The coming into being of organo-metallic and organic associations brought with it differences not only in composition but also in constitution resulting ultimately in the separation of optically active isomers by a process of gradual elimination.[4] The arboreal growth, retaining certain basic features of form inherent in their structural mineral radicles or groups, lost its arbitrary direction and became definitely orientated in accordance with the predominating stereo-isomeric form of its constituents.

The alteration in the direction of twist with age, recorded by several observers, is not really surprising. The great enzymatic transformation during embryonic development, ripening of fruit, as well as the intimate connection existing between enzymes and the cell nucleus—naturally involve a radical change in all plant constituents, which may of course be followed by a corresponding reversal of the helix.

Thus we find that the cause of the general twisting of trees is two-fold—internal and external. The internal factor is found in the specific character of the plant constituents (fusion products of heredity and environment) which determine the type of capillary spiral movement of its fluid nutrients and fibrillar depositions operating on the general principles of periodicity. In the case of young non-rigid plants these internal influences are enhanced or retarded (as the case may be) by light tropism and prevailing air currents. The systematic effect of these contributing external causes is however reduced to a minimum in old rigid formations.

Here, temperature, pressure, winds, sunlight as well as various parasitic and toxic influences may affect stature and produce structural abnormalities but do not participate in the evolution of the regular twisting in trees.

MAURICE COPISAROW

RESEARCH LABORATORY,
145 ALEXANDRA RD.,
MANCHESTER, ENGLAND

CHLORPICRIN INJURIOUS TO GREENHOUSE PLANTS

IN view of the promising indications for chlorpicrin as a soil fumigant for nematode control, reported elsewhere,[1] recent evidence of the capacity of small concentrations of this gas in the air to injure greenhouse plants may be of special interest to investigators.

In an experimental fumigation of a plant bed just outside one of the Plant Pathology greenhouses at the University of California, Berkeley, California, some of the gas escaping from the soil found its way into the house and caused severe injury to tobacco, strawberry, coleus and other plants. The actual concentration of the gas as it became diffused into the greenhouse atmosphere was very low, probably not greater than 20 parts per million. It was detectable by a smarting of the eyes but not by odor. Details of the arrangement of the fumigated plot with relation to the greenhouse, together with illustrations and descriptions of the signs of injury produced upon the plants, will be presented in another paper, probably in *Phytopathology*. This preliminary statement is made as a warning to other investigators who may be contemplating making applications of chlorpicrin to greenhouse soils to control nematodes. If applications are made in benches or beds inside the house with growing plants elsewhere in the house, such plants may become severely injured from the escaping gas, even though they may be some distance away from the site of fumigation.

G. H. GODFREY

UNIVERSITY OF CALIFORNIA

THE ANNIVERSARY OF THE NORMAL CURVE

THE two hundredth anniversary of the discovery of the normal probability curve falls this year. It is interesting to note that the discovery of the curve was made by a man whose name is seldom, if ever, attached to it. It is also significant that the discoverer thought that his contribution was to pure or abstract mathematics and that the most practical use that could ever be made of his discovery was in connection with games of chance.

The man was DeMoivre. He published his findings on November 12, 1733. Since that time such wide use has been made of the curve that the above date becomes a landmark of considerable importance, especially in the social sciences.

In a recent book on the history of statistics[1] the following treatment of the event is found:

> The intensive study which DeMoivre gave to this work, together with his applications of the binomial theorem, led him a few years later—probably about 1721—to discover a formula for the ratio between the middle term and the sum of all the terms of $(1-1)^n$, and thus become the discoverer of the normal curve. Many of the recent treatises on probability and sampling approach the matter by a method quite similar to DeMoivre's use of the binomial expansion.

This formula, first published November 12, 1733, is the *fons et origo* of the normal curve. In 1730 DeMoivre had brought out his *Miscellanea Analytica* and

[4] Mills, Brit. Assoc. Adv. Science, York meeting, 1932.

[1] M. O. Johnson and G. H. Godfrey, "Chloropicrin for Nematode Control." *Indust. and Eng. Chem.*, 24: 311–313. 1932. Other papers on this subject have been submitted for publication.

[1] Helen M. Walker, "Studies in the History of Statistical Method," pp. 13–14. Williams and Wilkins: Baltimore, 1929.

three years later he presented privately to a few friends a brief paper of seven pages with the title *Approximatio ad Summam Terminarum Binomii $a - b^n$ in Seriem Expansi.* The discovery of this exceedingly rare document is due to Pearson. . . .

In this obscure treatise on abstract mathematics, written in Latin nearly two centuries ago, and supposed by its author to have no practical implications outside the realm of games of chance, in this brief supplement now so rare that only two copies have been reported extant, we have the first formulation of the momentous concept of a law of errors.

CHARLES J. MARSH

STANFORD UNIVERSITY

QUESTIONS

IF tomatoes grown in greenhouses have vitamins, does it mean that ordinary window-glass transmits ultra-violet radiations: or does it mean that plants can build up vitamins without the help of ultra-violet?

If sunlight is essential for chlorophyll formation by plants, how did it happen that sprouted seeds with primary and secondary roots, a stem and fully chlorophyllated cotyledons and primary leaves were found *inside* an opened Spanish succulent yellow gourd which had been in the shade in the house for eight months?

FREDERICK S. HAMMETT

PROVINCETOWN, MASS.

REPORTS

PUBLIC SERVICE AS AN ELEMENT IN THE LIFE OF THE AMERICAN SCIENTIST[1]

IT has been said truly, that our universities magnify the advantage of the individual at the expense of humanity. Few that leave academic halls with degrees in their pockets carry with them any considerable sense of public duty or think of anything beyond their own personal advancement. Recognition of the duty of parentage, for instance, is an essential element in any lasting civilization; but any sense of such a duty is almost entirely lacking among our collegiate young men and women. What professor in his lectures, what college president in his baccalaureate ever mentions that subject? Yet to teach and to practise public service, and service to humanity are especially the duties of scientific men.

Ours is the most humane and altruistic of professions. Yet we commonly fail, I believe, rather grievously in respect to public service. I shall deal with this subject quite concretely, as it is illustrated in a great social, political, moral and toxicological question now before the American people. I refer to the public duty resting upon American physiologists, biochemists, pharmacologists and pathologists in relation to the alcohol question.

Through an odd chain of events I became during the past year virtually, although of course unofficially, consulting toxicologist to the Congress of the United States. It is mainly on my advice that legal beer is to be 4 per cent. by volume and 3.2 by weight. The volume of such a beverage that must be taken to induce even the lowest slightly intoxicating concentration of alcohol in the blood (one milligram of alcohol per cubic centimeter of blood) is at the limit of the capacity of the human stomach.

The studies which this service involved led me to read practically all the testimony on this subject that has ever been given before Congressional Committees by scientific witnesses. And the more I read the more I was exasperated by the attitude that we scientists generally take when called on by legislators for advice; and the more tolerant and even sympathetic I become toward those much maligned bodies of men, the members of Congress and of the legislatures.

Legislators are necessarily called upon to decide a vast number of questions in all fields of human activity. On many of these questions even the most broadly educated man, unless he has specialized on that one subject, can have only superficial information. Legislators are not specialists. But they can and do call upon scientific men who have specialized on each particular question.

In this case the question is the toxicological properties of alcoholic beverages. What do they get in reply? One scientist says, "Alcohol is a food." Another says, "Alcohol is a powerful narcotic drug." Others add other facts. All these statements are true scientifically. But what is the poor legislator, anxious to do his duty and to legislate wisely, to make out of such raw facts? Scarcely any scientific witness seems to realize that what is actually needed is that he himself shall emphasize the practical significance of the scientific facts, and shall show the legislators to what conclusion and to what policy these facts point in relation to the public welfare.

I know that many scientific men will disagree with me on this. One of our most eminent colleagues, when I presented this view to him, offered the objection that what I proposed "involves more than the scientist's function; it requires him to speak as a citizen." To this I would reply that one does not escape the responsibilities of a citizen merely because he is a scientific expert.

As to the alcohol problem it is surely clear that the American people have made a woeful failure to control its evils both before and under prohibition;

[1] Part of an address at the dinner of the Federation of American Societies for Experimental Biology, at Cincinnati, April 11, 1933.