THE BEGINNING OF WINTER

IN the discussions relating to the beginning of winter that have appeared from time to time in SCIENCE, one phase of the question seems to have received hardly sufficient attention.

If we look up what the Century and Standard Dictionaries have to say about winter or the seasons, we find that historically and, apparently until recent times, popularly, the general conception of winter was that it covered the three coldest months of the year. The idea involved was simply our experience of average meteorological or climatic conditions. In most parts of the north temperate zone the interval from the first of December to the end of February was regarded as representing this period, and modern meteorological data seem to indicate that this does represent a satisfactorily close approximation. The exact beginning of the coldest period doubtless varies somewhat in different regions. In the District of Columbia it falls on the seventh of December;[1] in Minneapolis apparently about the third of December.[2]

More recently there has been manifest a growing tendency, especially in the United States, to change this conception and to assert that winter should be regarded as beginning with the winter solstice and ending with the vernal equinox. As nearly as I can ascertain, this is due to a certain number of astronomers, with the enthusiastic support of a multitude of newspaper scientists. The favorite expression of the latter group is that "astronomically considered, winter begins at the winter solstice." Of course, "astronomically considered," winter does nothing of the kind. If it is possible to consider astronomically an event which is not astronomical in nature, it is the middle of winter that, in the northern hemisphere, should be regarded as coinciding with the solstice, for it is at the solstice that the sun appears farthest to the south, the day is shortest, and the heat received per second on unit area of horizontal surface is a minimum. As a matter of fact, however, there is a lag in the seasons such that the coming of winter is considerably delayed, though not to the degree that would cause its beginning to coincide, even approximately, with the solstice. As far as winter is concerned, the solstice is the solstice, and nothing more.

In spite of ancient usage, it might be desirable to modify the conception of the term winter, if any good reason could be advanced for making the change, but all the argument seems to point in the contrary direction. To nearly every one, scientific men and laymen alike, the coldest quarter of the year, the hottest quarter, and the quarters of intermediate temperature are of direct personal interest and importance. They govern many of our daily habits, plans and activities. To very few people except astronomers are the solstices and the equinoxes of more than general interest. Educated people are supposed to have a fair idea of their significance and time of occurrence, but to enforce this knowledge by erecting them as monuments by which to date the seasons hardly seems wise. It is not the way to teach science or respect for science. In fact, it seems to be generating a distinctly wrong impression. Many people seem to have acquired the idea that something occurs at the solstice which, according to the laws of nature, definitely fixes this as the beginning of winter. They do not realize that to declare that winter begins at the solstice is as arbitrary as it would be to declare that it begins on the nineteenth or the twelfth or the twenty-fifth of December.

There is evident at times an unfortunate tendency on the part of one or another group of scientific workers to take a word of general usage and give it a special meaning which adapts it better to their particular purposes, and then to insist that this should be accepted as the essential meaning. If astronomers find it useful to have a name for the period from the winter solstice to the vernal equinox, it would be desirable, in order to lessen the misapprehension and confusion that are resulting, to choose another term than winter. Failing this, they should be especially careful to point out to inquirers that their use of the word is in a special sense, which does not affect and is not intended to supersede the old-established meaning.

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[1] W. P. White: SCIENCE 62, 286.

[2] C. H. Briggs: SCIENCE 65, 424.

QUOTATIONS

ONE TOOTH GONE WRONG

THIS week's excitement about the "million dollar tooth" from Nebraska is a trifle belated. It is now two months since Dr. William K. Gregory, one of the original examiners of this famous tooth, decided that it had belonged neither to an ape nor a man and published this conclusion in SCIENCE. No evolutionist slept less well for this explosion of the tooth's significance. To correct conclusions that turn out to be false is a continual duty of scientific men, and even false assumptions not infrequently result in progress by uncovering facts or engendering ideas previously unknown. It is to be noted, too, that the scientists who now reject the man-like origin of the Nebraska tooth are the same who originally accepted it. They are merely correcting a mistaken theory which they previously proposed, something which all scientific men do almost daily and as a matter of course.

To imply that the theory of evolution is in the least endangered by this discovery of a mistake about a single fossil is as though a bridge builder abandoned his bridge and helped to destroy it because a single girder, not yet built into the structure, was found defective on the testing floor. Certainly no evolutionist believes that the theory is impaired. Had the tooth proved really to belong to some man-like or ape-like creature, that might have meant something about the history of the New World monkeys. It would neither have strengthened nor weakened materially the idea that evolution is a fact.

To have the public interested in science is a great advantage to both parties, but not entirely free from danger. Scientific research going on in a show window might mislead watchers who tarry too short a time to understand what it is all about. When first found the Nebraska tooth was heralded popularly beyond its real importance. Doubtless its fall will be too widely hailed now as another "mistake" of the scientists. In truth it is but a trivial incident in the slow rise of the edifice of science. The theory of evolution is far too hardy a creation to be ruined by losing one tooth.—*New York Herald-Tribune.*

SCIENTIFIC BOOKS

The Abilities of Man, their Nature and Measurement. By C. SPEARMAN. New York, The Macmillan Co., 1927. vi + 415 + xxxii pp.

THE Grote professor of philosophy of mind at the University of London has written an important book. It could not be otherwise when the book represents the cumulation of intellectual endeavor for a period of a quarter century by such as he. It may well be that he does not know exactly what his theories and facts signify; it is certain that I do not. The work has been supported during its progress by the collaboration of a multitude of Spearman's pupils and by others, it has drawn widely upon the investigations of other schools, it has also had constant opposition and the book has been severely criticized in a review in *Nature* (August 6, 1927, p. 180) which has led to an interchange of views between author and reviewer (*Nature,* November 12, 1927, p. 690). Into this difference I will not enter except to say that whether the book is mathematically complete or not does not interest me; this is unimportant. Science advances not so much by the completeness or elegance of its mathematics as by the significance of its facts. You can not upset the findings of the "Origin of Species" either by the contraposition of your religious convictions or by observing that Darwin's statistical technique was not up to standard. Science goes forward upon "evidence beyond reasonable doubt"; to that evidence incomplete mathematics may contribute valuable elements.

Spearman's chief thesis is that when a group of persons x, y, z, . . . are given a test *a,* say of arithmetic or spelling or literary interpretation, the marks m_{ax}, m_{ay}, m_{az}, . . . which they score represent in part their respective general intelligences g_x, g_y, g_z, . . . and in part their special abilities in the subject, s_{ax}, s_{ay}, s_{az}, . . . This would seem incontrovertible provided we mean by ability in the subject, ability to get scores in the test. The necessity for this proviso may be illustrated as follows. I have some general intelligence; I have some mathematical ability; yet if an examiner should set me a mathematical test in Yiddish, which might be "easy meat" for a lot of candidates for admission to our colleges, I should miserably fail. It may further be remarked that the scores m_{ax}, m_{ay}, . . . may depend on the manner of scoring used by the examiner or his clerk. For example, if the test be of the simple sort where a large number of questions are answered yes or no, one method of scoring is to count the number of right answers, R_x, R_y, . . .; another method is to take the difference between the numbers right and wrong $(R–W)_x$, $(R–W)_y$, ... If all the N questions are answered, the scores are equivalent since $W = N - R$ and the series of scores R_x, R_y, . . . and $2R_x - N$, $2R_y - N$, . . . are in the same order, will give the same correlations with other tests, etc. But if some of the questions are unanswered (U), the second series becomes $2R_x - U_x - N$, $2R_y - U_y - N$, . . . which need not be equivalent to R_x, R_y, ... How are we to compare the answers of two persons to 50 questions if one answers 40 all correctly and the other answers all 50 with 45 right and 5 wrong?

The next thesis is that when a battery of tests *a, b,* . . . are sufficiently different, so that the scores may be assumed to have in common only the general intelligence we may write for the nk marks of the n individual x, y, z, . . . on the k tests *a, b,* . . .

$$\begin{aligned} m_{ax} &= c_a g_x + s'_{ax} & m_{bx} &= c_b g_x + s'_{bx} \\ m_{ay} &= c_a g_y + s'_{ay} & m_{by} &= c_b g_x + s'_{by} \end{aligned} \qquad (1)$$

in such a manner that the general intelligence g and the special abilities s′, are uncorrelated, *i.e.,*

$$\Sigma g_x s'_{ax} = 0, \qquad \Sigma g_x s'_{bx} = 0, \ldots \qquad (2)$$

$$\Sigma s'_{ax} s'_{bx} = 0, \qquad \Sigma s'_{ax} s'_{cx} = 0, \ldots \qquad (3)$$

when the summation runs over the individuals x, y, z, ... This leads to some correlation algebra to prove both that such a resolution of the marks is possible and that it is unique. I have read the proofs with care (including the references to the literature,