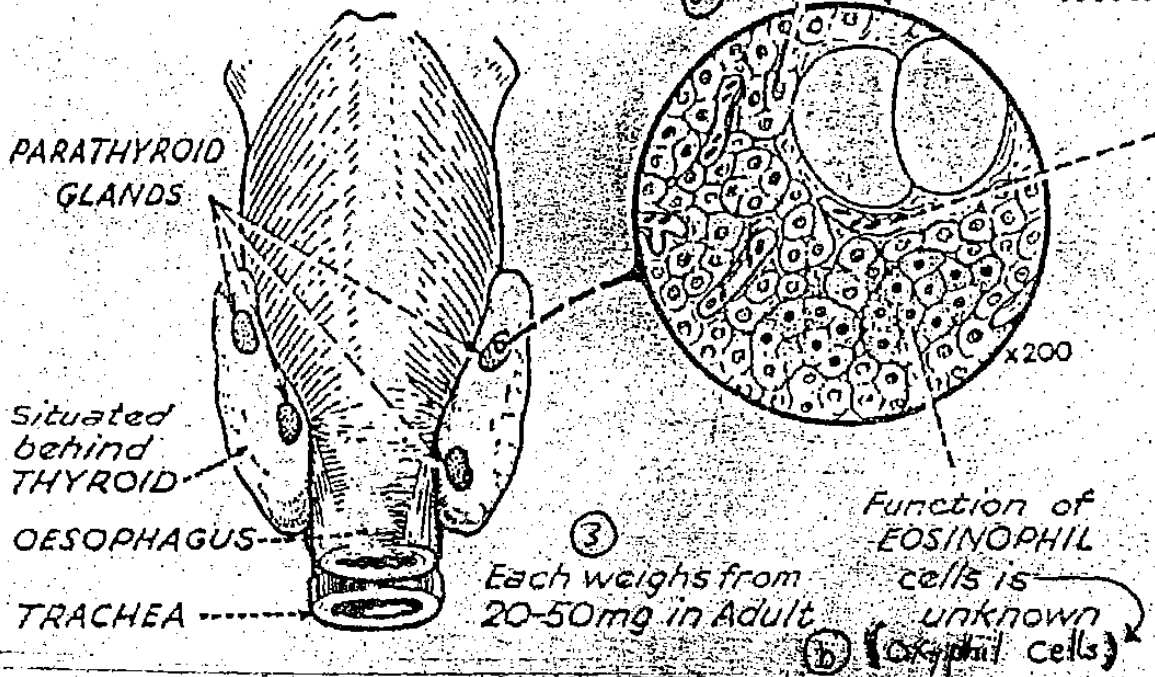
(42 p.s)

PARATHYROIDS

) FOUR small glands composed of *cords of cells* which secrete Parathyroid Hormone – PARATHORMONE or PTH



③ Each weighs from 20-50mg in Adult

Function of EOSINOPHIL cells is unknown

CAPILLARIES → GENERAL CIRCULATION → to ALL TISSUES of the body

But not all tissues are sensitive to it.

It plays an important rôle in CALCIUM and PHOSPHATE METABOLISM

④ PARATHORMONE acts on KIDNEY TUBULES, BONE and on GUT to maintain ionized BLOOD CALCIUM level at 11mg/100ml PLASMA (*necessary for normal neuromuscular excitability*).

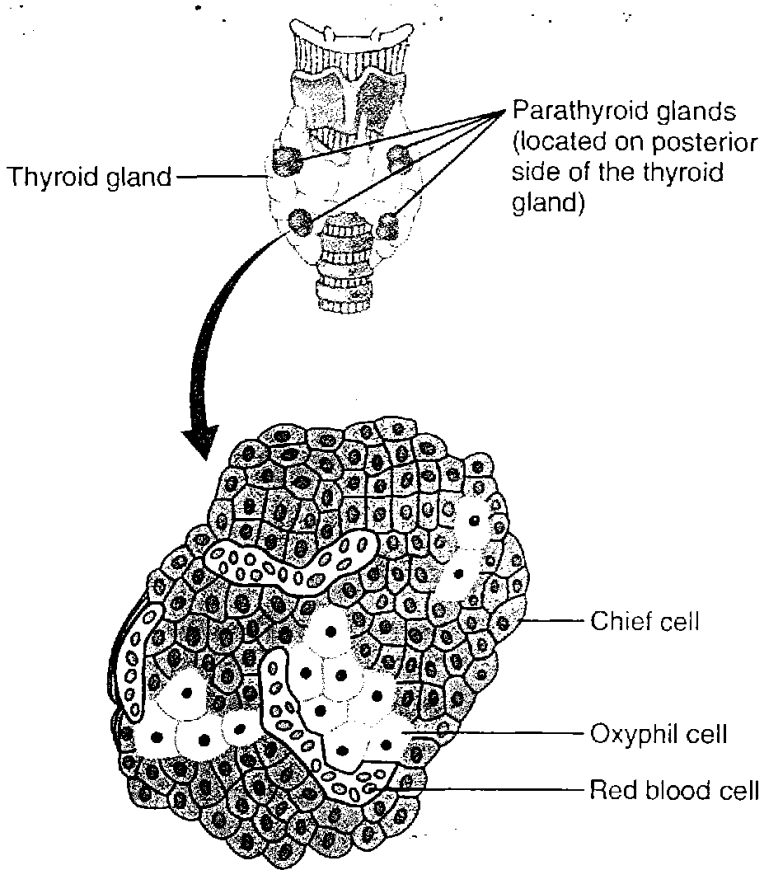


Figure 79-10 The four parathyroid glands lie immediately behind the thyroid gland. Almost all of the parathyroid hormone (PTH) is synthesized and secreted by the chief cells. The function of the oxyphil cells is uncertain, but they may be modified or depleted chief cells that no longer secrete PTH.

1-The parathyroid glands develop at 5-14 weeks of gestation.

2- PTH is a single chain protein (9600 molecular weight) that contains 84 amino acids.

The biologic activity of the hormone resides within a.a.1-34.

3- PTH interacts with receptors on the surface of the target cells increasing the formation of cAMP, IP & diacylglycerol.

4- PTH is free in plasma with half life 25 m.

5- PTH is essential for life, without it Ca++ falls in plasma neuromuscular excitability ↑, tetany & death occurs.

6- The dominant regulator of PTH secretion is the plasma Ca++ level.

7- Ca++ also regulates the size & the number of parathyroid cells.

8- Hypomagnesemia stimulates PTH secretion such as Ca++ but less potent.

9- Arise in plasma phosphate concentration indirectly causes a transient ↑ in PTH secretion.

10- 1,25 $(OH)_2$ -D directly redues PTH secretion.

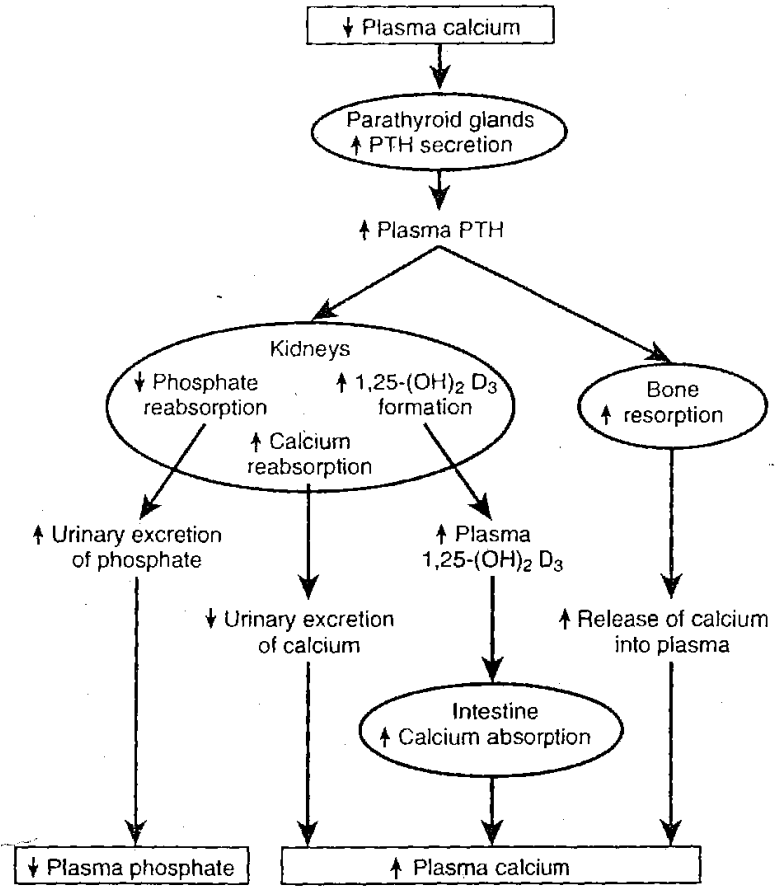
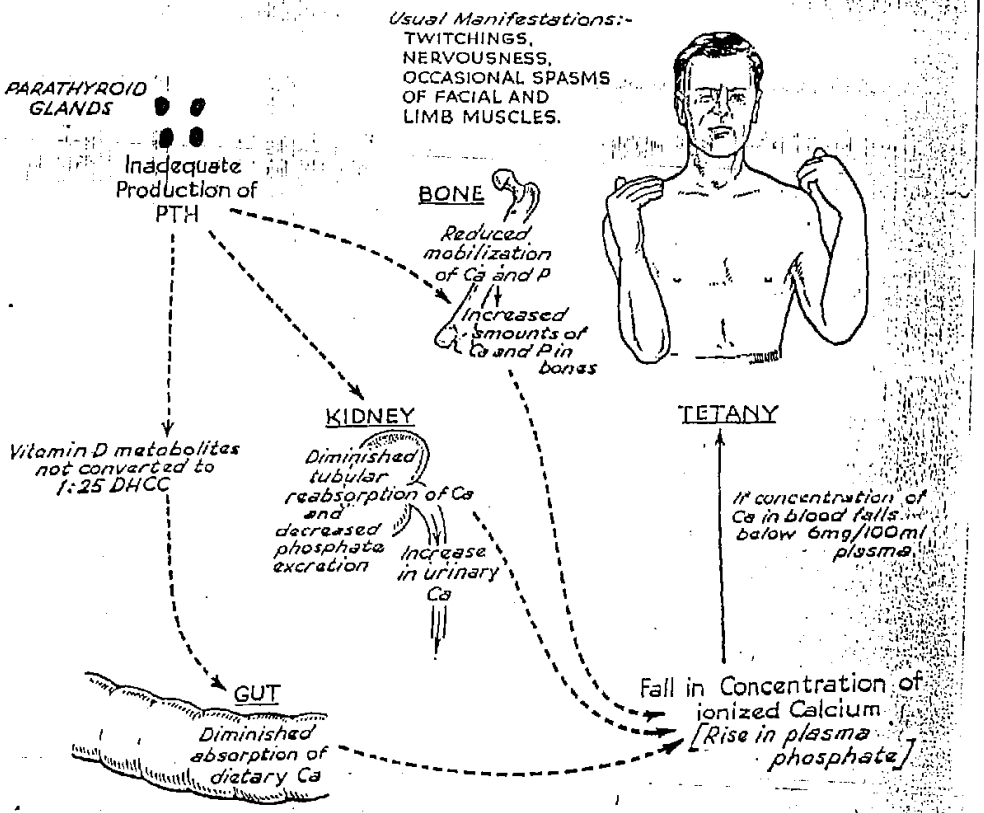


FIGURE 36.7 Effects of parathyroid hormone (PTH) on calcium and phosphate metabolism.

UNDERACTIVITY of PARATHYROIDS

Atrophy or removal of Parathyroid tissue causes a fall in BLOOD CALCIUM level and increased excitability of Neuromuscular tissue. This leads to severe convulsive disorder – TETANY.



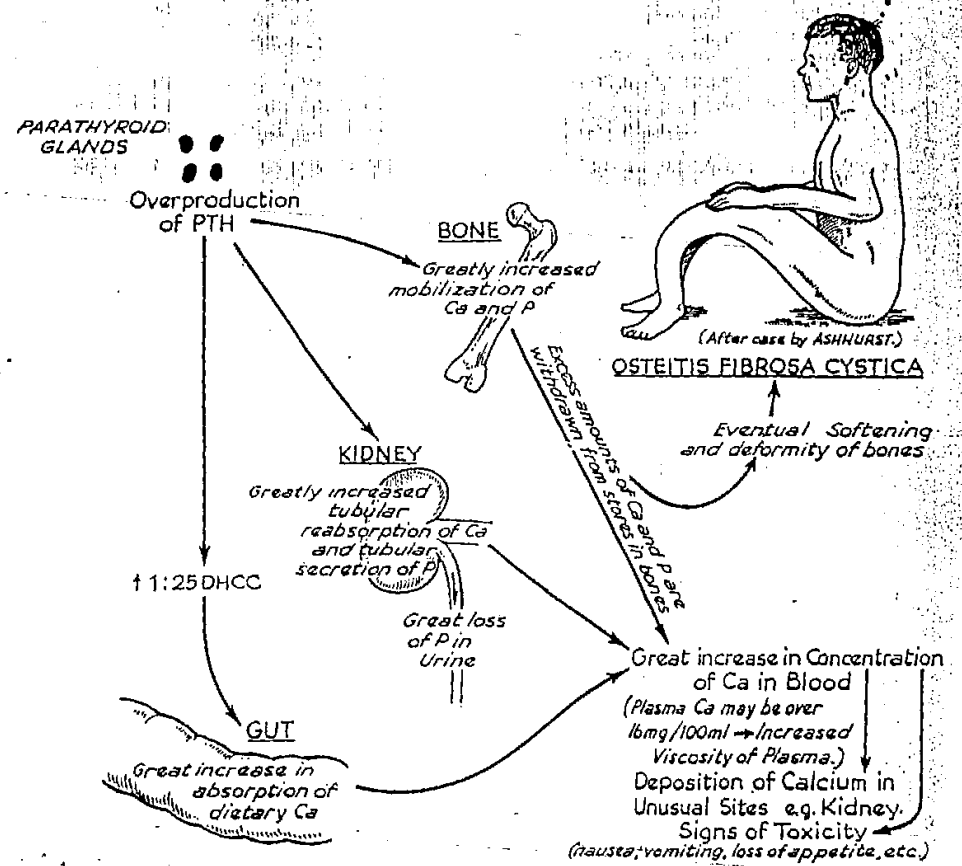
[Note the inverse relationship between plasma calcium and inorganic phosphate]

Symptoms are relieved by injection of Calcium, large doses of a Vit.D compound and Parathormone.

8

OVERACTIVITY of PARATHYROIDS

Overactivity of the Parathyroids *(due often to tumour)* leads to rise in BLOOD CALCIUM level and eventually to OSTEITIS FIBROSA CYSTICA.



The increased level of blood calcium eventually leads to excessive loss of CALCIUM in URINE (in spite of ↑ reabsorption) and also of WATER since the salt is excreted in solution. POLYURIA and THIRST result.

Excision of the overactive Parathyroid tissue abolishes syndrome.

Vitamin D & its Metabolism

1. Vitamin D, is a major regulator of calcium & phosphate metabolism.

2. Vitamin D is a hormone in the sense that it is synthesized in the body, although not by an endocrine gland; after further processing, it is transported via the circulation to act on target cells.

3. It is a vitamin in the sense that when it cannot be synthesized in sufficient quantities, it must be ingested in minimal amounts for health to be maintained.

4. Deficiency of vitamin D causes failure of bone mineralization & results in the classic disease of rickets in children & softening of the bones (osteomalacia) in adults.

5. The sterol structure of the synthesized form of vitamin D (D_3) differs slightly from the form usually ingested (D_2).

6. Vitamins D_3 & D_2 are essentially prohormones that undergo identical processing that converts them to molecules with identical qualitative & quantitative actions.

7. Once vitamin D enters the circulation from the skin or the gut, it is concentrated in the liver. There it is hydroxylated to 25-OH-D. this molecule is transported to the kidney where it undergoes alternative fates.

8. 24,25-$(OH)_2$-D is only 1/20th as potent as 1,25-$(OH)_2$-D & mainly serves to dispose of excess vitamin D.

9. Vitamin D, 25-OH-D & 1,25-$(OH)_2$-D circulate bound to a protein carrier. 1,25-$(OH)_2$-D has by far the lowest concentration & the shortest half-life of the three.

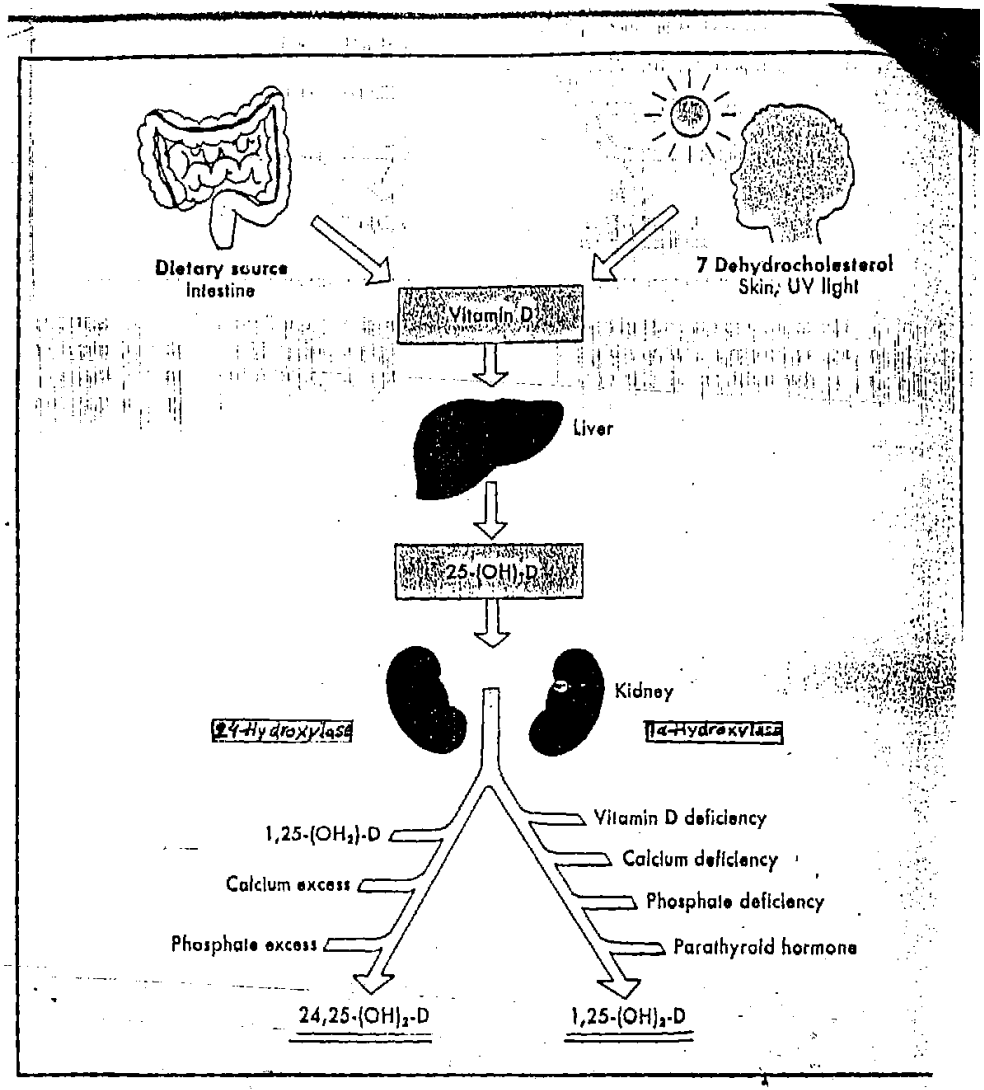


FIGURE 38-5 Vitamin D metabolism. Whether synthesized in the skin or absorbed from the d vitamin D undergoes 25 hydroxylation in the liver. In the kidney, it is further hydroxylated in 1 position when more biological activity is required or in the 24 position when less biol activity is required.

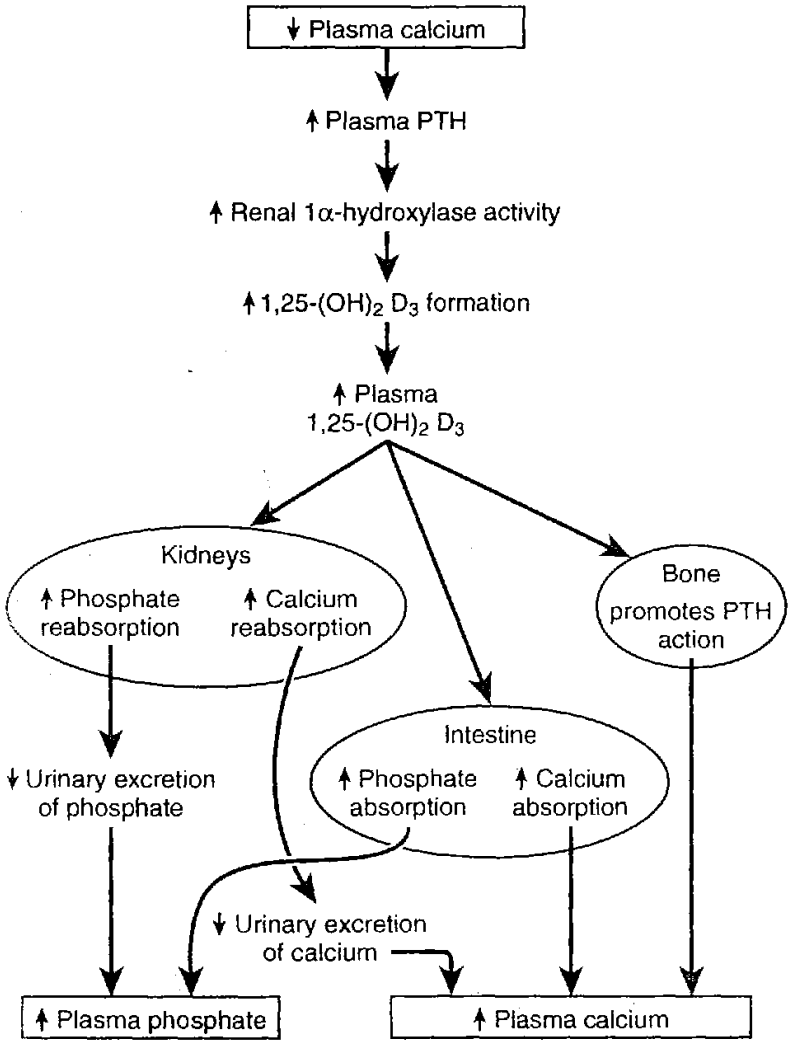


FIGURE 36.9 Effects of 1,25-dihydroxycholecalciferol [1,25-$(OH)_2$ D_3] on calcium and phosphate metabolism.