mented with it in about 25 different cases involving tobacco, cotton, wheat and corn. Presumably it can be extended to other crops. In every case where it has been tested the ratio of the yields of two successive years and not the absolute yield of the second year has served as the dependent variable. If for some reason primary statistical interest should rest on the absolute yield, instead of the annual change, the method outlined would have to be modified and a curve of the form $y = ax - bx^2$ fitted to the observed data. In actual practise the need hardly arises for following this alternative procedure.

Simplifications which have been effected in the technique of forecasting still leave ample ground for further improvement. Econometricians familiar with this field perceive that the day is not yet in sight when the extent of an annual crop change can be foretold with anything like complete accuracy. The results of climatological investigations eventually may help to clarify the reasons for errors which are made. Measurements of the periodicities of possible component curves of the total solar energy curve by Dr. C. G. Abbot, of the Smithsonian Institution, are being regarded in a sympathetically critical and hopeful spirit. Likewise the studies of Dr. A. E. Douglass, of the University of Arizona, on tree rings as a medium for determining annual growth variations of the past, and of the staff of the Scripps Institution of Oceanography of the University of California on the relationship between ocean temperatures and solar energy, are being watched with interest. The suspicion persists that if the research of these and other investigators should lead ultimately to the development of long-range weather forecasting on a practical basis, long-range crop forecasting also may follow. In that event both the old methods of predicting crop yield changes and those lately developed will be revealed at best as being only makeshift attempts.

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IS METHYLENE-BLUE ANTI-CARCINOGENIC?

WARBURG[1] in his study of yeast found methylene-blue to counteract the effect of carbon monoxide and potassium cyanide. This protective action of methylene blue upon the respiratory enzymes was extended by Sahlin,[2] Eddy[3] and Brooks[4] to small mammals, and ultimately by Geiger[5] to human cases.

Now, as already shown,[6] malignant growth is based upon the suppression of respiratory enzyme (oxidase-dehydrogenase) activity by (a) dietary enzyme depletion and (b) environmental inhibition.

In cases where malignant growth is dominated by such specific industrial conditions as the effect of coal-tar and mineral oils, we find the respiratory enzymes are influenced by definite carcinogenic substances such as 1:2:5:6 Dibenzanthracene, 5:6 cyclo-penteno, 1:2 Benzanthracene, 1:2 benzpyrene, etc., the activity of which may perhaps be likewise counteracted by methylene blue.

Some support to such a possibility is afforded by (1) the action of carcinogenic substances upon the dehydrogenase group of enzymes,[7] (2) the existence of anti-carcinogenic substances, as, for example, dichloro-diethyl sulphide (mustard gas),[8] and (3) the intimate connection existing between respiratory enzymes and certain coloring matters,[9] the function of the latter being that of a co-enzyme rather than substrate.

Bearing in mind the colloidal nature of the enzymes in relation to the whole system of their contact and inductive activity—the characterization of the cancerous cell by its abnormal state of colloidal dispersion and the suggested extension of Bancroft's physico-chemical corrective treatment to such malignant cell colloids[10] is also in full accord with the conception put forward here.

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COURSES IN THE LITERATURE OF BOTANY

FOR several years, the writer has been developing a graduate course entitled "Literature of Botany," the aim being to acquaint advanced students with classic and current literature related to botany. This work has proved both difficult and interesting, having opened new worlds of botanical thought, appreciation and knowledge. Since the work has been crystallizing, it was thought desirable to compare the course with similar courses in other educational institutions. This led to the study of the university and college catalogues which were on file in the Kansas State College library. With few exceptions the 1931–1932 catalogues were available. The institutions which included courses in botany in their curricula totaled 545. Of these, 20 were outside of the United States. Of the 545 institutions, only six offered courses in or including literature of botany as such. These are as follows: University of Montana, "Botanical Literature"; University of Nebraska, "Botanical Literature"; Kansas State College, "Literature of Botany";

[1] *Zeits. Physiol. Chem.*, 66: 305, 1910.
[2] *Skand. Arch. Physiol.*, 47: 284, 1926.
[3] *Jour. Pharm. and Exp. Ther.*, 41: 449, 1931.
[4] *Proc. Soc. Exp. Biol. and Med.*, 29: 1228, 1932.
[5] SCIENCE, 77: 1986, January 20, 1933.
[6] Copisarow, *Nature*, 130: 1001, 1932.
[7] Boyland, *Nature*, 130: 274, 1932.
[8] Berenblum, *Rep. Brit. Emp. Cancer Camp.*, 76, 1932.
[9] Warburg and Christian, *Biochem. Zeits.*, 257: 492, 1933.
[10] Crawley, *Jour. Phys. Chem.*, 36: 1282, 1932.

Nebraska Wesleyan states in a seminar course that "topics including botanical literature will be offered according to demand"; Oberlin College, "History and Classics of Botany"; Pittsburgh University, "Comprehensive Survey of Botany."

There were, however, 164 additional related courses offered by 139 of the 545 institutions. In the field of botanical literature, in addition to the 6 courses already mentioned, there were 13 courses covering recent or current literature offered in the form of colloquia, conferences, etc.; 4 courses in the literature of foreign journals and 13 in problems or assigned readings. Twenty-five courses were offered in the history of botany, and one covered modern or contemporary botany and another history of early botany.

In the closely related field of the literature of biology, there were 4 courses under that name; 23 courses covering recent and current literature in seminars, colloquia, conferences; 2 of foreign biological literature; and 8 in biological literature problems. History of biology boasts 38 courses, the largest number, with 19 additional courses covering special histories or theories of biology.

Then there were 11 miscellaneous courses related to the literature of botany, covering such subject-matter as the literature of the sciences, of horticulture, zoology, entomology, or history of inductive sciences, science, agriculture, forestry, life and applied botany. It is interesting to note that only one course is offered in the preparation of biological manuscripts for publication and that one by Lingnan University; also a course in botanical illustration for publication by Washington State College.

While some errors in classification may have crept into this condensed distribution of 170 courses, due to the indefinite nature of the information in certain catalogues, it nevertheless shows that the value of the historical and literary approach to the mastery of the biological sciences has wide acceptance. But this need appears in some measure to be met in only about 25 per cent. (139 out of 545) of the universities and colleges for their advanced students. It seems that this approach should be more widely introduced and not reserved for graduate students only. Certainly the undergraduate, who rarely becomes an advanced student in a biologic subject, should be introduced to the biographic method. Exposure to an occasional superbly illustrated botanical classic may leave a profound impression on a pliant mind. Furthermore, the development of a thought which leads to a demonstrated fact contains more human interest and abiding qualities than a mere dry statement in a drier text.

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ON THE AUDIBILITY OF THE AURORA BOREALIS

THE proposition of the audibility of the aurora borealis has been the subject of considerable speculation and much doubt. Some scientists have claimed with much positiveness that the aurora emits no audible sounds and that the beams of light or electrical waves, such as they may choose to call them, do not come close enough to the earth's surface to be audible, even if any sound were emitted. In my own mind there can be no doubt left as to the audibility of certain types of aurora, for I have heard them under conditions when no other sound could have been interpreted as such, for no other sounds were present.

From the Eskimos I first learned that the aurora could be heard and, like most people, was rather skeptical about it, believing that their statements were based to a great extent on their superstitions. I was told by some of the older Eskimos that when the aurora displays become audible they are able to imitate the sound by whistling in such manner that the beams of light will be attracted or drawn down to them. This, of course, is purely superstition. However, it does bring out the fact that the Eskimos were frequently able to hear the aurora.

The following is my own personal experience which convinced me that the aurora borealis was actually audible. In the winter of 1925–1926 I was engaged in making a drive of reindeer across the mountain range bordering the Arctic coast north of Cape Prince of Wales on Bering Strait. One night during this drive found me traveling by starlight across the divide at the head of Nuluk River. This divide has an elevation of approximately two thousand feet. It was two o'clock in the morning when my native driver and I broke camp in order to overtake the reindeer herd ahead of us. As we climbed with our dog team to the summit of the divide we were both spellbound and astounded by the magnificent display of aurora, the most wonderful display I have ever witnessed during my eight years of life among the Eskimos.

Great beams of light shot up from the northern horizon as if a battery of gigantic searchlights were searching the arctic landscape. In front of these beams and throughout the whole length of the northern horizon great waves of iridescent light traveled from west to east like gigantic draperies before the stage of nature's amphitheater. Great folds or waves, ever changing in color, traveled one after another across the horizon and from behind them streamed the powerful beams of white light. These beams of light could be seen passing directly over our heads, and when one chanced to come over the divide it appeared to be not more than a hundred feet above