banded structure many of the "bands" are represented by what appear to be rows of granules across the chromosome, and in some cases faint longitudinal lines appear to connect granules in successive bands, giving the impression of strings of beads, as described by Koltzoff. This is particularly true where a chromosome has been stretched. Careful study of the finer structure in such cases indicates that these lines represent the walls of "alveolar" spaces, and that the structure, in fixed material, is in reality honeycomb-like, as indicated schematically in figure 1, *B*. In the clearest cases we have examined, the lines are not continuous, but forked, following the walls of the (often hexagonal) "alveoli." In some cases the alveoli appear to be elongated in a more or less diagonal direction, suggesting that the chromosome is twisted. In others the honeycomb structure is comparatively uniform and lines may be traced diagonally in both directions (clockwise and counter-clockwise) from a given point as indicated schematically in figure 1, *C*.

In our material each region in the chromosome appears to have a definite type of protoplasmic structure which usually extends through the chromosome transversely at that level. The type may change abruptly in passing from one region to another. At some places the protoplasm appears to be essentially homogeneous, while at others the appearance of fine or coarse alveolation is evident, suggesting that qualitative chemical differences are associated with the morphological differences.

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DEMONSTRATION OF THE EXISTENCE OF TWO FORMS OF VITAMIN D IN FISH LIVER OILS

SINCE the discovery that the vitamin D of irradiated ergosterol is different from that of cod liver oil, the latter form has sometimes been distinguished by such terms as "natural vitamin D" or "fish oil vitamin D." The implication that the vitamin D naturally occurring in different fish oils is always the same qualitatively has been put to test, with the surprising observation that fish oils differ qualitatively as well as quantitatively in their vitamin D content.

To distinguish the two forms in fish oil we employed essentially the same procedure that was used in 1930 to differentiate between cod liver oil and irradiated ergosterol, *i.e.*, the administration to chickens of materials previously assayed with rats. A precision method of assay with chickens, which will be described elsewhere, was developed to measure the response of this species with accuracy comparable to that attained in the critical method with rats.

The first experiment was done with oil extracted from the livers of halibut, *Hippoglossus hippoglossus*. This was assayed with rats, and diluted with maize oil. The dilution was administered to chickens in parallel with cod liver oil of the same potency. Rat unit for rat unit, the halibut liver oil induced slightly less calcification in the chickens than did cod liver oil, but the difference was perhaps no greater than the errors of assay. We were left with the suspicion that a greater difference might be observed in other oils.

Compared with certain liver oils, cod liver oil is a weak source of vitamin D, containing usually about 100 international units per gm. Halibut liver oil contains on the average about 1,200 I. U. per gm, but even this is weak in comparison with several other fish oils that we have examined. One of the more potent liver oils is that of the bluefin tuna, *Thunnus thynnus*, which contains on the average 40,000 I. U. of vitamin D per gm. A pure specimen of this oil was assayed with rats, diluted and administered to chickens as before. Rat unit for rat unit, it was only one sixth as effective as cod liver oil. Similarly, the unsaponifiable fraction of the tuna liver oil was found to be one seventh as effective, rat unit for rat unit, as the unsaponifiable fraction of cod liver oil.

The effectiveness ratio which was thus found to be 1:6 or 1:7 is several times greater than the probable error of the assays. One must therefore conclude that the vitamin D of bluefin tuna liver oil and the vitamin D of cod liver oil are different substances (or different mixtures of substances), one rat unit of the former having only 15 per cent. of the antirachitic effectiveness of one rat unit of the latter *for the chicken*. A detailed account of these experiments will be published elsewhere, together with data on additional liver oils.

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