

CHEMICAL EVOLUTION AND THE ORIGIN OF LIFE

Bibliography Supplement 1977

Compiled by

LINDA G. PLEASANT

Science Communication Division, The George Washington University Medical Center, Washington, D.C., U.S.A.

and

CYRIL PONNAMPERUMA

Laboratory of Chemical Evolution, Chemistry Department, University of Maryland, College Park, MD, U.S.A.

This bibliography is the eighth annual supplement to the comprehensive bibliography on the same subject which was published in *Space Life Sci.* 2 (1970), 225–295; 3 (1972), 293–304; 4 (1973) 309–329 and in *Origins of Life* 5 (1974), 507–527; 6 (1975), 285–300; 7 (1976), 75–85; 8 (1977), 59–66; 9 (1978), 67–74.

- 3346 Abadi, H. and Wickramasinghe, N. C.: 1977, 'Pre-biotic Molecules in Martian Dust Clouds', *Nature* 267 (5613), 687–688.
- 3347 Abelson, P. H.: 1977, 'Voyager Missions', *Science* 197 (4308), 1039.
- 3348 Abt, H. A.: 1977, 'The Companions of Sunlike Stars', *Sci. Am.* 236 (4), 96–104.
- 3349 Adelson, H. E., Brown, F. S., and Gilje, R. I.: 1977, 'Looking for Life on Mars', *Quest* 1, 29–50.
- 3350 Anders, E. and Owen, T.: 1977, 'Mars and Earth: Origin and Abundance of Volatiles', *Science* 198(4316), 453–465.
- 3351 Anderson, D. L.: 1977, 'Formation and Composition of the Moon', in *The Soviet-American Conference on Cosmochemistry of the Moon and Planets, Part 2* (ed. by J. H. Pomeroy and N. J. Hubbard), NASA, Washington, D.C., pp. 823–845. Avail. NTIS: NASA-SP-370-Pt-2.
- 3352 Anderson, R., Kates, M., Baedeker, M. J., Kaplan, I. R., and Ackman, R. G.: 1977, 'The Stereoisomeric Composition of Phytanyl Chains in Lipids of Dead Sea Sediments', *Geochim. Cosmochim. Acta* 41(9), 1381–1390.
- 3353 Aono, H. and Yuasa, S.: 1977, 'Evolutionary Significance of the System Utilizing D-Amino Acid Enantiomers', *BioSystems* 9(2,3), 151–154.
- 3354 Argyle, E.: 1977, 'Chance and the Origin of Life', *Origins of Life* 8(4), 287–298.
- 3355 Armitage, J.: 1977, 'The Prospect of Astro-palaeontology', *J. Br. Interplanet. Soc.* 30, 466–469. IAA: A78–16231.
- 3356 Armstrong, D. W. and Fendler, J. H.: 1977, 'Differential Partitioning of tRNAs between Micellar and Aqueous Phases: A Convenient Gel Filtration Method for Separation of tRNAs', *Biochim. Biophys. Acta* 478(1), 75–80.
- 3357 Armstrong, D. W., Nome, F., Fendler, J. H., and Nagyvary, J.: 1977, 'Novel Prebiotic Systems: Nucleotide Oligomerization in Surfactant Entrapped Water Pools', *J. Mol. Evol.* 9(3), 213–223.
- 3358 Armstrong, D. W., Seguin, R., and Fendler, J. H.: 1977, 'Partitioning of Amino Acids and Nucleotides between Water and Micellar Hexadecyltrimethylammonium Halides: The Prebiotic Significance of Cationic Surfaces', *J. Mol. Evol.* 10(3), 241–250.

- 3359 Atreya, S. K., Donahue, T. M., and Kuhn, W. R.: 1977, 'The Distribution of Ammonia and Its Photochemical Products on Jupiter', *Icarus* 31(3), 348-355.
- 3360 Audouze, J., Lequeux, J., Rocca-Volmerange, B., and Vigroux, L.: 1977, 'Galactic Evolution of CNO Isotopes: The Case of ^{15}N ', in *CNO Isotopes in Astrophysics*, Proceedings of the General Assembly, Special Session, Grenoble, France, August 30, 1976 (ed. by J. Audouze), D. Reidel, Dordrecht, pp. 155-171. IAA: A77-42695.
- 3361 Awramik, S. M.: 1977, 'Paleobiology of Stromatolites', in *Chemical Evolution of the Early Precambrian*, Papers Presented at the Second College Park Colloquium on Chemical Evolution, University of Maryland, 1975 (ed. by C. Ponnampereuma), Academic Press, New York, pp. 111-131.
- 3362 Awramik, S. M. and Barghoorn, E. S.: 1977, 'The Gunflint Microbiota', *Precambrian Res.* 5(2), 121-142.
- 3363 Ayala, F. J.: 1977, 'Genetic Variation and Evolution', *Recherche* 8(81), 736-744. (French)
- 3364 Balch, W. E., Magrum, L. J., Fox, G. E., Wolfe, R. S., and Waese, C.: 1977, 'An Ancient Divergence among the Bacteria', *J. Mol. Evol.* 9(4), 305-311.
- 3365 Baltscheffsky, H.: 1977, 'Life - A Link in Cosmic Development', *Forsk. Framsteg.*, No. 7, 6-11. (Swedish) CA88: 17436m.
- 3366 Barghoorn, E. S.: 1977, 'Eoastrion and the Metallogenium Problem', in *Chemical Evolution of the Early Precambrian*, Papers Presented at the Second College Park Colloquium on Chemical Evolution, University of Maryland, 1975 (ed. by C. Ponnampereuma), Academic Press, New York, pp. 185-186.
- 3367 Barker, W. C. and Dayhoff, M. O.: 1977, 'Evolution of Lipoproteins Deduced from Protein Sequence Data', *Comp. Biochem. Physiol.* 57B(4), 309-315.
- 3368 Bar-Nun, A.: 1977, 'Shock Waves and the Origin of Life', *UTIAS Rev.* 41, 22 pp. CA87: 104498f.
- 3369 Barricelli, N. A.: 1977, 'On the Origin and Evolution of the Genetic Code. I. Wobbling and Its Potential Significance', *J. Theor. Biol.* 67(1), 85-109.
- 3370 Bayev, A. A.: 1977, 'Chemical Foundations of Life', in *Dktyabr'i Nauka*, Nauka Press, Moscow, pp. 417-435. (Russian) Library of Congress S & T Alert No. 4769.
- 3371 Beck, M. L.: 1977, 'Chemical Evolution and Regulation', *Kem.-Kemi.* 4(4), 121-124. CA87: 48940e.
- 3372 Belliveau, J. W. and Lanyi, J. K.: 1977, 'Analogies between Respiration and a Light-Driven Proton Pump as Sources of Energy for Active Glutamate Transport in *Halobacterium halobium*', *Arch. Biochem. Biophys.* 178(1), 308-314.
- 3373 Bettis, C., Bonnell, J., and Branch, D.: 1977, 'The Fraction of Solar-type Stars Having Stellar or Massive Nonstellar Companions', *Icarus* 32(4), 461-463.
- 3374 Biemann, K., Oro, J., Toulmin, P., 3rd, Origel, L. E., Nier, A. O., Anderson, D. M., Simmonds, P. G., Flory, D., Diaz, A. V., Rushneck, D. R., Biller, J. E., and Lafleur, A. L.: 1977, 'The Search for Organic Substances and Inorganic Volatile Compounds in the Surface of Mars', *J. Geophys. Res.* 82(28), 4641-4658.
- 3375 Binder, A. B., Arvidson, R. E., Guinness, E. A., Jones, K. L., Morris, E. C., Mutch, T. A., Pieri, D. C., and Sagan, C.: 1977, 'The Geology of the Viking Lander 1 Site', *J. Geophys. Res.* 82(28), 4439-4451.
- 3376 Black, D., Tarter, J., Cuzzi, J. N., Connors, M., and Clark, T. A.: 1977, 'Searching for Extraterrestrial Intelligence: The Ultimate Exploration', *Mercury* 6, 3-7.
- 3377 Blake, A. J. and Carver, J. H.: 1977, 'The Evolutionary Role of Atmospheric Ozone', *J. Atmos. Sci.* 34, 720-728.
- 3378 Bonner, W. A., Van Dort, M. A., Yearian, M. R., Zeman, H. D., and Li, G. C.: 1976/1977, 'Polarized Electrons and the Origin of Optical Activity', *Isr. J. Chem.* 15(1-2), 89-95.
- 3379 Boureau, E.: 1977, 'The Origin of Large Spheroids from the Precambrian of Mali', *C. R. Hebd. Seances Acad. Sci. Ser. D* 285(6), 645-648. (French)
- 3380 Brack, A.: 1977, ' β -Structures of Alternating Polypeptides and Their Possible Role in Chemical Evolution', *BioSystems* 9(2,3), 99-103.
- 3381 Bradley, F. D. and Young, R. S.: 1977, *Publications of the Planetary Biology Program for 1976: A Special Bibliography*, NASA, Washington, D.C. Avail. NTIS: NASA-TM-75017.

- 3382 Broda, E.: 1977, 'The Evolution of Photosynthesis', *Precambrian Res.* 4(2), 117–132.
- 3383 Broda, E.: 1977, 'The Length of the Transition Period from the Reducing to the Neutral Biosphere', *Origins of Life* 8(2), 87–90.
- 3384 Broda, E.: 1977, 'The Position of Nitrate Respiration in Evolution', (Reply to F. Egami), *Origins of Life* 8(2), 173–174.
- 3385 Brooke, S. and Fox, S.W.: 1977, 'Compartmentalization in Proteinoid Microspheres', *BioSystems* 9(1), 1–22.
- 3386 Brown, R. D.: 1977, 'Interstellar Molecules, Galactochemistry, and the Origin of Life', *Interdiscip. Sci. Rev.* 2(2), 124–139.
- 3387 Brush, S. G.: 1977, 'The Origin of the Planetesimal Theory', *Origins of Life* 8(1), 3–6.
- 3388 Buvet, R.: 1977, 'Compared Energetics of Primordial Life and Biological Metabolisms', *Origins of Life* 8(4), 361–370.
- 3389 Buvet, R.: 1977, 'A Simple Analogical Model for the Selection of Optical Activity and of the Most Efficient Catalysts in the Course of Molecular Evolution', *Origins of Life* 8(3), 267–270.
- 3390 Cairns-Smith, A. G.: 1977, 'Takeover Mechanisms and Early Biochemical Evolution', *BioSystems* 9(2,3), 105–109.
- 3391 Cassidy, W. A., Olsen, E., and Yanai, K.: 1977, 'Antarctica: A Deep-Freeze Storehouse for Meteorites', *Science* 198(4318), 727–731.
- 3392 Choughuley, A.S.U., Subbaraman, A. S., Kazi, Z. A., and Chadha, M. S.: 1977, 'A Possible Prebiotic Synthesis of Thymine: Uracil-Formaldehyde-Formic Acid Reaction', *BioSystems* 9(2,3), 73–80.
- 3393 Clutton-Brock, M.: 1977, 'Entropy Per Baryon in a "Many-Worlds" Cosmology', *Astrophys. Space Sci.* 47(2), 423–433.
- 3394 Coeckelenbergh, Y., Rein, R., and MacElroy, R. D.: 1977, 'Ames Interactive Molecular Model Building System: A 3-D Computer Modelling System Applied to the Study of the Origin of Life', *BioSystems* 9(2,3), 121–129.
- 3395 Combes, M., Maillard, J. P., and de Bergh, C.: 1977, 'Evidence for a Telluric Value of the $^{12}\text{C}/^{13}\text{C}$ Ratio in the Atmospheres of Jupiter and Saturn', *Astron. Astrophys.* 61(4), 531–537.
- 3396 Czégé, J. and Fajsz, Cs.: 1977, 'Remark on Models for Amplification of Asymmetry', *Origins of Life* 8(3), 271–275.
- 3397 Delano, J. W.: 1977, 'Constraints on the Composition and Chemical Evolution of the Earth's Moon', *Diss. Abstr. Int., B* 1977 38(4), 1609. Order No. 77–20,959.
- 3398 Delsemme, A. H. and Rud, D.: 1977, 'Low-temperature Condensates in Comets', in *Comets, Asteroids, Meteorites: Interrelations, Evolution and Origins*, Proceedings of the 39th International Colloquium, Lyons, France, August 17–20, 1976 (ed. by A. H. Delsemme), University of Toledo, Toledo, Ohio, pp. 529–535. IAA: A78–19818.
- 3399 Dickman, S. R.: 1977, 'Ribonucleotide Reduction and the Possible Role of Cobalamin in Evolution', *J. Mol. Evol.* 10(3), 251–260.
- 3400 Dobrovolskii, O. V., Matveev, I. N., and Kaimakov, E. A.: 1977, 'Molecules of the Interstellar Medium and Cometary Nuclei', *Komety i Meteory*, No. 26, 3–8. (Russian)
- 3401 Dobzhansky, T., Ayala, F. J., Stebbins, G. L., and Valentine, J. W.: 1977, *Evolution*, Freeman, San Francisco.
- 3402 Draganić, I., Draganić, Z., Shimoyama, A., and Ponnampereuma, C.: 1977, 'Evidence of Amino Acids in Hydrolysates of Compounds Formed by Ionizing Radiations. II. Aqueous Solutions of CH_3CN and $\text{C}_2\text{H}_5\text{CN}$ ', *Origins of Life* 8(4), 377–382.
- 3403 Draganic, I. G., Draganic, Z. D., Jovanovic, S., and Ribnikar, S.V.: 1977, 'Infrared Spectral Characterization of Peptidic Material Produced by Ionizing Radiation in Aqueous Cyanides', *J. Mol. Evol.* 10(2), 103–109.
- 3404 Draganić, Z., Draganić, I., Shimoyama, A., and Ponnampereuma, C.: 1977, 'Evidence for Amino Acids in Hydrolysates of Compounds Formed by Ionizing Radiations. I. Aqueous Solutions of HCN , NH_4CN , and NaCN ', *Origins of Life* 8(4), 371–376.
- 3405 Duley, W. W. and McCullough, J. D.: 1977, 'Surface Activity of Interstellar Grains: Adsorbed Molecular Ions and the Diffuse Interstellar Bands', *Astrophys. J.* 211(3, Pt. 2), L145-L148.
- 3406 Edelson, E. H.: 1977, 'The Possible Role of Hydrogen Cyanide in Chemical Evolution', *Diss. Abstr. Int., B* 1978 39(2), 747. Order No. 7811531.

- 3407 Egami, F.: 1977, 'Anaerobic Respiration and Photoautotrophy in the Evolution of Prokaryotes', (Reply to E. Broda), *Origins of Life* 8(2), 169–171.
- 3408 Eglinton, G. and Maxwell, J. R.: 1977, 'Mars: Questions and Answers from Viking', *Nature* 265(5594), 493–494.
- 3409 Ehler, K. W., Girard, E., and Orgel, L. E.: 1977, 'Reactions of Poly-functional Amino Acids with *N,N'*-Carbonyldiimidazole in Aqueous Solution – Oligopeptide Formation', *Biochim. Biophys. Acta* 491, 253–264.
- 3410 Eichberg, J., Sherwood, E., Epps, D. E., and Oro, J.: 1977, 'Cyanamide Mediated Syntheses under Plausible Primitive Earth Conditions. IV. The Synthesis of Acylglycerols', *J. Mol. Evol.* 10(3), 221–230.
- 3411 Eigen, M. and Schuster, P.: 1977, 'The Hypercycle. A Principle of Natural Self-Organization. Part A: Emergence of the Hypercycle', *Naturwissenschaften* 64(11), 541–565.
- 3412 Encrenaz, T. and Combes, M.: 1977, 'The Far Infrared Spectrum of Saturn: Observability of PH₃ and NH₃', *Astron. Astrophys.* 61(3), 387–390.
- 3413 Erhan, S.: 1977, 'Origins of the First Cell, a New Model for the Spontaneous Formation of the First Living Cell Based on a Novel Approach', *Z. Naturforsch. C: Biosci.* 32(11), 1003–1010.
- 3414 Evreinova, T. N., Mel'nikova, E. V., Allakhverdov, B. L., and Karnaukhov, V. N.: 1977, 'Coexistence of Coacervate Systems with Different Chemical Composition', *Zh. Evol. Biokhim. Fiziol.* 13(3), 330–335. (Russian) CA87: 64371a.
- 3415 Fahey, R. C., Hunt, J. S., and Windham, G. C.: 1977, 'On the Cysteine and Cystine Content of Proteins: Differences between Intracellular and Extracellular Proteins', *J. Mol. Evol.* 10(2), 155–160.
- 3416 Fajsz, Cs. and Czégé, J.: 1977, 'β-Decay and the Origin of Optical Purity', *Origins of Life* 8(3), 277–281.
- 3417 Fang, T. C. and Kiang, N. N.: 1977, 'On the Properties of Life – A Criticism of Monod's Chance and Necessity', *Sci. Sin.* 20(3), 280–286.
- 3418 Farley, J.: 1977, *The Spontaneous Generation Controversy from Descartes to Oparin*, Johns Hopkins University Press, Baltimore.
- 3419 Ferrara, L., Andini, S., and Temussi, P. A.: 1977, 'Correlation between Prebiotic Amino Acid Compositions and Contemporary Proteins', *J. Theor. Biol.* 67(2), 241–254.
- 3420 Ferris, J. P., Joshi, P. C., and Lawless, J. G.: 1977, 'Chemical Evolution. XXIX. Pyrimidines from Hydrogen Cyanide', *BioSystems* 9(2,3), 81–86.
- 3421 Ferris, J. P., Nakagawa, C., and Chen, C. T.: 1977, 'Photochemical Synthesis of Organic Compounds on Jupiter Initiated by the Photolysis of Ammonia', in *Life Sciences and Space Research, Volume XV*. Proceedings of the Open Meeting of the Working Group on Space Biology of the 19th Plenary Meeting of COSPAR, Philadelphia, Pennsylvania, June 8–19, 1976 (ed. by R. Holmquist), Pergamon Press, New York, pp. 95–99.
- 3422 Finkelstein, A. V.: 1977, 'Did the Primitive Ribosomal RNA Code Primitive Ribosomal Protein?', *FEBS Lett.* 82(2), 169–171.
- 3423 Flores, J. J., Bonner, W. A., and Massey, G. A.: 1977, 'Asymmetric Photolysis of (*RS*)-Leucine with Circularly Polarized Ultraviolet Light', *J. Am. Chem. Soc.* 99(11), 3622–3625.
- 3424 Flores, J. J., Bonner, W. A., and Van Dort, M. A.: 1977, 'The Gas Chromatographic Resolution of DL-Isovaline', *J. Chromatogr.* 132(1), 152–154.
- 3425 Folsome, C.: 1977, 'The Permuted Generator Hypothesis for the Origin of a Genetic Code', *Origins of Life* 8(4), 391–392.
- 3426 Folsome, C.: 1977, 'Reply [Concerning the Role of Organic Microstructures and the Origin of Cellular Life]', *Naturwissenschaften* 64(7), 381.
- 3427 Folsome, C.: 1977, 'Synthetic Organic Microstructures as Model Systems for Early Protobionts', in *Chemical Evolution of the Early Precambrian*, Papers Presented at the Second College Park Colloquium on Chemical Evolution, University of Maryland, 1975 (ed. by C. Ponnamperuma), Academic Press, New York, pp. 171–179.
- 3428 Fox, G. E., Magrum, L. J., Balch, W. E., Wolfe, R. S., and Woese, C. R.: 1977, 'Classification of Methanogenic Bacteria by 16S Ribosomal RNA Characterization', *Proc. Natl. Acad. Sci. U.S.A.* 74(10), 4537–4541.
- 3429 Fox, G. E., Pechman, K. R., and Woese, C. R.: 1977, 'Comparative Cataloging of 16S Ribosomal Ribonucleic Acid: Molecular Approach to Prokaryotic Systematics', *Int. J. Syst. Bacteriol.* 27(1), 44–57.

- 3430 Fox, S. W.: 1977, 'Bioorganic Chemistry and the Emergence of the First Cell', in *Bioorganic Chemistry. Volume III: Macro- and Multimolecular Systems* (ed. by E. E. van Tamelen), Academic Press, New York, pp. 21–32.
- 3431 Fox, S. W.: 1977, 'Organic Microstructures and Terrestrial Protocells', *Naturwissenschaften* 64(7), 380.
- 3432 Fox, S. W. and Dose, K.: 1977, *Molecular Evolution and the Origin of Life* (Revised edition), Marcel Dekker, New York.
- 3433 Francis, S., Margulis, L., Caldwell, W., and Barghoorn, E. S.: 1977, 'Comparison of Laboratory Silicified Blue-Green Algae with Precambrian Microorganisms', in *Chemical Evolution of the Early Precambrian*, Papers Presented at the Second College Park Colloquium on Chemical Evolution, University of Maryland, 1975 (ed. by C. Ponnampuruma), Academic Press, New York, pp. 181–183.
- 3434 Fripiat, J. J.: 1977, 'Molecular Organization on Clay Surfaces and Their Possible Role in Biogenesis', *Proc. Eur. Clay Conf.* 3, 197–214. CA90: 12664.
- 3435 Gabel, N. W.: 1977, 'Chemical Evolution: A Terrestrial Reassessment', *Prog. Mol. Subcell. Biol.* 5, 145–172. CA87: 64129c.
- 3436 Gancarz, A. J. and Wasserburg, G. J.: 1977, 'Initial Pb of Amitsoq Gneiss, West Greenland, and Implications for Age of the Earth', *Geochim. Cosmochim. Acta* 41(9), 1283–1301.
- 3437 Garduno, R., Rein, R., Egan, J. T., Coeckelenbergh, Y., and MacElroy, R. D.: 1977, 'Purine-Purine Base Pairs and the Origin of Transversion Type Mutations', *Int. J. Quantum Chem. Symp.* 4, 197–204.
- 3438 Geisler, W.: 1977, 'Communication with Extraterrestrial Civilizations. II', *Astronautyka* 20(20), 17–21. (Polish) IAA: A78–27552.
- 3439 Giese, R. H.: 1977, 'Interpretation of the Optical Properties of Interplanetary Dust', *J. Geophys.* 42(6), 705–716.
- 3440 Glass, I. I.: 1977, 'Terrestrial and Cosmic Shock Waves', *Am. Sci.* 65(4), 473–481.
- 3441 Goel, N. S. and Islam, S.: 1977, 'Error Catastrophe in and the Evolution of the Protein Synthesizing Machinery', *J. Theor. Biol.* 68(2), 167–182.
- 3442 Gokhlerner, G. B.: 1977, 'Development of Aerobic Life and the Problems of Cellular Evolution', *Priroda* (Moscow), No. 6, 47–57. (Russian)
- 3443 Goldanskii, V. I.: 1977, 'Interstellar Grains as Possible Cold Seeds of Life', *Nature* 269(5629), 583–584.
- 3444 Goldanskii, V. I.: 1977, 'Mechanism for Formaldehyde Polymer Formation in Interstellar Space', *Nature* 268(5621), 612–613.
- 3445 Goldanskii, V. I.: 1977, 'On the Mechanism of Formaldehyde Polymer Formation in the Interstellar Space', *Dokl. Akad. Nauk SSSR* 235(5), 1053–1055. (Russian)
- 3446 Gol'dovskii, D. Iu.: 1977, 'The Search for Life on Mars', *Zemlya i Vseleennaya*, No. 3, 22–25. (Russian)
- 3447 Golubic, S. and Barghoorn, E. S.: 1977, 'Interpretation of Microbial Fossils with Special Reference to the Precambrian', in *Fossil Algae: Recent Results and Developments* (ed. by E. Flügel), Springer-Verlag, New York, pp. 1–14.
- 3448 Gore, R.: 1977, 'Sifting for Life in the Sands of Mars', *Natl. Geog. Mag.* 151(1), 9–31.
- 3449 Grassé, P.-P.: 1977, *Evolution of Living Organisms*, Academic Press, New York.
- 3450 Greenberg, J. M.: 1977, 'From Dust to Comets', in *Comets, Asteroids, Meteorites: Interrelations, Evolution and Origins*, Proceedings of the 39th International Colloquium, Lyons, France, August 17–20, 1976 (ed. by A. H. Delsemme), University of Toledo, Toledo, Ohio, pp. 491–497. IAA: A78–19813.
- 3451 Griffith, E. J.: 1977, 'Condensed Phosphates from Abiotic Systems in Nature', in *Chemical Evolution of the Early Precambrian*, Papers Presented at the Second College Park Colloquium on Chemical Evolution, University of Maryland, 1975 (ed. by C. Ponnampuruma), Academic Press, New York, pp. 61–67.
- 3452 Griffith, E. J., Ponnampuruma, C., and Gabel, N. W.: 1977, 'Phosphorus, A Key to Life on the Primitive Earth', *Origins of Life* 8(2), 71–85.
- 3453 Gringauz, K. I., Bezrukikh, V. V., Breus, T. K., Verigin, M. I., and Remizov, A. P.: 1977, 'The Magnetic Field of Mars Estimated from the Data of Plasma Measurements by Soviet Artificial Satellites of Mars', in *The Soviet-American Conference on Cosmochemistry of the Moon and*

- Planets, Part 2* (ed. by J. H. Pomeroy and N. J. Hubbard), NASA, Washington, D.C., pp. 859–863. Avail. NTIS: NASA-SP-370-Pt-2.
- 3454 Grossman, L.: 1977, 'Chemical Fractionation in the Solar Nebula', in *The Soviet-American Conference on Cosmochemistry of the Moon and Planets, Part 2* (ed. by J. H. Pomeroy and N. J. Hubbard), NASA, Washington, D.C., pp. 787–796. Avail. NTIS: NASA-SP-370-Pt-2.
- 3455 Gualtieri, D. M.: 1977, 'Trace Elements and the Panspermia Hypotheses', *Icarus* 30(1), 234–238.
- 3456 Hainebach, K. L. and Schramm, D. N.: 1977, 'Comments on Galactic Evolution and Nucleocosmochronology', *Astrophys. J.* 212(2, Pt. 1), 347–359.
- 3457 Hall, D. O., Lumsden, J., and Tel-Or, E.: 1977, 'Iron-Sulfur Proteins and Superoxide Dismutases in the Evolution of Photosynthetic Bacteria and Algae', in *Chemical Evolution of the Early Precambrian*, Papers Presented at the Second College Park Colloquium on Chemical Evolution, University of Maryland, 1975 (ed. by C. Ponnampereuma), Academic Press, New York, pp. 191–210.
- 3458 Hanel, R., Conrath, B., Gautier, D., Gierasch, P., Kumar, S., Kunde, V., Lowman, P., Maguire, W., Pearl, J., Pirraglia, J., Ponnampereuma, C., and Samuelson, R.: 1977, 'The Voyager Infrared Spectroscopy and Radiometry Investigation', *Space Sci. Rev.* 21(2), 129–157.
- 3459 Harada, K. and Suzuki, S.: 1977, 'Formation of Amino Acids from Ammonium Bicarbonate or Ammonium Formate by Contact Glow-Discharge Electrolysis', *Naturwissenschaften* 64(9), 484.
- 3460 Harada, K. and Suzuki, S.: 1977, 'Formation of Amino Acids from Elemental Carbon by Contact Glow Discharge Electrolysis', *Nature* 266(5599), 275–276.
- 3461 Hargreaves, W. R., Mulvihill, S. J., and Deamer, D. W.: 1977, 'Synthesis of Phospholipids and Membranes in Prebiotic Conditions', *Nature* 266(5597), 78–80.
- 3462 Hatanaka, H. and Egami, F.: 1977, 'The Formation of Amino Acids and Related Oligomers from Formaldehyde and Hydroxylamine in Modified Sea Mediums Related to Prebiotic Conditions', *Bull. Chem. Soc. Jpn.* 50(5), 1147–1156.
- 3463 Hauser, H., Howell, K., and Phillips, M. C.: 1977, 'Comparison of the Effects of Inorganic and Organic (Hydrophobic) Cations on the Physical States of Proteins and Phospholipid Bilayer Membranes', *FEBS Letters* 80(2), 355–359.
- 3464 Hawkes, G. E., Randall, E. W., and Hull, W. E.: 1977, 'Natural Abundance Nitrogen-15 Nuclear Magnetic Resonance Spectroscopy. The Pyrimidine and Purine Nucleosides', *J. Chem. Soc. Perkin Trans. II*, No. 10, 1268–1275.
- 3465 Hayatsu, R., Matsuoka, S., Scott, R. G., Studier, M. H., and Anders, E.: 1977, 'Origin of Organic Matter in the Early Solar System. VII. The Organic Polymer in Carbonaceous Chondrites', *Geochim. Cosmochim. Acta* 41(9), 1325–1339.
- 3466 Henderson, J. B.: 1977, 'Archean Geology and Evidence of Ancient Life in the Slave Structural Province, Canada', in *Chemical Evolution of the Early Precambrian*, Papers Presented at the Second College Park Colloquium on Chemical Evolution, University of Maryland, 1975 (ed. by C. Ponnampereuma), Academic Press, New York, pp. 41–54.
- 3467 Hoering, T. C.: 1977, 'The Stable Isotopes of Hydrogen in Precambrian Organic Matter', in *Chemical Evolution of the Early Precambrian*, Papers Presented at the Second College Park Colloquium on Chemical Evolution, University of Maryland, 1975 (ed. by C. Ponnampereuma), Academic Press, New York, pp. 81–86.
- 3468 Hohlfield, R. G. and Terzian, Y.: 1977, 'Multiple Stars and the Number of Habitable Planets in the Galaxy', *Icarus* 30(3), 598–600.
- 3469 Holzer, G. and Oro, J.: 1977, 'Pyrolysis of Organic Compounds in the Presence of Ammonia. The Viking Mars Lander Site Alteration Experiment', *Org. Geochem.* 1(1), 37–52.
- 3470 Hönl, H.: 1977, 'Some Considerations on the Thermodynamics of the Universe', *Gen. Relat. Grav.* 8(8), 647–654.
- 3471 Horneck, G.: 1977, 'Radiobiological Problems of Exobiology', in *Life-Sciences Research in Space*, Proceedings of a Symposium, Cologne, May 24–26, 1977 (ed. by W. R. Burke and T. D. Guyenne), European Space Agency, Paris, pp. 279–284. Avail. NTIS: ESA-SP-130.
- 3472 Horowitz, N. H.: 1977, 'The Search for Life on Mars', *Sci. Am.* 237(5), 52–61.
- 3473 Horowitz, N. H., Hobby, G. L., and Hubbard, J. S.: 1977, 'Viking on Mars: The Carbon Assimilation Experiments', *J. Geophys. Res.* 82(28), 4659–4662.

- 3474 Hoyle, F. and Wickramasinghe, C.: 1977, 'Does Epidemic Disease Come from Space?', *New Sci.* 76(1078), 402–404.
- 3475 Hoyle, F. and Wickramasinghe, N. C.: 1977, 'Polysaccharides and Infrared Spectra of Galactic Sources', *Nature* 268(5621), 610–612.
- 3476 Hoyle, F. and Wickramasinghe, N. C.: 1977, 'Prebiotic Molecules and Interstellar Grain Clumps', *Nature* 266(5599), 241–243.
- 3477 Hurst, R., Farhat, J., and Wetherill, G.: 1977, 'Very Old (>3100 Million Years) Rocks in North America', in *Chemical Evolution of the Early Precambrian*, Papers presented at the Second College Park Colloquium on Chemical Evolution, University of Maryland, 1975 (ed. by C. Ponnampuruma), Academic Press, New York, pp. 25–26.
- 3478 Iglesias, E.: 1977, 'The Chemical Evolution of Molecular Clouds', *Astrophys. J.* 218(3, Pt. 1), 697–715.
- 3479 Ilczuk, Z.: 1977, 'Aspects of Terrestrial and Extraterrestrial Biogenesis', *Postepy Astronaut.* 10(1), 27–42. (Polish) IAA: A77–38896.
- 3480 Il'nitskii, A. P., Gvildis, V.Iu., Mishchenko, V. S., and Shabad, L. M.: 1977, 'The Role of Volcanoes in Forming the Natural Level of Carcinogenic Substances', *Dokl. Akad. Nauk. SSSR* 234(3), 717–719. (Russian)
- 3481 Imshenetskii, A. A. and Murzakov, B. G.: 1977, 'Search for Life on Mars', *Mikrobiologiya* 46(6), 1103–1113. (Russian) English translation available from NTIS: NASA-TM-75519.
- 3482 Imshenetskii, A. A., Pisarenko, N. F., Kuziurina, L. A., and Iakshina, V. M.: 1977, 'Physiology of Xerophytic Microorganisms Growing under Martian Conditions', in *Life Sciences and Space Research, Volume XV*, Proceedings of the Open Meeting of the Working Group on Space Biology of the 19th Plenary Meeting of COSPAR, Philadelphia, Pennsylvania, June 8–19, 1976 (ed. by R. Holmquist), Pergamon Press, New York, pp. 47–52.
- 3483 Ingmanson, D. E. and Dowler, M. J.: 1977, 'Chemical Evolution and the Evolution of the Earth's Crust', *Origins of Life* 8(3), 221–224.
- 3484 Isaacman, R. and Sagan, C.: 1977, 'Computer Simulations of Planetary Accretion Dynamics: Sensitivity to Initial Conditions', *Icarus* 31(4), 510–533.
- 3485 Ishigami, M., Nagano, K., and Tonotsuka, N.: 1977, 'The Origin of the Protein Synthesis Mechanism', *BioSystems* 9(4), 229–243.
- 3486 Ishikawa, H.: 1977, 'Minireview: Evolution of Ribosomal RNA', *Comp. Biochem. Phys.* 58 B(1), 1–7.
- 3487 Ivanov, Ch. and Slavcheva, N.: 1977, 'A Study on the Alkylamines, Obtained on Heating Glycine under Possible Primitive Earth Conditions', *Dokl. Bolg. Akad. Nauk.* 30, 727–730. CA: 87–147354y.
- 3488 Ivanov, Ch.P. and Slavcheva, N. N.: 1977, 'Formation of Amino Acids on Heating Glycine with Alumina', *Origins of Life*, 8(1), 13–19.
- 3489 Jastrow, R.: 1977, *Until the Sun Dies*, W. W. Norton, New York.
- 3490 Johnson, R. D.: 1977, 'Organic Chemistry in Space', *Chemistry* 50, 17–22.
- 3491 Jukes, T. H.: 1977, 'The Amino Acid Code', in *Comprehensive Biochemistry, Volume 24: Biological Information Transfer* (ed. by M. Florkin, A. Neuberger, and L. L. M. Van Deenan), Elsevier/North-Holland, Amsterdam, pp. 235–293.
- 3492 Jukes, T. H.: 1977, 'Evolution and Back-Contamination', in *Life Sciences and Space Research, Volume XV*, Proceedings of the Open Meeting of the Working Group on Space Biology of the 19th Plenary Meeting of COSPAR, Philadelphia, Pennsylvania, June 8–19, 1976 (ed. by R. Holmquist), Pergamon Press, New York, pp. 9–14.
- 3493 Jukes, T. H.: 1977, 'How Many Anticodons?', *Science* 198(4314), 319–320.
- 3494 Jukes, T. H.: 1977, 'Nearest-Neighbor Doublets in Protein-Coding Regions of MS2 RNA', *J. Mol. Evol.* 9(3), 299–303.
- 3495 Jurka, J. W.: 1977, 'On Replication of Nucleic Acids in Relation to the Evolution of the Genetic Code and of Proteins', *J. Theor. Biol.* 68(4), 515–520.
- 3496 Kalinischenko, V. I., Bondarev, V. B., Gerasimov, M. V., Mukhin, L. M., and Safonova, Ye.N.: 1977, 'Synthesis of Organic Compounds under Conditions Simulating the Jovian Atmosphere', *Dokl. Akad. Nauk SSSR* 236(1), 245–248. (Russian)
- 3497 Kaneda, T.: 1977, 'Fatty Acids of the Genus *Bacillus*: An Example of Branched-Chain Preference', *Bacteriol. Rev.* 41(2), 391–418.

- 3498 Kaplan, R. W.: 1977, 'Life's Origins, Single Happenstance or Controlled Events', *Naturwiss. Rundsch.* 30(6), 197–209. (German) CA87: 113168a.
- 3499 Kaplan, R. W.: 1977, 'Multi-hit Theory of the Origin of Life: Problems of Growth Rate of Protobionts and of Speed of Earliest Evolution. II', *Z. Allg. Mikrobiol.* 17(1), 11–27.
- 3500 Kaplan, R. W.: 1977, 'Multi-hit Theory of the Origin of Life: Problems of Growth Rate of Protobionts and of Speed of Earliest Evolution. III', *Z. Allg. Mikrobiol.* 17(2), 99–108.
- 3501 Karkhanis, S. N.: 1977, 'Synthesis of Abiogenic Graphite under Precambrian Conditions', *J. Geol. Soc. India* 18, 97–103.
- 3502 Kavasmaneck, P. R. and Bonner, W. A.: 1977, 'Adsorption of Amino Acid Derivatives of *d*- and *l*-Quartz', *J. Am. Chem. Soc.* 99(1), 44–50.
- 3503 Kawashiro, K., Morimoto, S., Yoshida, H., and Sugiura, K.: 1977, 'The Synthesis and Chromatography of Peptide Nitriles', *Origins of Life* 8(4), 347–353.
- 3504 Kelly, W. R. and Larimer, J. W.: 1977, 'Chemical Fractionations in Meteorites. VIII. Iron Meteorites and the Cosmochemical History of the Metal Phase', *Geochim. Cosmochim. Acta* 41(1), 93–111.
- 3505 Kelly, W. R., Larimer, J. W., and Rambaldi, E. R.: 1977, 'The Origin of Iron Meteorites', in *Comets, Asteroids, Meteorites: Interrelations, Evolution and Origins*, Proceedings of the 39th International Colloquium, Lyons, France, August 17–20, 1976 (ed. by A. H. Delsemme), University of Toledo, Toledo, Ohio, pp. 405–413. IAA: A78–19803.
- 3506 Keszthelyi, L.: 1977, 'Origin of the Asymmetry of Biomolecules and Weak Interaction', *Origins of Life* 8(4), 299–340.
- 3507 Khan, N. A.: 1977, *Molecular Oxygen Interactions and Oxygenation in Initiation, Propagation, and Termination of Molecular Reactions and Life Processes with Chemistry and Physics in Biochemistry Behind Evolution, Irrespective of Different Disciplines of Knowledge*, BCSIR Lab Chittagong, Dacca, Bangladesh. (Research Bulletin No. 12)
- 3508 Khare, B. N. and Sagan, C.: 1977, 'On the Temperature Dependence of Possible S₈ Infrared Bands in Planetary Atmospheres', *Icarus* 30(1), 231–233.
- 3509 Khenokh, M. A. and Nikolaeva, M. V.: 1977, 'Abiogenic Photochemical Synthesis of Amino Acids in an Aqueous Medium Containing Carbohydrates and Nitrates', *Zh. Evol. Biokhim. Fiziol.* 13, 105–110. (Russian)
- 3510 Khenokh, M. A. and Nikolaeva, M. V.: 1977, 'Photochemical Synthesis of Amino Acids in Hydrosphere Containing Carbohydrates and Nitrates', *Stud. Biophys.* 63(1), 107. (Russian)
- 3511 King, G. A. M.: 1977, 'Symbiosis and the Evolution of Prokaryotes', *BioSystems* 9(1), 35–42.
- 3512 King, G. A. M.: 1977, 'Symbiosis and the Origin of Life', *Origins of Life*, 8(1), 39–53.
- 3513 Klein, H. P.: 1977, 'The Viking Biological Investigation: General Aspects', *J. Geophys. Res.* 82(28), 4677–4680.
- 3514 Klein, H. P.: 1977, 'Where Are We in the Search for Life on Mars?', *J. Astron. Soc. Pacific* 6(2), 2–6.
- 3515 Knacke, R. F.: 1977, 'Carbonaceous Compounds in Interstellar Dust', *Nature* 269(5624), 132–133.
- 3516 Kolesnikov, M. P. and Egorov, I. A.: 'Chlorophyll Derivatives in Recent Soils in Connection with the Problem of the Chemical Evolution and the Origin of Life on Earth', *Dokl. Akad. Nauk SSSR* 235(1), 228–231. (Russian)
- 3517 Kolesnikov, M. P. and Egorov, I. A.: 1977, 'Porphyrins and Phycobilins in Precambrian Rocks', *Origins of Life* 8(4), 383–390.
- 3518 Kosiur, D. R.: 1977, 'Porphyrin Adsorption by Clay Minerals', *Clays Clay Miner.* 25(5), 365–371.
- 3519 Krasovskii, N. N.: 1977, 'Differential Evolutionary Systems', *Prikl. Mat. Mekh.* 41, 774–782. (Russian)
- 3520 Kudrina, E. V.: 1977, 'Inevitability and Randomness in the Origin of Life on Earth', in *Metodologicheskiye Problemy Sovremennoy Nauki*, Yaroslavl' State University Press, Yaroslavl', pp. 61–71. (Russian) Library of Congress S & T Alert No. 5225.
- 3521 Kuhn, W. R., Atreya, S. K., and Chang, S.: 1977, 'The Distribution of Methylamine in the Jovian Atmosphere', *Geophys. Res. Lett.* 4(5), 203–206.

- 3522 Kuiper, T. B. H. and Morris, M.: 1977, 'Searching for Extraterrestrial Civilizations', *Science* 196(4290), 616–621.
- 3523 Kumar, S. S.: 1977, 'On the Origin and Evolution of Jupiter and Saturn', *Astrophys. Space Sci.* 49(2), L17-L19.
- 3524 Kuskov, O. L. and Khitarov, N. I.: 1977, 'The Chemical Composition of the Cores of the Terrestrial Planets and the Moon', in *The Soviet-American Conference on Cosmochemistry of the Moon and Planets, Part I* (ed. by J. H. Pomeroy and N. J. Hubbard), NASA, Washington, D.C., pp. 231–242. Avail. NTIS: NASA-SP-370-Pt-1.
- 3525 Lacey, J. C., Jr. and Weber, A. C.: 1977, 'Genetic Coding and Protein Synthesis: Concerted Evolution', *Precambrian Res.* 5(1), 1–22.
- 3526 Lanyi, J. K.: 1977, 'Transport in *Halobacterium halobium*: Light-Induced Cation-Gradients, Amino Acid Transport Kinetics, and Properties of Transport Carriers', *J. Supramol. Struct.* 6(2), 169–177.
- 3527 Large, R. R.: 1977, 'Chemical Evolution and Zonation of Massive Sulfide Deposits in Volcanic Terrains', *Econ. Geol. Bull. Soc. Econ. Geol.* 72(4), 549–572.
- 3528 Levin, G. V. and Straat, P. A.: 1977, 'Life on Mars? The Viking Labeled Release Experiment', *BioSystems* 9(2,3), 165–174.
- 3529 Levin, G. V. and Strat, P. A.: 1977, 'Recent Results from the Viking Labeled Release Experiment on Mars', *J. Geophys. Res.* 82(28), 4663-4667.
- 3530 Levine, J. S., Kraemer, D. R., and Kuhn, W. R.: 1977, 'Solar Radiation Incident on Mars and the Outer Planets: Latitudinal, Seasonal, and Atmospheric Effects', *Icarus* 31(1), 136–145.
- 3531 Levinthal, E. C., Jones, K. L., Fox, P., and Sagan, C.: 1977, 'Lander Imaging as a Detector of Life on Mars', *J. Geophys. Res.* 82(28), 4468–4478.
- 3532 Lohrmann, R.: 1977, 'Formation of Nucleoside 5'-Phosphoramidates under Potentially Prebiological Conditions', *J. Mol. Evol.* 10(2), 137–154.
- 3533 Lowe, D. R. and Knauth, L. P.: 1977, 'Sedimentology of the Onverwacht Group (3.4 Billion Years), Transvaal, South Africa, and Its Bearing on the Characteristics and Evolution of the Early Earth', *J. Geol.* 85(6), 699–723.
- 3534 Lu, T.-S.: 1977, 'The Origin of Biological Macromolecules on the Earth. The Hypothesis of Inorganic Template', *Kexue Tongbau* 21(3), 112–119. (Chinese) English translation available from NTIS, NASA-TM-75176.
- 3535 Ma, T.-J.: 1977, 'The Polyphyletic Origin of Life from Pre-life and Its Significance', *Sheng Wu Hua Hsueh Yu Sheng Wu Wu Li Hsueh Pao* 9, 223–235. CA88: 184706.
- 3536 MacDonald, R. E., Greene, R. V., and Lanyi, J. K.: 1977, 'Light-Activated Amino Acid Transport System in *Halobacterium halobium* Envelope Vesicles: Role of Chemical and Electrical Gradients', *Biochemistry* 16(4), 3227–3235.
- 3537 MacDonald, R. E. and Lanyi, J. K.: 1977, 'Light-Activated Amino Acid Transport in *Halobacterium halobium* Envelope Vesicles', *Fed. Proc.* 36(6), 1828–1832.
- 3538 MacElroy, R. D., Coeckelenbergh, Y., and Rein, R.: 1977, 'Macromolecular Simulations as an Approach to the Study of the Origins of Self-Replicating Systems', *BioSystems* 9(2,3): 111–119.
- 3539 MacElroy, R. D., Coeckelenbergh, Y., and Rein, R.: 1977, *Molecular Modeling Approaches to the Study of the Origin of Life*, NASA, Moffett Field, California. Avail. NTIS: NASA-TM-73269.
- 3540 Macy, W., Jr. and Sinton, W.: 1977, 'Detection of Methane and Ethane Emission on Neptune But Not on Uranus' (Letter to the Editor), *Astrophys. J.* 218(2, Pt. 1), L79.
- 3541 Margulis, L.: 1977, 'Evolution of Mitosis and the Late Appearance of Metazoa, Metaphyta, and Fungi', in *Chemical Evolution of the Early Precambrian*, Papers Presented at the Second College Park Colloquium on Chemical Evolution, University of Maryland, 1975 (ed. by C. Ponnampertuma), Academic Press, New York, pp. 187–189.
- 3542 Margulis, L.: 1977, 'Life on the Early Earth', *Eng. Sci.* 40(4), 13–19.
- 3543 Margulis, L., Halvorson, H. O., Lewis, J., and Cameron, A. G. W.: 1977, 'Limitations to Growth of Microorganisms on Uranus, Neptune, and Titan', *Icarus* 30(4), 793–808.
- 3544 Margulis, L. and Lovelock, J. E.: 1977, 'The View from Mars and Venus', *The Sciences* 17(2), 10–13.

- 3545 Markhinin, E. K. and Podkletnov, N. E.: 1977, 'Formation of Prebiological Compounds in Eruptions of the Tolbachik Volcano', *Dokl. Akad. Nauk SSSR* 235(5), 1203–1206. (Russian)
- 3546 Markhinin, E. K. and Podkletnov, N. E.: 1977, 'The Phenomenon of Formation of Prebiological Compounds in Volcanic Processes', *Origins of Life* 8(3), 225–235.
- 3547 Matthews, C., Nelson, J., Varma, P., and Minard, R.: 1977, 'Deuterolysis of Amino Acid Precursors: Evidence for Hydrogen Cyanide Polymers as Protein Ancestors', *Science* 198(4317), 622–625.
- 3548 Maugh, T. H., 2nd: 1977, 'Phylogeny: Are Methanogens a Third Class of Life?', *Science* 198(4319), 812.
- 3549 McCloskey, J. A. and Nishimura, S.: 1977, 'Modified Nucleosides in Transfer RNA', *Acc. Chem. Res.* 10(11), 403–410.
- 3550 McCormick, D. B.: 1977, 'Interactions of Flavins with Amino Acid Residues: Assessments from Spectral and Photochemical Studies', *Photochem. Photobiol.* 26(2), 169–182.
- 3551 McCoy, J. W.: 1977, 'Complexity in Organic Evolution', *J. Theor. Biol.* 68(3), 457–458.
- 3552 McElroy, M. B., Kong, T. Y., and Yung, Y. L.: 1977, 'Photochemistry and Evolution of Mars' Atmosphere: A Viking Perspective', *J. Geophys. Res.* 82(28), 4379–4388.
- 3553 McLean, A. D., Loew, G. H., and Berkowitz, D. S.: 1977, 'Structures and Spectra of the Isomers HNCO, HOCN, HONC, and HCNO from ab initio Quantum Mechanical Calculations', *J. Mol. Spectrosc.* 64(2), 184–198.
- 3554 Mikeš, O.: 1977, 'Evolution of Proteolytic Enzymes', *Chem. Listy* 71(11), 1154–1196. (Czech)
- 3555 Miquel, J., Oro, J., Bensch, K. G., and Johnson, J. E., Jr.: 1977, 'Lipofuscin: Fine Structural and Biochemical Studies', in *Free Radicals in Biology, Volume III* (ed. by W. A. Pryor), Academic Press, New York, pp. 133–182.
- 3556 Mizutani, H. and Ponnampereuma, C.: 1977, 'The Evolution of the Protein Synthesis System. I. A Model of a Primitive Protein Synthesis System', *Origins of Life* 8(3), 183–219.
- 3557 Moorbath, S.: 1977, 'Ages, Isotopes and Evolution of Precambrian Continental Crust', *Chem. Geology* 20(2), 151–187.
- 3558 Moore, C. B. and Welch, D.: 1977, 'Carbon Contents of Early Precambrian Rocks', in *Chemical Evolution of the Early Precambrian*, Papers Presented at the Second College Park Colloquium on Chemical Evolution, University of Maryland, 1975 (ed. by C. Ponnampereuma), Academic Press, New York, pp. 55–60.
- 3559 Moore, G. W. and Goodman, M.: 1977, 'Alignment Statistic for Identifying Related Protein Sequences', *J. Mol. Evol.* 9(2), 121–130.
- 3560 Morgan, J. W., Ganapathy, R., Higuchi, H., and Anders, E.: 1977, 'Meteoritic Material on the Moon', in *The Soviet-American Conference on Cosmochemistry of the Moon and Planets, Part 2* (ed. by J. H. Pomeroy and N. J. Hubbard), NASA, Washington, D.C., pp. 659–689. Avail. NTIS: NASA-SP-370-Pt-2.
- 3561 Morimoto, S., Kawashiro, K., and Yoshida, H.: 1977, 'The Asymmetric Adsorption of α -Aminopropionitrile on D-Quartz', *Origins of Life* 8(4), 355–360.
- 3562 Morimoto, S., Kawashiro, K., and Yoshida, H.: 1977, 'The Polymerization of α -Aminopropionitrile', *Origins of Life* 8(4), 341–346.
- 3563 Morowitz, H. J.: 1977, 'Perspectives on Thermodynamics and the Origin of Life', *Adv. Biol. Med. Phys.* 16, 151–163.
- 3564 Morrison, P., Billingham, J., and Wolfe, J. (eds.): 1977, *The Search for Extraterrestrial Intelligence*, NASA, Scientific and Technical Information Office, Washington, D.C. (NASA SP-419).
- 3565 Muir, M. D., Grant, P. R., Bliss, G. M., Diver, W. L., and Hall, D. O.: 1977, 'A Discussion of Biogenicity Criteria in a Geological Context with Examples from a Very Old Greenstone Belt, a Late Precambrian Deformed Zone, and Tectonized Phanerozoic Rocks', in *Chemical Evolution of the Early Precambrian*, Papers Presented at the Second College Park Colloquium on Chemical Evolution, University of Maryland, 1975 (ed. by C. Ponnampereuma), Academic Press, New York, pp. 155–170.
- 3566 Müller, H. E.: 1977, 'Age and Evolution of Bacteria', *Experientia* 33(8), 979–1120.
- 3567 Murzakov, B. G.: 1977, *Problems of Detecting Life on Planets*, Znaniye Press, Moscow, (Russian) English Translation available from NTIS: NASA-TM-75526.
- 3568 Nagano, K.: 1977, 'Some Topics on Chemical Evolution', *Seitai No Kagaku* 28(5), 386–392, (Japanese) CA88: 33282p.

- 3569 Nagy, B. and Nagy, L. A.: 1977, 'Organic Matter in Ancient Sediments of the Earth', *Correl. Precambrian* 1, 236–256.
- 3570 Nagy, B., Nagy, L. A., Zumberge, J. E., Sklarew, D. S., and Anderson, P.: 1977, 'Indications of a Biological and Biochemical Evolutionary Trend during the Archean and Early Proterozoic', *Precambrian Res.* 5(2), 109–120.
- 3571 Nakashima, T., Jungck, J. R., Fox, S. W., Lederer, E., and Das, B. C.: 1977, 'A Test for Randomness in Peptides Isolated from a Thermal Polyamino Acid', *Int. J. Quantum Chem. Symp.* 4, 65–72.
- 3572 Newman, M. J. and Rood, R. T.: 1977, 'Implications of Solar Evolution for the Earth's Early Atmosphere', *Science* 198(4321), 1035–1037.
- 3573 Nikitin, S. A.: 1977, 'Search for Life on Mars', *Priroda* (USSR), No. 10, 118–125. (Russian)
- 3574 Nir, S., Garduno, R., Rein, R., Coeckelenbergh, Y., MacElroy, R. D., and Egan, J. T.: 1977, 'Display, Manipulation, and Simulation of Macromolecules', *Int. J. Quantum Chem. Symp.* 4, 135–141.
- 3575 Nir, S., Garduno, R., Rein, R., and MacElroy, R. D.: 1977, 'Simulation and Display of Macromolecular Complexes', *Polymer* 18(5), 431–434.
- 3576 Noonan, D. W. and Oro, J.: 1977, 'Hydrocarbons and Fatty Acids in Oil Shale of Permian Irati Formation, Brazil', in *Chemical Evolution of the Early Precambrian*, Papers Presented at the Second College Park Colloquium on Chemical Evolution, University of Maryland, 1975 (ed. by C. Ponnampuruma), Academic Press, New York, pp. 69–79.
- 3577 Noonan, D. W., Sherwood, E., More, M. A., and Oro, J.: 1977, 'Cyanamide Mediated Syntheses under Plausible Primitive Earth Conditions. III. Synthesis of Peptides', *J. Mol. Evol.* 10(3), 211–220.
- 3578 Norden, B.: 1977, 'Was Photoresolution of Amino Acids the Origin of Optical Activity in Life?', *Nature* 266(5602), 567–568.
- 3579 Noyes, H. P., Bonner, W. A., and Tomlin, J. A.: 1977, 'On the Origin of Biological Chirality Via Natural Beta-Decay', *Origins of Life* 8(1), 21–23.
- 3580 Oehler, D. Z.: 1977, 'Pyrenoid-like Structures in Late Precambrian Algae from the Bitter Springs Formation of Australia', *J. Paleontol.* 51(5), 885–901.
- 3581 Ogievetskaia, M. M.: 1977, 'Determination of Rate of Protein Evolution on the Basis of Amino Acid Composition. I. Rate of Evolution of Actins', *Mol. Biol.* 11(1, Pt. 1), 58–64.
- 3582 Ogievetskaia, M. M.: 1977, 'Method for the Determination of Protein Evolution Rates by Amino Acid Composition. Evolution Rate of Actins', *Origins of Life* 8(2), 145–154.
- 3583 Ohnishi, T.: 1977, 'IMF for Chemical Evolution of Galaxies. I', *Kyoto Daigaku Genshi Enerugi Kenkyusho Iho* 51, 33. (Japanese) CA87: 142441q.
- 3584 Oparin, A. I.: 1977, 'Problem of the Origin of Life: Results and Prospects', in *Oktyabr' i Nauka*, Nauka Press, Moscow, pp. 436–446. (Russian)
- 3585 Oparin, A. I., Gladilin, K. L., Kirpotin, D. B., Chertikhin, G. V., and Orlovskii, A. F.: 1977, 'Coacervate Drops Containing Polyphosphates and Model of Protobiont Division', *Dokl. Akad. Nauk SSSR* 232(2), 485–488. (Russian)
- 3586 Oparin, A. I., Ponnampuruma, C., and Imahori, K.: 1977, *Approach to the Origins of Life: How Far We've Come* (Discussion), Kodansha Publ. Co., Tokyo. (Japanese)
- 3587 Orgel, L. E.: 1977, 'β-Turns and the Evolution of Protein Synthesis', in *The Organization and Expression of the Eukaryotic Genome*, Proceedings of the International Symposium, Tehran, May 3–6, 1976 (ed. by E. M. Bradbury and K. Javaherian), Academic Press, New York, pp. 499–504.
- 3588 Orgel, L. E.: 1977, 'Gene-Duplication and the Origin of Proteins with Novel Functions', *J. Theor. Biol.* 67(4), 773.
- 3589 Oro, J.: 1977, 'The Origin of Life', *Bol. Inf.* 65, 3–25. (Spanish)
- 3590 Oro, J.: 1977, 'Prebiological Chemistry and the Origin of Life: A Personal Vision', in *Avances de la Bioquímica* (ed. by L. Cornudella, J. Oro, A. Sols, and C. Fernandez-Heredia), Salvat, Barcelona, pp. 515–541. (Spanish)
- 3591 Oro, J., Miller, S. L., and Urey, H. C.: 1977, 'Energy Conversion in the Context of the Origin of Life', in *Living Systems as Energy Converters*, Proceedings of the Conference, Pont-à-Mousson, France, October 18–22, 1976 (ed. by R. Buvet, M. J. Allen, and J. P. Massué), North-Holland, Amsterdam, pp. 7–19.

- 3592 Ostroumov, S. A.: 1977, 'Participation of Chloroplasts and Mitochondria in Virus Reproduction and the Evolution of the Eukaryotic Cell', *J. Theor. Biol.* **67**(2), 287–297.
- 3593 Otroshchenko, V. A. and Vasilyeva, N. V.: 'The Role of Mineral Surfaces in the Origin of Life', *Origins of Life* **8**(1), 25–31.
- 3594 Owen, T., Biemann, K., Rushneck, D. R., Biller, J. E., Howarth, D. W., and Lafleur, A. L.: 1977, 'The Composition of the Atmosphere at the Surface of Mars', *J. Geophys. Res.* **82**(28), 4635–4639.
- 3595 Oyama, V. I., Berdahl, B. J., and Carle, G. C.: 1977, 'Preliminary Findings of the Viking Gas Exchange Experiment and a Model for Martian Surface Chemistry', *Nature* **265**(5590), 110–114.
- 3596 Pacault, A.: 1977, 'Chemical Evolution Far from Equilibrium,' in *Synergetics*, Proceedings of the Workshop (ed. by H. Haken), Springer, Berlin, pp. 133–154. CA88: 159024z.
- 3597 Pacltová, B.: 1977, 'The Colonial Rock-forming Microfossils of the Bohemian Upper Proterozoic (Czechoslovakia), 'Bohemipora Pragensis' n.g., n.sp.', *Origins of Life* **8**(2), 155–168.
- 3598 Paecht-Horowitz, M.: 1977, 'The Mechanism of Clay Catalyzed Polymerization of Amino Acid Adenylates', *BioSystems* **9**(2,3), 93–98.
- 3599 Paecht-Horowitz, M. and Lahav, N.: 1977, 'Polymerization of Alanine in the Presence of a Non-swelling Montmorillonite', *J. Mol. Evol.* **10**(1), 73–76.
- 3600 Panagia, N., Bussoletti, E., and Blanco, A.: 1977, 'Abundance of Carbon in NGC 7027', in *CNO Isotopes in Astrophysics*, Proceedings of the General Assembly, Special Session, Grenoble, France, August 30, 1976 (ed. by J. Audouze), D. Reidel, Dordrecht, pp. 45–58. IAA: A77-42681.
- 3601 Paprotny, Z.: 1977, 'Nonradio Methods of SETP', *Postepy Astronaut.* **10**(3), 39–67. (Polish)
- 3602 Philipp, M. and Seliger, H.: 1977, 'Spontaneous Phosphorylation of Nucleosides in Formamide-Ammonium Phosphate Mixtures', *Naturwissenschaften* **64**(5), 273.
- 3603 Pollock, G. E., Cheng, C.-N., and Cronin, S. E.: 1977, 'Determination of the D and L Isomers of Some Protein Amino Acids Present in Soils', *Anal. Chem.* **49**(1), 2–7.
- 3604 Pollock, G. E., Day, R., Kinsey, S., and Miller, S. L.: 1977, 'Detection of Optical Asymmetry in Amino Acids by Gas Chromatography for Extraterrestrial Space Exploration: Results of a New Soil Processing Scheme with Broadboard Instrumentation', in *Life Sciences and Space Research, Volume XV*, Proceedings of the Open Meeting of the Working Group on Space Biology of the 19th Plenary Meeting of COSPAR, Philadelphia, Pennsylvania, June 8–19, 1976 (ed. by R. Holmquist), Pergamon Press, New York, pp. 27–34.
- 3605 Ponnampereuma, C. (ed.): 1977, *Chemical Evolution of the Early Precambrian*, Papers Presented at the Second College Park Colloquium on Chemical Evolution, University of Maryland, 1975, Academic Press, New York.
- 3606 Ponnampereuma, C.: 1977, 'Cosmo-chemistry and the Origins of Life', in *Origins of Life, the Earth and the Universe* (ed. by Mitsubishi-Kasei Institute of Life Sciences), Heibonsha, Tokyo, pp. 35–70. (Japanese)
- 3607 Ponnampereuma, C., Shimoyama, A., Yamada, M., Hobo, T., and Pal, R.: 1977, 'Possible Surface Reactions on Mars: Implications for Viking Biology Results', *Science* **197**(4302), 455–457.
- 3608 Prinz, M., Fodor, R. V., and Keil, K.: 1977, 'Comparison of Lunar Rocks and Meteorites: Implications to Histories of the Moon and Parent Meteorite Bodies', in *The Soviet-American Conference on Cosmochemistry of the Moon and Planets, Part 1* (ed. by J. H. Pomeroy and N. J. Hubbard), NASA, Washington, D.C., pp. 183–199. Avail. NTIS: NASA-SP-370-Pt-1.
- 3609 Radhakrishna, B. P. and Vasudev, V. N.: 1977, 'The Early Precambrian of the Southern Indian Shield', *J. Geol. Soc. India* **18**(10), 525.
- 3610 Rambler, M., Margulis, L., and Barghoorn, E. S.: 1977, 'Natural Mechanisms of Protection of a Blue-Green Alga against Ultraviolet Light', in *Chemical Evolution of the Early Precambrian*, Papers Presented at the Second College Park Colloquium on Chemical Evolution, University of Maryland, 1975 (ed. by C. Ponnampereuma), Academic Press, New York, pp. 133–141.
- 3611 Rasool, I. S., DeVincenzi, D. L., and Billingham, J.: 1977, 'Cosmic Evolution', in *The Search for Extraterrestrial Intelligence* (ed. by P. Morrison, J. Billingham, and J. Wolfe), NASA, Scientific and Technical Information Office, Washington, D.C., pp. 39–45. (NASA SP-419).

- 3612 Rasool, S. I., Hunten, D. M., and Kaula, W. M.: 1977, 'What the Exploration of Mars Tells Us about Earth', *Phys. Today* 30(7), 23–30, 32.
- 3613 Rastogi, R. P.: 1977, 'Chemistry of the Dynamical Origin of Life', *J. Chem. Sci.* 2–3, 1–7. CA88: 46468d.
- 3614 Rauchfuss, H.: 1977, 'Proteinoids as Model Substances of a Chemical Evolution', *Chim. Didact.* 3(1), 1–8. (German) CA: 87–195579x.
- 3615 Rauchfuss, H.: 1977, 'Teaching Proposals on the Treatment of the Subject: Proteinoids as Model Substances of Chemical Evolution', *Chim. Didact.* 3, 225–231. (German)
- 3616 Raulin, F., Bloch, S., and Toupance, G.: 1977, 'Addition Reactions of Malonic Nitriles with Alkanethiol in Aqueous Solution', *Origins of Life* 8(3), 247–257.
- 3617 Raulin, F. and Toupance, G.: 1977, 'The Role of Sulphur in Chemical Evolution', *J. Mol. Evol.* 9(4), 329–338.
- 3618 Rein, R.: 1977, 'Studies of Biomolecular Interactions: Principles of Nucleic Acid Structure and Function from the Point of View of Constituent Interactions', in *Perspectives in Quantum Chemistry* (ed. by B. Pullman), John Wiley & Sons, New York, pp. 307–362.
- 3619 Rein, R., Garduno, R., Egan, J. T., Columbano, S., Coeckelenbergh, Y., and MacElroy, R. D.: 1977, 'Elements of a DNA-Polypeptide Recognition Code: Electrostatic Potential Around the Double Helix, and a Stereospecific Model for Purine Recognition', *BioSystems* 9(2,3), 131–137.
- 3620 Rich, A.: 1977, 'The Molecular Structure of Transfer RNA and Its Interaction with Synthetases', in *Nucleic Acid-Protein Recognition* (ed. by H. J. Vogel), Academic Press, New York, pp. 281–291.
- 3621 Rich, A.: 1977, 'An Overview of Protein-Nucleic Acid Interactions', in *Nucleic Acid-Protein Recognition* (ed. by H. J. Vogel), Academic Press, New York, pp. 3–11.
- 3622 Rich, A.: 1977, 'Three-Dimensional Structure and Biological Function of Transfer RNA', *Acc. Chem. Res.* 10(11), 388–396.
- 3623 Rich, A. and Schimmel, P. R.: 1977, 'Introduction to Transfer RNA', *Acc. Chem. Res.* 10(11), 385–387.
- 3624 Rich, A. and Schimmel, P. R.: 1977, 'Structural Organization of Complexes of Transfer RNAs with Aminocyl Transfer RNA Synthetases', *Nucleic Acids Res.* 4(5), 1649–1665.
- 3625 Rich, A., Seeman, N. C., and Rosenberg, J. M.: 1977, 'Protein Recognition of Base Pairs in a Double Helix', in *Nucleic Acid-Protein Recognition* (ed. by H. J. Vogel), Academic Press, New York, pp. 361–374.
- 3626 Robinson, P. R., Moorehead, E. L., Weathers, B. J., Ufkes, E. A., Vickrey, T. M., and Schrauzer, G. N.: 1977, 'The Chemical Evolution of a Nitrogenase Model. 14. Stoichiometric Reactions of Complexes of Molybdenum(V), Molybdenum(IV), and Molybdenum(III) with Acetylene and Nitrogen', *J. Am. Chem. Soc.* 99(11), 3657–3663.
- 3627 Rogers, J. J. W.: 1977, 'Three Arguments for Continual Evolution of Sial throughout Geologic Time', in *Chemical Evolution of the Early Precambrian*, Papers Presented at the Second College Park Colloquium on Chemical Evolution, University of Maryland, 1975 (ed. by C. Ponnampuruma), Academic Press, New York, pp. 27–39.
- 3628 Royer, Ch.: 1977, 'Viking Experiments on Mars', *Mem. Sci. Rev. Metall.* 74(4), 261–263. (French) IAA: A77–39156.
- 3629 Runau, R., Peyerimhoff, S. D., and Buenker, R. J.: 1977, 'Ab Initio Study of the Photodissociation of Ammonia', *J. Mol. Spectrosc.* 68(2), 253–268.
- 3630 Safronov, V. S.: 1977, 'Time Scale for the Formation of the Earth and Planets and Its Role in Their Geochemical Evolution', in *The Soviet-American Conference on Cosmochemistry of the Moon and Planets, Part 2* (ed. by J. H. Pomeroy and N. J. Hubbard), NASA, Washington, D.C., pp. 797–803. Avail NTIS: NASA-SP-370-Pt-2.
- 3631 Sagan, C.: 1977, 'Reducing Greenhouses and the Temperature History of Earth and Mars', *Nature* 269(5625), 224–226.
- 3632 Sagan, C., Pieri, D., Fox, P., Arvidson, R. E., and Guinness, E. A.: 1977, 'Particle Motion on Mars Inferred from Viking Lander Cameras', *J. Geophys. Res.* 82(28), 4430–4438.
- 3633 Sakata, A., Nakagawa, N., Iguchi, T., Isobe, S., Morimoto, M., Hoyle, F., and Wickramasinghe, N. C.: 1977, 'Spectroscopic Evidence for Interstellar Grain Clumps in Meteoritic Inclusions', *Nature* 266(5599), 241.

- 3634 Saleme, F. R., Miller, M. D., and Jordan, S. R.: 1977, 'Structural Convergence during Protein Evolution', *Proc. Natl. Acad. Sci. U.S.A.* 74(7), 2820–2824.
- 3635 Sasisekharan, V., Pattabiraman, N., and Gupta, G.: 1977, 'An Alternative Structure for DNA and Its Relevance to DNA Supercoiling', *Curr. Sci.* 46(22), 763–764.
- 3636 Schidlowski, M. and Eichman, R.: 1977, 'Evolution of the Terrestrial Oxygen Budget', in *Chemical Evolution of the Early Precambrian*, Papers Presented at the Second College Park Colloquium on Chemical Evolution, University of Maryland, 1975 (ed. by C. Ponnampereuma), Academic Press, New York, pp. 87–99.
- 3637 Schmitt, H. H.: 1977, 'Evolution of the Moon: The 1974 Model', in *The Soviet-American Conference on Cosmochemistry of the Moon and Planets, Part 1* (ed. by J. H. Pomeroy and N. J. Hubbard), NASA, Washington, D.C., pp. 63–80. Avail. NTIS: NASA-SP-370-Pt-1.
- 3638 Schneider, J.: 1977, 'A Model for a Non-chemical Form of Life: Crystalline Physiology', *Origins of Life* 8(1), 33–38.
- 3639 Schopf, J. W.: 1977, 'Biostratigraphic Usefulness of Stromatolitic Precambrian Microbiotas: A Preliminary Analysis', *Precambrian Res.* 5(2), 143–173.
- 3640 Schopf, J. W.: 1977, 'Earliest Evidence of Fossil Eucaryotes', in *Chemical Evolution of the Early Precambrian*, Papers Presented at the Second College Park Colloquium on Chemical Evolution, University of Maryland, 1975 (ed. by C. Ponnampereuma), Academic Press, New York, pp. 107–109.
- 3641 Schopf, J. W.: 1977, 'Evidences of Archean Life', in *Chemical Evolution of the Early Precambrian*, Papers Presented at the Second College Park Colloquium on Chemical Evolution, University of Maryland, 1975 (ed. by C. Ponnampereuma), Academic Press, New York, pp. 101–105.
- 3642 Schwartz, A. W.: 1977, 'Fifth International Conference on the Origin of Life', *BioSystems* 9(2,3), 71.
- 3643 Schwartz, A. W. and Chittenden, G. J. F.: 1977, 'Synthesis of Uracil and Thymine under Simulated Prebiotic Conditions', *BioSystems* 9(2,3), 87–92.
- 3644 Schwartzman, D. W.: 1977, 'The Absence of Extraterrestrials on Earth and the Prospects for CETI', *Icarus* 32(4), 473–475.
- 3645 SEXTL, G. and Schwankner, R.: 1977, 'A Report on a New Understanding of the Stanley-Miller Experiments on Abiogenic Amino Acid Synthesis', *Prax. Naturwiss. Chem.* 26(12), 309–321. (German) CA: 88–73679e.
- 3646 Sheaffer, R.: 1977, '1977 SETI Progress Report', *Spaceflight* 19(9), 307–310.
- 3647 Sherwood, E., Joshi, A., and Oro, J.: 1977, 'Cyanamide Mediated Syntheses under Plausible Primitive Earth Conditions. II. The Polymerization of Deoxythymidine 5'-Triphosphate', *J. Mol. Evol.* 10(3), 193–209.
- 3648 Sherwood, E. and Oro, J.: 1977, 'Cyanamide Mediated Syntheses under Plausible Primitive Earth Conditions. I. The Synthesis of P¹, P² Dideoxythymidine 5'-Pyrophosphate', *J. Mol. Evol.* 10(3), 183–192.
- 3649 Siegel, B. Z.: 1977, 'Kakabekia, A Review of Its Physiological and Environmental Features and Their Relation to Its Possible Ancient Affinities', in *Chemical Evolution of the Early Precambrian*, Papers Presented at the Second College Park Colloquium on Chemical Evolution, University of Maryland, 1975 (ed. by C. Ponnampereuma), Academic Press, New York, pp. 143–154.
- 3650 Siever, R.: 1977, 'Early Precambrian Weathering and Sedimentation: An Impressionistic View', in *Chemical Evolution of the Early Precambrian*, Papers Presented at the Second College Park Colloquium on Chemical Evolution, University of Maryland, 1975 (ed. by C. Ponnampereuma), Academic Press, New York, pp. 13–23.
- 3651 Simionescu, C., Lixandru, T., Gorduza, V., and Gorea, C.: 1977, 'Synthesis of Purine and Pyrimidine Bases and Nucleosides under the Cold Plasma Conditions (IX)', *Origins of Life* 8(3), 237–246.
- 3652 Simionescu, C. I., Simionescu, B. C., Mora, R., Leanca, M., and Ioanid, E.: 1977, 'Abiotic Synthesis of Porphyrins: The Preparation of Porphyrin-like Compounds through High-frequency Discharge in a Methane-Ammonia-Water Vapor Mixture', *C. R. Hebd. Seances Acad. Sci. Ser. C* 284(18), 743–746. (French) CA87: 17728n.

- 3653 Simoneit, B. R. T.: 1977, 'Diterpenoid Compounds and Other Lipids in Deep-Sea Sediments and Their Geochemical Significance', *Geochim. Cosmochim. Acta* 41(4), 463–476.
- 3654 Singer, S. F.: 1977, 'The Early History of the Earth-Moon System', *Earth Sci. Rev.* 13(2), 171–189.
- 3655 Smith, B. A., Briggs, G. A., Danielson, G. E., Cook, A. F., 2nd, Davies, M. E., Hunt, G. E., Masursky, H., Soderblom, L. A., Owen, T. C., Sagan, C., and Suomi, V. E.: 1977, 'Voyager Imaging Experiment', *Space Sci. Rev.* 21(2), 103–127.
- 3656 Smith, D. H., Achenbach, M., Yeager, W. J., Anderson, P. J., Fitch, W. L., and Rindfleisch, T. C.: 1977, 'Quantitative Comparison of Combined Gas Chromatographic/Mass Spectrometric Profiles of Complex Mixtures', *Anal. Chem.* 49(11), 1623–1632.
- 3657 Smoluchowski, R.: 1977, 'The Interior Structure of Jupiter (Consequences of Pioneer 10 Data)', in *The Soviet-American Conference on Cosmochemistry of the Moon and Planets, Part 2* (ed. by J. H. Pomeroy and N. J. Hubbard), NASA, Washington, D.C., pp. 849–858. Avail. NTIS: NASA-SP-370-Pt-2.
- 3658 Soffen, G. A.: 1977, 'The Viking Project', *J. Geophys. Res.* 82(28), 3959–3970.
- 3659 Sovetov, Iu.K. and Shenfil, V.Iu.: 1977, 'New Pre-cambrian Microbiota (South Kazakhstan)', *Dokl. Akad. Nauk SSSR* 232(5), 1193–1196. (Russian)
- 3660 Stebbins, G. L.: 1977, *Processes of Organic Evolution* (3rd edition), Prentice-Hall, Englewood Cliffs, New Jersey.
- 3661 Stillwell, W.: 1977, 'On the Origin of Photophosphorylation', *J. Theor. Biol.* 65, 479–497.
- 3662 Stoeckenius, W., Lozier, R. H., and Niederberger, W.: 1977, 'Photoreactions of Bacteriorhodopsin', *Biophys. Struct. Mech.* 3(1), 65–68.
- 3663 Tinsley, B. M.: 1977, 'Chemical Evolution in the Solar Neighborhood. III. Time Scales and Nucleochronology', *Astrophys. J.* 216(2, Pt. 1), 548–559.
- 3664 Tiplady, B. and Goodman, M.: 1977, 'Primitive Haemoglobin', *J. Mol. Evol.* 9(4), 343–347.
- 3665 Toksoez, M. N. and Johnston, D. H.: 1977, 'The Evolution of the Moon and the Terrestrial Planets', in *The Soviet-American Conference on Cosmochemistry of the Moon and Planets, Part 1* (ed. by J. H. Pomeroy and N. J. Hubbard), NASA, Washington, D.C., pp. 295–327. Avail. NTIS: NASA-SP-370-Pt-1.
- 3666 Toon, O. B., Pollack, J. B., and Sagan, C.: 1977, 'Physical Properties of the Particles Composing the Martian Dust Storm of 1971–1972', *Icarus* 30(4), 663–696.
- 3667 Toupance, G., Bossard, A., and Raulin, F.: 1977, 'Far UV Irradiation of Model Prebiotic Atmospheres', *Origins of Life* 8(3), 259–266.
- 3668 Trimble, V.: 1977, 'Cosmology: Man's Place in the Universe', *Am. Sci.* 65(1), 76–86.
- 3669 Trombka, J. I., Arnold, J. R., Adler, I., Metzger, A. E., and Reedy, R. C.: 1977, 'Lunar Elemental Analysis Obtained from the Apollo Gamma-ray and X-ray Remote Sensing Experiment', in *The Soviet-American Conference on Cosmochemistry of the Moon and Planets, Part 1* (ed. by J. H. Pomeroy and N. J. Hubbard), NASA, Washington, D.C., pp. 153–182. Avail. NTIS: NASA-SP-370-Pt-1.
- 3670 Turcotte, D. L., Cisne, J. L., and Nordmann, J. C.: 1977, 'On the Evolution of the Lunar Orbit', *Icarus* 30(2), 254–266.
- 3671 Usher, D. A.: 1977, 'Early Chemical Evolution of Nucleic Acids: A Theoretical Model', *Science* 196(4287), 311–313.
- 3672 Valkovic, V.: 1977, 'A Possible Mechanism for the Influence of Geomagnetic Field on the Evolution of Life', *Origins of Life* 8(1), 7–11.
- 3673 Van der Velden, W. and Schwartz, A. W.: 1977, 'Search for Purines and Pyrimidines in the Murchison Meteorite', *Geochim. Cosmochim. Acta* 41(7), 961–968.
- 3674 Van Dort, M. A. and Bonner, W. A.: 1977, 'The Quantitative Gas Chromatographic Resolution of Amino Ester Diastereomers', *J. Chromatogr.* 133(1), 210–213.
- 3675 Ventilla, M. and Egami, F.: 1977, 'Formation of Amino Acids and Related Oligomers from Formaldehyde and Hydroxylamine in a Solution of Transition Metal Ions', *J. Mol. Evol.* 9(2), 105–109.
- 3676 Vinogradov, A. P.: 1977, 'Differentiation of the Matter of the Moon', in *The Soviet-American Conference on Cosmochemistry of the Moon and Planets, Part 1* (ed. by J. H. Pomeroy and N. J. Hubbard), NASA, Washington, D. C., pp. 5–33. Avail NTIS: NASA-SP-370-Pt-1.

- 3677 Visser, C. M.: 1977, 'Biotins and the Evolution of Life', *Chem. Weekbl. Mag.* (July), 333–335. CA87: 128965g.
- 3678 Vogel, F. and Kopun, M.: 1977, 'Higher Frequencies of Transitions among Point Mutations', *J. Mol. Evol.* 9(2), 159–180.
- 3679 Walker, G. W. R.: 1977, 'Nucleotide-Binding Site Data and the Origin of the Genetic Code', *BioSystems* 9(2,3), 139–150.
- 3680 Walker, J. C. G.: 1977, 'Origin of the Atmosphere: History of the Release of Volatiles from the Solid Earth', in *Chemical Evolution of the Early Precambrian*, Papers Presented at the Second College Park Colloquium on Chemical Evolution, University of Maryland, 1975 (ed. by C. Ponnampuruma), Academic Press, New York, pp. 1–11.
- 3681 Walter, M. R.: 1977, 'Interpreting Stromatolites', *Am. Sci.* 65(5), 563–571.
- 3682 Wannier, P. G.: 1977, 'CNO Isotope Abundances in Interstellar Clouds', *CNO Isotopes in Astrophysics*, Proceedings of the General Assembly, Special Session, Grenoble, France, August 30, 1976 (ed. by J. Audouze), D. Reidel, Dordrecht, pp. 71–77. IAA: A77–42684.
- 3683 Wasserburg, G. J., Papanastassiou, D. A., Tera, F., and Huneke, J. C.: 1977, 'Outline of a Lunar Chronology', *Phil. Trans. Roy. Soc. Lond. A* 285(1327), 7–22.
- 3684 West, M. W., Koch, R. A., and Chang, S.: 1977, 'Chemical Evolution and the Origin of Life: Bibliography Supplement 1975', *Origins of Life* 8(1), 59–66.
- 3685 Wetherill, G. W.: 1977, 'Pre-mare Cratering and Early Solar System History', in *The Soviet-American Conference on Cosmochemistry of the Moon and Planets, Part 2* (ed. by J. H. Pomeroy and N. J. Hubbard), NASA, Washington, D.C., pp. 553–567. Avail. NTIS: NASA-SP-370-Pt-2.
- 3686 Whitaker, N. S. and Klein, H. P.: 1977, 'Low Oxygen Levels and the Palmitoyl CoA Desaturase of Yeast: Relation to Primitive Biological Evolution', in *Chemical Evolution of the Early Precambrian*, Papers Presented at the Second College Park Colloquium on Chemical Evolution, University of Maryland, 1975 (ed. by C. Ponnampuruma), Academic Press, New York, pp. 211–214.
- 3687 Wickramasinghe, C.: 1977, 'Where Life Begins?', *New Sci.* 74(1048), 119–121.
- 3688 Wickramasinghe, N. C., Hoyle, F., Brooks, J., and Shaw, G.: 1977, 'Prebiotic Polymers and Infrared Spectra of Galactic Sources', *Nature* 269(5630), 674–676.
- 3689 Wilen, S. H., Collet, A., and Jacques, J.: 1977, 'Strategies in Optical Resolutions', *Tetrahedron* 33(21), 2725–2736.
- 3690 Williams, K. M. and Smith, G. G.: 1977, 'A Critical Evaluation of the Application of Amino Acid Racemization to Geochronology and Geothermometry', *Origins of Life* 8(2), 91–144.
- 3691 Williams, R. J. P.: 1977, 'Bringing Inorganic Chemistry to Life', *Proc. R. Inst. G. B.* 49, 93–109. CA86: 170072t.
- 3692 Winnewisser, G.: 'Interstellar Grains and Interstellar Molecules', *Naturwissenschaften* 64(10), 526.
- 3693 Woese, C. R.: 1977, 'A Comment on Methanogenic Bacteria and the Primitive Ecology', *J. Mol. Evol.* 9(4), 369–371.
- 3694 Woese, C. R.: 1977, 'Endosymbionts and Mitochondrial Origins', *J. Mol. Evol.* 10(2), 93–96.
- 3695 Woese, C. R. and Fox, G. E.: 1977, 'The Concept of Cellular Evolution', *J. Mol. Evol.* 10(1), 1–6.
- 3696 Wolczek, O.: 1977, 'Occurrence of Life and Rise of Intelligent Beings as Stages of Evolution of Cosmic Matter', *Postepy Astronaut.* 10(1), 67–87.
- 3697 Wolczek, O.: 1977, 'Results of Biological Experiments Carried Out by the Viking Probes and the Possible Existence of Life on Mars', *Postepy Astronaut.* 10(4), 51–90. (Polish)
- 3698 Wood, J. A.: 1977, 'A Survey of Lunar Rock Types and Comparison of the Crusts of Earth and Moon', in *The Soviet-American Conference on Cosmochemistry of the Moon and Planets, Part 1* (ed. J. H. Pomeroy and N. J. Hubbard), NASA, Washington, D.C., pp. 35–53. Avail. NTIS: NASA-SP-370-Pt-1.
- 3699 Woodman, J. H., Trafton, L., and Owen, T.: 1977, 'The Abundances of Ammonia in the Atmospheres of Jupiter, Saturn, and Titan', *Icarus* 32(3), 314–320.
- 3700 Yockey, H. P.: 1977, 'A Calculation of the Probability of Spontaneous Biogenesis by Information Theory', *J. Theor. Biol.* 67(3), 377–398.

- 3701 Yockey, H. P.: 1977, 'On the Information Content of Cytochrome *c*', *J. Theor. Biol.* 67(3), 345–376.
- 3702 Yockey, H. P.: 1977, 'A Prescription Which Predicts Functionally Equivalent Residues at Given Sites in Protein Sequences', *J. Theor. Biol.* 67(3), 337–343.
- 3703 Yung, Y. L. and McElroy, M. B.: 1977, 'Stability of an Oxygen Atmosphere on Ganymede', *Icarus* 30(1), 97–103.

Acknowledgement

This work was performed under NASA contract NASw-3165 (GWU) and NASA grant NGR 21–00–317 (U. of Md).

Keyword Subject Index

- Acylglycerols, 3410
 Aerobic life, 3442
 Alanine, 3599
 Algae, 3457
 Alkanethiol, 3616
 Alkylamines, 3487
 Alpha-aminopropionitrile, 3562
 D-Amino acids, 3353, 3358
 Amino acids, 3419, 3459, 3460, 3462, 3488, 3494, 3502, 3509, 3510, 3547, 3603, 3604, 3675
 Ammonia, 3629
 Ancient sediments, 3569
 Anticodons, 3493
 Archean, 3466, 3570, 3641
 Astro-paleontology, 3355
 Asymmetry, 3396, 3423, 3506, 3561, 3604
- Bacillus*, 3497
 Back-contamination, 3492
 Bacteria, 3364, 3566
 Bacteriorhodopsin, 3662
 Biogenesis, 3565, 3700
 Biosphere, 3383
 Biotins, 3677
- Carbonaceous chondrites, 3465
 Carbonaceous compounds, 3515
 Cell 3413, 3430
 Cellular evolution, 3695
 Chirality, 3579
 Chlorophyll derivatives, 3516
 Clays, 3434, 3518, 3598
 Coacervate division, 3585
 Coacervate systems, 3414
 Cobalamin, 3399
 Comets, 3398, 3450
 Computer Modelling, 3394, 3484, 3538, 3539, 3574, 3575
- Crystalline physiology, 3638
 Cyanamides, 3577, 3647, 3648
 Cytochrome *c*, 3701
- Deoxythymidine oligonucleotides, 3647, 3648
 Descartes/Oparin, 3418
 Diterpenoid compounds, 3653
 DNA, 3635
 DNA-polypeptide, 3619
- Endosymbiosis, 3694
 Energy conversion, 3591
 Entropy, 3393
 Eoastrian, 3366
 Eucaryotes, 3640
 Eukaryotic cell, 3592
 Exobiology, 3471
 Extraterrestrial biogenesis, 3479
 Extraterrestrial life, 3376, 3438, 3468, 3522, 3564, 3567, 3601, 3644, 3646
- Flavins, 3550
 Formaldehyde, 3444, 3445
- Galactochemistry, 3386
 Ganymede, 3703
 Gas chromatography, 3424, 3656, 3674
 Gene-duplication, 3588
 Genetic code, 3369, 3425, 3491, 3495, 3679
 Genetic coding, 3525
 Geomagnetic field, 3672
 Graphite, 3501
 Gunflint microbiota, 3362
- Halobacterium halobium*, 3372, 3526, 3536, 3537
 Hydrogen cyanide, 3406
 Hypercycle, 3411