"SCIENCE IN PROGRESS": *The sixth volume in Sigma Xi's biennial series provides a permanent record of significant research programs in progress throughout the country and points up the fact that traditional boundaries between fields of knowledge have practically ceased to exist.*

EVERY two years the Society of the Sigma Xi publishes its "Science in Progress," a volume which brings to layman and scientist alike authoritative accounts of significant research programs under way in the country. The sixth in this series (Yale University Press, New Haven, $5) contains eleven chapters covering work in nuclear physics, chemistry, biology, medicine and soil science. Most of the chapters are based upon manuscripts originally prepared as Sigma Xi National Lectureships during 1947 and 1948. The remainder are based upon Silliman Lectures presented at Yale in October, 1947, at the Centennial of the Sheffield Scientific School.

The Sigma Xi lectures in the present volume include "From X-rays to Nuclear Fission" by H. D. Smyth of Princeton University; "Elementary Particle Physics" by John A. Wheeler, also of Princeton; "The Eight New Synthetic Elements" by Glenn T. Seaborg of the University of California; "Chromatography and Spectroscopy in Organic Chemistry and Stereochemistry" by L. Zechmeister of Caltech; "The Tubercle Bacillus and Tuberculosis" by Rene J. Dubos of the Rockefeller Institute for Medical Research; "The Evolution and Function of Genes" by A. H. Sturtevant of Caltech; and "Modern Soil Science" by Charles E. Kellogg, of the United States Department of Agriculture.

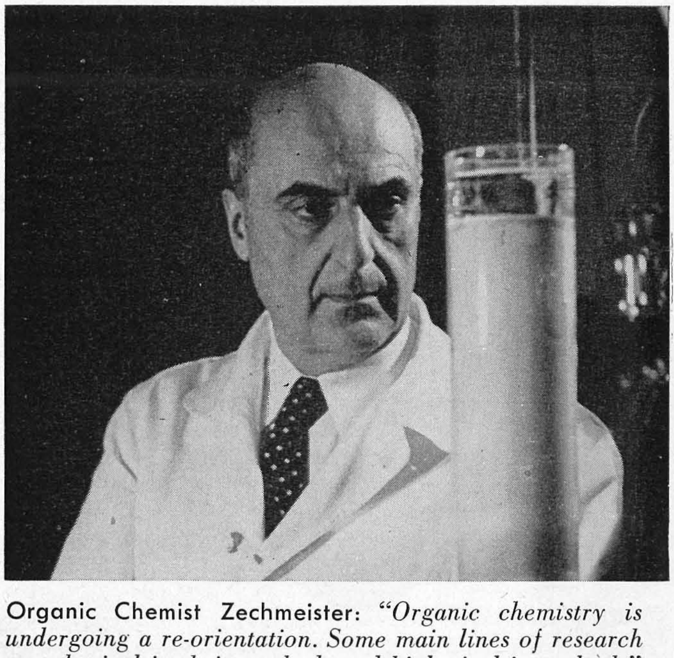
The Silliman lecturers were Ernest O. Lawrence of the University of California, who spoke on "High Energy Physics"; Linus Pauling of Caltech, "Chemical Achievement and Hope for the Future"; W. M. Stanley, now at the University of California, "Virus Research: Achievement and Promise"; and George W. Beadle of Caltech, "Genes and Biological Enigmas."

In commenting on the book's contents, Dr. George Baitsell, Editor and Executive Secretary of Sigma Xi, says, "Creative thinking flourishes in the no man's land between what were once separate systems of ideas; both facts and methods are freely transferred across frontiers of rapidly diminishing significance. In an age of heightening interdependence between fields of scientific investigation and also between science and statesmanship, the sphere of the individual scientist is becoming increasingly the province of every other scientist, indeed of every intelligent person."

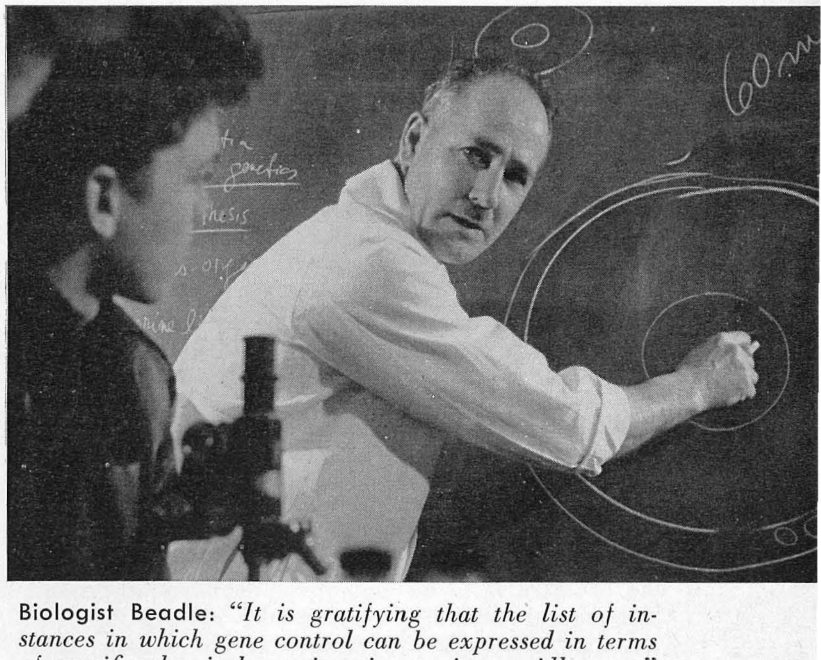
The interdependence of which Dr. Baitsell speaks is evident in almost any of the book's chapters. But it is most striking, perhaps, in the four written by Caltech scientists: Linus Pauling, who heads the Chemistry Division; L. Zechmeister, Professor of Organic Chemistry; George W. Beadle, Chairman of the Biology Division; and A. H. Sturtevant, Professor of Genetics.

Linus Pauling came to his present job at Caltech with a background in theoretical physics and physical chemistry and a strong interest in structural chemistry— in what makes atoms join molecules and molecules react with one another. For Sigma Xi's anthology, Dr. Pauling surveys the progress of chemical science through the past century, then plunges into his favorite subject: the structural basis of immunological and chemotherapeutical reactions.

Immunologists, concerned with the way in which antibodies and their homologous antigens combine, have



Organic Chemist Zechmeister: *"Organic chemistry is undergoing a re-orientation. Some main lines of research are physical in their methods and biological in outlook."*



Biologist Beadle: *"It is gratifying that the list of instances in which gene control can be expressed in terms of specific chemical reactions is growing rapidly . . . "*

been faced with two great questions: what are the forces between antibody and antigen which lead to the power of selective combination; and what is the mechanism by which the antibody is made and endowed with this power. Dr. Pauling's answer: this specificity is the result of detailed complementariness in structure. When the surfaces of bulky, complex antibody and antigen molecules are brought together, the fit is a close one indeed.

Dr. Pauling then goes on to describe how enzyme action, too, is dependent on complementariness of structure. For him the very nature of enzyme action means a rosy future for chemotherapeutics; for every enzyme (and in particular every enzyme essential for bacterial growth) the chemist ought to be able to find an inhibiting molecule more closely complementary in structure to the enzyme than the substrate itself. For example: the chemist could perhaps synthesize a molecule which would combine with penicillinase, an enzyme which inhibits pencillin's action. The new substance could then be given to a patient along with penicillin to increase its bacteriostatic action.

The preparation of very pure samples of compounds for the structural chemist's study is becoming an increasingly important job for the organic chemist. And in his chapter, Dr. Zechmeister describes an increasingly important technique for doing just that. This technique is known as chromatography, and it is a field in which Dr. Zechmeister is an international leader.

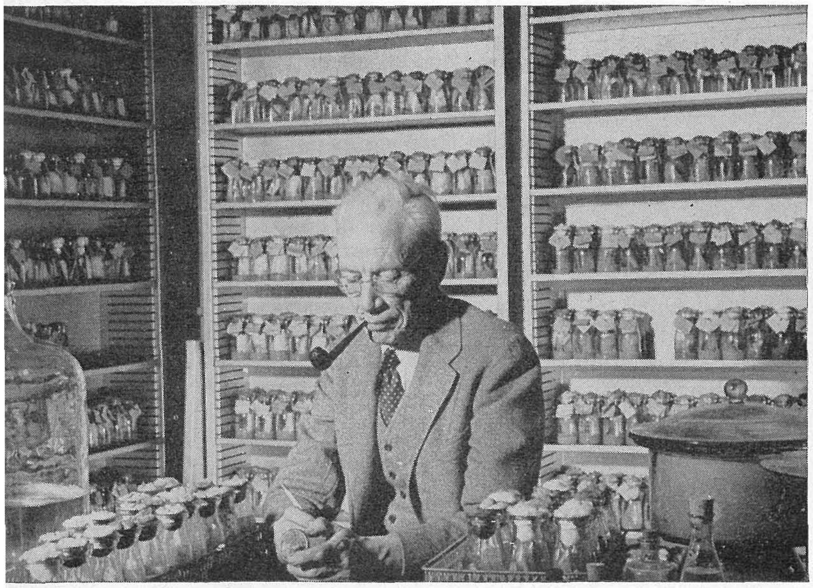
A chromatographic column is a tall glass tube filled with absorbent material; in the photo below, Dr. Zechmeister is standing beside one. When a solution is poured through the column, its respective compounds take their places in chronological order, depending on the adsorption affinity of their molecules. Sometimes the compounds form different colored layers and so can be readily separated. If they are colorless, the chemist bathes them in ultraviolet light to distinguish them by fluorescence.

Dr. Zechmeister describes the development of the chromatographic art, and his own experiments, which have been mainly on carotenoids, and through these, on vitamin A. Because adsorption has to do with the shape of the molecule and the presence or absence of certain atom groupings in the compounds, the chromatographer has been led into steriochemistry—the study of spatial configurations of atoms within a molecule, and of sterioisomers—forms of the same molecule with different spatial arrangements. Dr. Zechmeister winds up his article with an account of some recent experiments in which chromatography and steriochemistry were used to help a geneticist solve a problem in yeast mutation.

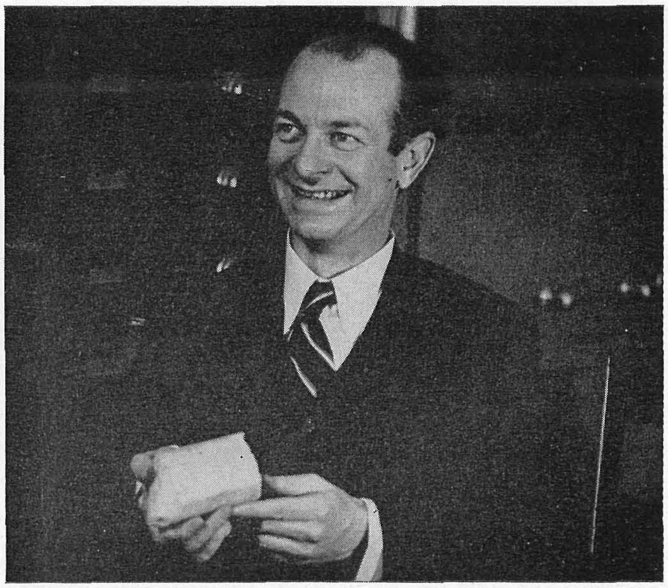
The close ties that exist between geneticist and chemist are even more strongly brought out by Dr. Beadle, who came to Caltech from Stanford, where for ten years he had been working in genetics. There he and E. L. Tatum developed their now-famous technique for using *Neurospora*, or red bread mold, to show how chemical reactions involved in nutritional processes are gene directed.

In "Genes and Biological Enigmas," Dr. Beadle reviews the evidence which has led scientists to believe that genes are the basic templates from which new generations of organisms are built, and that genes are composed of nucleoproteins. As for the enigmas—Dr. Beadle points out that it is impossible for the biologist to understand how a gene directs the synthesis of a copy of itself until he first knows how simple proteins and nucleic acids are synthesized in living cells. When chemists and geneticists and biologists understand that, they can go on to answer some other enigmas: the nature of gene mutation, more details of the origin of living systems and the evolutionary process, and the riddle of differentiation: what it is that makes some cells form skin while others turn into nervous tissue.

Dr. A. H. Sturtevant, who succeeds the late Thomas Hunt Morgan as the "Dean of *Drosophila* Genetics," goes into the problem of differentiation in some detail. He reviews the present state of genetic knowledge as seen through years of careful experiments with fruit flies and discusses the reasons for the geneticist's belief that related species have essentially the same sets of genes. With his colleagues, Dr. Sturtevant looks to other fields for help—to the chemists and biologists who may, through their studies of the basic life-stuff protein, come up with some answers to unsolved genetic problems.



Geneticist Sturtevant: *"The geneticist may expect help from other biologists concerned with protein specificities —such groups as enzyme chemists and immunologists."*



Chemist Pauling: " . . . *with knowledge of atomic structure of biological substances we may hope for a more effective attack on problems of biology and medicine."*