

ISSOL

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INTERNATIONAL SOCIETY FOR THE STUDY OF THE ORIGIN OF LIFE

ISSOL-86 MEETING UPDATE

The ISSOL-86 Local Organizing Committee (LOC) met in mid-March to review abstracts and select those to be presented at the ISSOL Conference July 21-25, 1986. Over 200 abstracts were selected for either poster or oral presentation in the various symposia or general sessions. The preliminary program is printed in this issue of the ISSOL Newsletter. The final program and abstract booklet will be distributed at the conference in July.

A new conference site on the UC-Berkeley campus recently became available for our consideration. This site has all the facilities required for the conference, including meeting rooms, lodging, dining areas, recreational facilities, etc. The LOC held its planning meeting at the new location and enthusiastically adopted a proposal to relocate the conference to this site, which is the UC-Berkeley Clark

Kerr Conference Center at 2601 Warring Street, Berkeley, California, U.S.A. The new site is located a few blocks from the previously planned site and is described fully in a recent mailing sent to all participants.

The following mailings have been distributed recently by the LOC: (1) A notice of the change in meeting location; (2) A confirming letter to participants acknowledging inclusion of their abstracts in the program and their registration for the conference, food, lodging, etc.; and (3) Special letters of encouragement to attendees at the Mainz meeting who have not yet registered for ISSOL-86 and to colleagues who had submitted preliminary forms but have not yet registered formally.

Vera Buescher
ISSOL '86 LOC

ISSOL-86 PRELIMINARY PROGRAM

Program Co-Chairs: S. Chang, D. DeVincenzi

Sunday, July 20

- 6:30 p.m. ✓ Introductory Lecture
COSMOLOGY OF LIFE AND MIND
George Wald *21 Lake View Av.
Cambridge, Mass, 02138
U.S.A.*
- 7:30 - Welcome Mixer
10:00 p.m.

Monday, July 21

- 8:00 a.m. Opening Remarks and Announcements
- 8:30 a.m. ISSOL Presidential Address
Cyril Ponnampetuma
- 9:15 a.m. (001) HISTORICAL PERSPECTIVE: THE PROBLEM OF THE ORIGIN OF LIFE IN THE CONTEXT OF DEVELOPMENTS IN BIOLOGY
Harmke Kamminga
- Symposium 1 WHAT WERE CONDITIONS LIKE ON THE PRIMITIVE EARTH?
- Invited Papers Session Chairman: S. Chang
- 10:00 a.m. (002) PHYSICAL CONDITIONS ON EARLY EARTH: IMPLICATIONS FOR THE ORIGIN OF LIFE
N. Sleep
- 10:45 a.m. (003) SURFICIAL CONDITIONS ON THE EARLY EARTH: IMPLICATIONS FOR LIFE
J. Veizer
- 11:15 a.m. (004) EARLY ARCHEAN ORGANISMS AND PALEOENVIRONMENTS
D. Lowe
- 12:00 noon - Lunch and Poster Session
2:00 p.m.

Symposium 1 (continued)

- Contributed Papers Session Co-Chairs: P. Brimblecombe, J. Levine
- 2:00 p.m. ✓ (005) DID EXTRATERRESTRIAL IMPACTORS SUPPLY THE ORGANICS NECESSARY FOR THE ORIGIN OF TERRESTRIAL LIFE?: AMINO ACID EVIDENCE IN CRETACEOUS-TERTIARY BOUNDARY SEDIMENTS
J. Bada, M.-X. Zhao and N. Lee
- 2:20 p.m. ✓ (006) CLIMATIC CONSEQUENCES OF VERY HIGH CO₂ LEVELS IN EARTH'S EARLY ATMOSPHERE
W J. Kasting *245-3 Ames Research Center, Moffett Field
CA 94035 U.S.A.*
- 2:40 p.m. (007) PHOTOCHEMISTRY OF CH₄ AND HCN IN THE PRIMITIVE ATMOSPHERE
K. Zahnle
- 3:00 p.m. (008) PHOTOPRECIPITATION AND THE BIFS: SOME QUANTITATIVE ASPECTS
P. Braterman and A.G. Cairns-Smith
- 3:20 p.m. ✓ (009) ON THE ROLE OF SUBMARINE HOT SPRINGS ON THE ARCHEAN EARTH: THE CHEMISTRY OF SEA WATER, DEGASSING, AND THE OXIDATION/REDUCTION BALANCE
J. Corliss
- Contributed Posters (Displayed July 21-23)
- ✓ (010) FORMATION OF HYDROGEN ON IRRADIATION OF AQUEOUS FERROUS ION WITH UV LIGHT AT NEUTRAL pH
Z. Borowska and D. Mauzerall
- ✓ (011) THE PHOTOCHEMISTRY OF OXIDATION AND REDUCTION OF TRACE METALS IN THE ARCHEAN OCEANS
P. Brimblecombe
- (continued on next page)

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- ✓(012) THE ORIGIN AND EVOLUTION OF THE ATMOSPHERE: CLASSROOM EXPERIMENTS, DEMONSTRATIONS, AND ACTIVITIES
J. Exline and J. Levine
- ✓(013) CARBON AND NITROGEN ISOTOPIC ANALYSIS OF ARCHEAN SEDIMENTS: EVIDENCE OF EARTH'S EARLY ATMOSPHERE?
E. Gibson, L. Carr, I. Gilmour and C. Pillinger
- ✓(014) POTENTIAL ROLE OF BUBBLES AND DROPLETS IN PRIMORDIAL AND PLANETARY CHEMISTRY: EXPLORATION OF THE LIQUID-GAS INTERFACE AS A REACTION ZONE FOR CONDENSATION PROCESS
L. Lerman
- ✓(015) OXYGEN IN THE EARLY ATMOSPHERE
J. Levine
- (016) ENVIRONMENTAL EVOLUTION AND THE ORIGINS OF LIFE: A COURSE IN PLANETARY BIOLOGY
L. Margulis and G. Fleischaker
- ✓(017) PLANETARY PROPERTIES LEADING TO LIQUID WATER AND THROUGH IT TO LIFE
M. Papagiannis, *Dept. Astronomy, Boston Uni. Boston, MA 02215 U.S.A.*
- (018) GEOLOGICAL CONDITIONS OF PREBIOLOGICAL EVOLUTION
F. Raulin, J. Brunn and P. Allard
- (019) INTERPRETATION OF PRECAMBRIAN HYDROGEN ISOTOPIC VALUES AND POSSIBLE PALEOECOLOGICAL CORRELATIONS
G. Strathearn

General Session 1

PREBIOTIC EVOLUTION IN EXTRATERRESTRIAL ENVIRONMENTS

Contributed Papers

Session Co-Chairs: A. Bar-Nun, F. Raulin

- 3:40 p.m. (020) ✓ THE FORMATION OF AMINO ACIDS IN THE REACTION OF ATOMIC CARBON WITH AMMONIA AND WATER
P. Shevlin, K. Rahman and D. McPherson
- 4:00 p.m. (021) ENERGY YIELDS FOR THE PRODUCTION OF HCN IN ATMOSPHERES WITH HIGH H₂/CH₄ RATIOS: IMPLICATIONS FOR THE JOVIAN ATMOSPHERE AND THE SOLAR NEBULA
R. Stribling and S. Miller
- 4:20 p.m. (022) ✓ ORGANIC COMPOUNDS OF CARBONACEOUS CHONDRITES FROM ANTARCTICA AND THEIR IMPLICATION TO A PRIMITIVE CONDENSATE
A. Shimoyama, H. Naraoka and K. Harada
Dept. Chemistry, Tsukuba Uni, IBARAKI, 305, Japan.
- 4:40 p.m. (023) ✓ PREBIOTIC CHEMICAL EVOLUTION: EVIDENCE FROM CARBONACEOUS METEORITES
J. Kerridge
- 5:00 p.m. (024) ✓ THE EARLY ATMOSPHERES OF EARTH AND MARS
J. Levine and W. Kuhn

Contributed Posters (Displayed July 21-23)

- ✓(025) TRAPPING AND RELEASE OF GASES BY WATER ICE AND IMPLICATIONS FOR ICY BODIES
A. Bar-Nun, J. Dror, E. Kochavi, D. Laufer, D. Kovetz and T. Owen (*Telaviv*)
J. H. Earth & Space Sci., Univ. of New York, Stony Brook, Long Island, NY 11790 U.S.A.
- ✓(026) INTERSTELLAR AND COMETARY MOLECULES: PREBIOLOGICAL CONNECTIONS
J. Berry and J. Oro (*Johns Hopkins Univ. Baltimore, MD*)
- (027) GAS PHASE SYNTHESIS OF ORGANOPHOSPHOROUS COMPOUNDS AND THE ATMOSPHERE OF THE GIANT
SR. I, Univ. of Houston, 4800 Calhoun Road, Houston, TX 77004 U.S.A.

PLANETS

- A. Bossard, R. Kanga and F. Raulin
- (028) THEORETICAL STUDIES OF INTERSTELLAR ISOMERS
D. DeFrees and A. McLean
- (029) IDENTIFICATION AND QUANTIFICATION OF NUCLEIC ACID BASES IN CARBONACEOUS CHONDRITES
L.-L. Hua, K. Kobayashi, E.-I. Ochiai, C. Gehrke, K. Gerhardt and C. Ponnampereuma
- (030) HCN FORMATION ON JUPITER BY PHOTOLYSIS OF AMMONIA-ACETYLENE MIXTURES
Y. Ishikawa, H. Khwaja and J. Ferris
- (031) ELECTRIC DISCHARGE REACTIONS IN A MIXTURE OF PHOSPHINE, METHANE, NITROGEN AND WATER
K. Kobayashi, W. Wang, N. Zhao and C. Ponnampereuma
- (032) RAMAN SPECTROSCOPIC STUDIES OF CARBON IN EXTRATERRESTRIAL MATERIALS
J. Macklin, D. Brownlee, S. Chang and T. Bunch
- (033) INTERACTION OF THOLIN MATERIAL AND A LIQUID ETHANE OCEAN ON TITAN
J. Mathog, C. McKay and R. Mancinelli
- (034) LASER MICROPROBE STUDY OF CARBON IN INTERPLANETARY DUST PARTICLES (IDP)
F. Radicati di Brozolo, T. Bunch and S. Chang
- (035) ABIOTIC SYNTHESIS OF ORGANIC GASES AND AEROSOLS IN THE ATMOSPHERE OF TITAN
T. Scattergood, C. McKay, W. Borucki, J. Kasting, B. O'Hara and S. Miller
- ✓(036) ON THE ORIGIN OF ESSENTIAL TRACE ELEMENT REQUIREMENTS
V. Valkovic

7:00 - 10:00 p.m.

ISSOL Reception

7:00 p.m.

Evening Reception Lecture
Guest Lecturer:
Stephen Jay Gould

8:00 - 10:00 p.m.

Reception

Tuesday, July 22

Symposium 2

WHAT IS PRIMITIVE IN BIOLOGY?

Invited Papers

Session Chairman: L. Hochstein

8:00 a.m. (037)

READING THE METABOLIC RECORD
H. Hartman (*Hyman 54-1920, Dept. of Earth Sci's Massachusetts Inst. of Technology, Cambridge, MA.*)

8:45 a.m. (038)

MAPPING THE EARLY EVOLUTION OF CELLS WITH RIBOSOMAL RNA SEQUENCES AND STRUCTURES
J. Lake *USA.*

9:30 a.m. (039)

EVOLUTION OF BIOCHEMICAL PATHWAYS IN PROKARYOTES
R. Jensen

Contributed Papers

Session Co-Chairs: O. Kandler, A. Krasnovsky, J. Oro

10:15 a.m. (040)

CANDIDATE FOR A MOST PRIMITIVE PRIMORDIAL GENE COMMONLY ANCESTRAL TO THE GENES FOR THE ADENYLATE KINASE, F₁-ATPase ϵ AND γ

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SUBUNITS, AMINOACYL-tRNA SYNTHETASE AND RNA POLYMERASE CORE ENZYME
K. Ohnishi

- 10:35 a.m. (041) EARLY BACTERIAL RESPONSES TO ULTRAVIOLET AND VISIBLE LIGHT: DNA REPAIR EVOLVED IN THE ARCHEAN AEON
R. Guerrero and J. Barbe
- 10:55 a.m. (042) THE EVOLUTION OF ANTIBIOTIC BINDING SITES ON EUBACTERIAL, EUKARYOTIC AND ARCHAE-BACTERIAL RIBOSOMES. A RECORD OF THE EVOLUTION OF THE TRANSLATIONAL MACHINERY?
R. Amils, J. Sanz, I. Marin and J. Teixido
- 11:15 a.m. (043) MEMBERSHIP OF THE PRIMITIVE AMINO ACID CODE
J. Wong and R. Cedergren
- 11:35 a.m. (044) CELL WALL CHEMISTRY AND EARLY EVOLUTION OF ORGANISMS
O. Kandler

Contributed Posters (Displayed July 21-23)

- (045) ON ARCHAEBACTERIAL CLASS I AND CLASS II ALDOLASES FROM EXTREME HALOPHILES
W. Altekari and N. Dhar
- (046) ON THE EVOLUTION OF PRIMITIVE CELLS IN ARCHAIC SUBMARINE HOT SPRING ENVIRONMENTS: THE EMERGENCE OF ARCHAEBACTERIA, EUBACTERIA AND EUKARYOTES
J. Corliss
- (047) STUDIES ON THE EVOLUTION OF THIOREDOXINS: PROPERTIES OF THIOREDOXINS f AND m IN A PHOTOTROPHICALLY AND HETEROTROPHICALLY GROWN GREEN ALGA
H. Huppe and B. Buchanan
- (048) A UNIQUE ATPase IN THE ARCHAEBACTERIUM, *Halobacterium saccharovorum*
H. Kristjansson and L. Hochstein
- (049) THERMODYNAMICS OF THERMOPHILIC ARCHAEBACTERIA
A. Liquori
- (050) WHY TERMINATORS ARE UAA, UAG, AND UGA?
L. Luo and Q. Li
- (051) A POSSIBLE EXPLANATION ON INITIATOR CODONS
L. Luo and W. Su
- (052) WHY ARE THERE FOUR BASES IN DNA?
L. Luo
- (053) THE RELATIONSHIP BETWEEN THE ORIGINS OF THE BIOSYNTHETIC PATHS TO THE AMINO ACIDS AND THEIR CODING
J. McClendon
- (054) THE OXYGEN AFFINITY OF MAMMALIAN HEMOGLOBINS IN THE ABSENCE OF 2,3-DIPHOSPHOGLYCERATE IN RELATION TO BODY WEIGHT
M. Nakashima, H. Noda, M. Hasegawa and A. Ikai
- (055) ENERGY METABOLISM OF AN ACIDO-THERMOPHILIC ARCHAEBACTERIUM, *Sulfolobus acidocaldarius*
T. Oshima and T. Wakagi

12:00 noon - Lunch, Poster Session, Executive Council Meeting 1
2:00 p.m.

General
Session 2

Contributed
Papers

- 2:00 p.m. (056) FIXATION OF MOLECULAR NITROGEN UNDER NON-REDUCING PREBIOTIC CONDITIONS - FORMATION OF AMMONIA AND ORGANIC AMINO COMPOUNDS
K. Harada, M. Takasaki, S. Igari and A. Shimoyama
- 2:20 p.m. (057) PREBIOTIC SYNTHESIS OF IMIDAZOLE-4-ACETALDEHYDE, IMIDAZOLE-4-GLYCOL AND IMIDAZOLE-4-ETHANOL
C. Shen, L. Yang, S. Miller and J. Oro
- 2:40 p.m. (058) ABIOTIC SYNTHESIS OF NUCLEOSIDES BY ELECTRIC DISCHARGE IN A SIMULATED PRIMITIVE EARTH ATMOSPHERE
K. Kobayashi, L.-L. Hua, P. Hare, M. Hobish and C. Ponnampereuma

- 3:00 p.m. (059) ENERGY YIELDS IN THE PREBIOTIC SYNTHESIS OF HYDROGEN CYANIDE AND FORMALDEHYDE
R. Stribling and S. Miller
- 3:20 p.m. (060) THERMODYNAMICS OF THE ABIOTIC SYNTHESIS OF AQUEOUS ORGANIC SPECIES AT HIGH TEMPERATURES
E. Shock and H. Helgeson

- 3:40 p.m. (061) PREBIOTIC RIBOSE SYNTHESIS: A CRITICAL ANALYSIS
R. Shapiro (Rohat) *Dept. Chem., N.Y. Univ., 4 Washington Place, New York, N.Y. 10023, USA.*
- 4:00 p.m. (062) THE ROLE OF LOWER ALDEHYDES IN THE PROCESSES OF THE PREBIOLOGICAL AND BIOLOGICAL EVOLUTIONS
T. Pavlovskaya and T. Telegina *A.N. Bach Inst. A. Biochem., 33 Leninsky, P.R. Moscow 117071 USSR.*

Contributed Posters (Displayed July 21-23)

- (063) THE ROLE OF SULFUR IN PREBIOTIC CHEMISTRY
A. Bhadra and C. Ponnampereuma
- (064) SYNTHESIS OF URACIL FROM GLYCINE: A POSSIBLE PATHWAY IN PREBIOTIC SYNTHESIS
S. Diones
- (065) FORMATION OF ORGANIC COMPOUNDS AND CO₂ BY SEGREGATION OF CARBON FROM MgO - KINETIC AND ISOTOPIC DATA
F. Freund, S. Chang, F. Pineau, R. Knobel and F. Struwe

- (066) ORGANIC MOLECULES RELEASED FROM OLIVINE BY SLOW IMPACT FRACTURE
F. Freund, J. Dickinson, C. Becker, M. Freund and S. Chang

- (067) SYNTHESIS OF ORGANIC MOLECULES UNDER PRESUMED PREBIOTIC CONDITIONS
K. Goto and M. Ishigami *Kaih. Reactor Institute, Kyoto Uni., Kumatori-cho, Senri-gun, Osaka - 590-04*
- (068) AN APPLICATION OF COMPUTERIZED FACTORIAL DESIGN FOR OPTIMUM SEPARATION OF BIOCHEMICAL COMPOUNDS IN HPLC
L.-L. Hua, F. Hu and Y-G. Lin

- (069) PREBIOTIC SYNTHESIS OF PURINES FROM METABOLIC INTERMEDIATES
C. Katsigiannis, A. Mar and J. Oro

- (070) ABIOTIC SYNTHESIS OF NUCLEIC ACID BASES BY ELECTRIC DISCHARGE IN A SIMULATED PRIMITIVE ATMOSPHERE
K. Kobayashi, L.-L. Hua, C. Gehrke, K. Gerhardt and C. Ponnampereuma

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(071) METHANE AS A CHEMICAL DOSIMETER IN PREBIOTIC EXPERIMENTS. I. ELECTRICAL DISCHARGES, HEAT AND SHOCK WAVES
R. Navarro-Gonzalez, A. Negron-Mendoza and C. Ponnampertuna

(072) INFLUENCE OF Na-MONTMORILLONITE IN THE GAMMA RADIOLYSIS OF ACETIC ACID. IMPLICATIONS IN PREBIOTIC SYNTHESIS
A. Negron-Mendoza, R. Navarro-Gonzalez and C. Ponnampertuna

(073) SOME ASPECTS OF THE GAMMA RADIOLYSIS OF AQUEOUS SOLUTIONS OF UREA IN THE CONTEXT OF CHEMICAL EVOLUTION
A. Negron-Mendoza, R. Navarro-Gonzalez and J. Torres

(074) PREBIOTIC SYNTHESIS OF PANTOIC ACID AND THE OTHER COMPONENTS OF COENZYME A
G. Schlesinger and S. Miller

(075) PHOSPHORYLATION MECHANISMS IN AMIDE MEDIA
A. Schoffstall, S. Mahone and C. Martin (Allen)
Dept. Chem., Univ. Colorado, Colorado Spring, CO, 80907 USA.
Moderator: L. Orgel

Debate 1

4:20 p.m.

WHAT WERE THE FIRST ENZYMES: PROTEINS OR NUCLEIC ACIDS?

PROTEINS -- A. Brack and A. Weber (Arthur) *Salk Inst. for Biological Studies, P.O. Box 85800, San Diego, CA. 92138 USA.*
NUCLEIC ACIDS -- N. Pace and H. Hartman

Wednesday, July 23

General Session 3

EARLY BIOLOGICAL EVOLUTION INFERRED FROM CONTEMPORARY ORGANISMS

Contributed Papers

Session Co-Chairs: T. Jukes, T. Oshima

8:00 a.m.

(076) PHYLOGENETIC PEDIGREES MARKING EVENTS LYING BETWEEN THE FIRST DARWINIAN ANCESTORS AND THE LAST COMMON ANCESTOR
D. Bloch and M. Staves

8:20 a.m.

(077) EFFECTS OF CONFORMATIONAL FACTORS ON PROTEIN EVOLUTION
Y. Momotani

8:40 a.m.

(078) STUDIES ON THE SYNTHETIC ACTIVITY OF BOVINE PANCREATIC RIBONUCLEASE A AND ITS RELEVANCE TO THE PREBIOTIC SYNTHESIS OF OLIGORIBONUCLEOTIDES
R. de Llorens, C. Cuchillo and J. Oro

9:00 a.m.

(079) EVOLUTION OF GLUTATHIONE METABOLISM IN PHOTOTROPHIC MICROORGANISMS
R. Fahey, R. Buschbacher and G. Newton

9:20 a.m.

(080) THE EFFECTS OF LOW OXYGEN ON THE SYNTHESIS OF UNSATURATED FATTY ACIDS AND STEROLS: IMPLICATIONS FOR THE EVOLUTION OF EUKARYOTES
L. Jahnke

9:40 a.m.

(081) SYMBIOSIS IN EVOLUTION: STATUS OF THE HYPOTHESIS OF THE SPIROCHETE ORIGIN OF UNDULIPODIA
(Lyrrn) L. Margulis, D. Bermudes, R. Obar and G. Tzertzinis
Dept. Biology, Boston Univ., 2 Cummington Street, Boston, MA 02215 USA.

Contributed Posters (Displayed July 21-23)

(082) FITTING EARLY PROKARYOTE LINEAGES BASED ON GLOBAL MINIMIZATION APPROACHES OF MACROMOLECULAR SEQUENCE PHYLOGENY
J. Barnabas, T. Row and S. Barnabas

(083) VARIATIONS IN THE GENETIC CODE AND THEIR POSSIBLE EVOLUTIONARY SIGNIFICANCE
T. Jukes

(084) CYANOBACTERIAL GENES FOR THE CYTOCHROME B6-F COMPLEX: SEQUENCE HOMOLOGY WITH ORGANELLAR AND BACTERIAL GENES BUT DIVERGENCE OF OPERON STRUCTURE
T. Kallas, S. Spiller and R. Malkin

(085) WHAT IS LIFE? LIFE AS A BIOINFORMATION SYSTEM
R. Lahoz-Beltra

(086) EVOLUTIONARY CO-ORIGIN OF AMINOACYL-tRNA SYNTHETASES FOR DIFFERENT AMINO ACIDS, AS INFERRED FROM SEQUENCE HOMOLOGIES
K. Ohnishi

(087) MOLECULAR EVOLUTION OF THE DOMAINS OF IMMUNOGLOBULIN SUPERFAMILY
K. Ohnishi

(088) EARLY MOLECULAR EVOLUTION OF NUCLEIC ACID POLYMERASES AS INFERRED FROM THE AMINO ACID AND NUCLEOTIDE SEQUENCE HOMOLOGIES
K. Ohnishi

(089) EVOLUTIONARY SIGNIFICANCE FOR UTILIZATION OF D-AMINO ACIDS IN CONTEMPORARY BACTERIA
A. Shimada, T. Fukuhara and S. Yuasa

(090) OBLIQUE HOMOLOGIES MAY INDICATE RELATIVELY RECENT EVOLUTION OF SOME TRANSFER RNAs
M. Staves, J. Lacey, Jr., and D. Bloch

(091) ON THE CODON EVOLUTION
J. Toha and M. Soto

(092) MICROBIAL MAT WITH AN INCOMPLETE VERTICAL STRUCTURE, FROM BRACKISH-WATER ENVIRONMENT, THE PUCK BAY, POLAND. A POSSIBLE ANALOG OF AN "ADVANCED ANAEROBIC ECOSYSTEM"?
A. Witkowski

General Session 4

THE GEOLOGICAL RECORD OF EARLY BIOLOGICAL EVOLUTION

Contributed Papers

Session Co-Chairs: D. Lowe, M. Schidlowski

10:00 a.m.

(093) NEWLY DISCOVERED EARLY ARCHEAN (3.4-3.5 Ga OLD) MICROORGANISMS FROM THE WARRAWOONA GROUP OF WESTERN AUSTRALIA
J. W. Schopf and B. Packer *(Williams) Dept. Earth and Space Sci., Univ. California, Los Angeles, CA 90024 USA.*

10:20 a.m.

(094) ARCHEAN CARBON ISOTOPIC ABUNDANCES: NEW RESULTS AND A COMMENTARY ON THE UTILITY OF THE RECORD
J. Hayes, A. Kaufman and A. Hickman

10:40 a.m.

(095) CARBON ISOTOPIC STUDIES OF MICROBIAL MATS AND STROMATOLITES
D. DesMarais and H. Bui

11:00 a.m.

(096) DID LIFE ORIGINATE IN SOIL?
G. Retallack

11:20 a.m.

(097) BIOGENIC GENESIS OF BANDED IRON FORMATION FROM HYDROTHERMAL SOLUTIONS
N. Holm

11:40 a.m.

(098) BACTERIAL MAGNETITE AS TRACE FOSSIL AND PALEOOXYGEN INDICATOR
J. Stolz, S-B.R. Chang and J. Kirschvink

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 Contributed Posters (Displayed July 21-23)

(099) MODES OF CHANGE IN THE EVOLUTIONARY RECORD: SYMBIOSIS AS A MECHANISM OF EVOLUTION
 D. Bermudes and L. Margulis

(100) THE MAINTENANCE OF STRATIFIED MICROBIAL COMMUNITIES IN THE LABORATORY
 M. Enzien

(101) ISOTOPE ASPECTS OF BACTERIAL MAT FORMATION: ARCHAEOA TO RECENT
 M. Schidlowski (Manfred) Max Planck Inst. für Chemie, SAARST-23, D-650 Mainz, FRG.

(102) PRECAMBRIAN PALEOBIOLOGICAL 35mm SLIDES FOR USE IN TEACHING
 J. W. Schopf

12:00 noon Free Time - No Afternoon Sessions

Thursday, July 24

Symposium 3 HOW DID BIOENERGETIC AND BIOMEMBRANE SYSTEMS DEVELOP IN THE PREBIOTIC MILIEU?

Invited Papers Session Chairman: D. Deamer

8:00 a.m. (103) PROTON CHEMISTRY AND BIOGENESIS
 H. Morowitz

8:45 a.m. (104) EVOLUTION OF ION-TRANSPORT MECHANISMS
 P. Maloney

9:30 a.m. (105) ORIGIN AND EVOLUTION OF PHOTOSYNTHETIC REACTION CENTERS
 J. Olson and B. Pierson

Contributed Papers Session Co-Chairs: H. Baltscheffsky, A. Weber

10:15 a.m. (106) BOUNDARY STRUCTURES AND THE NON-POLAR ORGANIC COMPONENTS OF THE MURCHISON CARBONACEOUS CHONDRITE
 D. Deamer

10:35 a.m. (107) MODELS OF GLYCOLYSIS: GLYCERALDEHYDE AS A SOURCE OF ENERGY AND MONOMERS FOR PREBIOTIC CONDENSATION REACTIONS
 A. Weber

10:55 a.m. (108) ARCHITECTURE OF MODELS FOR PROTOCELLULAR STRUCTURES: FORMATION OF PROTEIN, LIPID AND LIPID-PROTEIN VESICLES

H. Yanagawa, K. Kojima and Y. Ogawa (Hiroshi) Mitsubishi-Kasei Inst. Life Sci., 11 Minamiooya, Machida, Tokyo-194, Japan
 11:15 a.m. (109) ABIOTIC PHOTOSYNTHESIS FROM FERROUS CARBONATE (SIDERITE) AND WATER
 H. Joe, K. Kuma, W. Paplawsky, B. Rea and G. Arrhenius

11:35 a.m. (110) CLAY ENERGETICS IN CHEMICAL EVOLUTION - SOLVATION/DESOLVATION LUMINESCENCE OF SOME ARTIFICIALLY AND NATURALLY HYDRATED KAOLINS
 L. Coyne

Contributed Posters (Displayed July 24-25)

(111) LIPOSOMES WITH POLYRIBONUCLEOTIDES AS MODELS OF PRECELLULAR SYSTEMS
 I. Baeza, M. Ibanez, A. Lazcano, J. Santiago, C. Wong and J. Oro

(112) ORIGIN AND EVOLUTION OF BIOLOGICAL ORGANIZATION
 K. Bahadur, S. Ranganayaki and M. Bahadur

(112a) LIGHT AND INORGANIC PYROPHOSPHATES AS POSSIBLE KEY COMPONENTS IN THE DEVELOPMENT OF THE EARLIEST BIOENERGETIC SYSTEMS
 H. Baltscheffsky and M. Baltscheffsky (Henrick)

Dept. Biochem., Uni. Stockholm, S-10691 Stockholm, S-10691
 (113) PREBIOTIC ENTROPY FLOW: THE ROLE OF GASEOUS CARBON DIOXIDE
 R. Clapp Stockholm, Sweden

(114) ON THE CREATION OF LIVING CELLS IN SUBMARINE HOT SPRING FLOW REACTORS: ATTRACTORS AND BIFURCATIONS IN THE NATURAL HIERARCHY OF DISSIPATIVE SYSTEMS
 J. Corliss

(115) MODELLING OF THE INTERACTIONS BETWEEN BIOLOGICALLY ACTIVE SUBSTANCES AND LIPIDS OF PRIMITIVE-LIKE MEMBRANES
 G. Deborin and A. Sorokina, A.N. Bach Inst. of Biochem. 33, Leningrad P.R., Moscow 117071 USSR

(116) SPECULATIONS ON THE ORIGIN AND EVOLUTION OF PHOTOSYNTHESIS AND THE MEMBRANE
 H. Hartman

(117) GEMOPROTEINOIDS AS PROBABLE SENSITIZERS OF PREBIOTICAL PHOTOPHOSPHORYLATION
 M. Kolesnikov, N. Maksudova and I. Egorov Pskov Inst. USSR

(118) ORIGIN OF PRIMITIVE CELLS I: BIOCHEMICAL EVOLUTION WITHIN BILAYER LIPID VESICLES
 G. Naresh Kumar and M. Ravi Kumar

(119) NON-ENZYMATIC SYNTHESIS OF UDPG AND PHOSPHORYLATED METABOLIC INTERMEDIATES
 A. Mar, J. Dworkin, S. Porbunderwalla and J. Oro

(120) BIOENERGETICS: ORIGIN AND EARLY EVOLUTION
 Z. Masinovsky

(121) ORIGIN AND EVOLUTION OF BIOLOGICAL MOTILITY
 K. Matsuno (Koichiro) Inst. Mol.-cellular Evol. Uni. Miami, 521 Anastasia Ave., Coral Gables, FL. 33134 USA

(122) METABOLIC EVOLUTION AND ORIGIN OF EUKARYOTIC CELL-MEMBRANE EVOLUTION THEORY
 H. Nakamura

(123) BIOMIMETIC PROPERTIES OF SIMULATED PROTO-MEMBRANES
 A. Przybylski and S. Fox

(124) CONCEPT OF THE ORIGIN OF PROTOMEMBRANES
 A. Przybylski (Aleksander)

(125) NON-ENZYMATIC FORMATION OF CONDENSED PHOSPHATES UNDER PREBIOTIC CONDITIONS
 F. Seel, K. Klos and J. Schuh

12:00 noon - 2:00 p.m. Lunch, Poster Session, Executive Council Meeting 2

General Session 5 EXOBIOLGY AND SPACE MISSIONS

Contributed Papers Session Co-Chairs: D. DeVincenzi, G. Horneck

2:00 p.m. (126) OBSERVATIONAL EXOBIOLGY
 J. Tarter

2:20 p.m. (127) DETECTION OF PLANETS AND EVIDENCE OF LIFE
 B. Burke

2:40 p.m. (128) PREBIOTIC CHEMICAL EVOLUTION IN TITAN'S OCEAN
 (Francis) F. Raulin, F. Cerceau, M. Hakdaoui and A. Vargass

(continued on next page)

(continued from previous page)

- 3:00 p.m. (129) LABORATORY INVESTIGATIONS OF MARS: CHEMICAL AND SPECTROSCOPIC CHARACTERISTICS OF A SUITE OF MARS SOIL ANALOGS
A. Banin, G. Carle, S. Chang, L. Coyne, *Dept. Soil & Water* (144)
J. Orenberg and T. Scattergood
Scis, Hebrew Univ., P.O. Box 12, Rehovot, Israel.
- 3:20 p.m. (130) EXOBIOLOGICAL EXPERIMENTS ON THE FIRST EURECA MISSION
(Gerda) G. Horneck, J. Barrett, A. Bieger, H. Buckner, K. Dose, J. Greenberg, J. Kiefer, H. Mennigmann, G. Reitz and P. Weber
DFVLR - FF-ME, ABT. Biophysik, Postfach, 90 60 58, Linder Höhe, 5000 KÖLN 90, Germany.
- Contributed Posters (Displayed July 24-25)
- (131) SETI: PAST, PRESENT AND FUTURE
P. Backus
- (132) SURVIVAL UNDER VACUUM
A. Bieger, K. Dose, B. Koenig and K. Martens
- (133) BARRIERS TO NATURAL INTERCHANGE OF BIOLOGICALLY ACTIVE MATERIAL BETWEEN EARTH AND MARS
B. Clark
- (134) EMERGING SPACE FLIGHT OPPORTUNITIES IN EXOBIOLGY
D. DeVincenzi and L. Griffiths
- (135) CAN MICROORGANISMS WITHSTAND THE MULTISTEP TRIAL OF INTERPLANETARY TRANSFER? CONSIDERATIONS AND EXPERIMENTAL APPROACHES
G. Horneck and H. Buckner
FRG
- (136) EXOBIOLGY AND FUTURE MARS MISSIONS
C. McKay, R. Mancinelli and G. Carle
- (137) INFRARED SPECTRA OF GASEOUS NITRILES AND THE SEARCH FOR ORGANIC COMPOUNDS IN PLANETARY ATMOSPHERES
F. Raulin, F. Cerceau, M. Hakdaoui, J. Nedelec and J. Forgerit
- (138) EXOBIOLGY IN EARTH ORBIT
J. Tarter, D. DeFrees, D. Brownlee, D. Usher, H. Klein and W. Irvine *(William)*
Astronomy Dept., Graduate Reach Tower B, Uni. Massachusetts, Amherst, MA, 01003 USA.
- Contributed Papers
Session Co-Chairs: A. Rich, W. Thiemann
- 3:40 p.m. (139) ASYMMETRIC PHOTOREACTIONS AS A MODEL FOR EVOLUTION OF CHIRALITY
H. Teutsch and W. Thiemann *(Wolfram)*
Forschereich Chemie/Biologie, Uni. Bremen, Postfach 330 440.
- 4:00 p.m. (140) HAS NUCLEAR CHIRALITY BEEN A PREBIOTIC SOURCE OF OPTICAL PURITY OF LIVING SYSTEMS? THE QUANTUM YIELDS OF GAMMA- AND BETA-DECARBOXYLATION OF 1-¹⁴C LABELLED D- AND L-LEUCINE IN THE SOLID STATE CAN INDICATE CONSIDERABLE SELECTIVITY
R. Tokay, B. Norden, J-O. Liljenzin, and S. Andersson
Bremen (FRG) (Germany) Federal Republic of Germany
- 4:20 p.m. (141) HIGH Z METALLOCHIRAL COMPOUNDS AND THE ORIGIN OF BIOLOGICAL CHIRALITY: EXPERIMENTAL RESULTS USING POLARIZED POSITRONS
A. Rich and J. Van House
- 4:40 p.m. (142) SELECTION OF MOLECULAR CHIRALITY BY EXTREMELY WEAK CHIRAL INTERACTIONS
D. Kondepudi
- Contributed Posters (Displayed July 24-25)
- (143) SPACE SCENARIO OF THE ORIGIN OF LIFE: THE PROBLEM OF CHIRAL PURITY
S. Anikin, V. Avetisov and V. Goldanskii
- CHIRAL PURITY - THE JUNCTION OF CHEMICAL EVOLUTION AND PREBIOSPHERE
V. Goldanskii, V. Kuzmin, V. Avetisov and S. Anikin
- (145) SPONTANEOUS SYMMETRY BREAKING IN BIOLOGICAL SYSTEMS
A. Kovacs
- (146) CRITICAL CONDITIONS FOR THE "BIOLOGICAL BIG BANG"
V. Kuzmin, V. Goldanskii, V. Avetisov and S. Anikin
- (147) WEAK NEUTRAL CURRENT EFFECTS ON THE ABSORPTION OF LIGHT BY CHIRAL MOLECULES
R. Hegstrom
- (148) RECOGNITION OF L-AMINO ACIDS BY D-HEXOSE OR -PENTOSE POLYMERS: A MODEL EXPERIMENT FOR CHIRAL EVOLUTION OF AMINO ACIDS
T. Fukuhara and S. Yuasa
- (149) ²⁶Al IN METEORITES AND THE ORIGIN OF BIOLOGICAL OPTICAL ACTIVITY
(Arthur) A. Rich and J. Van House *Dept. Physics, Uni. Michigan ANN ARBOR, MI 48109 (U.S.A.)*
Open Business Meeting
- 5:00 p.m.
Friday, July 25
- Symposium 4
WHAT WERE THE FIRST SELF-REPLICATING SYSTEMS?
- Invited Papers
Session Chairman: D. White
- 8:00 a.m. (150) SEARCH FOR CRYSTAL GENES
A. Cairns-Smith and P. Braterman
Dept. Chemistry, Univ. Glasgow, Glasgow, Scotland)
- 8:45 a.m. (151) REPLICATION MODELS
L. Orgel
912 899.
- 9:30 a.m. (152) TRANSLATION MODELS
D. Usher
- Contributed Papers
Session Co-Chairs: S. Fox, K. Matsuno
- 10:15 a.m. (153) TEMPLATE-DIRECTED LIGATION OF OLIGONUCLEOTIDES ON HYDROXY-APATITE: A MODEL FOR COMPLEXATION IN A PRIMITIVE OCEAN
O. Acevedo and L. Orgel
- 10:35 a.m. (154) ELONGATION OF RIBOOLIGOGUANYLATES UNDER TEMPLATE-DIRECTED CONDITIONS
A. Kanavarioti and D. White
- 10:55 a.m. (155) SPONTANEOUS OLIGOMERIZATION OF PURINE DERIVATIVES
A. Schwartz
- 11:15 a.m. (156) CHIRAL SELECTION IN TEMPLATE-DIRECTED RNA SYNTHESIS AND THE CASE FOR A PROCHIRAL ANCESTOR OF RNA
G. Joyce, L. Orgel and S. Miller
- 11:35 a.m. (157) AUTOCATALYTIC SETS OF PROTEINS
S. Kauffman, J. Farmer and N. Packard
- Contributed Posters (Displayed July 24-25)
- (158) STUDIES OF THE NON-ENZYMATIC TEMPLATE-DIRECTED SYNTHESIS OF OLIGOGUANYLATES
G. Armangue and J. Oro

(continued on next page)

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✓ (159) RELATIONSHIP BETWEEN CRYSTAL AND JEEWANU,
THE MODEL OF PROTO CELL
K. Bahadur, S. Ranganayaki, M. Bahadur
and M. Karbanda

(160) INFLUENCE OF SIMPLE POLYPEPTIDES ON
NUCLEOTIDE POLYMERIZATION
B. Barbier and A. Brack

✓ (161) NATIONAL PROGRAMME ON STUDIES RELATED TO
CHEMICAL EVOLUTION, ORIGIN OF LIFE AND CO-
ORDINATED STUDIES OF THE INDIAN PRECAM-
BRIAN ROCK DEPOSITS *Dr. M.S. Chadha, Bio-Organic Div.,
M. Chadha Bhabha Atomic Resch. Center, Trombay, Bombay 400085,
INDIA.*

✓ (162) ON THE MINIMAL CONDITIONS FOR THE
EMERGENCE OF LIFE ON EARTH
*Prof. F. Eirich, Polytechnic Institute of New York,
333 Jay Street, Brooklyn, NY 11201 U.S.A.*

✓ (162a) LIESEKING RING - A SIMPLE MODEL FOR THE
FORMATION OF ORDER FROM CHAOS
W. Jacobi and W. Thiemann *(Wistar, etc.)*

(163) CONSEQUENCES OF TEMPLATE SELF-STRUCTURE
IN POLY(C,G)-DIRECTED SYNTHESIS OF
OLIGO(G,C)S
G. Joyce and L. Orgel

(164) ARCHITECTURE OF MODELS FOR PREBIOTIC SYN-
THESIS OF NUCLEIC ACIDS: TEMPLATE-DIREC-
TED SYNTHESIS OF OLIGOADENYLATES USING
CYANOGEN BROMIDE AND DIIMINOSUCCINONITRILE
E. Kanaya and H. Yanagawa

(165) SYMMETRY-BREAKINGS AND THE EMERGENCE OF
REPLICATING SYSTEMS: A NEW DIMENSION OF
PHYSICS
K. Matsuno

✓ (166) EVOLUTION WITHOUT SELF-REPLICATION:
GROWTH OF COMPLEXITY IN CATALYTIC NETWORKS
G. Nelson

✓ (167) FORMAL CONSIDERATIONS ON THE ORIGIN OF
LIFE
*S. Salthe, Dep. Biology, Brooklyn College,
Brooklyn, NY, 11210 U.S.A.*

(169) MOLECULAR SELF-ORGANIZATION IN PROTOBIO-
GENESIS AND DIALECTICS
D. Velkov

✓ (170) A SELF-REPRODUCING MOLECULAR ROBOT
G. von Kiedrowski

(171) STUDIES OF THE OLIGOMERIZATION AND
PROPERTIES OF OLIGONUCLEOTIDE ANALOGS
BEARING (3'→5') PHOSPHORAMIDATE BACKBONE
W. Zielinski and L. Orgel

12:00 noon -
2:00 p.m.

Lunch and Poster Session

General
Session 6B

MODELS FOR DEVELOPMENT OF BIOLOGICAL
STRUCTURES AND FUNCTIONS: PEPTIDES,
NUCLEIC ACIDS, GENETIC CODE

Contributed
Papers

Session Co-Chairs: J. Ferris, A. Lazcano

2:00 p.m.

✓ (172) THEORETICAL INVESTIGATIONS OF THE ROLE OF
CLAY EDGES IN PREBIOTIC PEPTIDE BOND FOR-
MATION. 2. STRUCTURE AND ELECTRON DIS-
TRIBUTION OF ACTIVATED AMINO ACID ESTERS
G. Loew, J. Collins, B. Luke, J.
Lawless and D. White *(James) 239-12 Ames Resch. Center,
Moffett Field, CA 94035 USA.*

2:20 p.m.

✓ (173) CLAYS AS PROTOTYPICAL ENZYMES FOR THE PRE-
BIOLOGICAL FORMATION OF PHOSPHATE ESTERS
*(James) J. Ferris, C.-H. Huang and W. Hagan Jr.
Dep. Chem., Rensselaer Polytechnic Institute,
Troy, NY 12181 USA.*

2:40 p.m.

(174) RACEMIC ORIGINS OF THE STEREOCHEMICAL
HOMOGENEITY OF THE BIOSPHERE. ISOTACTIC
BIASING IN THE FORMATION OF OLIGOMERIC
PEPTIDES
S. Goldberg, J. Crosby, N. Iusem and U.
Younes

3:00 p.m.

(175) EXPERIMENTS ON REVERSE TRANSLATION
T. Nakashima and S. Fox

3:20 p.m.

(176) SPECIFIC BINDING OF HAIRPIN OLIGONUCLEO-
TIDES TO HOMO-OLIGONUCLEOTIDES BY TRIPLET
RECOGNITION
U. Baumann

3:40 p.m.

(177) STEREOSELECTIVE INTRAMOLECULAR INTERAC-
TIONS IN AMINOACYL-NUCLEOTIDE ESTERS
INFLUENCES THE 2'-3' DISTRIBUTION
J. Lacey, Jr., M. Wolfe and C. Watkins

4:00 p.m.

(178) ASPECTS ON THE DEVELOPMENT OF ACCURACY AND
THERMODYNAMIC EFFICIENCY, AND ITS RELATION
TO THE OVERALL PRODUCTION RATE
C. Blomberg

Contributed Posters (Displayed July 24-25)

✓ (179) ELEMENTARY CATALYTIC SYSTEM AS A COMPONENT
OF LARGE ENZYMATIC SYSTEMS
M. Borowskiak

(180) EMERGENCE AND SURVIVAL OF PROTEIN-LIKE
PEPTIDES IN WATER
A. Brack

(181) SELF ORDERING OF AMINO ACIDS IN POLY-
PEPTIDES RECONSIDERED
W. Bradley

(182) THERMODYNAMIC ANALYSIS OF PREBIOTIC
SYNTHESIS OF PROTEIN
W. Bradley

(183) EVOLUTION OF PROTEINS: AN ERGODIC MARKOV
CHAIN
G. Cullmann and J. Labouygues

✓ (183a) OPTIMIZATION OF INFORMATION TRANSFER IN
SELF-REPLICATING SYSTEMS
S. Glauser and T. Glauser

(184) A POSSIBLE ROUTE FOR THE FORMATION OF
PROTEIN LIKE COPOLY (AMINO ACIDS) -
COPOLYCONDENSATION OF THERMAL PRECURSORS
OF ASPARTIC ACID WITH AMINO ACIDS
K. Harada, H. Mizumoto, K. Ikeda and
N. Fujii

(185) IN VITRO PROTEIN SYNTHESIS USING D-AMINO
ACIDS AND ITS EVOLUTIONARY IMPLICATION
M. Isoyama and S. Yuasa

(186) ARCHITECTURE OF MODELS FOR PREBIOTIC
SYNTHESIS OF PROTEINS: THE STRUCTURE AND
FUNCTION OF POLYPEPTIDES SYNTHESIZED IN A
FLUCTUATING SYSTEM
M. Ito, N. Handa and H. Yanagawa

✓ (187) EXPERIMENTAL APPROACH TO THE CHEMICAL
EVOLUTION OF IRON CONTAINING ENZYMES:
ROLE OF MIXED LIGAND COMPLEXES OF IRON(II)
Kamaluddin, M. Singh and S. Deopujari

(188) SIMULATION OF PROCESSES OF AMINO ACIDS
THERMAL POLYCONDENSATION DURING THE
MIGRATION OF AMINO ACID SOLUTION IN
LITHOSPHERE OF THE EARTH
G. Lavrentiev, T. Strigunkova and
I. Egorov

(continued on next page)

(continued from previous page)

- (189) SIMULTANEOUS SYNTHESIS OF POLYPEPTIDES AND POLYNUCLEOTIDES? HYDROGEN CYANIDE POLYMERS AS PREBIOTIC CONDENSING AGENTS
C. Matthews
- (190) SOME CONCEPTUAL CONSIDERATIONS ON THE POLYMERIZATION OF AMINO ACIDS
F. Mosqueira
- (191) EFFECT OF ENVIRONMENT ON ORGANIZATION AND RECOGNITION IN PREBIOTIC SYSTEMS
A. Pohorille, B. Owenson and R. MacElroy
- (192) THE ROLE OF PIGMENTS OF THE MELANIN-MELANOIDIN TYPE IN THE SUCCESSION OF THE PREBIOLOGICAL AND BIOLOGICAL EVOLUTIONS
T. Telegina and T. Pavlovskaya
- (193) STUDIES ON THE STRUCTURE OF HCN OLIGOMERS
K. Umemoto, M. Takahasi, K. Yokota and N. Noto
- (194) ARCHITECTURE OF MODELS FOR PREBIOTIC SYNTHESIS OF PROTEINS: FORMATION OF POLYPEPTIDES UNDER POSSIBLE PRIMITIVE EARTH CONDITIONS
H. Yanagawa, K. Kojima and M. Ito
- (195) RNA PRIOR TO DNA: THE ORIGIN OF ARCHEAN CELLS
A. Lazcano, R. Guerrero, L. Margulis and J. Oro
- (196) INTERRELATED ABIOTIC SYNTHESIS OF PEPTIDES AND POLYNUCLEOTIDES UNDER HETEROGENEOUS CONDITIONS
L. Moiseeva and T. Pavlovskaya
- (197) THE POSSIBILITY OF THE POLYNUCLEOTIDES AND THEIR COMPLEX FORMATION UNDER PREBIOLOGICAL CONDITIONS OF THE PRIMORDIAL EARTH
V. Otroshchenko, N. Vasiljeva, T. Shvedova and T. Strigunkova
- (198) THE INFLUENCE OF ALIPHATIC DIAMINES ON ADENOSINE CYCLIC 3',5'-PHOSPHATE POLYCONDENSATION IN FLUCTUATING ENVIRONMENT
T. Strigunkova, G. Lavrentiev and I. Egorov
- (199) THE GENETIC PRINCIPLE OF EXCLUSION
G. Cullmann and J. Labouygues
- (200) STUDY OF GENETIC CODING 1st-2nd POSITION DOUBLETS
G. Cullmann and J. Labouygues
- (201) STUDY OF THE TRANSMISSION OF GENETIC INFORMATION
G. Cullmann and J. Labouygues
- (202) INFORMATION THEORY AND THE GENETIC CODE
A. Figureau
- (203) THE GENETIC CODE AND OPTIMIZATION
A. Figureau
- (204) STRUCTURE AND FUNCTION OF PRIMITIVE tRNA MODEL
M. Ishigami
- (205) EVOLUTION OF E. Coli tRNA^{Trp}
J. Lacey, Jr., M. Staves and D. Bloch
- (206) ON THE OPTIMALITY OF THE GENETIC CODE
P. Milanov, P. Kenderov and O. Ivanov
- (207) ORIGIN OF PRIMITIVE CELLS II: A PHYSICO-CHEMICAL PATHWAY TO THE EVOLUTION OF PRIMITIVE GENETIC APPARATUS
M. Ravi Kumar and G. Naresh Kumar
- (208) EXAMINATION OF PREBIOTIC ADAPTOR MODELS
M. Shibata, G. Raghunathan and R. Rein
- (209) EXPERIMENTAL BASES FOR A PRIMORDIAL GENETIC CODE
M. Soto, J. Toha and X. Cuadros

Debate 2

4:30 p.m.

Moderator: J.W. Schopf

WHAT WERE THE FIRST LIVING SYSTEMS: MINERALIC/AUTOTROPHIC OR ORGANIC/HETEROTROPHIC?

MINERALIC/AUTOTROPHIC — A.G. Cairns-Smith and H. Hartman
ORGANIC/HETEROTROPHIC — D. White and A. Schwartz

7:00 p.m.

ISSOL Banquet and Closing Ceremony

Oparin Medal Award and Lecture

Special Note to Poster Presenters:

This is a correction to the last sentence included in the first paragraph of poster instructions included on the back of your letter confirming the placement of your abstract: "The headline strip should be placed at the top of the left-hand poster panel. The posters will be displayed in clusters of three as indicated on the diagram included with the confirming letter."

ISSOL

INTERNATIONAL SOCIETY FOR THE STUDY OF THE ORIGIN OF LIFE

Code EBT-3

NASA Headquarters
Washington, D.C. 20546



BAHADUR, KRISHNA
HEAD, CHEMISTRY DEPARTMENT
UNIVERSITY OF ALLAHABAD
68, DILKUHUA, NEW KABRA
ALLAHABAD, INDIA

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THE NEWSLETTER OF



THE INTERNATIONAL SOCIETY FOR THE STUDY OF THE ORIGIN OF LIFE

Donald L. DeVincenzi, Editor

Sara E. Acevedo, Associate Editor

ISSOL '93 UP-DATE

All members are reminded that the deadline for abstracts for ISSOL '93 is March 1, 1993. However, because of the lateness of the second circular, the Abstract Committee recognizes that submissions from members in countries which regularly experience serious delays in the mail may not arrive in time. The Committee will attempt to take this into consideration for abstracts which are received after the March 1st deadline, and the final program will be constructed with this in mind. When possible, abstracts received very late will be accommodated as posters. The final program will be published in the next issue of the Newsletter, to be mailed in early May.

The Social Events calendar for ISSOL '93 is beginning to take shape.

The informal reception, to be held on Sunday evening, will be at the Royal Palace near the University. This palace, in the modernistic style, belonged originally to the Güell Family (who contracted with Paul Gaudí to design and construct the famous Parc Güell); the family later donated the palace to King Alfonso XIII to use as his personal residence.

The formal Welcome Reception will be held on Monday evening in the Palace of the Generalitat. This 15th century palace, which houses the Catalan government and is located in the Gothic Quarter of Barcelona, is said to have some of the most exquisite gardens in all of Catalonia.

The Wednesday afternoon excursion will be to Cavas Codorniu, the oldest and most important *cavas* producing winery in Catalonia. *Cava* is the patented name given to champagne produced in this region of Catalonia.

Cavas Codorniu, earlier called Raventos and Codorniu, has been manufacturing *cavas* since the 16th century. The winery itself is now a national monument, and parts of the architecture are in the modernistic design. The *cava* cellars themselves are completely underground and are so vast that there is an underground train that follows 3 kilometers of track winding between the rows of fermenting *cava* bottles.

The tour will be followed by a reception featuring *cavas* and hors d'oeuvres. Entertainment will be provided by Habaneras singers, demonstrating a style of music developed at the turn of the century when many Catalan fishermen emigrated to Cuba. The songs, a hybridization of Catalan and Spanish music sung along the Costa Brava, are typically accompanied by a hot rum and coffee drink called "cremat" (which, incidentally, is excellent!).

All members, who are planning to attend the meeting, are encouraged to plan to join in the various social festivities also. □

Juliet Wiersema
ISSOL '93 Local Organizing Committee
(Spain)

1992 WORLD SPACE CONGRESS

The 29th Plenary Meeting of the Committee on Space Research (COSPAR) and 43rd Congress of the International Astronautical Federation (IAF) were held simultaneously in Washington, DC, USA from August 28 to September 6, 1992. ISSOL sponsored three sessions at the World Space Congress:

- F3.1-S, Extraterrestrial Organic Chemistry and the Origin of Life;
- F3.2-S, Life on Mars: Past, Present and Future; and,
- F3.6-M, Carbon Chemistry and Isotopic Fractionations in Astrophysical Environments

ISSOL members, D.L. DeVincenzi, J. Oró and M. Schidlowski, served as representatives for the Society in making the arrangements for these sessions. Additionally, as approved by ISSOL's Officers, the Society provided partial travel support to one scientist to attend each of these three sessions. The awardees were: Manfred Schidlowski (Germany), Peter Bernath (Canada), and D. Gilichinsky (Russia).

The following reports summarize six COSPAR symposia of interest to the origin of life community, including the three sessions co-sponsored by ISSOL.

Symposium F3.1-S

EXTRATERRESTRIAL ORGANIC CHEMISTRY AND THE ORIGINS OF LIFE

**Main Scientific Organizers:
J.M. Greenberg, A. Brack, and J. Oró**

Terrestrial life can be schematically described as biochemical molecules which self-organized and evolved in a liquid water environment. According to the classical scenario, the organic building blocks required for early life were produced from the atmospheric reduced form of carbon, methane, however, geochemists favor now a primitive terrestrial atmosphere dominated by an oxidized form of carbon, carbon dioxide. The difficulty here is that in such an atmosphere, simulation organic syntheses are much less efficient leading to proposals of alternative supplies of these materials, such as delivery of prebiotic organics to the early Earth.

The session gave an excellent opportunity to hear the current ideas in the primary cosmic chemistry of the

biogenic light elements (C,H,N,O,P,S) which comprise the bulk of living matter, as well as the formation of organic molecules in the parent bodies and their processing by terrestrial liquid water.

It has already been determined that primary organic chemistry is occurring in interstellar space. The current inventory of interstellar molecules were reviewed with an emphasis on recent detections (W.M. Irvine, Univ. of Massachusetts, USA), as was observational evidence for the presence of organic molecules in circumstellar envelopes of stars in their late stages of evolution (J.H. Bieging, Univ. of Arizona, USA). The laboratory spectroscopy of pure carbon molecules (R.J. Saykally, Univ. of California, Berkeley, USA) was correlated to the observation of these molecules in a circumstellar shell (P. Bernath, Univ. of Waterloo, Canada).

There is little basis for speculating that interstellar organic molecules arrived intact at the prebiotic Earth's surface. However, cometary grains may bear some similitude with interstellar grains and it was proposed that cometary dust might have brought water for the oceans, volatiles to the atmosphere, and carbonates and organic carbon (J. Oró, Univ. Houston, USA, and

See 1992 World Space Congress, page 3

1992 World Space Congress, from page 2

A.H. Delsemme, USA). The comet pond was also considered as a macrobiont (B.C. Clark, Martin Marietta Aerospace Corp., USA). The idea that chiral molecules produced by the action of neutron star circularly polarized light might have been delivered to the primitive Earth via comets was reviewed and discussed (J.M. Greenberg, Univ. of Leiden, Netherlands), followed by a discussion of the possible existence of comets in other planetary systems (C. Chyba, NASA Ames Research Ctr., USA). The low temperature chemistry of comets was compared to that of Triton, Titan and other icy satellites, and the possible cometary origin of heavy noble gases in the atmospheres of terrestrial planets was presented (T. Owen, Univ. of Hawaii, USA), and the existence of both volatiles and organic solids in asteroids was reviewed (D.P. Cruikshank, NASA Ames Research Ctr., USA)

The study of meteorites, particularly the carbonaceous chondrites, allows close examination of extraterrestrial organic material. The origin of amino acids and amino acid precursors in the Murchison meteorite was argued in detail (J.R. Cronin, Arizona State Univ., USA, M.H. Engel, University of Oklahoma, USA, J.F. Kerridge, Univ. of California, Los Angeles, USA, S.L. Miller, Univ. of California, San Diego, USA), and the identification of organic phosphate, organophosphorous and organosulfur compounds in aqueous extracts of the Murchison meteorite was described (G.W. Cooper, Arizona State Univ., USA).

The fact that there is no significant accumulation of extraterrestrial amino acids in modern ocean waters and polar ice samples, and that their concentration in tertiary-cretaceous (K-T) boundary sediments is very low, seems to exclude micro-meteorites as important sources of amino acids and other organic molecules on the early Earth (J. Bada, Univ. of California, San Diego, USA). However, a new collection of micro-meteorites has been recently extracted from Antarctic old blue ice. Mass flux considerations indicate that micro-meteorites could have been one of the major carriers of prebiotic materials to the early Earth (M. Maurette, CSNSM, France).

On the primitive Earth, the chemistry and geochemistry of organic molecules were probably driven by liquid water (A. Brack, CNRS, France). From this session, it was clear that interstellar space can be considered a large 'reactor' where organic chemistry is very active and efficient. Data from the analyses of carbonaceous chondrites shows that amino acids can survive impact delivery, but whether the delivery of organic molecules was important enough to contribute substantially to the biomass is not yet clear. To refute such a scenario on the basis of the sole K-T bolide is premature. The chemical analysis of the 'un-melted' carbonaceous micro-meteorites will certainly give a more optimistic answer. □

J. Oró
University of Houston
(USA)

Symposium F3.2-S

LIFE ON MARS: PAST, PRESENT AND FUTURE

Main Scientific Organizer:
D.L. DeVincenzi

A lively symposium was held on the topic of "Life on Mars: Past, Present, and Future" within this well-attended session which covered the full spectrum of questions pertaining to life on Mars.

D.L. DeVincenzi (NASA Ames Research Ctr., USA) chaired the first session "Life on Mars: Past." One key question in relation to the evolution of life on Mars is the presence and state of water there. This topic was reviewed by B. Jakosky (Univ. of Colorado, USA). A major issue was the question of the total inventory of water on Mars, as evaluated on the basis of geomorphological observations, isotopic abundances and out-gassing scenarios. M.R. Walter (Macquarie Univ., Australia) and D.J. Des Marais (NASA Ames Research Ctr., USA) discussed in their invited paper an approach for the search for martian fossils, focusing on

See 1992 World Space Congress, page 5

1993 DUES INVOICE

The 1993 dues notices are included in this issue of the Newsletter.

You'll notice that we have a new format; instead of sending a letter requesting payment we have moved to an invoice format which we hope clearly and concisely describes exactly what each member owes and for what years. If you have already paid your 1993 dues your invoice indicates this and we thank you for anticipating our request.

Since nearly 100% of the dues collected go toward funding the travel of younger members to the triennial meeting an early payment adds a little extra to the travel fund by the interest it earns in ISSOL's bank account. With the meeting in Barcelona coming upon us quickly applications for travel assistance will soon be pouring in and the Society strives to support as many applicants as possible.

Please pay your dues promptly and we encourage you to consider including a little extra to boost the travel fund even further, to enable the participation of all our colleagues in ISSOL '93. □

SAVE MONEY! BECOME A MEMBER!

Did you notice that you can save US\$50.00 on the registration fees for ISSOL '93 by becoming a member? That's enough to pay your dues for 2 and a half years of a full membership or 5 years of an associate membership.

Use the membership application included in this issue – either for yourself or pass it on. □

1993 ELECTIONS

The Nominating Committee for the 1993 Society elections for Officers and Councillors has been named. A. Brack (France), N. Lahav (Israel), H. Mizutani (Japan), W. Thiemann (Germany), and R. Young (USA) will serve under Committee Chairperson, D.L. DeVincenzi (USA), to propose a slate of candidates for the ballot.

For those members who expect to vote in the 1993 election, remember that Society by-laws state that you must be *in good standing* to be eligible to vote. All provisional members and full members who are current in their dues payments are eligible to vote.

The ballots will be mailed to all eligible voting members of the Society on or about March 1, 1993. Completed ballots must be returned to the Secretary in the envelopes provided by June 1, 1993. □

ISSOL '93 SECOND CIRCULAR

The Second Circular for the meeting in Barcelona was mailed in January. This circular contains important information on the H.C. Urey Medal nominations, registration, accommodations, travel awards, and submission of abstracts, as well as the required abstract forms.

If you have not received your circular, or if you need extra copies of the abstract forms, please contact Ms. Juliet Wiersema:

Office of the Secretariat of ISSOL '93
Fundació Catalana per a la Recerca
Provença 269
08008 Barcelona (Catalonia)
SPAIN

TEL#: (34-3) 215-67-84
FAX#: (34-3) 487-71-31 □

1992 World Space Congress, from page 3

ancient thermal springs as promising sites. The knowledge of the chemical and physical environment of early Mars was reviewed by A. Banin (Hebrew Univ., Israel) and R.L. Mancinelli (NASA Ames Research Ctr., USA) in two companion papers. After comparing the chemical make-up of Mars' surface and its thermal and radiation regimes to those of Earth, they arrived at the conclusion that the single most important factor for the evolution of life on primitive Mars was, quite probably, the presence of liquid water in sufficient quantities and for long enough periods to support abiotic and early biotic evolution.

Comparative modeling of evolution of life on Earth and Mars was discussed by W.L. Davis, J.P. Cozzatti and C.P. McKay (NASA Ames Research Ctr., USA). A similar comparative approach was taken by C. Ponnampertuma, R. Navarro-Gonzalez and Y. Honda (Univ. of Maryland, USA), emphasizing synthesis experiments of biologically important molecules.

Plans for future missions to Mars (e.g. Mars'94/'96) which emphasize the study of the chemistry and mineralogy of Mars' surface, were presented by L.M. Mukhin (Inst. for Space Research, Russia). The results of these planned missions may add considerably to our understanding of possible exobiology on Mars. The results of a comparative experimental search for the best instrument technology for detection of life's fingerprints on Mars' surface, were reported by D. Schwartz, R. Mancinelli and M. White (NASA Ames Research Ctr., USA). Various Mars soil analogs, some containing biomarker minerals and some containing added organics, were studied by several laboratories. Technologies tested were: γ -ray spectrometry, x-ray fluorescence and diffraction, DTA, DSC, pyrolysis, GC, α -proton backscatter, electron microscopy and specific-element detectors. On the basis of the results, it was suggested that differential thermal analysis, coupled with evolved-gas analysis/gas chromatography (DTA/EGA/GC), is the method showing the most promising results. A paper by G. Weckwerth (DLR, Germany) and M. Schidlowski (Max Planck Inst., Germany) (read by G. Horneck), suggested a geochemical method for search for life's fingerprints on Mars. It was suggested that high P/Nd or P/Th ratios in phosphorites on Mars may indicate

life-related formation due to significant selective enrichment of P in living organisms.

D. Andersen (Lockheed Engineering and Science Co., USA) and co-workers reviewed the activities of a joint US/Russian Antarctic expedition which pertain to life in extremely cold environments. A paper by H.P. Klein (Santa Clara Univ., USA), R. Landheim and R. Greeley (Arizona State Univ., USA) on site selection for exobiology studies on Mars was read by D. Des Marais. A site selection protocol, emphasizing exobiological interests, has been applied to various locales on Mars, scoring and prioritizing them as promising for future search (by remote sensing and landing rovers) for possible remnants of life, or life-related chemicals. A proposed science strategy for the search for life on Mars, as developed during a recent workshop on the topic, was presented in a paper by H.P. Klein and D.L. DeVincenzi. It emphasized the study of past and present martian environments, addressing questions of the history of water, atmosphere and geology.

Under the title "Life on Mars: Present," the second session of the symposium, chaired by A. Banin (Israel), was opened with an invited paper by M.H. Carr (U.S. Geological Survey, USA) on the present martian environment. The present-day thermal, atmospheric, radiative, and geologic conditions on Mars are generally inhospitable to life but niches may exist where life may still survive. M.V. Ivanov and A. Yu Lein (Russian Academy of Sciences, Russia) discussed carbon isotope ratios in SNC meteorites and suggested that the isotopically-heavy carbonate and organic matter of these meteorites are related to globally active anaerobic, methanogenic microorganisms causing isotopic fractionation. A microbial mat, discovered by L.J. Rothschild (NASA Ames Research Ctr., USA) in sand dunes in Baja, California, was proposed as a possible Mars community since it developed under a layer of sand at xeric conditions and is autotrophic, producing its own organic material by photosynthesis.

The survival of living but dormant organisms under cold and dry high vacuum conditions was discussed by K. Dose, A. Bieger-Dose, R. Dillman, M. Gill, M. Labusch, O. Kerz and C. Nieman (J. Gutenberg Univ., Germany).

See 1992 World Space Congress, page 6

1992 World Space Congress, from page 5

Slow degradation of DNA was observed, leading to the conclusion that long-term (on geological time-scales) survival of dormant organisms is limited by irreparable damage to DNA at extremely dry conditions. Experimental studies on the survivability of microorganisms in simulated planetary environments were reported by J. Koike and T. Oshima (Tokyo Inst. of Technology, Japan).

Terrestrial models for extant life on Mars were discussed in three related papers by researchers from the Russian Academy of Sciences. Viable bacterial communities discovered in permafrost at ages of 3–5 million years, lead D. Gilichinsky (Inst. of Soil Science and Photosynthesis, Russia) to suggest that life can survive in cryo-environments for geological periods. The physico-chemical conditions prevailing in these geological environments were analyzed by V.E. Ostroumov (Inst. of Soil Science and Photosynthesis, Russia). The presence of enough 'un-frozen' water at subzero temperatures in the permafrost was singled out as the essential requirement for prolonged survival. The results of excellent micro-morphological studies of the surviving procaryotes were reported by V. Soina, E. Vorobiova, D. Zviagintser, and D. Gilichinsky (Inst. of Soil Science and Photosynthesis, Russia). Adaptation to freeze-thaw conditions was attributed to development of specialized cell walls enriched in mucilaginous material.

"Life on Mars: Future" was discussed in the third and concluding session of the symposium chaired by C.P. McKay. Terraforming Mars was discussed by R.H. Haynes (York Univ., Canada) in his invited paper. By analogy to the evolution of the biosphere on Earth, Mars may have gone spontaneously through the first two evolutionary phases, i.e. abiotic synthesis of organic molecules (biopoiesis) and formation of the first microbial systems (ecopoiesis). Haynes speculated that the third evolutionary phase (terraformation), i.e. the evolution of oxygenic photosynthesis in a long-term series of processes, may be directly undertaken by Earthlings. Another view was taken by L. Margulis and D. Sagan (Univ. of Massachusetts, USA) in their invited paper. Reviewing the evidence from the Viking missions and other studies of Mars, they concluded that no life is present

on Mars. They further cautioned against a rushed and deliberate evolutionary martian colonization process which could be very unpredictable. A cyanobacterium which survives and thrives in diverse extreme environments from the cold Antarctic desert to thermal springs on Earth was suggested as a candidate for the pioneering microbial emissary from Earth to Mars by E. Friedmann (Florida State Univ., USA) and R. Ocampo-Friedmann (Florida A&M Univ., USA).

The active participation in the symposium, and the broadness of subjects presented in it, attest to the curiosity and interest still existing regarding life on the "second best" planet for life in the solar system. Future missions to Mars will, no doubt, add to our knowledge of the environment of Mars, its chemical makeup and its evolutionary pathways. These, hopefully, will also contribute to our ability to answer some of the enigmatic questions still surrounding the intriguing dilemmas related to life on Earth and other planetary bodies.

A. Banin
Hebrew University
(Israel)

Symposium F3.3-M

PLANETARY PROTECTION FOR MARS MISSIONS

**Main Scientific Organizers:
J.D. Rummel and M.V. Ivanov**

This meeting was sponsored by COSPAR, NASA and the Russian Academy of Sciences. The purpose of the meeting was to discuss the scientific, technical, and legal aspects of forward and backward contamination issues associated with Mars missions; the emphasis was on requirements to be levied on robotic missions.

The meeting attracted an audience of over 50, and was introduced by its Co-Chairs, J.D. Rummel (NASA, USA) and M.V. Ivanov (Inst. of Microbiology, Russia). J.D. Rummel, delivered the first paper of the day, entitled "Planetary Protection Provisions for US Mars

See 1992 World Space Congress, page 7

1992 World Space Congress, from page 6

Missions" which reviewed the links between NASA and COSPAR policies on planetary protection, and described a study on planetary protection policy for Mars that had recently been completed by the US National Research Council's Space Studies Board.

The Board's report, "Biological Contamination of Mars: Issues and Recommendations," published in August 1992, recommends a significant relaxation in planetary protection provisions for Mars, compared to the Viking mission. Viking-level procedures, with extensive bioload reduction, were recommended by the Board only in the case of lander missions seeking to conduct life-detection experiments, whereas other types of lander missions would only be expected to conduct cleaning of the spacecraft at the level employed by Viking prior to its heat treatment. Rummel presented a resolution recommending that the Board's recommendations be studied for two years by the COSPAR member nations, and that new requirements for Mars, based on those recommendations, be taken forward to COSPAR for adoption at the next plenary meeting in Hamburg, Germany.

The second paper of the morning was delivered by V.I. Trofimov (SIA Biotechnology, Russia) on behalf of himself and three co-authors. The paper, entitled "Modern Aspects of Planetary Protection Requirements for Sterilization of Space Hardware," described the recent thinking of Russian experts on planetary protection, and proposed methods for the implementation of planetary protection measures for the Russian Mars '94 spacecraft currently under development. The proposal includes: cleanroom assembly of individual parts and the entire spacecraft in order to lower the microbial burden; appropriate orbits and trajectories to ensure non-contamination by launch vehicles and orbiters not intended to contact Mars; the sterilization of parts prior to assembly into landed systems; and the use of radioactive gas for further sterilization of the spacecraft systems while the spacecraft is encapsulated enroute to Mars. Some results on the stability of various materials and the efficacy of the cleaning under gaseous radiation were also presented.

"Designing Planetary Protection into the Mars Observer Mission," was presented by T.H. Sweetser

(Jet Propulsion Laboratory, USA) who described the methods and results of the planetary protection provisions taken by JPL in preparing the Mars Observer mission for launch and operations around Mars. The approach taken by JPL can be considered a model for planetary protection implementation under the COSPAR policy. D.L. DeVincenzi described the steps taken so far in planning for the implementation of planetary protection on the US MESUR mission. These measures have included early-on teamwork between planetary protection personnel and mission designers in developing implementation and costing strategies that are reflective of the most current thinking about Mars.

G.H. Schwehm (ESTEC, Netherlands) addressed "Planetary Environment Protection: Implications for the Development of a Network of Surface Stations on Mars." His paper described the planning conducted by ESA on the Marsnet mission, the scientific objectives of the mission, and the current concepts for planetary protection for such a network of surface landers. Working on the assumption of updated Mars planetary protection requirements, this paper recommended particular care be taken for the landing of probes on the Mars surface to reduce the likelihood of bioload proliferation, cleanroom assembly of all of the landers, bioburden assessment and reduction for specific major components, and the prevention of recontamination, perhaps by the use of a bioshield. As always, cost and mission success constrain the planetary protection options under consideration.

Delivering his second paper of the day, V.I. Trofimov provided an extensive discussion of "The Experimental Study of Microbial Contamination of the Space Hardware." The paper identified various spacecraft materials, the taxa of the various microbial contaminants that may be associated with them, and the efficacy of various control methodologies that can be applied to reduce the microbial burden.

G. Horneck (Institute for Aerospace Medicine, Germany) delivered the paper, "Planetary Protection Considerations for Marsnet and Mars Sample Return Missions," on behalf of herself and co-author, C. Lindberg. This paper provided an outline of the planetary protection issues associated with future Mars

See 1992 World Space Congress, page 8

1992 World Space Congress, from page 7

missions, and an evaluation of the means for arriving at appropriate planetary protection requirements for both forward and backward contamination, as well as a discussion of some of the research facilities needed to focus planetary protection policies in the light of scientific and societal requirements.

P.M. Sterns (Sterns and Tennen, Corp., USA) analyzed the divergent international legal regimes that may impose legal requirements on parties attempting to conduct the scientific exploration of Mars, in her paper entitled "Legal Aspects of Planetary Protection for Mars Missions." Compliance with the various legal requirements, and the various protections they seek, is important to the overall success of our plans for understanding the universe.

The final paper of the morning was delivered by M.S. Race (Univ. of California, Berkeley, USA) on "Societal Issues as Mission Impediments: Planetary Protection and Contamination Concerns." This paper concentrated on the public perceptions that can be engendered by the handling of activities that deal with a number of scientific unknowns, and may be perceived to have societal consequences. A case was made for advanced planning to deal with these perceptions in the course of undertaking any program of Mars exploration. □

J.D. Rummel
NASA
(USA)

Symposium F3.4-M

CHEMICAL EVOLUTION ON TITAN

Main Scientific Organizer: F. Raulin

The most important extraterrestrial planetary bodies in the solar system for the study of the origins of life and exobiology are Mars, the comets, and Titan, the largest satellite of Saturn, with its dense, organic-rich gaseous and condensed-phase atmosphere, and the possible presence of hydrocarbon oceans. Titan provides a planetary-sized laboratory to study prebiotic

chemistry occurring in a reduced atmosphere, in the presence of liquid bodies on the surface, and aerosols in the atmosphere.

The main goal of the symposium was to get an exobiological overview of this quasi-planet, on the basis of the most recent data related to Titan and its prebiotic-like organic chemistry, with special emphasis on:

- modeling of the origin and evolution of its atmosphere
- laboratory simulations, modeling of the aerosols and atmospheric organic chemistry
- remote sensing of Titan's organics
- impact of the Cassini-Huygens mission on Titan's exobiological aspects.

Indeed, all these aspects were covered, within eleven presentations from speakers from various countries and scientific fields.

T. Owen (Univ. of Hawaii, USA) started the session by discussing the question of the origin of Titan's atmosphere; because of the absence of neon, it is likely to be of secondary origin. The relatively high D/H ratio suggests that CH₄ may come from organics but the pyrolysis processes necessary for the release of methane have to be studied. In addition, atmospheric CO seems clearly to be of primordial origin, but two origins are possible for N₂, which can be primordial or may come from organics. As reported by D. Gautier (Meudon Observatory, France), a great deal has been learned in the last 10 years about Titan's atmospheric composition, however, our present view of this atmosphere and its interactions with Titan's surface is a subtle mixture of certainties and speculations: the true nature of the surface, existence of methane clouds, presence of argon, temporal variability of the photochemistry, wind distribution, super-rotation of the atmosphere, are all still controversial.

As discussed by C.P. McKay (NASA Ames Research Ctr., USA), key questions also remain related to the organic hazes on Titan: the processes which can explain their formation, their size distribution, and C/N ratio are still to be found. Some information on these aerosols can be obtained by laboratory simulations

See 1992 World Space Congress, page 9

19. 2 World Space Congress, from page 8

such as those done by T. Scattergood (State Univ. of New York, USA); such simulations already indicate that Titan's aerosol could involve the formation of aggregates. It has also been suggested that rain may be present in the lower atmosphere. Modeling of the physics of precipitation by R.D. Lorenz (Univ. of Kent, UK) suggests that there could be small drops of low speed, implying that erosion due to rainfall is a weak process on Titan. Nevertheless, for J. Lunine (Univ. of Arizona, USA), the surface-atmosphere interactions on Titan, especially if Titan has substantial reservoirs of liquid hydrocarbons, provide a unique example, analogous to that of the Earth. Modeling of impact processing on Titan's surface by W.R. Thompson & C. Sagan (Cornell Univ., USA) shows that liquid water could have been involved in such surface interactions, allowing the occurrence of prebiotic chemistry in aqueous solution.

In any case, in Titan's atmosphere, several of the already detected organics can be the starting ingredients of a complex organic chemistry. This is especially the case of cyanoacetylene, the photochemistry of which was found by D.W. Clarke and J.P. Ferris (Rensselaer Polytechnic Inst., USA) to produce a large variety of N-organics, including cyclic compounds. For F. Raulin and C. Frere (Univ. of Paris, France), with or without liquid water, organic chemistry on Titan could have produced molecules of biochemical interest, or their "ammono" analogs, where O-atoms are replaced by N-atoms. But this chemistry is also driven by the chemical properties of organics of low thermal stability.

The Huygens probe of the Cassini-Huygens mission, as presented by J.P. Lebreton (ESA-ESTEC, Netherlands) will offer a unique occasion to study these chemical processes. Several laboratories are right now working directly on the preparation of this mission and of its several scientific instruments, in particular the GC-MS and ACP (Aerosol Collector and Pyrolyser) on the Huygens probe. The laboratory studies of models of Titan's organic aerosols, presented by P. Ehrenfreund (Service d'Aeronomie, France) et al., is a good example.

With an orbiter around Saturn and a probe in the atmosphere of Titan, both including many state of the art scientific instruments, the Cassini-Huygens mission is expected to provide scientific returns at least 10 times higher (if this can be scaled...) than that of the Voyager mission. It is planned to be launched in October 1997, for an arrival in the Saturn system in 2004, and a probe entry in 2005. Several of the scientific experiences aboard the orbiter and the probe are expected to provide many data of crucial importance for our understanding of Titan's environment. Not all the questions will be solved, but this mission will certainly give important returns for the field of the origins of life and exobiology. □

F. Raulin
University of Paris
(France)

Symposium F3.5-M

ORIGIN AND EARLY EVOLUTION OF BIOLOGICAL ENERGY TRANSDUCTION, MEMBRANES, INFORMATION, AND CATALYSIS

Main Scientific Organizer: H. Baltscheffsky

This one-day symposium brought into focus current knowledge about the origin and evolution of four basic characteristics of all known life: energy transduction, membranes, information, and catalysis. The well-known rapid progress in these distinct but overlapping areas may have contributed to the presence of listeners from other areas of space research.

The first three lectures reflected the growing opinion that primordial reactions involving the transformation, transduction, conversion and conservation of energy must have preceded nucleic acid-based information systems in the long process of molecular evolution leading to the origin and early evolution of life. New concepts on the apparent early roles, in this respect, of thioesters, inorganic pyrophosphate, light and chemiosmosis involving iron cyanides were presented and intensely discussed.

See 1992 World Space Congress, page 10

1992 World Space Congress, from page 9

Several new links have emerged, which earlier may have been only dimly perceived at best, between various chemical, geological and biological findings. For example, the biologically useful energy donor inorganic pyrophosphate has been found to exist not only in a mineral but also in hot volcanic magma.

The rest of the morning was devoted to various basic aspects of self-organization, mutation and metabolism as prerequisites for natural selection and the evolution of molecular information. Early evolution of catalysis and enzymes was considered, particularly from the points of view of diversification of function and also the increase in specificity of individual units. The roles of transition metal ions was discussed on the basis of new results on the role of iron and other essential metal ions in free radical oxidation and reduction. The molecular information aspects were elucidated with new observations on association constants for interactions between nucleotides and amino acids.

The afternoon program was mainly on the evolution of molecular information. Primitive precursors of RNA and mineral catalysis of prebiotic RNA synthesis are areas where steady progress is being made, as in the case of primordial coding in tRNA-like molecules. In summary, the "RNA world" concept is alive and well, and today shares attention with an "inorganic pyrophosphate world," "thioester world" and an "iron-sulfur world." □

H. Baltscheffsky
Stockholm University
(Sweden)

Symposium F3.6-M

CARBON CHEMISTRY AND ISOTOPIC FRACTIONATIONS IN ASTROPHYSICAL ENVIRONMENTS

**Main Scientific Organizers:
K. Roessler and M. Schidlowski**

In this symposium, an attempt was made to draw "the big picture" of carbon transformations and attendant isotopic fractionations from radiation-induced reactions in interstellar dust clouds to carbon cycling scenarios on a life-dominated planet such as the Earth. The first section of the proceedings was devoted to the interaction of electromagnetic and particulate radiation with either frozen gases or refractory carbon mantles of dust grains in the interstellar medium (with contributions by V. Pirronello, G. Strazzulla, W.A. Schutte, L.J. Allamandola, and R.M. Mahfouz), stressing in particular the importance of simulation experiments for our understanding of these processes. Further contributions by R.I. Kaiser and K. Roessler addressed the potential role of "hot" carbon chemistry in both astrophysical and terrestrial impact scenarios.

The symposium continued into a second session which was concerned with a review of the empirical evidence pertaining to the presence of carbon and carbon compounds in interstellar space as revealed

See 1992 World Space Congress, page 11

ARE WE REACHING YOU?

Periodically we receive calls, letters, or FAXes from members who have not been receiving their Newsletters, dues notices, or other Society mailings. Most of the time this is because we have an incomplete or incorrect address for the member.

In the months before a triennial meeting it is especially important that we have your correct address, telephone and FAX numbers, so that all the meeting-related mailings reach you in a timely fashion.

When you return your dues payment invoice please indicate any changed or missing information at the top of the form. Sending messages by FAX or electronic mail is becoming increasingly common so if you have a FAX number or E-mail address please be sure to provide that information. □

1992 World Space Congress, from page 10

directly by mass spectrometric analysis during the Halley encounter (F.R. Krueger), and by the different spectral signatures of carbonaceous species that form part of the interstellar medium (H. Leger, F. Salama). A contribution by F. Ferguson and co-workers briefed the audience on the forthcoming STARDUST project conceived for experimentally simulating the condensation of cosmic grains in artificial microgravity environments.

During the third and final session, several speakers (C. de Bergh, F. Robert, S.W. Imbus, and M. Schidlowski) reviewed the current body of knowledge regarding isotope fractionations (D/H, $^{13}\text{C}/^{12}\text{C}$, $^{15}\text{N}/^{14}\text{N}$, $^{18}\text{O}/^{16}\text{O}$) that beset chemical transformations of these elements, specifically in our solar system. Apart from the fairly reliable information available for the Earth, isotopic compositions have also been obtained for a fairly large number of planetary and satellite atmospheres which often allow inferences about the formation and chemical evolution of the parent planetary body.

Altogether, the symposium has unquestionably succeeded in providing us with a summary of the present state of the field, identifying also important frontiers and active interfaces with neighboring disciplines, where most future research activities are likely to occur. □

M. Schidlowski
Max Planck Institute
(Germany)

NEWSLETTER ARTICLES WELCOME

Many thanks to all the contributors to this issue of the Newsletter.

All ISSOL members are invited and encouraged to submit materials for the Newsletter that they feel would be of interest to other Society members, such as: meeting announcements, reports, or summaries, book announcements and reviews, research notes, member news, editorials, etc.

Please submit all materials directly to the Editor:

Dr. D.L. DeVincenzi
MS 245-1
NASA Ames Research Center
Moffett Field CA 94035-1000
USA

TEL#: 415-604-5251
FAX#: 415-604-6779

The deadline for input to the Summer Newsletter is May 1, 1993. □

TRAVEL FUND CONTRIBUTIONS

Many thanks to those members who sent a contribution to the Travel Grant Fund. You have made a direct contribution toward the most basic reasons for ISSOL's existence: to encourage and facilitate the exchange of scientific data at an international level and to increase the participation of young scientists in the field of origin of life research. With the ISSOL '93 meeting just around the corner, these contributions are particularly timely.

It is with great appreciation that the most recent contributors are listed here: A.G. Cairns-Smith, M. Kinjo, J. Oró, and H. Yanagawa. □

TUNING IN THE EXTRATERRESTRIALS

Years in the making, NASA's search for cosmic company has finally begun. On October 12, 1992 telescopes in Arecibo, Puerto Rico, and Goldstone, California began listening for signals that might reveal intelligent life elsewhere in the Galaxy. The inaugural date, exactly 500 years after Columbus' arrival in the New World, was chosen to symbolize the boldness and potential importance of the experiment.

The High Resolution Microwave Survey (HRMS) is the latest in a series of radio "eavesdropping" efforts that began with Frank Drake's celebrated Project Ozma, an experiment in which Drake spent two weeks in 1960 observing the nearby, solar-type stars Tau Ceti and Epsilon Eridani. By contrast, the Targeted Search component of the HRMS, which was inaugurated in Arecibo, will scrutinize a thousand such stars over the coming decade. The new SETI (Search for ExtraTerrestrial Intelligence) experiment differs from its predecessors in more than the length of its observing list, however. New digital-based receivers slice the radio energy collected by the 305-meter diameter Arecibo antenna into 14 million channels, each a hair-thin 1 Hz wide (Project Ozma employed a receiver with a single, 100 Hz-wide channel on a 26-meter telescope). During the October 12th ceremonies in Puerto Rico, Drake remarked on this enormous technological advance, calling it "an improvement of a million million times in 30 years."

The Targeted Search, which is managed from California's Ames Research Center, is deliberately focussed on solar-type stars for the obvious reason that terrestrial life has developed near such a star. But a second component of the HRMS, the Sky Survey, will scan the entire sky. If advanced cultures have migrated from their original stellar neighborhoods, or occur so infrequently that a sample larger than a thousand stars is necessary to find them, then an all-sky search may be the best detection strategy.

Pasadena's Jet Propulsion Laboratory is in charge of the Sky Survey, and began initial observations using the Goldstone 34-meter antenna and a multi-million channel receiver of its own design. Hundreds of visitors, primarily SETI scientists and engineers, NASA

managers and the press, were drawn to the observatories for the inauguration ceremonies. Featured speakers included Carl Sagan at Goldstone, and MIT's Philip Morrison at Arecibo. At precisely 3:00 pm in Puerto Rico (noon at Goldstone), the antennas at both locations were slewed in the direction of the constellation Serpens to begin observations. The mammoth Arecibo dish, "humanity's largest telescope," bore in on the star Gliese 615.1A, and the Goldstone 34-meter antenna began to trace out a 1-degree wide strip of sky nearby.

Although there wasn't much to see beyond the incomprehensible spectral plots on observatory workstations, participants were aware of the privilege of being present for the start of this comprehensive and impressive effort. By the start of 1993, Arecibo had observed 25 stars and Goldstone had scanned 17 "sky frames," strips of 1 by 30 degrees. The results of these preliminary observations are still being analyzed, but no obvious signals from extraterrestrials have been found.

A major difficulty in such work is recognizing and removing terrestrial radio interference, and much of the current engineering effort is directed at making this process more efficient. While many inaugural speakers voiced optimism at the chances for a detection sometime in the decade-long lifetime of the HRMS, John Billingham, Chief of the SETI Office, candidly noted that we really don't know if the project will succeed. An acknowledgement of the many uncertainties in the quest was reiterated by Project Scientist Jill Tarter, who feels that if anyone can mount a thorough search, this team of scientists can.

While the detection strategies will undoubtedly evolve with time, the basic belief that there must be other sentient beings in the Galaxy seems unshakeable. The Galaxy is roughly three times as old as the sun. Consequently, it's possible that radio waves from advanced beings have been bombarding the Earth since its formation. On October 12th, the chances got considerably better that we will finally notice. □

Seth Shostak
SETI Institute
(USA)

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To



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Dear Sir,

I am a full member of the International Society for the Study of the Origin of life (ISSOL) and I have to send \$40 (dollar forty only) as the fee for the year 1987-88 and 1988-87 to Dr. D. De Vincenzi, Secretary of ISSOL, Mail Code 239-11, Ames Research Center, Moffett Field, CA. 94035 U.S.A.

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With regards

Yours sincerely

Krishna Bahadur



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D. DeVINCENZI - Secretary
Mail Stop 245-1
NASA Ames Research Center
Moffett Field, California 94035
U.S.A.

J. FERRIS - Treasurer
Department of Chemistry
Pensselaer Polytechnic Institute
Troy, New York 12180-3590
U.S.A.

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February 6, 1989



TO: ISSOL Membership

FROM: Secretary, ISSOL

SUBJECT: 1989 Membership Renewal

Dear Colleague:

This letter is to advise you that your 1989 ISSOL membership renewal fees are due by March 31, 1989. According to our records, no renewal fees were received from you in 1988. If you wish to retain your active ISSOL membership, payment for both years is, therefore, due at this time. It will be important that your membership fees are paid in full in order to qualify for the reduced registration fee for our meeting in Prague. On April 15, 1989 we will forward to the Local Organizing Committee the current membership list based on the dues received by that date.

You are also encouraged to include a contribution to the ISSOL travel fund to provide travel grants to students and young scientists to attend the meeting in Prague. Thanks for the contributions made thus far.

To minimize bank collection fees, we ask that members from countries other than the United States make payments in one of the following ways: checks drawn on banks with a U.S. branch (please check with your bank to ensure acceptance of the check in the U.S. Federal Reserve System); travellers checks; or international money orders (but not international postal money orders—we are unable to negotiate them). All forms of payment must be in U.S. dollars.

We look forward to receiving your payment promptly. A pre-addressed envelope is included for your convenience. Please make all necessary address corrections on the envelope and enclose a check or international money order for the proper amount.

Donald L. DeVincenzi
ISSOL Secretary

Enclosure:
Payment envelope

Dear Prof. Novak,

I hope you remember me. We met at ISSOL
Congress at Mainz in 1983. We have been working the formula
of JEEWANU, the model of the Procell since least 2½ decade
and you may have heard about this system which has
boundary wall and internal structure, grow from within, multiply
by budding and have metabolic activity. These particles can
adapt and have ~~peroxidase~~ ^{inferred with} ferrioxin-like and
nitrogenase-like properties and are able to fix ~~split water~~
in hydrogen and oxygen ~~and~~ in sunlight and fix molecular
nitrogen. These particles are auto-synthesised by the action of
sulphate or aqueous mixtures of ammonia, methylolite, diammonium
hydrogen phosphate, mineral solution and formaldehyde. ^{as in the original}
~~I have been to publish in the Sixth ISSOL Meeting at The North District~~
~~and I am waiting to give an invited talk on these~~
particles which come under the topic (1) "Chemical evolution leading
to the origin of life" or (2) "Model of procell systems". If you ^{proposes}
I am willing to come to ~~Heppel to have for you~~ If you can arrange it
it will give us a chance of meeting again and discuss ~~the~~ my paper of course
into.

→ with our best regards
An interest I'm coming

Yours truly,

K,

31/5/88.



INTERNATIONAL SOCIETY FOR THE STUDY OF THE ORIGIN OF LIFE

7th ICOL 1983 Secretariat

Institut für Biochemie
Gutenberg-Universität
Postfach 3980
D-6500 Mainz
Bundesrepublik Deutschland

Local Organizing Committee

Chairmen:
K. Dose (Mainz)
W. Thiemann (Bremen)
Acting Secretary:
C. Brand (Mainz)

CONCERN: 7TH ICOL 1983 MAINZ

P R O C E E D I N G S

Dr. Krishna Bahadur
Chemistry Dept.
Allahabad University
68, Dilkusha, New Katra
Allahabad 211002 INDIA

DEAR COLLEAGUE:

WE GRATEFULLY ACKNOWLEDGE THE RECEIPT OF YOUR CONTRIBUTION(S)
TO THE PROCEEDINGS OF THE 7TH ICOL 1983 ENTITLED

SB *Synthesis of Feenann, the Potentials and Study
of Their Functional Properties*