leges have already found it decidedly worth while, in spite of increase in cost, to use the macaque monkey exclusively for mammalian dissection. This is so very desirable, from the standpoint of the premedical student, that it would have been a progressive step to substitute this mammal for rabbit and cat.

Workers in the phylogeny of vertebrates, including anatomists and embryologists, have been increasingly aware during recent years that one of the greatest needs in this general field is a scrutiny and revaluation of all the old concepts laid down dogmatically several scores of years ago and copied in one generation of text-books after another. The old masters were most gifted zoologists, but the style then was to build, at all costs, complete evolutional and developmental pictures, filling voids with what they believed to be plausible interpretations. Recent books have far too many old illusions interlarded among proven facts. Although Miss Hyman specifically recognizes this situation, she, nevertheless, has succumbed to the temptation of presenting complete, rule-of-thumb developmental pictures. The temptation is great and I have done the same myself, frequently.

One using this book will, I think, wish for more illustrations of a factual nature. There is a sufficient number of embryological figures, and of some other categories, but still other subjects are scantily pictured. Although the turtle is the reptile stressed, none of its musculature is shown, but instead, that of the tuatara, alligator and reconstructions of extinct reptiles. The student needs facts shown, and of forms that he is able to observe. There is no illustration of the peripheral nerves, although the limb plexuses, for instance, may be much more clearly pictured than described; there are no figures of the eye, *et cetera*. The anatomy of hand and foot is of much importance, and yet consideration of the soft parts of the limbs ends at wrist and ankle.

Much of the criticism that might with justice be aimed at this book would apply to any short treatise on the subject. The fact remains, however, that the author has given us the most useful text-book on comparative vertebrate anatomy so far available in the English language.

A. BRAZIER HOWELL

COLLEGE CHEMISTRY

Essentials of College Chemistry. By NORMAN KHARASCH and HELEN S. MACKENZIE. xii + 513 pp. New York: D. Van Nostrand Company, Inc. 1942. $3.50.

UNDER this title the authors, both staff members of the Illinois Institute of Technology, have produced a very readable, well-indexed introduction to general chemistry. Their style is clear, direct and unhurried. The illustrations, consisting of 99 figures and 48 tables, are pertinent and well-balanced. The value of the text is enhanced by the use of large, clear type, non-glossy paper and durable binding.

Faced with the necessity of choosing from the vast accumulation of introductory material, the authors have placed extra emphasis upon the structure of matter, and by their omissions and order of arrangement constantly remind us that success lies around many corners.

Each of the twenty-three chapters includes selected references; twenty of them are followed by exercises and six by summaries. Some of the others could have been similarly treated to advantage. The reference book list records but seven general chemistry texts.

Separate title pages divide the text as follows: Introduction; The States of Matter; The Theory of Ionization; The Non-Metals; The Metals; Introduction to Organic Chemistry; The Ceramic Industries; Appendix; Index. These sections do not necessarily indicate their scope. For example, the section titled "The States of Matter" comprises eight chapters, among them, "Atoms-Molecules-Chemical Changes," "The Velocity of Chemical Reactions" and "The Periodic Classification of the Elements." The appendix includes an "Outline of the History of Chemistry," "Rules of Nomenclature for Inorganic Compounds," "Solubilities of some Salts at 20° C" and "Vapor Pressure of Water." A "Table of International Atomic Weights" appears on the inside back cover. The excellent chapter on "Ceramics" was written by an invited specialist in the field.

Some teachers will object to the compression within a single chapter of oxygen, ozone, hydrogen, hydroxides, oxidation, reduction, endo- and exothermic reactions, the activity series of the metals, valence and chemical equivalents. These 22 pages are busy ones indeed. Other teachers will be delighted to find 20 per cent. of the text devoted to carbon and organic chemistry—trimmed freely with structural formulas for sugar and vitamins and such substances as mercurochrome, alizarine, salvarsan and phenolphthalein.

Strong features of the text are acids, bases, hydrolysis, chemical equilibrium, isomerism and structural formulas. The authors employ delightful analogies and techniques to make their points clear. The same strength does not carry over into the field of applied chemistry. And it is unfortunate that the text should be marred by inaccuracies and inconsistencies.

Explosives and combustible mixtures are confused. "$\triangle$" over an equation is used promiscuously to indicate either endothermic action or elevated temperature. Electrolytic equations are written first $2\,Cl^- - 2\,e \rightarrow 2\,Cl$ and then $2\,Br^- \rightarrow 2\,Br + e$.

According to the authors, "the free metal (barium) is not prepared commercially and has no uses"; the fluorine molecule is "stable at all temperatures"; "the oxide (of aluminum) is infusible"; "the decomposition of potassium chlorate into potassium chloride and oxygen . . . (is) . . . endothermic"; "barium melts at 850° C and boils at 1140°."

R. A. BAKER

Brief College Chemistry. By LEON B. RICHARDSON and ANDERW J. SCARLETT. vi + 385 pp. 128 figs. New York: Henry Holt and Company. 1942. $3.00.

WRITTEN in the refreshing style already associated with these authors, this brief text is no scissors-and-paste abstract, but a paraphrase of their earlier works. Because it is scholarly it happily stands apart from those "science survey" texts which dilute science to the level of the tabloid.

There are five introductory chapters on valence, atomic structure and the periodic table; eight chapters on physical chemistry, including energy, states of matter, equilibrium—introduced probably too early for an elementary course—chemical calculations, the ionic properties of solutions, and a logical use of the Brønsted treatment of acids and bases; eight chapters on the non-metals and seven on the metals, with two concluding chapters on organic chemistry. Sandwiched into physical chemistry is the chemistry of water and its constituent elements; electrochemistry is interposed between aluminum and iron; colloids are inserted between phosphorus and carbon. Although these special topics are arbitrarily located, at least they are consistently handled.

This brief, elementary, but authoritative text should supplant its several inferior predecessors.

HUBERT N. ALYEA

Introductory College Chemistry. Second edition. By HORACE G. DEMING. 521 pp. 176 figs. New York: John Wiley and Sons, Inc. 1942. $3.00.

NOW written in collaboration with Professor Hendricks, this well-known, attractive and particularly reliable elementary text has been entirely reset in larger, clearer type. Chapter headings remain the same as in the first, 1933, edition. Cuts of modern industrial products and processes, new sections on the structure of liquids and solids, x-ray studies, photography, plastics, vitamins and animal nutrition considerably improve and modernize the subject-matter.

HUBERT N. ALYEA

PRINCETON UNIVERSITY

SPECIAL ARTICLES

INCREASED SYNTHESIS OF p-AMINOBENZOIC ACID ASSOCIATED WITH THE DEVELOPMENT OF SULFONAMIDE RESISTANCE IN STAPHYLOCOCCUS AUREUS

THE means by which bacteria become resistant to the bacteriostatic action of the sulfonamide drugs has remained obscure, although this phenomenon has been known for several years[1] and has been observed in a number of bacterial species.[2,3,4,5,6] While a sizable body of information on the technique of development of resistance *in vitro* has accumulated and its clinical analogue has been described, careful study has failed to disclose significant differences (in morphology, carbohydrate fermentation, growth rates, virulence, etc.) between sulfonamide-resistant and susceptible organisms. With the failure to solve the problem by the use of orthodox bacteriological procedures, the method of attack has shifted to the biochemical.

It has been postulated[7] and indirect evidence suggests[8,9,10] that increased p-aminobenzoic acid (PAB) synthesis by sulfonamide-resistant organisms may account for their lack of sensitivity to sulfonamides. This explanation has not been proved heretofore, since no adequate test for PAB was available. The development by Landy and Dicken[11] of a suitable microbiological method for the determination of PAB made possible a quantitative comparison of the amounts of PAB synthesized by sulfonamide-sensitive and resistant bacteria. Evidence presented in this report indicates that sulfonamide-resistant strains of *Staphylococcus aureus* produced significantly more PAB than the corresponding sensitive strains.

The cultures investigated were *S. aureus* strains 7 and 14 supplied by Dr. Wesley Spink, of the University of Minnesota Medical School, who has described their susceptibility to sulfonamide inhibition *in vitro*.[12]

[1] I. H. MacLean, K. B. Rogers and A. Fleming, *Lancet*, I: 562, 1939.
[2] C. M. MacLeod and G. Daddi, *Proc. Soc. Exp. Biol. and Med.*, 41: 69, 1939.
[3] L. Westphal, R. L. Charles and C. M. Carpenter, *Ven. Dis. Inform.*, 21: 183, 1940.
[4] E. Strauss, J. H. Dingle and M. Finland, *Jour. Immunol.*, 42: 313, 1941.
[5] E. Strauss, J. H. Dingle and M. Finland, *Jour. Immunol.*, 42: 331, 1941.
[6] H. N. Green, *Brit. Jour. Exp. Path.*, 21: 38, 1940.
[7] D. D. Woods, *Brit. Jour. Exp. Path.*, 21: 74, 1940.
[8] C. M. MacLeod, *Jour. Exp. Med.*, 72: 217, 1940.
[9] H. N. Green and F. Bielschowsky, *Brit. Jour. Exp. Path.*, 23: 1, 1942.
[10] G. S. Mirick, *Jour. Clin. Invest.*, 21: 628, 1942.
[11] M. Landy and D. M. Dicken, *Jour. Biol. Chem.*, 146: 109, 1942.
[12] J. J. Vivino and W. W. Spink, *Proc. Soc. Exp. Biol. and Med.*, 50: 336, 1942.