Communications

Origin of the Word *Climate*

According to *Webster's New International Dictionary* our word *climate* comes from the Greek κλίμα, which meant "inclination, the supposed slope of the earth toward the pole." Several editions of *The Encyclopaedia Britannica* make essentially the same statement but add, "or the inclination of the earth's axis."

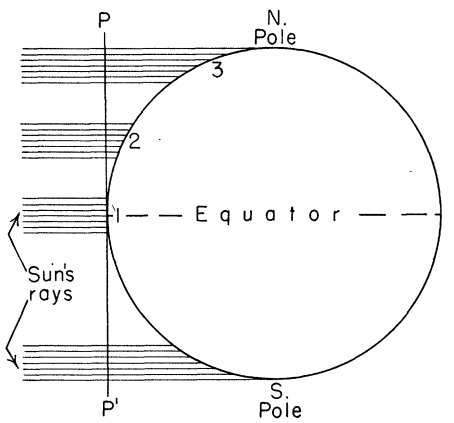

Fig. 1. This relationship of the sun's rays to the equatorial plane is an average for a full year.

A current textbook of geology states categorically that the word *climate* commemorates one of the oldest scientific discoveries, that the earth's axis is inclined to the ecliptic. Which of these two widely different interpretations has the better basis?

My good friend G. Lincoln Hendrickson, Professor Emeritus of Latin and Greek Literature, kindly examined early writings for clues to an answer. Ptolemy of Alexandria, the well-known mathematician and astronomer of the second century A.D., divided the world into κλίματα, a succession of zones from the equatorial region poleward, differing in the obliquity of the sun's rays to the earth's surface within the several zones. Ptolemy inherited this concept from earlier scholars; Eratosthenes, of the third century B.C., probably was the true inventor. His κλίματα were not conceived as contiguous zones but as a series of average latitudes. Hipparchus, of the second century B.C., tried to replace this rough concept by a more definite idea of latitudes. No doubt he saw that a change in latitude means a change in atmospheric conditions as well as in length of day. Probably the present meaning of *climate* developed gradually; but it is significant that divisions into torrid, temperate, and frigid zones still are made formally by parallels of latitude, although climatic belts in the modern sense are highly irregular in form.

The globular shape of the earth was common knowledge among Greek scholars from an early date, and presumably the general concept represented in Fig. 1 would have been acceptable to Hipparchus. On the average the sun's rays come to us parallel to the equatorial plane, or perpendicular to *PP'*. Bands with equal cross section are spread more and more, on the curving surface of the earth, with increasing distance from the equator. To the Greeks, belts 1, 2, and 3 would have been in different *climates,* on the basis of the angle between the solar rays and the earth's surface. Differences in the angle are the primary reason for different climatic conditions in the modern sense also. The inclination of the earth's axis has only a secondary, modifying effect on climates.

Analysis, then, favors the interpretation that the Greek κλίμα referred to the increasing slope of the earth's surface away from the equator. Perhaps the rival theory, that the inclination of the earth's axis was intended, has arisen from the literal translation of the Greek term.

My attention has been called to an exhaustive study of "the seven climates. . . ." in a book by Ernst Honigmann, published in Heidelberg by Carl Winter, 1929. This work was reviewed by George Sarton in *Isis,* **14**, 270, (1930). The evidence presented in this book strongly supports the conclusion given here on the origin of *climate.*

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Occurrence of Mutarotase in Animals: Its Proposed Relationship to Transport and Reabsorption of Sugars and Insulin

Mutarotase previously demonstrated in molds (*1*) occurs in animals. One milliliter of a centrifuged homogenate of 1 g organ per 4 ml phosphate buffer 0.025*M* *p*H 7.1 was diluted to 25 ml with buffer, and the mutarotation rate constant K of 0.21 g of a freshly dissolved sugar was measured at 24°C in the photoelectric polarimeter #2, described by Keston and Lospalluto (*2*), attached to the Beckman DU spectrophotometer. D-xylose (A), d-galactose (B), arabinose (C), and d-glucose (D) were found to be substrates of rat kidney mutarotase, the ratio K catalyzed/K uncatalyzed being, respectively, 1.6, 4.2, 1.9, 4.3. L-rhamnose (E), d-mannose (F), and d-arabinose (G) were not substrates, and this ratio was 1.0 for these sugars. K (uncatalyzed) for the seven sugars mentioned was, respectively, 0.23, 0.12, 0.31, 0.071, 0.30, 0.34, and 0.30 min^{-1}. Sorbitol (H), mannitol (I), sucrose (J), and raffinose (K) cannot mutarotate and were unaffected. Phlorizin (0.9 mg/ml) was strongly inhibitory (about 90 percent) for all substrates. Rat liver contained about one-third as much per gram as kidney. Other organs and blood plasma contained little or no activity. Kidney extracts from hog, rabbit, chicken, rat, beef and lamb contained large amounts