Returning to the biochromes, these are likewise placed in a subclass of a great and heterogeneous group of colored molecules because, in spite of chemical and physiological differences as great as those existing among the biocatalysts, biochromes also possess two chief characteristics in common, *i.e.*, their origin and occurrence in living organisms and their reflection of a fundamental chemical property, the selective absorption of light waves in the visible spectrum. Some biochromes are also biocatalysts, *e.g.*, chlorophyll, cytochrome, certain flavines and some of the carotenoids.

Reduction in the vibrational frequencies of certain valence electrons, and molecular resonance,[6] visible as color, are evoked by various kinds and degrees of chemical unsaturation. In many instances, unsaturated chromophoric groupings may impart both color and increased reactivity or chemical instability to the same molecule. Such compounds may therefore assume more readily important biochemical roles (*e.g.*, carotenoids, tetrapyrroles, flavines, some pterins and certain quinones) or may constitute representative by-products of special metabolic processes (*e.g.*, bile pigments, melanins, indoles and certain pterins). Color and biochemical activity are, in such instances, two interlocked effects of the same fundamental molecular phenomenon.[7,8]

Our present understanding of the parts played by various biochromic compounds in the metabolic economy of organisms leaves much to be desired, but it is expected that increased study will extend the borders of our knowledge in this field. It is hoped to treat the subject more fully in a review to be published elsewhere.

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THE OPPORTUNITY OF PURE SCIENCE

THIS is to take issue with some of the implications of "The Threat to Pure Science"[1] by Alexander W. Stern, and to complement it with a view of the other side of the picture.

The concept referred to by the words "pure science" is not concisely exposed in Mr. Stern's comments. One gathers from the context that science is pure only when uncontaminated by the hands of those who would put it to mundane use.

Doubts are expressed that the ". . . majority of the industrial physicists, not being in a university environment nor under the influence of the traditions of a university, feel . . . a moral responsibility to uphold pure science. . . ." Later on we find this astonishing statement: "Science is an intellectual activity—its very nature is not practical."

From this one would conclude that Mr. Stern considers that "pure science" is only metaphysics and excludes experimental and perhaps even theoretical science, if it is useful.

We, in industrial physics, find among us the whole range of human attitudes towards science just as is found in a university. We have the technological "hack" whose whole interest is to take his routine data, to get home and to seek his inner stimulation in a bridge game. He corresponds to that type of conscientious teacher who sticks to the text, answers pertinent questions, ignores impertinent questions and goes home in the same spirit.

We find all grades of intellectual activity among industrial scientists, up to and including those whose whole satisfaction is derived from "the pursuit of truth and the passion for understanding (which) give a dignity and nobility to man." These people, in industry exactly as in the universities, have achieved an intellectual freedom which is beyond usurpation by civil or economic forces.

One sees the dawn of a great era for science in the growing demands made upon it by our industrial society. To be sure, we may expect civil controls over the practice of our professions where that practice affects the public weal. We should be proud to furnish a recognized service, and should lend our skill to the establishment of ever higher professional standards, just as the faculties of our great universities endeavor to achieve a maximum of integrity and competence.

It certainly should be no more degrading for one engaged in "pure research" to earn his living as a professional physicist than as a professor of physics. The purity of the research in either case depends upon the soundness of the man's philosophy rather than upon his environment or condition of economic stress. The "threat to pure science" lies in intellectual incompetence wherever it may be found, and can be eliminated only by the concerted efforts of professors and professional workers.

In industry wherever one finds an outstanding research organization he finds an inspired leader at its head. The same rings true of the outstanding research organizations in our universities. Scientists, whether employed by universities or by industries, have before them a growing responsibility and a tremendous opportunity. If the leaders, wherever they work, maintain intellectual integrity and encourage enjoyment of the pursuit of truth in their associates, "pure science" need fear no threat. Public accep-

[6] L. Pauling, *Proc. Nat. Acad. Sci.*, 25: 577, 1939.
[7] L. Zechmeister and P. Tuzson, *Naturwiss.*, 40: 680, 1935.
[8] D. L. Fox, *Am. Nat.*, 70: 477, 1936.
[1] SCIENCE, 100: 2599, 356, October 20, 1944.

tance of and respect for professors and professional workers will depend directly upon the spirit of service exhibited by each.

I feel that science is an intellectual activity, and that its nature is the very essence of the practical.

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EDUCATION IN ARGENTINA

I WAS quite surprised to find two misstatements in Dr. Shellenberger's note under this title.[1] One is an insignificant slip—the revolution occurred June 4, 1943, not June 3—but the other is somewhat more important. His sentence, "Each change in the position brings about the resignation of each of the interventors assigned to Argentina's six universities," is too sweeping. The Universidad Nacional de La Plata has not had an interventor for many years, and since the revolution there has been but one change in the presidency. In October of 1943, a set-to between the then minister and the then president of the university, over the execution of decrees resulting from the Manifesto[2] made the tenure of the presidency unbearable to any conscientiously liberal-minded man, and the president, vice-president and several other members of the Superior Council resigned; while other members, with totalitarian sympathies or tendencies, remained, and one of these latter assumed the presidency. Several months later there was held an election at which he was, on the first balloting, confirmed in office for a full term. The proportion of blank ballots cast was large enough to be highly significant of discontent, but not sufficient to invalidate his election.

This correction does not alter the spirit of Dr. Shellenberger's note, nor in the least affect his conclusions; but in ticklish matters such as these one should be meticulously careful in stating facts, else a well-intentioned declaration may do more harm than good.

Local circumstances oblige me to use a pseudonym.

PANAMERICAN

BUENOS AIRES

SCIENTIFIC BOOKS

THE CHEMISTRY OF CELLULOSE

The Chemistry of Cellulose. By EMIL F. F. HEUSER. v + 660 pp. 15 chapters, with 87 tables and 112 figures. New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd. 1944. $7.50.

THE rapidly expanding research in the field of cellulose combined with the diverse and extensive uses of this product as a raw material of industry have created an urgent need for a concise summary of the present state of knowledge of this subject. A brief compendium was called for, which would not only serve as a digest of the literature on the chemistry, physics and uses of cellulose, but which would also offer a systematic, coherent and integrated presentation of the subject for the interested technologist and for the student. The author undertakes to meet most of these requirements and does so quite successfully.

Dr. Heuser's work in the field of cellulose has been extensive and distinguished. His first book, following many contributions to the literature on the subject, was published in 1921. The author is systematic in his presentation and meticulous in supporting his statements and conclusions with references to literature, characteristics for which the reader will be grateful.

After an introductory chapter, Dr. Heuser deals with morphology of the fiber and composition of the cell wall. In this reviewer's mind, Dr. Heuser has done well in this treatment in exercising discrimination as to the reliability of references which have been confusing in the literature. It might have been well if the author had exercised this prerogative even more extensively.

In Chapters III, IV and V, the reactions of cellulose with water, with aqueous alkalies and finally with organic bases, ammonia and concentrated salt solutions are taken up.

Great space and weight are naturally given to the reactions of cellulose with alkalies (Chapter IV), which form the basis of industrially important processes. This topic is confusing, as every worker in this field knows, but the author, by making his discussion replete with figures and tables, does much to bring clarity to the reader.

In the chapter on the action of cuprammonium hydroxide on cellulose, an important process in the textile industry, each of the factors and conditions affecting the reaction is separately treated from a purely scientific point of view but without much reference to the industrial process. Although this treatment accords with the author's intent, as stated in the preface, a brief discussion of the industrial process would have been helpful.

The bulk of the book (Chapters VII, VIII and IX) is devoted to the important chemistry of the cellulose esters, cellulose xanthates and cellulose ethers, respectively. In dealing with the cellulose esters the author

[1] SCIENCE, 100: 11, 1944.

[2] SCIENCE, 98: 467, 1943.