Chapter 5

VITAMIN D: THE BIOTECHNOLOGY OF ERGOSTEROL

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1 INTRODUCTION

Among the vitamins, vitamin D is outstanding because of its chemical nature, it being the only vitamin with a steroid structure. Vitamin D is necessary for the proper metabolism of minerals and bone formation, in mammals and birds. Biotechnologically speaking, however, one usually refers to the provitamin, ergosterol (1) the main sterol in yeasts and mycelial fungi. The provitamin may be converted to the proper vitamin (D$_2$) which undergoes further metabolism before exerting its hormonelike activity in controlling the processes involved in mineral metabolism.

\[
\begin{align*}
\text{HO} & \quad \text{HO} \\
28\text{CH}_3 & \quad 24 \\
\end{align*}
\]

Ergosterol is not the only provitamin suitable for antirachitic treatment. 7-dehydrocholesterol (2) as produced in the mammalian body, may also be transformed into vitamin D (D$_3$) with somewhat different chemical and physiological characteristics. Since the latter vitamin has certain advantages in use, ergosterol as a source for vitamin D no longer occupies the same position in the manufacturing of this vitamin.

Under natural circumstances, the human body produces its vitamin D from 7-dehydrocholesterol upon exposure to sunlight. In many geographical areas
where clouded skies prevail throughout most of the year not enough vitamin D is biosynthesized. The migration into cities and the increase in indoor professions led to a decline in the synthesis of the natural vitamin and created a demand for a dietary supplement that would protect the human body from rickets.

In rickets, the organic matrix of new bone is not mineralized. This is due to the body's inability to calcify the collagen matrix of the growing bone and results in large areas of uncalcified bone (osteoid). The resultant lack in rigidity of bones leads to the ends becoming entwisted and bent. Also, tooth enamel formation may be affected. Children are specially prone to this disease. Even with an optimal intake of calcium and phosphorus in vitamin D deficient children, the concentration in the blood serum of these minerals is very low. Vitamin D increases the calcium and phosphate absorption and restores the mineral balance which results in the appropriate calcium phosphate deposition in the bone.

The use of liver oil as a prophylactic against rickets, as well as the importance of light as an antirachitic factor, have been recognized since before

![Chemical structures of vitamin D precursors](image)

**Fig. 1.**