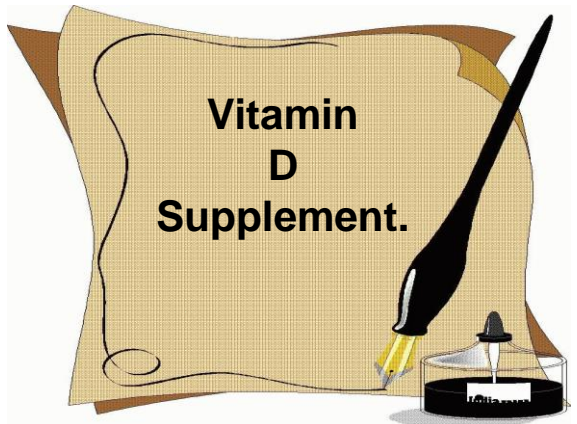
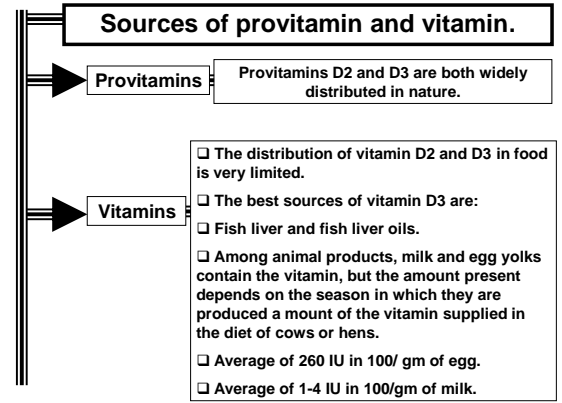
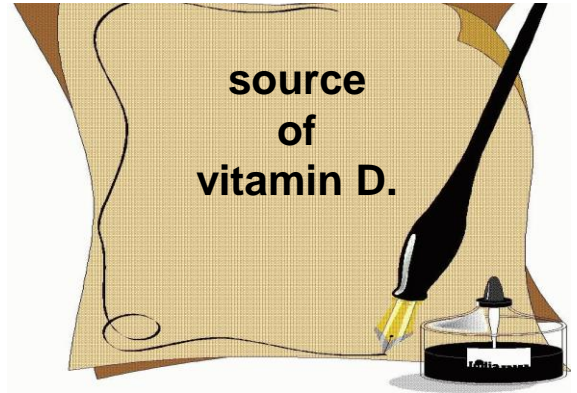
- ☐ A beading of the ribs at their junction with the spinal column.
- ☐ Crooked backbone (plate in atlas).

☐ In laying hens, the same signs are observed and the eggs become thin-shelled, hatchability is reduced and finally egg production decreased.

N.B:

- ☐ Rickets represents a disturbance of the mineral metabolism in such as way that the calcification of the growing bones does not take place normally (Ca and P are not deposited in bone)
- ☐ Osteomalacia softening of bone, represents a decrease in the mineral contents of adult bone.

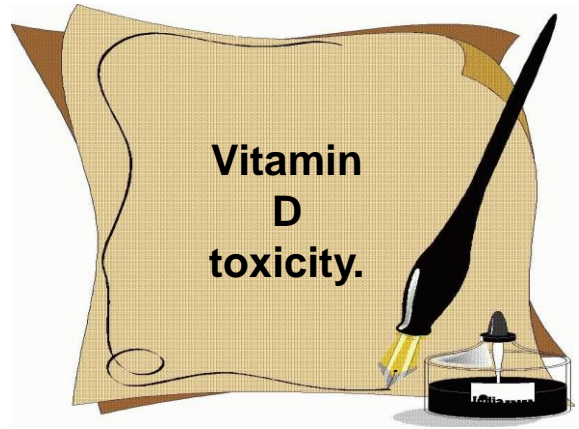
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Vitamin D supplement.

- The need for supplementing the diet of ruminants with vitamin D is not as great as for poultry.
- Ruminants can receive adequate amounts of vitamin D from irradiation or from sun-cured hays.
- In animals that do not have direct access to sunlight confined farm birds, the endogenous vitamin D production does not meet the requirement and their diets must be supplemented with vitamin D concentrates.
- The use of vitamin D and its metabolites for milk fever. This disease and metabolic bone disorders respond to very small doses of synthetic 1, (OH)D3 and 1.25 (OH)2 D3.
- Exposure of animals to sunlight for a short time during the day is sufficient to convert provitamin D3 present in the skin to vitamin D3 which eliminates the need for a dietary source.
- Vitamin D2 is almost as effective as vitamin D3 for mammals, but vitamin D2 is virtually inactive in birds, thus poultry feed must be fortified with vitamin D of animal origin or synthetic vitamin D3.

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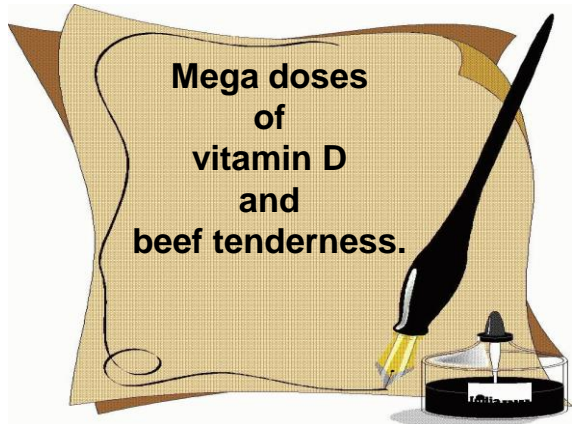
Vitamin D Toxicity.

- Safe feeding levels**
 - A few days - 25,000 IU/kg feed
 - 60 days - 2,200 IU/kg feed

Symptoms of toxicity

- Loss of appetite
- Weight loss
- Reduced rumination
- Depression
- Widespread calcification of soft tissue
- Kidneys, heart, pancreas, lymph glands, lung alveoli
- Inflammation
- Demineralization of skeletal system.

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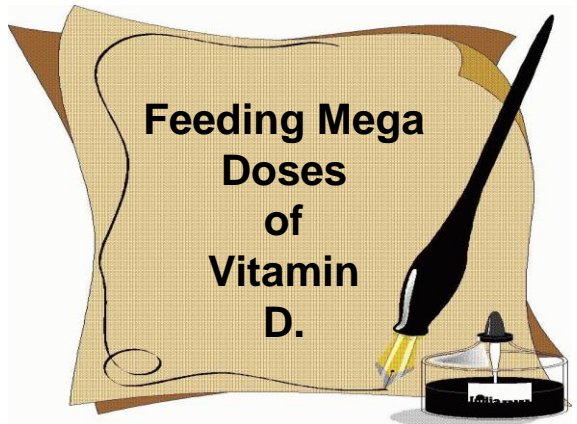


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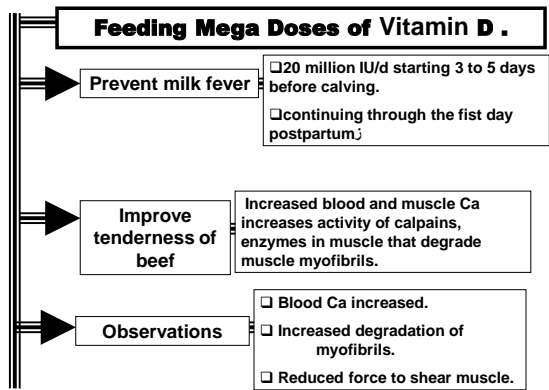
Feeding Mega Doses of Vitamin D and Beef Tenderness.

- Feed cattle 5 to 7 million IU/d of Vit D3 8 to 10 days prior to harvest improves tenderness of skeletal muscle.
- Response not consistent in all experiments.
- Less response with increased aging of beef.
- Accumulation of vitamin D and metabolites in tissues.
- Reduced feed intake.
- Loss of body weight.
- Feeding cattle 125 ug of 25-hydroxy Vit D3 for 4 days prior to harvest may be alternative.
- Response not consistent.

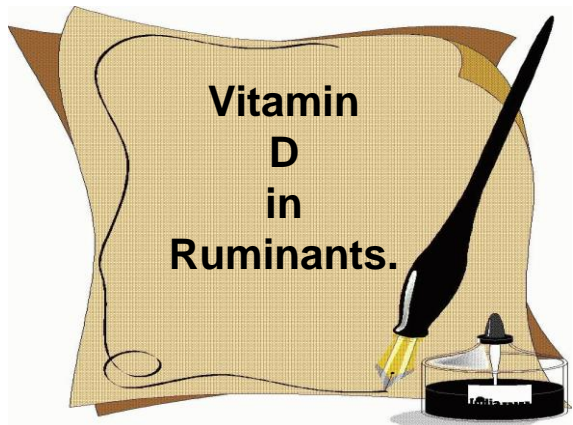
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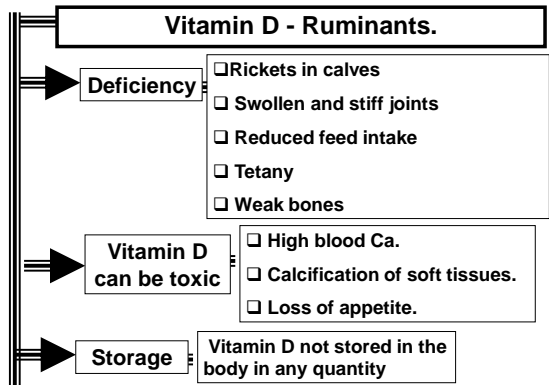
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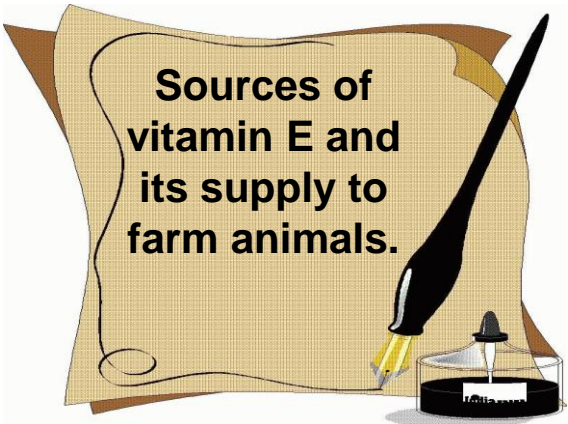
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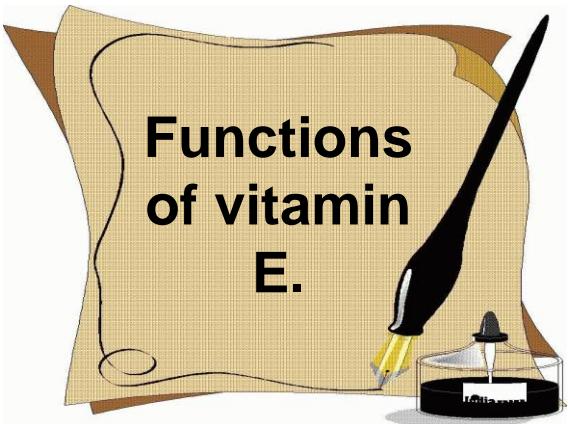


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Sources of vitamin E and its supply to farm animals.

- α-Tocopherol is practically the only tocopherol present in green plants and in animal products.
- The content is quite high in green plants but low in feedstuffs of animal origin.
- The germs of cereal, particularly the germ oil as well as other plant oils are rich sources of tocopherols.

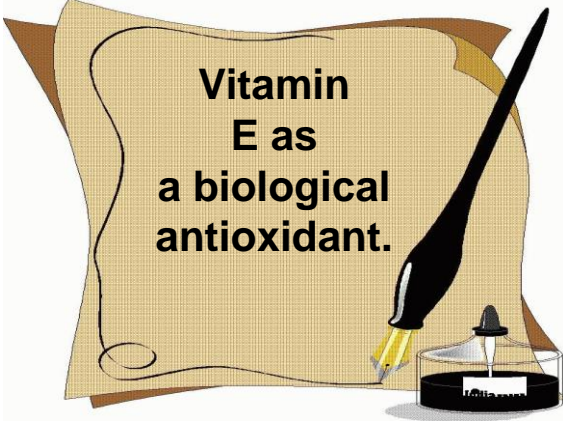
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Functions of vitamin E.

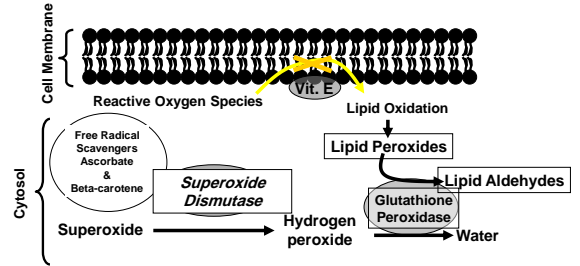
- 1 Vitamin E as a biological antioxidant.
- 2 Membrane structure and prostaglandin synthesis.
- 3 Blood clotting.
- 4 Disease resistance.
- 5 Electron transport and deoxyribonucleic acid.
- 6 Relationship to toxic Elements.
- 7 Other functions .



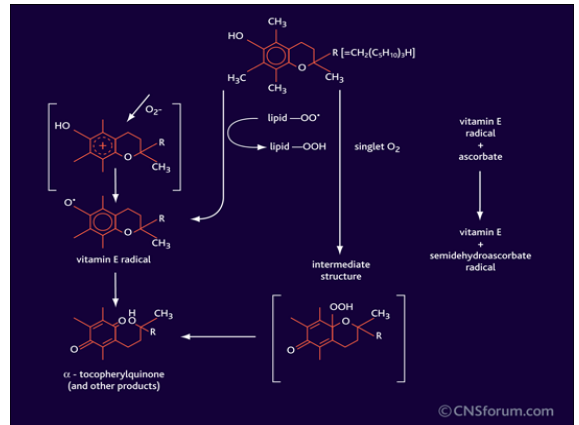
Vitamin E as a biological antioxidant.

- Function** □ Vitamin E is an intercellular and intracellular antioxidant .
- Mechanisms** □ Vitamin E reacts or functions as a chain-breaking antioxidant, thereby neutralizing free radicals and preventing oxidation of lipids within membran.
□ It prevents oxidation of unsaturated lipid materials within cells, thus protecting fast within the cell membrane from breaking down.
- Absence of vitamin E as antioxidants.** Destroys structural integrity of the cells and causes:
 - Metabolic derangements.
 - Morphological damage of the muscles.

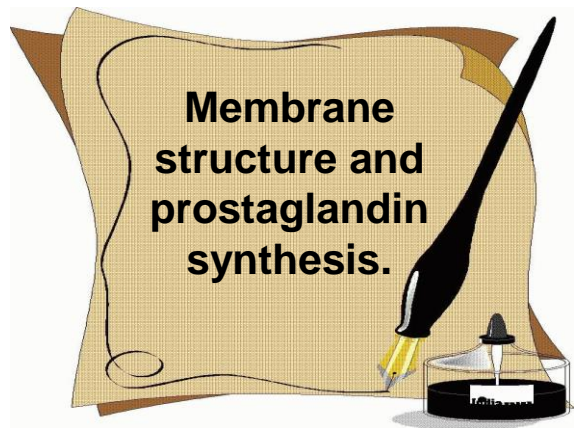
Cellular Antioxidant Defense Mechanisms



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Membrane structure and prostaglandin synthesis.

Membrane structure

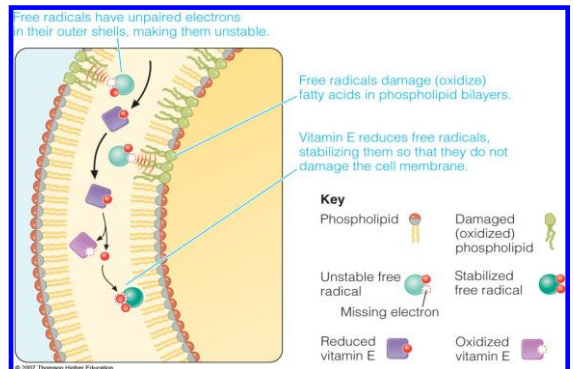
- α -Tocopherol may be involved in the formation of structural components of biological membranes.
- It is reported that-tocopherol stimulated the incorporation of C14 from linoleic acid into arachidonic acid in fibroblast phospholipids.

Prostaglandin synthesis

It was found that α -tocopherol exerted a pronounced stimulatory influence on formation of prostaglandin E from arachidonic, while a synthetic antioxidant had no effect.

^^

Cell Membrane Structure



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Blood clotting.

- ❑ Vitamin E is an inhibitor of platelet aggregation.
- ❑ It may play a role by inhibiting peroxidation of arachidonic acid, which is required for formation of prostaglandins involved in platelet aggregation.

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Disease resistance.

Function ❑ Vitamin E has a role in disease resistance.

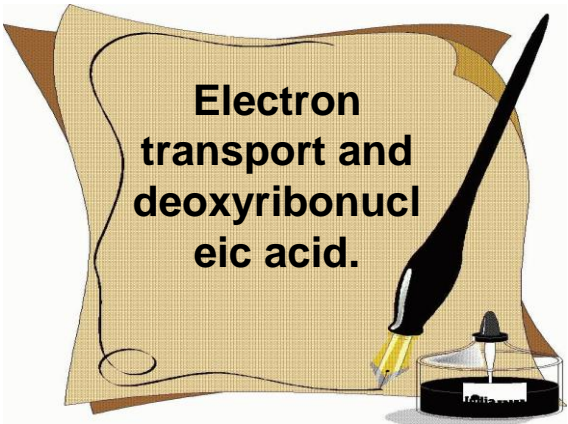
Mechanisms

- ❑ Vitamin and selenium play in protecting leukocytes and macrophages during phagocytosis.
- ❑ Vitamin E and selenium may help these cells to survive the toxic products that are produced in order to effectively kill ingested bacterial.

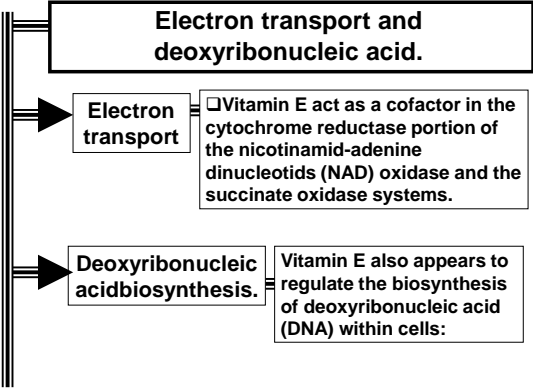
Examples

- ❑ Mice fed vitamin E-deficient diets are unable to produce a vigorous humoral response and this decreased immune reactivity undoubtedly contributes to increased susceptibility to bacterial infections associated with vitamin E-deficiencies.

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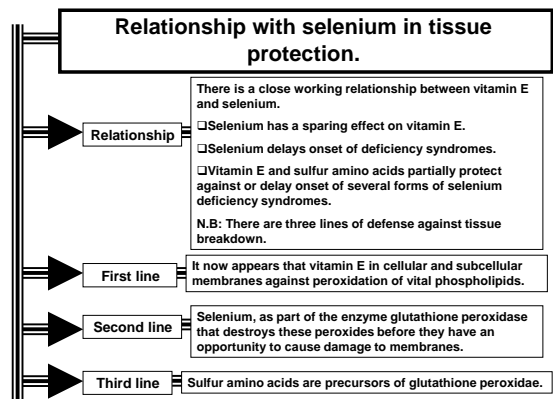
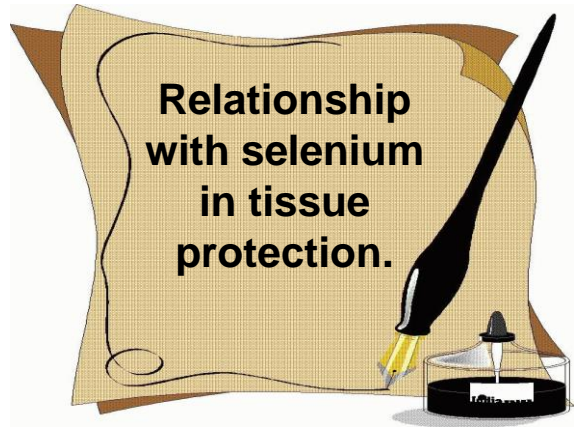
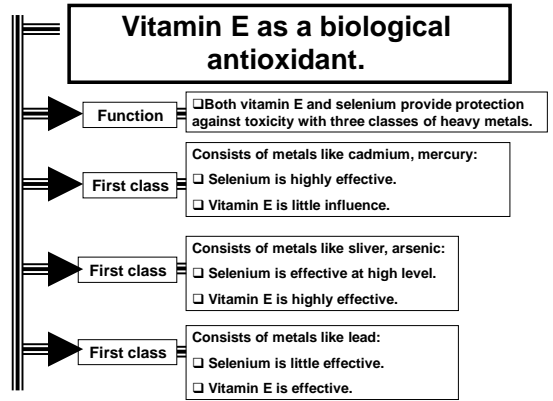
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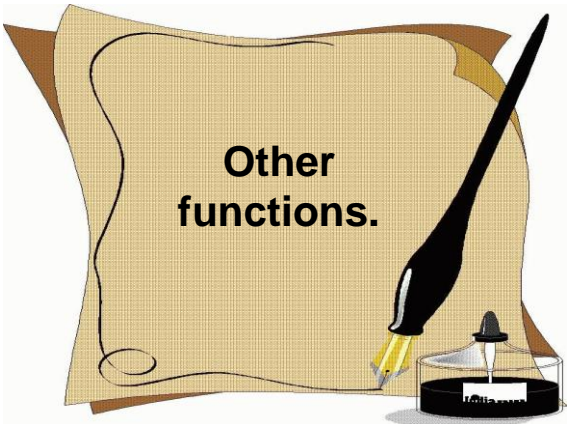


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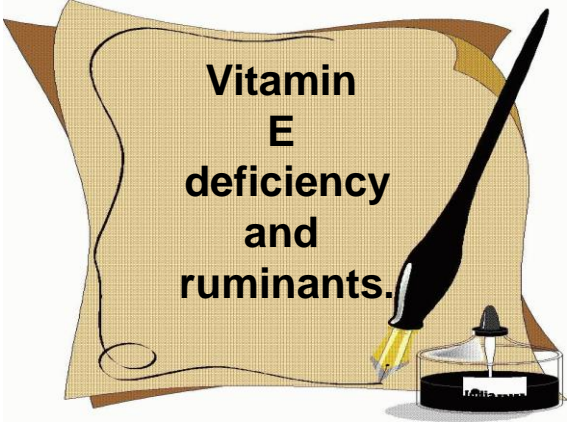


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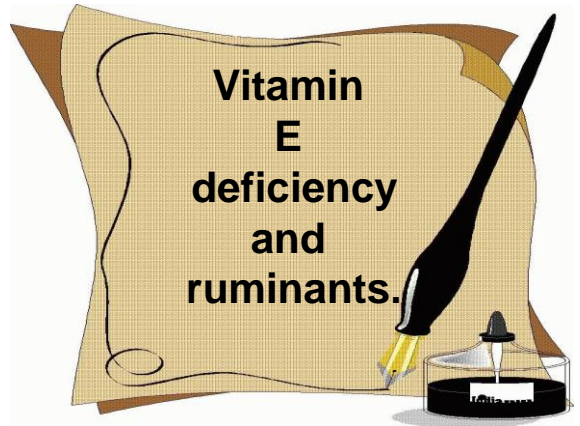
Other functions.

- Normal phosphorylation reactions, especially of high-energy phosphate compounds such as creatine phosphate and adenosine triphosphate.
- In synthesis of ascorbic acid.
- In synthesis of ubiquinone.
- In sulfur amino acid metabolism.
- Vitamin E is reported to have a role in vitamin B12 metabolism.

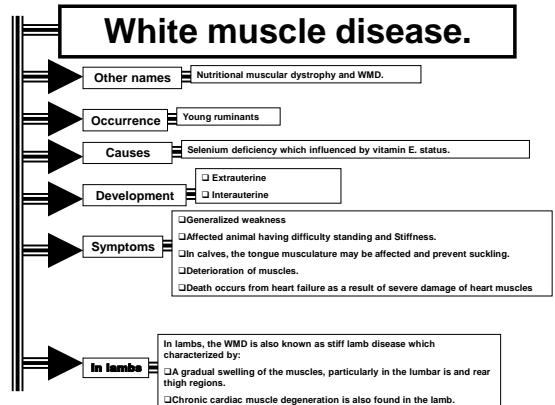
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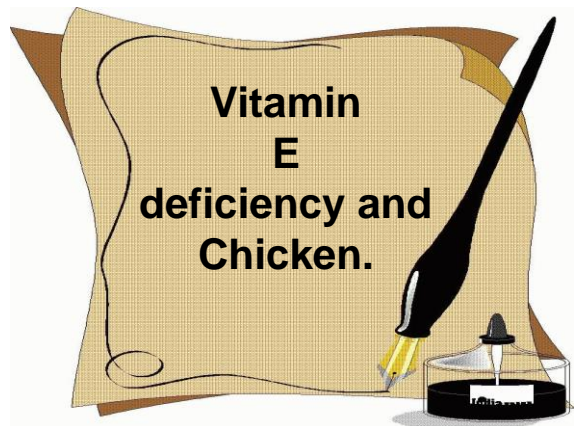
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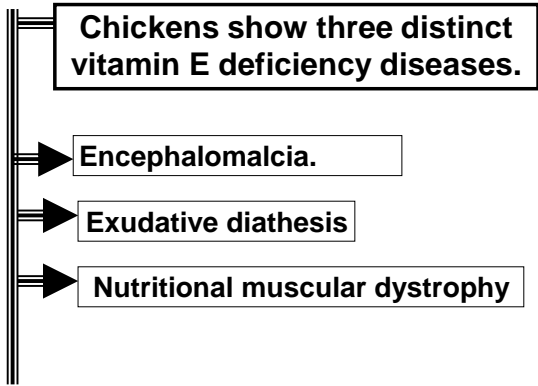
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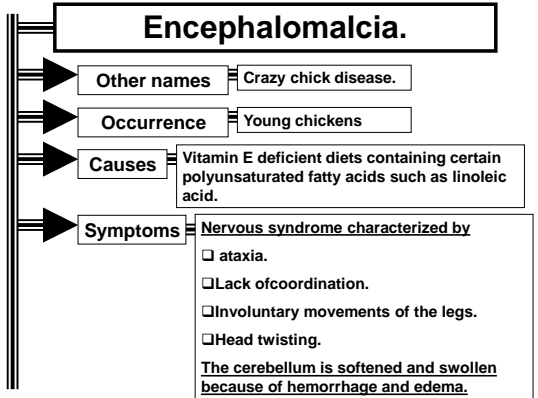
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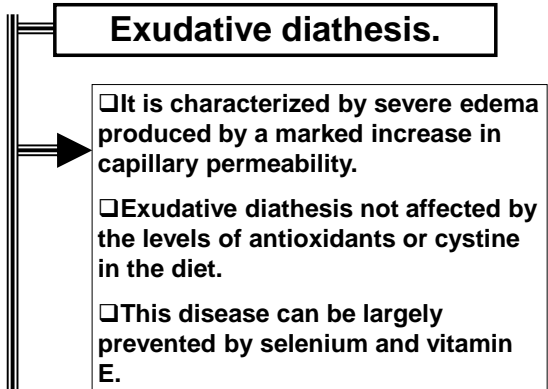
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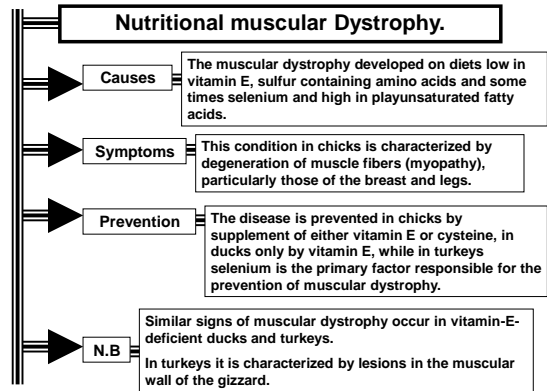
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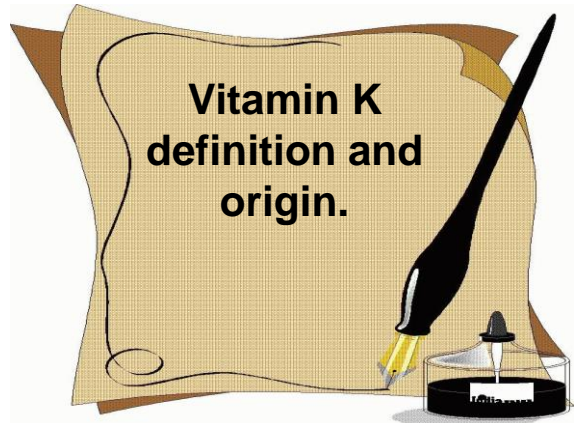
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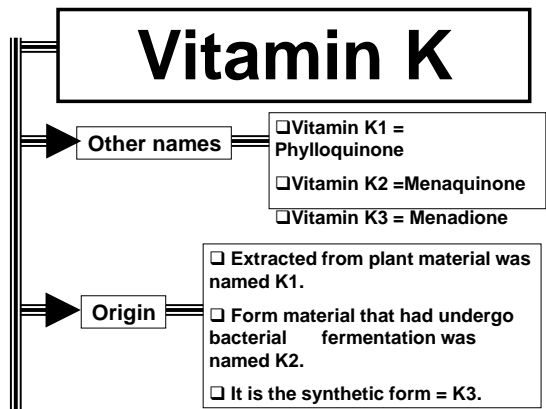
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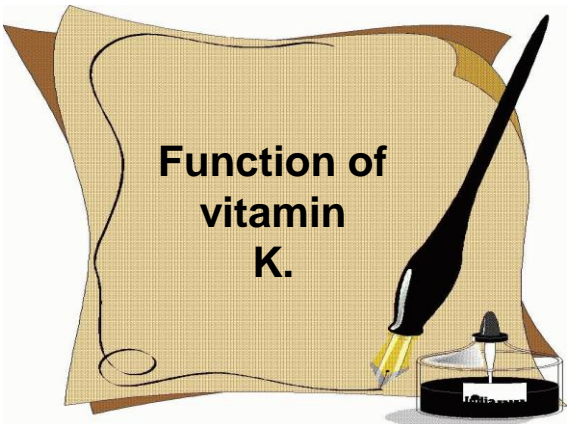
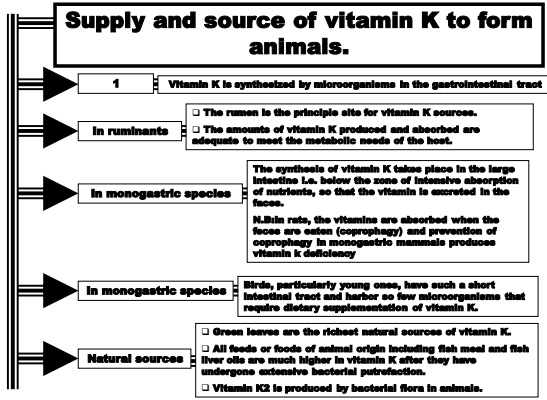
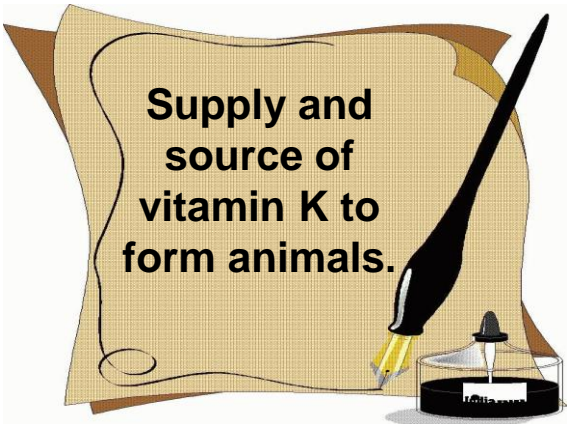
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Function of vitamin K.

Function

Vitamin K is required for normal blood clotting.

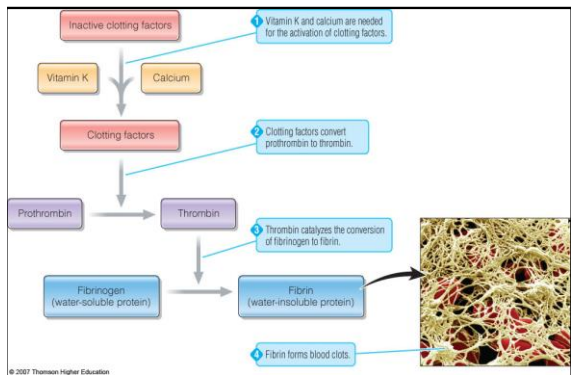
Mode of action

- The colorless protein mainly responsible for coagulation is fibrin.
- Fibrin is formed from its soluble precursor fibrinogen.
- This transformation is catalyzed by an enzyme called thrombin.
- Thrombin is formed from prothrombin.
- Vitamin K is required for:
 - The synthesis of the following three additional factors involved in the conversion of prothrombin to thrombin.
 - The synthesis of prothrombin in the liver.

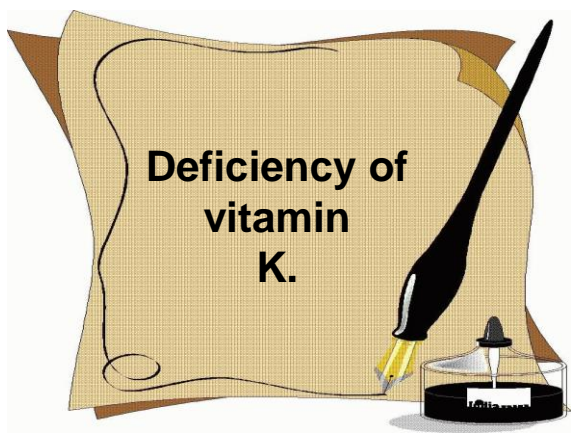
Fibrinogen → fibrin + peptide .

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Functions of Vitamin K in Coagulation



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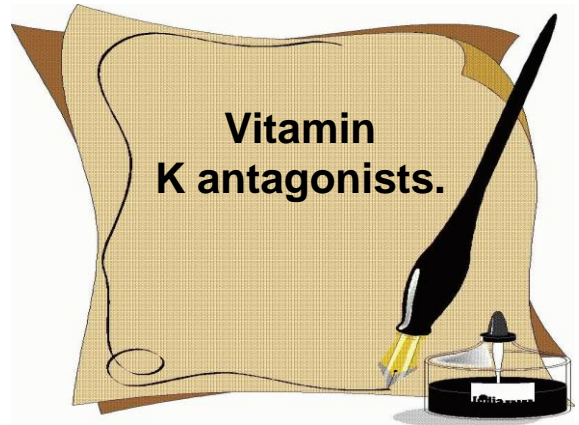
Deficiency of vitamin K.

Symptoms

Symptoms of vitamin K deficiency occur in practice only in intensively reared young chicks:

- Subcutaneous hemorrhages on the breast, legs, and wings or on the surface of the intestine.
 - Some deficient chicks may bleed to death from a slight bruise or other injury.
- N.B: Adult hens deficient in vitamin k produce eggs low in this vitamin and chicks hatched from such eggs are deficient and may bleed to death from slight injury.

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Vitamin K Antagonists.

Dicumarol

Dicumarol:

- Found in certain plants.
- Inters with blood clotting by blocking the action of vitamin K.

Mode of action

By reason of structural similarity it could occupy reaction sites and there by deny them to the metabolite. e.g., dicumarol and vitamin K.

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