seed has a moisture content greater than 10 per cent. In the case of seed with a moisture content less than 10 per cent, and where 'New Improved Ceresan' is used, a period of not more than eight weeks under good storage conditions should be allowed to elapse between treating and sowing.

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¹ Muskett, A. E., and Colhoun, J., *Nature*, 155, 367 (1945).

Nature, Nurture and Probability

SINCE Galton, it is customary to consider that characters are due to nature or to nurture, or to both, and that there is no third cause. From a practical point of view, however, factors of chance can surely be supposed to play a part. To clarify this conception, let me take an example.

A malignant tumour is caused by some single cell or group of cells reverting to the foetal stage and dividing afresh. If this is due to hereditary factors, we should expect a general tendency in the cells of a given tissue towards malignity. In that case, cancer would appear concurrently at several places. This is not so, however, which is why it is possible to treat cancer operatively. The same holds for the external environment. If this environment caused a tumour to arise, we should also as a rule expect an extensive formation of tumours. It is difficult to imagine environmental factors with an action on a single point.

But there is a third possibility. Let us assume a hereditary disposition to cancer, entailing a tendency towards faulty behaviour of a certain type among the cells, for example, in cell division. Let us further assume that the hereditary tendency towards such faulty behaviour is extremely weak, and that on this account there is, for example, a 1 : 30 probability that an individual may be overtaken by such defection each year when he gets older. This means that, among the extremely large number of cells present, and the very large number of cell divisions in process, the probability for each cell to become a cancer cell is diminutive. If we reckon per individual instead of per cell, the tendency becomes much greater. If it is 1 : 30 a year, this implies that one of a pair of monozygotic twins might get cancer relatively early, while the other would not get it until 30–40 years later. In most cases, then, the second twin in pairs of this kind should die from a disease other than cancer. The difference between monozygotic and dizygotic twins in respect of the occurrence of cancer should therefore be very small. This being so, studies on twins cannot be used to determine the part played by nature and nurture.

The situation can be illustrated by an analogy, which must not, however, be taken too far. Let us assume that, in two large towns, the population has exactly the same heredity and lives in the same environment. Let us assume further that this results in a great infrequency of suicide, so that the probability for such an act in any one year is 1 : 30. If a suicide then occurs in one of the two towns during any given year, it may be many years before a suicide occurs in the other town.

The conception of probability is therefore used at several different points in genetics, primarily in the distribution of the genes over the sex cells, and in their combination, secondly in genotypical asymmetries¹, and finally in certain other characters, where internal processes of a complicated nature are in process. The formation of cancer is an example of this. Similar conditions can also be thought to play a part in mental characters. From this point of view, the result of twin research in mental diseases may appear to some extent doubtful, since when processes of the kind touched on here are involved, the differences between monozygotic twins will be relatively large, and can by no means be taken as a gauge of the influence exerted by external environment.

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¹ Dahlberg, G., *Proc. Roy. Soc. Edin.*, B, 62, 20 (1943).

A Forecast of Solar Activity

I WISH to direct attention to the fact that a relatively long period of intensive solar activity seems to be imminent. If this should be the case, the coming years will probably be very suitable for studying possible relations between sunspots and such terrestrial phenomena as are supposed to be allied to solar activity.

While exact predictions of the future course of sunspot numbers are impossible, forecasts with a high degree of probability can be derived from the probability laws of sunspot variations which I have published¹. These forecasts may be summarized as regards the present new spot cycle as follows:

(1) It can be expected with a probability of 0.95 that the next sunspot maximum will be higher than the previous one, which occurred in 1937. It may be noticed that the height of the maximum of 1937 itself exceeded the heights of the five preceding maxima, which occurred in 1883, 1894, 1906–7, 1917 and 1928. Hence it seems very probable that the next maximum will be the greatest within living memory.

(2) It can be expected with a probability of 0.95 that the next sunspot maximum will occur before May 1948. At the meeting of Section D (Astronomy) of the American Association for the Advancement of Science held on September 14, 1944, S. B. Nicholson, of Mt. Wilson Observatory, reported that solar activity reached its last minimum as late as in April 1944; thus it follows from (1) and (2) that in the new spot cycle the ascent from minimum to maximum will probably be unusually steep.

(3) It can be expected with a probability of 0.98 that after the next maximum, solar activity will decrease so slowly that not until more than five years after this maximum will Wolf's smoothed sunspot numbers fall below a quarter of their maximum value. Such a slow decline has occurred in only four out of the seventeen spot cycles which have been observed hitherto.

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¹ *Astrophys. J.*, 96, No. 2 (Sept. 1942).