

De Moivre's "Miscellanea Analytica", and the Origin of the Normal Curve

IN a historical note by Karl Pearson in 1924¹, evidence was presented which shows that Abraham De Moivre (1667-1754) invented the 'normal' curve and the normal probability integral about 1721. The name of Gauss is usually attached to the normal curve, although it is not uncommon to find it more correctly attributed to Laplace. But as Pearson shows, De Moivre ante-dated both Laplace and Gauss in this by many years. "The matter is," Pearson says, "a very singular one historically. De Moivre published in 1730 his *Miscellanea Analytica* . . . Many copies of this work have attached to them a *Supplementum* with separate pagination, ending in a table of 14 figure logarithms of factorials from 10! to 900! by differences of 10. But only a very few copies have a second supplement, also with separate pagination (pp. 1-7) and dated Nov. 12, 1733." The title of the second supplement is "Approximatio ad Summam Terminorum Binomii $(a + b)^n$ in Seriem expansi", and it contains not only the first use of the normal curve, but also the first use of the approximation for large factorials commonly but improperly known as Stirling's. It is also clear that herein occurred the first correct use of the 'law of large numbers', usually attributed to Jacques Bernoulli (1654-1705) and often called 'Bernoulli's theorem'. Further pertinent comments have also been made by Karl Pearson².

The second supplement could be added only to copies of "Miscellanea Analytica" that remained unsold three years after the original issue, and this accounts for its rarity. At the time of writing, Pearson knew of only one copy containing the second supplement—that in University College Library, London—and since then only one more has been discovered; it is in the Preussische Staatsbibliothek, Berlin. However, the exceedingly rare and important pamphlet of seven pages has been made generally available by a photographic reproduction in a commentary by R. C. Archibald³.

It would be interesting to learn if there are other copies of "Miscellanea Analytica" with the second supplement. The union card catalogue at the Library of Congress in Washington lists three copies of the book; one in the John Crerar Library in Chicago, one in the Public Library of the City of Boston, and one at the United States Military Academy, West Point, New York. Through the courtesy of the John Crerar Library I have been privileged to examine the Chicago copy. I find that it contains the first supplement, but not the second. By correspondence I have ascertained that the Boston copy is identical with the Chicago copy, and that the one at West Point contains neither supplement. A fourth copy is listed in the card catalogue at the Library of Congress, but the book cannot be found. So far, then, only two copies of the second supplement have been reported extant.

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¹ *Biometrika*, 16, 402-404; 1924.

² *Biometrika*, 17, 201-210; 1925.

³ *Isis*, 8, No. 4, 671-683, October 1926.

Effect of Yeast Extract on the Growth of Plants

THE interesting observations of Virtanen and Hausen¹ confirm, in a remarkable manner, our earlier findings of more than a year ago, which have since appeared in a number of publications² and have been abstracted in several European and American journals. It is not improbable, however, that the above authors were unacquainted with our earlier work on the subject.

Our observations were first made on the sunflower plant (*Helianthus annuus*, Linn.) and then extended to other species. The plants were raised on soil or sand and treated with organic manures or mineral fertilisers. Aqueous extracts of different biological products were injected directly into the plants so as to avoid the possible effects of the products of their decomposition in the soil. A number of interesting observations were made, but the following illustrate the type of results obtained during two successive seasons:

Plants grown on soil; treated with farmyard manure.

Fluid injected	Percentage of plants that flowered	Average number of flowers per plant	Average weight of flowers per plant (gm.)
Yeast extract	75.0	4.1	6.9
Water (control)	44.0	1.8	3.7

Plants grown in washed sand; treated with complete minerals.

Fluid injected	Average dry weight of plant (gm.)	Average dry weight of flowers (gm.)	Percentage weight of flowers to whole plant
Yeast extract	39.24	9.64	24.6
Water (control)	25.21	3.29	13.1

Fairly mature plants responded better to injection of yeast extract than tender ones. Similar, but less marked, effects were observed when extracts of farmyard manure or soil or sewage effluent (activated sludge) were injected into the plants, while extract of dried blood merely increased the total weight of the plant without appreciably affecting the production of flower and seed.

In view of the practical significance of the above findings, the observations have now been extended to a variety of agricultural and horticultural crops. The effect of feeding a number of new substances, both by themselves and in combination with different inorganic salts, has been followed. The nature of the constituents responsible for the effects observed and the mechanism of their action are also being studied. It is hoped that the results of the above and related investigations will be published at an early date.

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¹ NATURE, 132, 408, Sept. 9, 1933.

² *Soc. Biol. Chemists* (India), Symposium, July 1932, p. 8; *Madras Agric. J.*, 20, Pt. 11; 1932; *Proc. Indian Sci. Congress*, 20, January 1933; *Proc. Joint Session S. Indian Sci. Assoc., Soc. Biol. Chemists* (India), and *Indian Chemical Society*, April 1933, p. 11; Appendix to *Ann. Rept. Indian Inst. Science*, 1932; *ibid.*, 1933.