carbene might thus provide a kinetically feasible way out of the thermodynamically quite unfavorable situation of titanium(II) in $(\pi\text{-}C_5H_5)_2Ti$.[25] We are presently investigating these possibilities in more detail experimentally.

(25) This analogy would require that $(\pi\text{-}C_5H_5)_2Ti$ be available in a singlet state. Such a low-lying singlet state has been claimed before, from a comparison of free ion states in titanium and other 3d transition metals (E. M. Shustorovich and M. E. Dyatkina, *Russ. J. Inorg. Chem.*, 4, 251 (1959)). Experimentally, a singlet–triplet equilibrium has in fact been observed at room temperature in the complex $(\pi\text{-}C_5H_5)_2Ti \cdot$ bipyridine (ref 4 and 5).

Acknowledgment. Financial support for this investigation by the National Science Foundation (Grant GP8300) is gratefully acknowledged.

Hans H. Brintzinger, Lawrence S. Bartell
Department of Chemistry, The University of Michigan
Ann Arbor, Michigan 48104
Received December 18, 1969

Additions and Corrections

The Conformation of 1,4-Cyclohexadiene from Stereoisomeric Allylic–Allylic Proton Couplings [*J. Am. Chem. Soc.*, **90**, 3590 (1968)]. By E. W. GARBISCH, JR., and M. G. GRIFFITH, Department of Chemistry, University of Minnesota, Minneapolis, Minnesota 55455.

The equation $\alpha \cong 180° - \frac{1}{2}|60° - \phi|$ is incorrect and should be replaced by $\alpha \cong 180° - |60° - \phi|$ [see D. J. Atkins and M. J. Perkins, *Tetrahedron Letters*, 2335 (1969)]. With this correction, $\alpha \cong 165°$ rather than the reported value of 172° and is in qualitative agreement with the value of 159° determined by electron diffraction [H. Oberhammer and S. H. Bauer, *J. Am. Chem. Soc.*, **91**, 10 (1969)]. From the electron diffraction structure of 1,4-cyclohexadiene, the calculated value of ϕ is 41.3° which compares well with the value of 45° that was estimated from the allylic–allylic proton couplings.

Nuclear Magnetic Resonance Spectroscopy. Conformational Equilibria and Equilibration of 5,5-Difluoro-*cis*-hydrindan and 9-Methyl-5,5-difluoro-*cis*-hydrindan [*J. Am. Chem. Soc.*, **90**, 6997 (1968)]. By RUTH E. LACK and JOHN D. ROBERTS, Gates and Crellin Laboratories of Chemistry, California Institute of Technology, Pasadena,California 91109.

Some of the labels on the curves in Figure 1 are incorrect. The correct temperatures and τ_1 values are (temp, °C; τ, sec): −46, 0.0000075; −78, 0.00008; −92, 0.0004; −105, 0.0014; −123, 0.0185. The other data and conclusions remain unchanged.

Mechanism of Secoiridoid Monoterpene Biosynthesis [*J. Am. Chem. Soc.*, **91**, 204 (1969)]. By ROCCO GUARNACCIA, LUIGI BOTTA, and CARMINE J. COSCIA, Department of Biochemistry, St. Louis University School of Medicine, St. Louis, Missouri 63104.

In Table I, the last entry in the column headed ^{14}C should be 1.16×10^4 rather than 1.16×10^6.

Chemistry in Super Acids. III. Protonation of Alkanes and the Intermediacy of Alkanonium Ions, Pentacoordinated Carbon Cations of the CH_5^+ Type. Hydrogen Exchange, Protolytic Cleavage, Hydrogen Abstraction, and Polycondensation of Methane, Ethane, 2,2-Dimethylpropane (Neopentane), and 2,2,3,3-Tetramethylbutane in FSO_3H–SbF_5 ("Magic Acid") Solution [*J. Am. Chem. Soc.*, **91**, 3261 (1969)]. By GEORGE A. OLAH, GILLES KLOPMAN, and RICHARD H. SCHLOSBERG, Department of Chemistry, Case Western Reserve University, Cleveland, Ohio 44106.

On page 3264, column 2, the last five lines of text should have been placed between the fourth and fifth lines at the top of the same column.

Addition of a Functionalized Isoprene Unit to an Allyl Alcohol. I. The Synthesis of β-Sinensal and Related Topics [*J. Am. Chem. Soc.*, **91**, 3281 (1969)]. By ALAN F. THOMAS, Research Laboratories, Firmenich Cie, Geneva, Switzerland.

In Scheme III, page 3283, the numbers **16**, **21**, and **24** should be placed under the third column of formulas leading to 2-*trans*,6-*trans* and not under the fourth column.

The Anisotropy Factor of Optically Active Ketones [*J. Am. Chem. Soc.*, **91**, 3709 (1969)]. By GLEN M. ROBINSON and OSCAR E. WEIGANG, JR., Richardson Chemical Laboratories, Department of Chemistry, Tulane University, New Orleans, Louisiana 70118.

The three perspective drawings of Figure 1, page 3710, are incorrect in that they show axial substitutions rather than the equatorial substitutions which were the basis for measurements and calculations.

Stereochemistry of Polynuclear Compounds of the Main Group Elements. IX. Structure of Bis(dimethylamino)-beryllium and Its Reaction with Trimethylaluminum [*J. Am. Chem. Soc.*, **91**, 4426 (1969)]. By J. L. ATWOOD and G. D. STUCKY, Department of Chemistry and Chemical Engineering and the Materials Research Laboratory, University of Illinois, Urbana, Illinois 61801.

In the abstract, on line 6 the value of the *b* lattice parameter should read 14.073 (8) Å.

Syntheses *via* Dihydro-1,3-oxazines. VI. A Carboxyl Protecting Group Stable to the Grignard Reagent. A New Synthesis of Carboxylic Acids [*J. Am. Chem. Soc.*, **91**, 5886 (1969)]. By A. I. MEYERS, I. R. POLITZER,

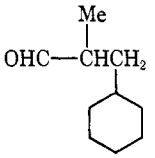
B. K. BANDLISH, and G. R. MALONE, Department of Chemistry, Louisiana State University in New Orleans, New Orleans, Louisiana 70122.

In footnote 8, 2,4-dimethyl-2,4-pentanediol should read 2-methyl-2,4-pentanediol.

Syntheses *via* Dihydro-1,3-oxazines. VII. A Simple Synthesis of Unsymmetrical Ketones [*J. Am. Chem. Soc.*, **91**, 5887 (1969)]. By A. I. MEYERS and A. C. KOVELESKY, Department of Chemistry, Louisiana State University in New Orleans, New Orleans, Louisiana 70122.

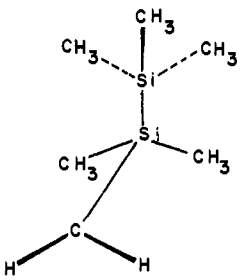
In footnote 3, 2,4-dimethyl-2,4-pentanediol should read 2-methyl-2,4-pentanediol.

Structure **6** should be



Electron Spin Resonance of Group IV Organometallic Alkyl Radicals in Solution [*J. Am. Chem. Soc.*, **91**, 6161 (1969)]. By PAUL J. KRUSIC and JAY K. KOCHI, Central Research Department, E. I. du Pont de Nemours and Co., Wilmington, Delaware 19898, and the Department of Chemistry, Indiana University, Bloomington, Indiana 47401.

On page 6164 the structure near the bottom of the left-hand column should be



Book Reviews

Antagonists and Nucleic Acids. By M. EARL BALIS, Sloan Kettering Institute for Cancer Research, Walker Laboratory. Wiley Interscience, John Wiley and Sons, Inc., 605 Third Ave., New York, N. Y. 1968. vi + 293 pp. 17.5 × 24.5 cm. $16.95.

This book is Volume 10 in the series "Frontiers of Biology" under the general editorship of A. Neuberger and E. L. Tatum. Its stated purpose is to consolidate and evaluate the available information on how various antagonists, natural and synthetic, interfere with the synthesis of purines, pyrimidines, and nucleic acids and with the functions of the nucleic acids. This material is organized around specific metabolic areas. Chapters 1 and 2 deal with purine synthesis and purine interconversion and the effects of inhibitors thereon, and Chapters 3 and 4 deal in a similar manner with pyrimidine metabolism. In each of these chapters the biosynthetic pathways to be considered are outlined very briefly, and then the remainder of the chapter is spent on a detailed consideration of the more important agents known to inhibit steps along the pathways. Chapter 5 is a review of the many agents known to interfere with transcription and replication by binding to polynucleotides or by inhibiting DNA and RNA polymerases. This is followed by a chapter on the incorporation of purine and pyrimidine analogs into polynucleotides and the metabolic consequences of such incorporation. Chapter 7 is a brief discussion of the major classes of compounds known to alkylate polynucleotides. Inhibitors that interfere with the function of polynucleotides in protein synthesis are considered in Chapter 8, and the volume concludes with a chapter by G. B. Brown on purine N-oxides as antimetabolites and oncogens. The text is well provided with structural formulas and outlines of major metabolic pathways.

Each unit of the material in this book has been reviewed repeatedly in annual review publications or in monographs. However, I know of no other single source in which all of the literature pertinent to antagonists of nucleic acids has been brought together, organized, and evaluated. Dr. Balis has done an excellent job in sorting out the voluminous literature that has accumulated in this area and in compressing it into a volume of easily readable size. Such compression demands a selection of references, and this has been accomplished with care and, to my knowledge, without the omission of any significant observations.

Inevitably, in a volume covering such a wide field, there will be errors, and a few of these are serious enough to be mentioned. Perhaps the most misleading is the statement on page 76 that "ribonucleosides of most 'natural' and 'derived' purines are more readily cleaved to the aglycones than phosphorylated, and as a result, cells resistant to purine analogs are usually resistant to their nucleosides." This statement is true only for analogs of inosine and guanosine; many analogs of adenosine are readily phosphorylated and cells resistant to the aglycones are sensitive to the nucleosides. On page 18 the statement is made that 6-thioxanthosine 5′-phosphate is perhaps the metabolite responsible for feedback inhibition of purine biosynthesis by 6-mercaptopurine; there is no experimental evidence for this statement. On page 63 it is stated that xanthine is an excellent precursor of nucleic acid purines in animals if xanthine oxidase is inhibited; at best, xanthine is a poor precursor in mammalian cells. There are also more than the average number of errors in structural formulas, the most serious being on page 202, where puromycin and the terminal adenosine of t-RNA are both written as 2′-deoxynucleosides. In the first four chapters there are numerous instances (for example, on pp 11, 40, 72, 74, 76, and 99) in which hydrogen atoms are missing from the nitrogen atoms of the purine or pyrimidine rings. These errors will not be serious to someone already knowledgeable in this area, but could badly mislead students or workers in other areas who will consult this book an an authoritative work in its field.

On the whole, this book can be recommended as a sound and reasonably comprehensive assessment of this area of research. It should also be useful to students and to investigators in nucleic acid biochemistry and chemotherapy as a source of references to the literature on antagonists of nucleic acids and as a single text in which can be found the structures of the many different agents known to act in this area.

L. Lee Bennett, Jr.
Kettering-Meyer Laboratory
Southern Research Institute
Birmingham, Alabama 35205