

# NASA Technical Memorandum 86653

NASA-TM-86653 19850002349

## Publications of the Exobiology Program for 1983

*A Special Bibliography*

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NASA Technical Memorandum 86653

Publications of the Exobiology  
Program for 1983

*A Special Bibliography*

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National Aeronautics  
and Space Administration

Scientific and Technical  
Information Branch

1984

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## INTRODUCTION

The Exobiology Program, within the Office of Space Science and Applications of the National Aeronautics and Space Administration, is an integrated program to methodically investigate those processes which may have been responsible for, or related to, the origin, evolution, and distribution of life in the universe.

This report contains a listing of 1983 publications supported by the Exobiology Program. Our intent in compiling this report is twofold: we want to provide the scientific community with an annual publication listing (as we have done since 1975), of current NASA-supported research in this field; and, we hope to stimulate the exchange of information and ideas among scientists working in the different areas of the program.

Research supported by the Exobiology program is carried out in the areas of Chemical Evolution, Organic Geochemistry, Origin and Evolution of Life, Planetary Environments, Life in the Universe, Search for Extraterrestrial Intelligence (SETI), and Planetary Protection. Each area is defined as follows:

Chemical Evolution focuses on the nonbiological synthesis of biologically significant organic molecules under conditions presumed to have existed on the primitive earth or on any primitive planet before the advent of life.

Organic Geochemistry involves 1) analyzing ancient terrestrial rocks for organic molecules and inclusions of biological origin, and 2) developing techniques to isolate organic matter and to distinguish organic matter of biological origin from that of nonbiological origin.

Origin and Evolution of Life studies 1) the origin of essential life processes and systems including the nucleic acid and protein biopolymers, genetic information transfer, energy collection mechanisms, and cellular and subcellular structures, and 2) the evolution of primitive microbial ecologies.

Planetary Environments includes 1) characterizing microorganisms capable of surviving and/or growing in extreme conditions approaching those of planetary environments, 2) developing methodologies and techniques to detect and characterize life-related molecules in extraterrestrial environments, and 3) developing methods to determine planetary environmental characteristics important for chemical evolution processes.

Life in the Universe involves research and analysis in two distinct but related areas: 1) forms, abundances, and reactivity of the biogenic elements; and 2) effect of planetary, solar, and astrophysical phenomena on evolution of complex life.

Search for Extraterrestrial Intelligence (SETI) involves the search for extraterrestrial intelligent life by detecting signals in the microwave region of the spectrum.

Planetary Protection focuses on 1) environmental protection of planets of biological interest from potential harmful contamination from terrestrial sources during future exploration, based on explicit guidelines established for each planet and for each type of mission, and 2) protection of the Earth from potential hazards posed by return sample missions.

The bibliography is divided into the seven research areas noted above and a miscellaneous section. Within each research area, references are listed alphabetically by author. Authors who are principal investigators are identified by an asterisk. Abstracts are listed separately starting on page . In addition, current addresses for all principal investigators are given in the Appendix.

We wish to thank all the participants in the Exobiology Program for their cooperation in responding to our request for a listing of their 1983 publications.

Donald L. DeVincenzi  
May 1984

## CHEMICAL EVOLUTION

- Bada, J.L., Cronin\*, J.R., Ho, M.-S., Kvenvolden, K.A., Lawless\*, J.G., Miller\*, S.L., Oro\*, J., and Steinberg, S. On the Reported Optical Activity of Amino Acids in the Murchison Meteorite. Nature 301: 494-497, 1983.
- Bar-Nun, A. and Chang\*, S. Photochemical Reactions of Water and Carbon Monoxide in Earth's Primitive Atmosphere. Journal of Geophysical Research 88: 6662-6672, 1983.
- Chang\* S., DesMarais\*, D., Mack, R., Miller\*, S.L., and Strathearn, G.E. Prebiotic Organic Syntheses and the Origin of Life. In: Earth's Earliest Biosphere: Its Origin and Evolution (ed. by J.W. Schopf). Princeton, NJ: Princeton University Press, p. 53-92, 1983.
- Chang\*, S. and Kerridge, J.F. Accretion of Volatiles. In: Conference on Planetary Volatiles (ed. by R.O. Pepin and R.O. Connell). Houston: Lunar and Planetary Institute, p. 50-51, 1983.
- Coyne\*, L., Sweeney, M., and Hovatter, W. Luminescence Induced by Dehydration of Kaolin--Association with Electron-Spin-Active Centers and with Surface Activity for Dehydration-Polymerization of Glycine. Journal of Luminescence 28: 395-409, 1983.
- Ferris\*, J.P. Biological Formation and Metabolic Transformations of Compounds Containing the Cyano Group. In: The Chemistry of Functional Groups, Supplement C (ed. by S. Patai and Z. Rappoport). New York: John Wiley & Sons, p. 325-340, 1983.
- Ferris\*, J.P. and Usher\*, D.A. Origins of Life. In: Biochemistry (ed. by G. Zubay). Reading, MA.: Addison-Wesley, p. 1190-1241, 1983.
- Ferris\*, J.P., Yanagawa, H., and Hagan, W.J., Jr. Prebiotic Synthesis and Reactions of Nucleosides and Nucleotides. Advances in Space Research 3(9): 61-68, 1983.
- Folsome\*, C., Brittain, A., and Zelko, M. Photochemical Synthesis of Biomolecules Under Anoxic Conditions. Origins of Life 13: 41-56, 1983.
- Gupta, A., Loew\*, G.H., and Lawless\*, J. Interaction of Metal Ions and Amino Acids: Possible Mechanisms for the Adsorption of Amino Acids on Homoionic Smectite Clays. Inorganic Chemistry 22: 111-120, 1983.
- Kasting, J.F., Zahnle, K.J., and Walker\*, J.C.G. Photochemistry of Methane in the Earth's Early Atmosphere. Precambrian Research 20: 121-148, 1983.

- Kuhn\*, W.R. and Kasting, J.F. Effects of Increased CO<sub>2</sub> Concentrations on Surface Temperature of the Early Earth. Nature 301: 53-55, 1983.
- Lazcano, A., Oro\*, J., and Miller\*, S.L. Primitive Earth Environments: Organic Syntheses and the Origin and Early Evolution of Life. Precambrian Research 20: 259-282, 1983.
- Lunine, J.I., Stevenson, D.J., and Yung\*, Y.L. Ethane Ocean on Titan. Science 222(4629): 1229-1230, 1983.
- Miller\*, S.L. and Schlesinger, G. The Atmosphere of the Primitive Earth and the Prebiotic Synthesis of Organic Compounds. Advances in Space Research 3(9): 47-53, 1983.
- Odom, D., Yamrom, T., and Oro\*, J. Prebiotic Oligodeoxynucleotide Synthesis in a Cyclic Evaporating System at Low Temperatures. Advances in Space Research 3(9): 55-59, 1983.
- Oro\*, J. Chemical Evolution and the Origin of Life. Advances in Space Research 3(9): 77-94, 1983.
- Oro\*, J. El Origen de la Vida en la Tierra y el Hombre Ante el Espacio. Astronomia y Astrofotografia Tecnica 2(6): 192-197, 1983.
- Pleasant, L.G. and Ponnamperuma\*, C. Chemical Evolution and the Origin of Life: Bibliography Supplement 1981. Origins of Life 13: 61-80, 1983.
- Ponnamperuma\*, C. Cosmochemistry and the Origin of Life. In: Cosmochemistry and the Origin of Life (ed. by C. Ponnamperuma). Dordrecht, Holland: D. Reidel Publishing Co., p. 1-34, 1983.
- Ponnamperuma\*, C. (ed.) Cosmochemistry and the Origin of Life, Proceedings of the NATO Advanced Study Institute, Maratea, Italy, June 1-12, 1981. Dordrecht, Holland: D. Reidel Publishing Co., 386 p., 1983.
- Prather, M.J. and McElroy\*, M.B. Helium on Venus: Implications for Uranium and Thorium. Science 220: 410-411, 1983.
- Samuelson, R.E., Maguire, W.C., Hanel, R.A., Kunde, V.G., Jennings, D.E., Yung\*, Y.L., and Aiken, A.C. CO<sub>2</sub> on Titan. Journal of Geophysical Research 88(A11): 8709-8715, 1983.
- Schlesinger, G. and Miller\*, S.L. Prebiotic Synthesis in Atmospheres Containing CH<sub>4</sub>, CO, and CO<sub>2</sub>. I. Amino Acids. Journal of Molecular Evolution 19: 376-382, 1983.
- Schlesinger, G. and Miller\*, S.L. Prebiotic Synthesis in Atmospheres Containing CH<sub>4</sub>, CO, and CO<sub>2</sub>. II. Hydrogen Cyanide,

- Formaldehyde and Ammonia. Journal of Molecular Evolution 19: 383-390, 1983.
- Summers, M.E., Yung\*, Y.L., and Haff, P.K. A Two-stage Mechanism for Escape of Na and K from Io. Nature 304: 710-712, 1983.
- Walker\*, J.C.G. Carbon Geodynamic Cycle. Nature 303: 730, 1983.
- Walker\*, J.C.G. Possible Limits on the Composition of the Archaean Ocean. Nature 302: 518-520, 1983.
- Walker\*, J.C.G., Klein, C., Shidlowksi, M., Schopf\*, J.W., Stevenson, D.J., and Walter, M.R. Environmental Evolution of the Archean-Early Proterozoic Earth. In: Earth's Earliest Biosphere: Its Origin and Evolution (ed. by J.W. Schopf). Princeton, NJ: Princeton University Press, p. 260-290, 1983.
- Weber\*, A.L. Thio-Catalyzed Formation of Lactate and Glycerate from Glyceraldehyde. Journal of Molecular Evolution 19: 237-243, 1983.



## ORGANIC GEOCHEMISTRY

- Ashwal, L.D., Colucci, M.T., Lambert, P., Henry, D.J., and Gibson\*, E.K. Fluid Inclusions in Meteorites: Direct Samples of Extraterrestrial Volatiles. In: Conference on Planetary Volatiles, Alexandria, Minnesota, October 9-12, 1982 (ed. by R.O. Pepin and R. O'Connell). Houston: Lunar and Planetary Institute, p. 18-19, 1983. (LPI Technical Report 83-01)
- Awramik, S.M., Schopf\*, J.W., and Walter, M.R. Filamentous Fossil Bacteria from the Archean of Western Australia. Precambrian Research 20: 357-374, 1983.
- Boon, J.J. and de Leeuw, J.W.<sup>1</sup> Early Stromatolite Lithification --Organic Chemical Aspects. In: Biom mineralization and Biological Metal Accumulation (ed. by P. Westbroek and E.W. de Jong). Dordrecht, Holland: D. Reidel, p. 327-334, 1983.
- Boon, J.J., Hines, H., Burlingame\*, A.L., Klok, J., Rijpstra, W.I.C., de Leeuw, J.W., Edmunds, K.E., and Eglinton, G. Organic Geochemical Studies of Solar Lake Laminated Cyanobacterial Mats. In: Advances in Organic Geochemistry 1981 (ed. by M. Bjoroy). New York: John Wiley & Sons, p. 207-227, 1983.
- Brassell, S.C., Eglinton, G., and Maxwell, J.R.<sup>1</sup> The Geochemistry of Terpenoids and Steroids. Biochemical Society Transactions 11: 575-586, 1983.
- Campbell\*, S.E. The Modern Distribution and Geological History of Calcium Carbonate Boring Microorganisms. In: Biom mineralization and Biological Metal Accumulation (ed. by P. Westbroek and E.W. de Jong). Dordrecht, Holland: D. Reidel, p. 99-104, 1983.
- Cardoso, J.N. and Eglinton, G.<sup>1</sup> The Use of Hydroxyacids as Geochemical Indicators. Geochimica et Cosmochimica Acta 47: 723-730, 1983.
- Cardoso, J.N., Gaskell, S.J., Quirk, M.M., and Eglinton, G.<sup>1</sup> Hydrocarbon and Fatty Acid Distributions in Rostherne Lake Sediment (England). Chemical Geology, 38: 107-128, 1983.
- Chapman, D.J. and Schopf\*, J.W. Biological and Biochemical Effects of the Development of an Aerobic Environment. In: Earth's Earliest Biosphere: Its Origin and Evolution (ed. by J.W. Schopf). Princeton: Princeton University Press, p. 302-320, 1983.

---

<sup>1</sup>A.L. Burlingame and M. Calvin, Co-Principal Investigators

- Cronin\* J.R. and Pizzarello, S. Amino Acids in Meteorites. Advances in Space Research 3(9): 5-18, 1983.
- Des Marais\*, D.J. Light Element Geochemistry and Spallogenesi in Lunar Rocks. Geochimica et Cosmochimica Acta 47: 1769-1781, 1983.
- Des Marais\*, D.J. and Chang\*, S. Processing Procedure for Abiotic Samples and Calculation of Model Atmospheric Compositions. In: Earth's Earliest Biosphere: Its Origin and Evolution (ed. by J.W. Schopf). Princeton, NJ: Princeton University Press, p. 416-427, 1983.
- Des Marais\*, D.J., Sakai, H., and Moore, J.G. Stable Carbon Isotopes in Midoceanic Basaltic Glasses. In: Conference on Planetary Volatiles, Alexandria, Minnesota, October 9-12, 1982 (ed. by R.O. Pepin and R. O'Connell). Houston: Lunar and Planetary Institute, p. 56-57, 1983. (LPI Technical Report 83-01)
- Eglinton, G.<sup>1</sup> Organic Molecules as Chemical Fossils - The Molecular Fossil Record. In: Cosmochemistry and the Origin of Life (ed. by C. Ponnampertuma). Dordrecht, Holland: D. Reidel, p. 323-359, 1983.
- Fry, B., Gest, H., and Hayes\*, J.M. Sulphur Isotopic Compositions of Deep-sea Hydrothermal Vent Animals. Nature 306: 51-52, 1983.
- Gest, H. and Schopf\*, J.W. Biochemical Evolution of Anaerobic Energy Conversion: The Transition from Fermentation to Anoxygenic Photosynthesis. In: Earth's Earliest Biosphere: Its Origin and Evolution (ed. by J.W. Schopf). Princeton, NJ: Princeton University Press, p. 135-148, 1983.
- Gibson\*, E.K. A Review of Distributions of Sulfur in Solar System Objects. In: Conference on Planetary Volatiles, Alexandria, Minnesota October 9-12, 1982 (ed. by R.O. Pepin and R. O'Connell). Houston: Lunar and Planetary Institute, p. 73-74, 1983. (LPI Technical Report 83-01)
- Gibson\*, E.K., Wentworth, S.J., and McKay, D.S. Chemical Weathering and Diagenesis of a Cold Desert Soil from Wright Valley, Antarctica: An Analog of Martian Weathering Processes. Journal of Geophysical Research 88(Suppl.): A912-A928, 1983.
- Hayes\*, J.M. Geochemical Evidence Bearing on the Origin of Aerobiosis, A Speculative Hypothesis. In: Earth's Earliest Biosphere: Its Origin and Evolution (ed. by J.W. Schopf). Princeton, NJ: Princeton University Press, p. 291-301, 1983.

---

<sup>1</sup>A.L. Burlingame and M. Calvin, Co-Principal Investigators

- Hayes\*, J.M., Kaplan\*, I.R., and Wedeking, K.W. Precambrian Organic Geochemistry, Preservation of the Record. In: Earth's Earliest Biosphere: Its Origin and Evolution (ed. by J.W. Schopf). Princeton, NJ: Princeton University Press, p. 93-134, 1983.
- Hofmann, H.J. and Schopf\*, J.W. Early Proterozoic Microfossils. In: Earth's Earliest Biosphere: Its Origin and Evolution (ed. by J.W. Schopf). Princeton, NJ: Princeton University Press, p. 321-360, 1983.
- Kerridge\*, J.F. Isotopic Composition of Carbonaceous-Chondrite Kerogen: Evidence for an Interstellar Origin of Organic Matter in Meteorites. Earth and Planetary Science Letters 64: 186-200, 1983.
- Nagy, L.A.<sup>1</sup> Microbial Paleontology. In: Microbiology--1983 (ed. by D. Schlessinger). Washington, DC: American Society for Microbiology, p. 389-390, 1983.
- Oremland, R.S. and Des Marais\*, D.J. Distribution, Abundance and Carbon Isotopic Composition of Gaseous Hydrocarbons in Big Soda Lake, Nevada: An Alkaline, Meromictic Lake. Geochimica et Cosmochimica Acta 47: 2107-2114, 1983.
- Rohrback, B.G., Peters, K.E., Sweeney, R.E., and Kaplan\*, I.R. Ammonia Formation in Laboratory Simulated Thermal Maturation: Implications Related to the Origin of Nitrogen in Natural Gas. In: Advances in Organic Geochemistry 1981 (ed. by M. Bjoroy). New York: John Wiley & Sons, p. 819-823, 1983.
- Schidlowski, M., Hayes\*, J.M., and Kaplan\*, I.R. Isotopic Inferences of Ancient Biochemistries: Carbon, Sulfur, Hydrogen, and Nitrogen. In: Earth's Earliest Biosphere: Its Origin and Evolution (ed. by J.W. Schopf). Princeton, NJ: Princeton University Press, p. 149-186, 1983.
- Schoeller, D.A., Peterson, D.W., and Hayes\*, J.M. Double-Comparison Method for Mass Spectrometric Determination of Hydrogen Isotopic Abundances. Analytical Chemistry 55: 827-832, 1983.
- Schopf\*, J.W. (ed.) Earth's Earliest Biosphere: Its Origin and Evolution. Princeton, NJ: Princeton University Press, 543 p., 1983.
- Schopf\*, J.W. Technical Terms. In: Earth's Earliest Biosphere: Its Origin and Evolution (ed. by J.W. Schopf). Princeton, NJ: Princeton University Press, p. 443-458, 1983.

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<sup>1</sup>B. Nagy, Principal Investigator

- Schopf\*, J.W., Hayes\*, J.M., Matzigkeit, U., Walter, M.R., and Wedeking, K.W. Appendix II: Flow Chart and Processing Procedure for Rock Samples. In: Earth's Earliest Biosphere: Its Origin and Evolution (ed. by J.W. Schopf). Princeton, NJ: Princeton University Press, p. 414-415, 1983.
- Schopf\*, J.W., Hayes\*, J.M., and Walter, M.R. Evolution of Earth's Earliest Ecosystems: Recent Progress and Unsolved Problems. In: Earth's Earliest Biosphere: Its Origin and Evolution (ed. by J.W. Schopf). Princeton, NJ: Princeton University Press, p. 361-384, 1983.
- Schopf\*, J.W. and Walter, M.R. Archean Microfossils: New Evidence of Ancient Microbes. In: Earth's Earliest Biosphere: Its Origin and Evolution (ed. by J.W. Schopf). Princeton, NJ: Princeton University Press, p. 214-239, 1983.
- Smith\*, G.G., Khatib, A., and Reddy, G.S. Effect of Nickel(II) and Cobalt(III) and Other Metal Ions on the Racemization of Free and Bound L-Alanine. Journal of the American Chemical Society 105(2): 293-295, 1983.
- Smith\*, G.G. and Sivakua, T. Mechanism of the Racemization of Amino Acids. Kinetics of Racemization of Arylglycines. Journal of Organic Chemistry 48(5): 627-634, 1983.
- Spies, R.B. and Des Marais\*, D.J. Natural Isotope Study of Trophic Enrichment of Marine Benthic Communities by Petroleum Seepage. Marine Biology 73: 67-71, 1983.
- Stroud, E.D., Fife, D.J., and Smith\*, G.G. A Method for the Determination of the  $pK_a$  of the alpha-Hydrogen in Amino Acids Using Racemization and Exchange Studies. Journal of Organic Chemistry 48: 5368-5369, 1983.
- Walker\*, J.C.G., Klein, C., Schidlowski, M., Schopf\*, J.W., Stevenson, D.J., and Walter, M.R. Environmental Evolution of the Archean-Early Proterozoic Earth. In: Earth's Earliest Biosphere: Its Origin and Evolution (ed. by J.W. Schopf). Princeton, NJ: Princeton University Press, p. 260-290, 1983.
- Walter, M.R., Hofmann, H.J., and Schopf\*, J.W. Geographic and Geologic Data for Processed Rock Samples. In: Earth's Earliest Biosphere: Its Origin and Evolution (ed. by J.W. Schopf). Princeton, NJ: Princeton University Press, p. 385-413, 1983.
- Warner, J.L., Ashwal, L.D., Bergman, S.C., Gibson\*, E.K., Jr., Henry, D.J., Lee-Berman, R., Roedder, E., and Belkin, H.E. Fluid Inclusions in Stony Meteorites. Journal of Geophysical Research 88(Suppl.): A731-A735, 1983.

- Wedeking, K.W. and Hayes\*, J.M. Carbonization of Precambrian Kerogens. In: Advances in Organic Geochemistry 1981 (ed. by M. Bjoroy). London: John Wiley & Sons, p. 546-553, 1983.
- Wedeking, K.W. and Hayes\*, J.M. Exchange of Oxygen Isotopes Between Water and Organic Material. Isotope Geoscience 1: 357-370, 1983.
- Wedeking, K.W., Hayes\*, J.M., and Matzigkeit, U. Appendix IV: Procedures of Organic Geochemical Analysis. In: Earth's Earliest Biosphere: Its Origin and Evolution (ed. by J.W. Schopf). Princeton, NJ: Princeton University Press, p. 428-441, 1983.

## ORIGIN AND EVOLUTION OF LIFE

- Dancshazy, Zs., Helgerson, S.L., and Stoeckenius\*, W. Regulation of the Bacteriorhodopsin Proton Pump, Photoelectric Generator "In Vivo". Acta Biochimica et Biophysica Academiae Scientiarum Hungaricae 18: 76, 1983.
- Dayhoff, M.O.<sup>1</sup> Evolutionary Connections of Biological Kingdoms Based on Protein and Nucleic Acid Sequence Evidence. Precambrian Research 20: 299-318, 1983.
- Dayhoff, M.O., Barker, W.C., and Hunt\*, L.T. Establishing Homologies in Protein Sequences. In: Methods in Enzymology, Vol. 91 (ed. by C.H.W. Hirs and S.N. Timasheff). New York: Academic Press, p. 524-545, 1983.
- Egan, J.T., Burt, S.K., and MacElroy\*, R.D. Viewing the Energy Optimization of Chemical Models with Computer Animation. Computers and Chemistry 7: 165-173, 1983.
- Fahey\*, R.C. and Newton, G.L. Occurrence of Low Molecular Weight Thiols in Biological Systems. In: Functions of Glutathione: Biochemical, Physiological, Toxicological, and Clinical Aspects (ed. by A. Larsson, et. al.). New York: Raven Press, p. 251-260, 1983.
- Fox\*, S.W. The Emergence of Biological Specificity and the Genetic Coding Mechanism. Trends in Biochemical Sciences 8(8): 277, 1983.
- Fox\*, S.W. and Matsuno, K. Self-organization of the Protocell was a Forward Process. Journal of Theoretical Biology 101: 321-323, 1983.
- Fox\*, S.W., Syren, R.M. Ancient Microspheres: Abiogenic, Protobiogenic, or Biogenic?. Precambrian Research 23: 1-8, 1983.
- Gadal, P.<sup>2</sup> (ed.) Thioredoxins: Structure and Functions. Paris: Centre National de la Recherche Scientifique, 288 p., 1983.
- George, D.G., Hunt\*, L.T., and Dayhoff, M.O. Sequence Evidence for the Symbiotic Origins of Chloroplasts and Mitochondria. In: Endocytobiology Vol II (ed. by W. Schwemmler and H.E.A. Schenk). Berlin: Walter de Gruyter & Co., p. 845-861, 1983.
- Golubic\*, S. Stromatolites, Fossil and Recent: A Case History. In: Biom mineralization and Biological Metal Accumulation (ed.

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<sup>1</sup>L.T. Hunt, Principal Investigator

<sup>2</sup>B.B. Buchanan, Principal Investigator

- by P. Westbroek and E.W. de Jong). Dordrecht, Holland: D. Reidel, p. 313-326, 1983.
- Grosovsky, B.D.-D.<sup>1</sup> Microbial Role in Witwatersrand Gold Deposition. In: Bio mineralization and Biological Metal Accumulation (ed. by P. Westbroek and E.W. de Jong). Dordrecht, Holland: D. Reidel, p. 495-498, 1983.
- Gupta, A., Loew\*, G.H., and Lawless\*, J. Interaction of Metal Ions and Amino Acids: Possible Mechanisms for the Adsorption of Amino Acids on Homoionic Smectite Clays. Inorganic Chemistry 22(1): 111-120, 1983.
- Gupta, R., Lanter, J.M., and Woese\*, C.R. Sequence of the 16S Ribosomal RNA from Halobacterium volcanii, an Archaeobacterium. Science 221: 656-659, 1983.
- Hammel, K.E., Cornwell, K.L., and Buchanan\*, B.B. Ferredoxin/ flavoprotein-linked Pathway for the Reduction of Thioredoxin. Proceedings of the National Academy of Sciences, USA 80: 3681-3685, 1983.
- Holmquist, R.<sup>2</sup> Transitions and Transversions in Evolutionary Descent: An Approach to Understanding. Journal of Molecular Evolution 19: 134-144, 1983.
- Holmquist, R., Goodman, M., Conroy, T., and Czelusniak, J.<sup>2</sup> The Spatial Distribution of Fixed Mutations Within Genes Coding for Proteins. Journal of Molecular Evolution 19: 437-448, 1983.
- Jahnke\*, L. and Klein\*, H.P. Oxygen Requirements for Formation and Activity of the Squalene Epoxidase in Saccharomyces cerevisiae. Journal of Bacteriology 155: 488-492, 1983.
- Jones, W.J., Paynter, M.J.B., and Gupta, R.<sup>3</sup> Characterization of Methanococcus maripaludis sp. nov., a New Methanogen Isolated from Salt Marsh Sediment. Archives of Microbiology 135: 91-97, 1983.
- Jukes\*, T.H. Changes in the Amino Acid Code. Advances in Space Research 3(9): 107-111, 1983.
- Jukes\*, T.H. Evolution of the Amino Acid Code. In: Evolution of Genes and Proteins (ed. by M. Nei and R.K. Koehn). Sunderland, MA.: Sinauer Associates Inc., p. 191-207, 1983.

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<sup>1</sup>L. Margulis, Principal Investigator  
<sup>2</sup>T.H. Jukes, Principal Investigator  
<sup>3</sup>C.R. Woese, Principal Investigator

- Jukes\*, T.H. Evolution of the Amino Acid Code: Inferences from Mitochondrial Codes. Journal of Molecular Evolution 19: 219-225, 1983.
- Jukes\*, T.H. Mitochondrial Codes and Evolution. Nature 301: 19-20, 1983.
- Jukes\*, T.H. Molecular Evidence for Evolution. In: Scientists Confront Creationism (ed. by L.R. Godfrey). New York: W.W. Norton & Co., p. 117-138, 1983.
- Kaine, B.P., Gupta, R., and Woese\*, C.R. Putative Introns in tRNA Genes of Prokaryotes. Proceedings of the National Academy of Sciences USA 80: 3309-3312, 1983.
- Kaveski, S., Margulis\*, L., and Mehos, D.C. There's No Such thing as a One-Celled Plant or Animal. The Science Teacher 50: 34-43, 1983.
- Khaled, M.A., Mullins, D.W., Jr., Swindle, M., and Lacey\*, J.C., Jr. Complexes of Polyadenylic Acid and the Methyl Esters of Amino Acids. Origins of Life 13: 87-96, 1983.
- Kothekar, V., Bolis, G., and Rein\*, R. Possible Incorporation of the Purine-Purine Mispairs in the DNA Helix and the Interpretation of the Transversion-Type Point Mutations. International Journal of Quantum Chemistry 23: 1295-1303, 1983.
- Lacey\*, J.C., Jr. and Mullins, D.W., Jr. Experimental Studies Related to the Origin of the Genetic Code and the Process of Protein Synthesis--A Review. Origins of Life 13: 3-42, 1983.
- Lanyi\*, J.K. and Schobert, B. Effects of Chloride and pH on the Chromophore and Photochemical Cycling of Halorhodopsin. Biochemistry 22: 2763-2769, 1983.
- Lipps, H.J., Nordheim, A., Lafer, E.M., Ammermann, D., Stollar, B.D., and Rich\*, A. Antibodies Against Z DNA React with the Macronucleus but Not the Micronucleus of the Hypotrichous Ciliare *Stylonychia mytilus*. Cell 32: 435-441, 1983.
- Lovelock, J.E. and Margulis\*, L. Un modele pour Gaia. CoEvolution 11: 48-52, 1983.
- Margulis\*, L. La naissance de la naissance. CoEvolution 12: 59-63, 1983.
- Margulis\*, L., Grosovsky, B.D.D., Stolz, J.F., Gong-Collins, E.J., Lenk, S., Read, D., and Lopez-Cortes, A. Distinctive Microbial Structures and the Pre-Phanerozoic Fossil Record. Precambrian Research 20: 443-477, 1983.



- Margulis\*, L. and Stolz, J. Microbial Systematics and a Gaian View of Sediments. In: Biom mineralization and Biological Metal Accumulation (ed. by P. Westbroek and E.W. de Jong). Dordrecht, Holland: D. Reidel, p. 27-53, 1983.
- Mortland, M.M. and Lawless\*, J.G. Smectite Interactions with Riboflavin. Clays and Clay Minerals 31: 435-439, 1983.
- Mullins, D.W., Jr. and Lacey\*, J.C., Jr. Highly Efficient Peptide Formation from N-Acetylaminoacyl-AMP Anhydride and Free Amino Acid. Journal of Molecular Evolution 19: 176-178, 1983.
- Nicholson, D.E. and Fox\*, G.E. Molecular Evidence for a Close Phylogenetic Relationship Among Box-shaped Halophilic Bacteria, Halobacterium vallismortis, and Halobacterium marismortui. Canadian Journal of Microbiology 29: 52-59, 1983.
- Nordheim, A. and Rich\*, A. Negatively Supercoiled Simian Virus 40 DNA Contains Z-DNA Segments within Transcriptional Enhancer Sequences. Nature 303: 674-679, 1983.
- Nordheim, A., Hao, W.M., Wogan, G.N., and Rich\*, A, Salt-induced Conversion of B-DNA to Z-DNA Inhibited by Aflatoxin. Science 219: 1434-1436, 1983.
- Oie, T., Loew\*, G.H., Burt, S.K., and MacElroy\*, R.D. Ab Initio Study of Catalyzed and Uncatalyzed Amide Bond Formation as a Model for Peptide Bond Formation: Ammonia-Glycine Reactions. Journal of Computational Chemistry 4(4): 449-460, 1983.
- Oie, T., Loew\*, G.H., Burt, S.K., and MacElroy\*, R.D. Quantum Chemical Studies of a Model for Peptide Bond Formation. 2. Role of Amine Catalyst in Formation of Formamide and Water from Ammonia and Formic Acid. Journal of the American Chemical Society 105(8): 2221-2227, 1983.
- Orcutt, B.C., George, D.G., and Dayhoff, M.O.<sup>1</sup> Protein and Nucleic Acid Sequence Database Systems. Annual Review in Biophysics and Bioengineering 12: 419-441, 1983.
- Parthasarathy, R., Rajeswaran, M., Kieber-Emmons, T., and Rein\*, R. Reciprocal Conformational Relationships of 2',5' and 3',5' Polynucleotides: Single Stranded Helices of 2',5' Polynucleotides. In: Conformation in Biology, the Festschrift Celebrating the Sixtieth Birthday of G.N. Ramachandran F.R.S. (ed. by R. Srinivasan and R.H. Sarma). New York: Adenine Press, p. 267-274, 1983.

---

<sup>1</sup>L.T. Hunt, Principal Investigator

- Pavlicek, K.A. and Yopp\*, J.H. Variation in Counteracting Effects of Glycinebetaine on Salt Inhibition of Glucose-6-Phosphate Dehydrogenase from Halotolerant Microorganisms (Abstract). Plant Physiology 72(1): 136, 1983.
- Przybylski, A.T., Syren, R.M., and Fox\*, S.W. Towards an Organic Photobattery: Photovoltaic Properties of Some Thermal Copolyamino Acids. In: Alternative Energy Sources V. Part B: Solar Applications (ed. by T.N. Veziroglu). Amsterdam: Elsevier Science Publishers B.V., p. 367-377, 1983.
- Read, L.K., Margulis\*, L., Stolz, J., Obar, R., and Sawyer, T.K. A New Strain of Partetramitus jugosus from Laguna Figueroa, Baja California, Mexico. Biological Bulletin 165: 241-264, 1983.
- Rein\*, R., Kieber-Emmons, T., Haydock, K., Garduno-Juarez, R., and Shibata, M. Molecular Modelling of Protein-Nucleic Acid Interactions. Journal of Biomolecular Structure and Dynamics 1: 1051-1079, 1983.
- Rein\*, R. and Shibata, M. Structures and Mechanisms of Mispairing in a Helical Environment Including Sequence Effect. In: Nucleic Acids: The Vectors of Life (ed. by B. Pullman and J. Jortner). Dordrecht, Holland: D. Reidel Publishing Co., p. 479-494, 1983.
- Rein\*, R., Shibata, M. Garduno-Juarez, R., and Kieber-Emmons, T. Structure of Mispairs Leading to Substitution Mutations. In: Structure and Dynamics: Nucleic Acids and Proteins (ed. by E. Clementi and R.H. Sarma). New York: Adenine Press, p. 269-288, 1983.
- Rich\*, A., Nordheim, A., and Azorin, F. Stabilization and Detection of Natural Left-Handed Z-DNA. Journal of Biomolecular Structure and Dynamics 1: 1-19, 1983.
- Sagan, D. and Margulis\*, L. The Gaian Perspective of Ecology. The Ecologist 13(5): 160-167, 1983.
- Sagan, D. and Margulis\*, L. In: Nascita ed evoluzioni della vita. Milan, Italy: Gruppo Editoriale Fabbri, p. 4-63, 1983.
- Schobert, B., Lanyi\*, J.K., and Cragoe, E.J., Jr. Evidence for a Halide-binding Site in Halorhodopsin. Journal of Biological Chemistry 258(24): 15158-15164, 1983.
- Shibata, M., Kieber-Emmons, T., and Rein\*, R. Comparison of Theoretical and Thermodynamic Values of Interconstituent Interactions in DNA. International Journal of Quantum Chemistry 23: 1283-1293, 1983.

- Spudich, E.N., Bogomolni, R.A., and Spudich, J.L.<sup>1</sup> Genetic and Biochemical Resolution of the Chromophoric Polypeptide of Halorhodopsin. Biochemical and Biophysical Research Communications 112(1): 332-338, 1983.
- Spudich, J.L. and Bogomolni, R.A.<sup>1</sup> Spectroscopic Discrimination of the Three Rhodopsinlike Pigments in Halobacterium halobium Membranes. Biophysical Journal 43: 243-246, 1983.
- Stackebrandt, E., Fowler, V.J., and Woese\*, C.R. A Phylogenetic Analysis of Lactobacilli, Pediococcus pentosaceus and Leuconostoc mesenteroides. Systematic and Applied Microbiology 4(3): 326-337, 1983.
- Volkman, C.M. and Klein\*, H.P. Stabilization of the Yeast Desaturase System by Low Levels of Oxygen. Origins of Life 13: 57-59, 1983.
- Weaver, D.L.<sup>2</sup> Diffusion-Mediated Localization on Membrane Surfaces. Biophysical Journal 41: 81-86, 1983.
- Woese\*, C.R. The Primary Lines of Descent and the Universal Ancestor. In: Evolution from Molecules to Men (ed. by D.S. Bendall). Cambridge: Cambridge University Press, p. 209-233, 1983.
- Woese\*, C.R., Gutell, R., Gupta, R., and Noller, H.F. Detailed Analysis of Higher-order Structure of 16S-like Ribosomal Ribonucleic Acids. Microbiology Reviews 47: 621-669, 1983.

---

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## PLANETARY ENVIRONMENTS

- Banin\*, A. and Margulies, L. Simulation of Viking Biology Experiments Suggests Smectites Not Palagonites, as Martian Soil Analogues. Nature 305: 523-525, 1983.
- Craig, R.A., Reynolds, R.T., Ragent, B., Carle\*, G.C., Woeller\*, F., and Pollack\*, J.B. Sulfur Trioxide in the Lower Atmosphere of Venus?. Icarus 53: 1-9, 1983.
- DeVincenzi\*, D.L. Impact of Solar System Exploration on Theories of Chemical Evolution and the Origin of Life . In: Cosmochemistry and the Origin of Life (ed. by C. Ponnampertuma). Dordrecht, Holland: D. Reidel, p. 143-174, 1983.
- Kappen, L. and Friedmann\*, E.I. Ecophysiology of Lichens in the Dry Valleys of Southern Victoria Land, Antarctica II. CO<sub>2</sub> Gas Exchange in Cryptoendolithic Lichens. Polar Biology 1: 227-232, 1983.
- Valentin, J.R., Carle\*, G.C., and Phillips, J.B. Concentration Modulation by Thermal Decomposition for Multiplex Gas Chromatography. Journal of High Resolution Chromatography and Chromatography Communications 6: 621-622, 1983.

LIFE IN THE UNIVERSE

Irvine\*, W.M., Good, J.C., and Schloerb, F.P. Observations of SO<sub>2</sub> and HCS<sup>+</sup> in Cold Molecular Clouds. Astronomy and Astrophysics 127: L10-L13, 1983.

Pollack\*, J.B., Toon, O.B., Ackerman, T.P., McKay, C.P., and Turco, R.P. Environmental Effects of an Impact-Generated Dust Cloud: Implications for the Cretaceous-Tertiary Extinctions. Science 219: 287-289, 1983.

Raup\*, D.M. and Valentine\*, J.W. Multiple Origins of Life. Proceedings of the National Academy of Sciences USA 80: 2981-2984, 1983.

SEARCH FOR EXTRATERRESTRIAL LIFE

- Bowyer\*, S., Zeitlin, G., Tarter\*, J., Lampton, M., and Welch, W.J. The Berkeley Parasitic SETI Program. Icarus 53: 147-155, 1983.
- Cullers, K.<sup>1</sup> Data Averaging and the Normal Curve. AstroSEARCH 1(2): 13-14, 1983.
- Cullers, K.<sup>1</sup> Intergalactic Communication, or Altruism and the Selfish Gene. AstroSEARCH 1(3): 12-13, 1983.
- Cullers, K.<sup>1</sup> Extraterrestrial Signal Detection. AstroSEARCH 1(1): 12, 1983.
- Cullers, K.<sup>1</sup> What Signals?. AstroSEARCH 1(5): 9-10, 1983.
- Cullers, D.K., Oliver, B.M., Day, J.R., and Olsen, E.T.<sup>1</sup> Signal Recognition. In: SETI Science Working Group Report (ed. by F. Drake, J.H. Wolfe, and C.L. Seeger). Washington, D.C.: NASA, p. 49-65, 1983. (NASA Technical Paper 2244), 1983.
- Downs, G.S. and Gulkis\*, S. SETI Investigations at Jodrell Bank, England: September Through November 1983. In: TDA Progress Report 42-76. Pasadena, CA: Jet Propulsion Laboratory, NASA, p. 196-205, 1983.
- Drake, F.D.<sup>1</sup> Estimates of the Relative Probability of Success of the SETI Search Program. In: SETI Science Working Group Report (ed. by F. Drake, J.H. Wolfe, and C.L. Seeger). Washington, D.C.,: NASA, p. 67-69 (NASA Technical Paper 2244), 1983.
- Drake, F.D. and Davis, M.M.<sup>1</sup> Antenna Feeds for the Arecibo Telescope. In: SETI Science Working Group Report (ed. by F. Drake, J.H. Wolfe, and C.L. Seeger). Washington, D.C.: NASA, 110 p., 1983. (NASA Technical Paper 2244), 1983.
- Drake, F., Wolfe\*, J.H., and Seeger, C.L. (eds.). SETI Science Working Group Report. Washington, D.C.: NASA, 110 p. (NASA Technical Paper 2244), 1983.
- Gulkis\*, S. and Olsen, E.T. Gain Stability Measurements at S-Band and X-Band. In: TDA Progress Report 42-74. Pasadena, CA: Jet Propulsion Laboratory, NASA, p. 159-168, 1983.
- Gulkis\*, S., Olsen, E.T., and Klein\*, M.J. Uranus: Variability of the Microwave Spectrum. Science 221(4609): 453-455, 1983.

---

<sup>1</sup>J.H. Wolfe, Principal Investigator

- Gulkis\*, S. and Wolfe\*, J.H. The NASA SETI Program. The Planetary Report 3(2): 6-7, 1983.
- Knapp, G.R.<sup>1</sup> HI and H<sub>2</sub>O Surveys. In: SETI Science Working Group Report (ed. by F. Drake, J.H. Wolfe, and C.L. Seeger). Washington, D.C.: NASA, p. 85-86, 1983. (NASA Technical Paper 2244), 1983.
- Levitt, B.K.<sup>2</sup> SETI Pulse Detection Algorithm: Analysis of False-Alarm Rates. In: TDA Progress Report 42-74. Pasadena, CA: Jet Propulsion Laboratory, NASA, p. 149-158, 1983.
- Linscott, I.R.<sup>1</sup> Potential Use of SETI Instrumentation in Pulsar Radio Astronomy. In: SETI Science Working Group Report (ed. by F. Drake, J.H. Wolfe, and C.L. Seeger). Washington, D.C.: NASA, p. 87-90, 1983. (NASA Technical Paper 2244), 1983.
- Oliver, B.M.<sup>1</sup> Concepts Supporting Microwave Searches as the Preferred Approach to SETI. In: SETI Science Working Group Report (ed. by F. Drake, J.H. Wolfe, and C.L. Seeger). Washington, D.C.: NASA, p. 41-42, 1983. (NASA Technical Paper 2244), 1983.
- Olsen, E.T. and Lokshin, A.<sup>2</sup> The SETI Interpreter Program (SIP) --A Software Package for the SETI Field Tests. In: TDA Progress Report 42-74. Pasadena, CA: Jet Propulsion Laboratory, NASA, p. 169-182, 1983.
- Peterson\*, A.M. and Chen, K.S. The Multichannel Spectrum Analyzer. In: SETI Science Working Group Report (ed. by F. Drake, J.H. Wolfe, and C.L. Seeger). Washington, D.C.: NASA, p. 43-48, 1983. (NASA Technical Paper 2244), 1983.
- Seeger, C.L.<sup>1</sup> Selected SETI References and Reading List. In: SETI Science Working Group Report (ed. by F. Drake, J.H. Wolfe, and C.L. Seeger). Washington, D.C.: NASA, p. 101-110, 1983. (NASA Technical Paper 2244), 1983.
- Sullivan, W.T., III<sup>1</sup> Data Archives. In: SETI Science Working Group Report (ed. by F. Drake, J.H. Wolfe, and C.L. Seeger). Washington, D.C.: NASA, p. 77-78, 1983. (NASA Technical Paper 2244), 1983.
- Sullivan, W.T., III<sup>1</sup> The Radio Frequency Interference Problem. In: SETI Science Working Group Report (ed. by F. Drake, J.H. Wolfe, and C.L. Seeger). Washington, D.C.: NASA, p. 75-76, 1983. (NASA Technical Paper 2244), 1983.

---

<sup>1</sup>J.H. Wolfe, Principal Investigator  
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- Swanson, P.N., Gulkis\*, S., Kuiper, T.B.H., and Kiya, M. Large Deployable Reflector (LDR): A Concept for an Orbiting Submillimeter-infrared Telescope for the 1990s. Optical Engineering 22(6): 725-731, 1983.
- Tarter\*, J. The Search from Arecibo. The Planetary Report 3(2): 16, 18, 1983.
- Tarter\*, J. SETI and Serendipity. In: SETI Science Working Group Report (ed. by F. Drake, J.H. Wolfe, and C.L. Seeger). Washington, D.C.: NASA, p. 91-93, 1983. (NASA Technical Paper 2244), 1983.
- Tarter\*, J.C., Duquet, R.T., Clark, T.A., and Lesyna, L. Recent SETI Observations at Arecibo. Acta Astronautica 10: 277-282, 1983.
- Welch, W.J.<sup>1</sup> The Advantages of Coherent Telescope Arrays for SETI. In: SETI Science Working Group Report (ed. by F. Drake, J.H. Wolfe, and C.L. Seeger). Washington, D.C.: NASA, p. 95-98, 1983. (NASA Technical Paper 2244), 1983.
- Wolfe\*, J.H. They're Not Here Because They're Out There. AstroSEARCH 1(4): 6-9, 1983.
- Zuckerman, B.<sup>1</sup> On the Optimum Frequency for Interstellar Communications: Centimeter Versus Millimeter Versus Infrared Wavelengths. In: SETI Science Working Group Report (ed. by F. Drake, J.H. Wolfe, and C.L. Seeger). Washington, D.C.: NASA, p. 99-100, 1983. (NASA Technical Paper 2244), 1983.
- Zuckerman, B.<sup>1</sup> Spectral Line Studies Using SETI. In: SETI Science Working Group Report (ed. by F. Drake, J.H. Wolfe, and C.L. Seeger). Washington, D.C.: NASA, p. 79-83, 1983. (NASA Technical Paper 2244), 1983.

---

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PLANETARY PROTECTION

Huguenin\*, R.L., Miller, K.J., and Leschine, S.B. Mars: A Contamination Potential. Advances in Space Research 3(8): 35-38, 1983.

MISCELLANEOUS

Margulis\*, L., Neelson\*, K.H., and Taylor, I. (eds.). Planetary Biology and Microbial Ecology: Biochemistry of Carbon and Early Life. Washington, D.C.: NASA, 135 p., 1983 (NASA TM-86043) , 1983.

Strehler\*, B.L. Fundamental Mechanisms of Neuronal Aging. In: Brain Aging: Neuropathology and Neuropharmacology (ed. by J. Cervos-Navarro and H.-I. Sarkander). New York: Raven Press, p. 75-95, 1983.

Takano, C.T., Folsome\*, C.E., and Karl, D.M. ATP As A Biomass Indicator for Closed Ecosystems. Biosystems 16: 75-78, 1983.

Wier, P., Keynan, A., Halvorson\*, H.O., and Hamlett, N.V. Germination Requirements of an Aerobic Spore-forming Marine Bacterium. FEMS Microbiology Letters 20: 27-30, 1983.

## ABSTRACTS

### CHEMICAL EVOLUTION

- Albrizzio, J., Ponnampereuma\*, C., and Eirich\*, F. Possible Role of Clay as a Catalyst in the Polymerization of Biomolecules (Abstract). Biochemistry 22(15): 34A, 1983.
- Bunch\*, T.E. and Chang\*, S. Allende Dark Inclusions: Samples of Primitive Regoliths (Abstract). In: Abstracts, 14th Lunar and Planetary Science Conference, Houston, TX, March 14-18, 1983. Houston: Lunar and Planetary Institute, p. 75-76, 1983.
- Cherayil, B., Hobish, M.K., and Ponnampereuma\*, C. Structural Requirements for Associations between Mononucleotides and Dipeptides (Abstract). Biochemistry 22(15): 34A, 1983.
- Corigliano-Murphy, M.A., Liang, X., Ponnampereuma\*, C., Dalzoppo, D., Fontana, A., Kanmera, T., and Chaiken, I. Synthesis and Properties of an All-D Model Ribonuclease S-Peptide (Abstract). Biochemistry 22(15): 34A, 1983.
- Hartman\* H., Fegley, B., Prinn\*, R.G., and Lewis, J.S. Organic Molecules and Carbonaceous Chondrites (Abstract). In: Abstracts, 14th Lunar and Planetary Science Conference, Houston, TX, March 14-18, 1983. Houston: Lunar and Planetary Institute, p. 279-280, 1983.
- Hobish, M.K. and Ponnampereuma\*, C. Structural Requirements for Associations between Phenylalanine and Nucleotides Comprising Its Genetic Code Sequences (Abstract). Abstracts of Papers, American Chemical Society 186(Aug.-Sept.): Biol-152, 1983.
- Kobayashi, K. and Ponnampereuma\*, C. Significances of Trace Metals (Abstract). Abstracts of Papers, American Chemical Society 186(Aug.-Sept.): Geoc-45, 1983.
- Orgel\*, L.E. An RNA Polymerase Model (Abstract). Chemica Scripta 21: 85, 1983.
- Peltzer, E.T., Bada, J.L., Schlesinger, G., and Miller\*, S.L. The Chemical Conditions on the Parent Body of the Murchison Meteorite: Some Conclusions Based on Amino, Hydroxy and Dicarboxylic Acids (Abstract). Abstracts of Papers, American Chemical Society 186(Aug.-Sept.): Geoc-7, 1983.
- Ponnampereuma\*, C. Organic Compounds in Carbonaceous Chondrites (Abstract). Abstracts of Papers, American Chemical Society 186(Aug.-Sept.): Geoc-4, 1983.

Walters, C., Kotra, R.K., and Ponnampereuma\*, C. Dipeptides in the Murchison and Yamato Meteorites (Abstract). Abstracts of Papers, American Chemical Society 186(Aug.-Sept.): Geoc-11, 1983.

Wenqing, W., Kobayashi, K., and Ponnampereuma\*, C. Prebiotic Synthesis in a Mixture of Methane, Nitrogen, Water, and Phosphine (Abstract). Biochemistry 22(15): 34A, 1983.

Xun, L., Hobish, M.K., and Ponnampereuma\*, C. Chirality of Amino Acids Formed by Electric Discharge on a Model Primitive Earth Atmosphere (Abstract). Biochemistry 22(15): 34A, 1983.

#### ORGANIC GEOCHEMISTRY

Cronin\*, J.R., Pizzarello, S., and Yuen\*, G.U. Recent Analyses of Amino Acids in the Murchison Meteorite (Abstract). Abstracts of Papers, American Chemical Society 186(Aug.-Sept.): Geoc-5, 1983.

Engel, M.H., Okino, H., and Nagy\*, B. Evaluation of the Stereochemistry of Some Amino Acids in a Stone of the Murchison Meteorite (Abstract). Abstracts of Papers, American Chemical Society 186(Aug.-Sept.): Geoc-6, 1983.

Galarraga, F., Albrizzio, J., and Ponnampereuma\*, C. Analysis of Aliphatic Hydrocarbons from Trinidad and Venezuela (Abstract). Abstracts of Papers, American Chemical Society 186(Aug.-Sept.): Geoc-47, 1983.

Khare, B.H., Sagan\*, C., Arakawa, E.T., Ogino, H., Willingham, T.O., and Nagy\*, B. Amino Acid Analysis of Titan Tholins (Abstract). Bulletin of the American Astronomical Society 15: 843, 1983.

Kotra, R.K. and Ponnampereuma\*, C. The Organic Geochemistry of Three Antarctic Meteorites (Abstract). Abstracts of Papers, American Chemical Society 186(Aug.-Sept.): Geoc-10, 1983.

Lu-lin, H. and Ponnampereuma\*, C. A Sensitive Technique for the Analysis of Nucleic Acid Bases in Chesapeake Bay Sediments (Abstract). Abstracts of Papers, American Chemical Society 186(Aug.-Sept.): Geoc-35, 1983.

Yuen\*, G., Blair, N., Des Marais\*, D., Chang\*, S. Carbon Isotopic Composition of Individual, Low Molecular Weight Hydrocarbons and Monocarboxylic Acids from Murchison Meteorite (Abstract). In: Abstracts of Papers 14th Lunar and Planetary Science XIV Conference, Houston, TX, March 14-18, 1983. Houston: Lunar and Planetary Institute, p. 875-876, 1983.

## ORIGIN AND EVOLUTION OF LIFE

- Groma, G.I., Dancshazy, Zs., Keszthelyi, L., Helgerson, S.L., Wolber, P.K., Beece, D., and Stoeckenius\*, W. The Kinetics and Mechanism of Bacteriorhodopsin Photocycle Are Controlled by Membrane Potential (Abstract). Acta Biochimica et Biophysica Academiae Scientiarum Hungaricae 18: 77-78, 1983.
- Johnson, T.C., Cornwell, K.L., Buchanan\*, B.B., Matthews, W.R., Hartman\*, H., Biemann\*, K., and Holmgren, A. Thioredoxins from Photosynthetic Bacteria (Abstract). Federation Proceedings 42: 2175, 1983.
- Mercer-Smith\*, J.A. and Mauzerall, D.C. Photochemistry of Porphyrins: Models for the Origin of Photosynthesis (Abstract). Abstracts of Papers, American Chemical Society 185(Mar): Phys-32, 1983.
- Nordheim, A. and Rich\*, A. Formation of Left-Handed Z-DNA in the SV40 Nucleosome-Free Transcriptional Enhancer Region (Abstract). DNA 2(2): 167, 1983.
- Schobert, B. and Lanyi\*, J.K. Effects of Chloride and pH on the Chromophore and Photochemical Cycling of Halorhodopsin (Abstract). Biophysical Journal 41: 332A, 1983.
- Schomer, D.F., Winkler, D.G., Taylor, G.R., Marquina, N.E., and Fox\*, G.E. The Application of Digital Image Processing for the Automation of 16SrRNA Oligonucleotide Fingerprint Analysis (Abstract). Analytical and Quantitative Cytology 5(3): 219, 1983.
- Yopp\*, J.H., Tindall, D.R., Pavledes, R., and Krishnamani, M.R.S. Influence of Light and Buffer Type on Glycinebetaine and Amino Acid Synthesis During Osmoregulation in the Halotolerant Cyanobacterium, *Aphanothece Halophytica* (Abstract). Plant Physiology 72(1): 136, 1983.

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This work was performed under NASA Contract NASw-3165.

1. Report No. NASA TM-86653		2. Government Accession No.		3. Recipient's Catalog No.	
4. Title and Subtitle PUBLICATIONS OF THE EXOBIOLGY PROGRAM FOR 1983 - A SPECIAL BIBLIOGRAPHY				5. Report Date August 1984	
				6. Performing Organization Code	
7. Author(s) Linda G. Pleasant and Donald L. DeVincenzi, Compilers				8. Performing Organization Report No.	
				10. Work Unit No.	
9. Performing Organization Name and Address Science Communication Studies, DCESS The George Washington University Washington, DC 20036 and NASA Office of Space Science and Applications Washington, DC 20546				11. Contract or Grant No.  NASW-3165	
				13. Type of Report and Period Covered Technical Memorandum	
12. Sponsoring Agency Name and Address National Aeronautics and Space Administration Washington, DC 20546				14. Sponsoring Agency Code EBR	
				13. Type of Report and Period Covered Technical Memorandum	
15. Supplementary Notes Linda G. Pleasant: The George Washington University, Washington, D.C. Donald L. DeVincenzi: NASA Office of Space Science and Applications, Washington, D.C.  For previous bibliography in this series, see NASA TM-85837.					
16. Abstract  List of 1983 publications resulting from research pursued under the auspices of NASA's Exobiology Program.					
17. Key Words (Suggested by Author(s)) Chemical Evolution, Organic Geochemistry, Life Detection, Origin of Life, Exo- biology, Extraterrestrial Life, SETI, Planetary Protection, Bibliography			18. Distribution Statement  Unclassified - Unlimited  Subject Category 55		
19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No. of Pages 42	22. Price* A03		

**End of Document**