

## Curriculum Vitae

### JOHN D. RUMMEL

Senior Scientist, SETI Institute, Mountain View, California 94043 USA  
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#### Education:

Stanford University, Stanford, California, 1979–1985

Ph.D. in Biological Sciences

Dissertation: *Investigations into Interspecific Competition and Evolutionary Theory*

Adviser: *Jonathan (now Joan) Roughgarden*

University of Colorado, Boulder, Colorado, 1970–1974

B.A. in Environmental Biology (minor in Mathematics)

– *cum laude* in general studies

Deerfield High School, Deerfield, Illinois, 1966–1970

#### Previous Professional Experience:

McGill University, Montréal, Québec, Canada (2014-2018)

- *Visiting Scholar, Institute of Air and Space Law*

East Carolina University, Greenville, North Carolina, 2008-2015

- *Professor of Biology, Department of Biology (2008-2015)*
- *Director, Institute for Coastal Science and Policy (2008-2013)*
- *Campus Director, North Carolina Space Grant Consortium (2010-2014)*
- *Research Associate, Center for Natural Hazards Research (2010-2015)*

Adjunct Scientist, Marine Biological Laboratory, Woods Hole, Mass., 2012-2015

NASA Headquarters, Washington, D.C., Science Mission Directorate, 1997-2008

- *SST-Senior Scientist for Astrobiology, 2006-2008*
- *Planetary Protection Officer / SST-Senior Scientist for Planetary Protection, 1997-2006*

Colorado State University, Fort Collins, Colorado, 1999-2001

- *Research Scientist / Associate Professor, Department of Civil Engineering*
- *Faculty Affiliate, Department of Civil Engineering, 2001-2003*

NASA–Ames Research Center, Moffett Field, California, 1998-1999

- *Associate Program Scientist, Fundamental Biological Sciences Program, Life Sciences Division, NASA Office of Life and Microgravity Science and Applications*

Marine Biological Laboratory, Woods Hole, Massachusetts, 1994-1999

- *Director of Research Administration and Education (1994-1998)*  
– *Responsible for all MBL educational programs and sponsored research arrangements*
- *Research Scholar, Center for Advanced Studies in the Space Life Sciences (1995-1997)*
- *Visiting Scientist / Co-Investigator, Marine Resources Center (1998-2001)*

NASA Headquarters, Washington, D.C., Office of Space Science, 1993

- *Deputy Chief, Mission From Planet Earth Study Office (Human Mission Studies)*
- *Planetary Protection Officer (1986–1993)*
- *NASA Co-Chair, NASA-NSF Antarctic Space Analog Program Committee*
- *SETI / High Resolution Microwave Survey Program Scientist (1986-1993)*

Professional Experience (cont.):

NASA Headquarters, Washington, D.C., Office of Space Science and Applications, 1986–1993; Office of Space Science, 1993

- *Program Manager & Discipline Scientist, Exobiology Program (1986-1993)*
- *Acting Chief, Biological Systems Research Branch Life Sciences Division (1987-1993) (Programs in Biospheric Research, CELSS, Exobiology, & Gravitational Biology)*
- *Manager, Life Support Systems Integration, Life Sciences Division (1990-1993)*
- *Member, FCCSET Subcommittee on Environmental Biology*
- *US Co-Chair, Life Support & Exobiology Implementation Teams (US-USSR/Russia Joint Working Group on Space Biology and Medicine)*

National Research Council Research Management Associate, 1986–1987

- *Acting Program Manager and Discipline Scientist, Exobiology Program, Life Sciences Division, NASA Headquarters, Washington, D.C.*

NRC Resident Research Associate, NASA–Ames Research Center, 1985–1986

- *Theoretical and Experimental work on Controlled Ecological Life Support Systems and Microbial Ecology*

Graduate Research Assistant, Stanford University, 1979–1984

- *Theoretical and Experimental Work in Population and Community Ecology*

Naval Flight Officer, United States Navy, 1974–1979; Naval Reserve 1979-1998

- *Maritime Air Patrol Mission Commander / Tactical Coordinator*
- *Ground Duties in Safety, Training, Standardization, Tactics, and Navigation*

Honors/ Awards:

North Carolina Art Education Association, 2012

- *Friend of the Arts 2012-13*

Name given to a Genus of microorganisms, the *Rummeliibacillus* (2 species)

- *Vaishampayan et al. 2009. International Journal of Systematic and Evolutionary Microbiology 59: 1094-1099.*

NASA Exceptional Performance Award, 2008

- *"For outstanding management of space science programs..."*

Member, International Academy of Astronautics, 2007

Life Sciences Award, International Academy of Astronautics, 2005

- *"For significant and lasting contributions to the advancement of the astronautical sciences"*

Member, Marine Biological Laboratory Corporation, 1995

Fellow, American Association for the Advancement of Science, 1990

- *"For leadership in fostering NASA-sponsored life science research"*

NASA Group Achievement Awards:

- *O/OREOS Nanosatellite Science & Engineering Group, 2011 (Originator)*
- *Phoenix Project System Engineering Team, 2009*
- *Mars Exploration Rovers HQ Management Team, 2004*
- *Essentials of Biology Design, Development, and Implementation Team, 2001*
- *Mars Surveyor 1998 Management and Support Team, 1999*
- *Deep Space 1 Management and Support Team, 1999*
- *High Resolution Microwave Survey Team, 1992*

Honors/Awards (cont.):

NASA Group Achievement Awards (cont.):

- Lunar and Mars Exploration Initiative Team, 1990

NASA Superior Accomplishment Award for Special Act or Service (multiple)

Research Management Associateship, National Research Council, 1986–1987

Research Associateship, National Research Council, 1985–1986

ARCS Foundation Scholarship, 1984

National Science Foundation Doctoral Dissertation Improvement Grant,  
1982–1983

National Science Foundation Graduate Fellowship, 1980–1983

Professional Societies:

American Association for the Advancement of Science (Fellow)

American Geophysical Union

American Society for Gravitational and Space Research

American Society for Microbiology

Ecological Society of America

International Academy of Astronautics

(Member; Chair, Commission on Space Life Sciences 2007-2008)

International Society for the Study of the Origin of Life

ICSU Committee on Space Research (COSPAR)

(IUBS Representative; Former Planetary Protection Panel Chair)

Sigma Xi

Professional/Editorial Activities:

Member, The Hague International Space Resources Governance Working Group,  
Leiden, The Netherlands, 2018-Present

Standing Review Board, Europa Lander Mission, Jet Propulsion Laboratory

Chair, Science Advisory Board, SETI Institute, Mountain View, CA, 2016-2019

Editorial Board, *Astrobiology*, Mary Ann Liebert, Inc., Publisher, 2001-Present

Member, Committee on the Review of NASA's Planetary Science Division's  
Restructured Research and Analysis Programs, Space Studies Board,  
National Academies of Science Engineering and Medicine, 2016–2017

Executive Secretary and Designated Federal Official, Planetary Protection  
Task Force/Advisory Committee/Subcommittee, Space Science Advisory  
Committee, NASA Advisory Council, 1999-2007; Member 2010-2015

Member, Science Advisory Board, ECU Center for Biodiversity, East Carolina  
University, 2010-2015

Member, North Carolina Space Grant Consortium Executive Board, 2010-2014

Member Representative, Consortium for Ocean Leadership, Washington, DC,  
2008-2013; Chair, Members Nominating Committee, 2009-2010; Ocean Futures  
Steering Committee, 2013-2014

Professional/Editorial Activities (cont.):

Member-at-Large, Executive Committee, Southern Association of Marine Laboratories, 2012-2013

Member, Advisory Board, North Carolina Coastal Resources Law, Planning and Policy Center, 2010-2013

Member, University of North Carolina Coastal and Marine Research Council (UNC Systemwide Group with Duke U.), 2008-2013

Chair, Panel on Planetary Protection, Committee on Space Research (COSPAR) of the International Council for Science (ICSU), 1999-2014; International Union of Biological Sciences, Representative to COSPAR, 1997-Present

Chair, International Academy of Astronautics Commission on Space Life Sciences, 2007-2008 (Vice Chair, 2005-2007) and Member, SETI Permanent Committee, 1999-2005; 2012-Present

Principal Lecturer, "Essentials of Biology" Course given by Colorado State University at NASA Headquarters and Field Centers, 1998-2000

Topics "*The Origin and Unity of Life*," "*Early Earth and the Evolution of Life*," and "*The Biological Future*"

Lecturer—MBL Summer Course: "Microbial Diversity;" MBL Teacher Training Course: "Living in the Microbial World," 1999; International Space University Summer Session, 1998; NASA Course: "Planetary Protection: Policies and Practices," 2003, 2004, 2005, 2006, 2016; European Space Agency Planetary Protection Course, 2004, 2005, 2009

Executive Committee, Woods Hole Science and Technology Education Partnership, 1994-1998; *Chair Emeritus*, 1998; *Chair*, 1997-1998; *Vice Chair*, 1996-1997

Board of Editors, *Space Biology and Medicine*, US-Russia Joint Publication, 1989-1993

Instructor, School Without Walls (Mars Course), NASA Headquarters, 1990-1992

K-12 Science Education Working Group, Foundation for Microbiology, 1995-2004

Major Conferences/Symposia Chaired/Co-Chaired

- *Bioastronomy '99: A New Era in Bioastronomy*, Hapuna Bay, Hawai'i, 1999
- *Prospecting for Extraterrestrial Microorganisms and the Origin of Life: An Exercise in Astrobiology*, American Society for Microbiology Annual Meeting, Atlanta, Georgia, 1998 (with Mitchell Sogin)
- *Chair, Gordon Conference on Origin of Life*, 1997; *Vice-Chair*, 1996

Radiation Safety Committee, Marine Biological Laboratory, 1996-1998

Institutional Animal Care and Use Committee, Marine Biological Laboratory, 1994-1998

Member, Committee on Planetary and Lunar Exploration, Space Studies Board, National Research Council, 1995-1997

Manuscript Reviewer for *NASEM SSB*, *SAE Transactions*, *Adv. in Space Research*, *Am. Naturalist*, *Astrobiology*, *Ecology*, *Icarus*, *Journal of Theoretical Biology*, *Origin of Life and Evolution of the Biosphere*, *Oecologia*, *Planetary and Space Science*, Praxis Publishing, Ltd.

Professional/Editorial Activities (cont.):

Peer Review Committee Member / Subpanel Chair / Chair

- for NASA via NRESS or the Earth and Space Science Support Office (LaRC)
  - Planetary Science and Technology through Analog Research (PSTAR), 2015
  - HOPE-4, 2013; Planetary Protection Research, 2012, 2013, 2014, 2015, 2016
  - Discovery TMCO, 2010-2011 & Discovery TMCO Final, 2012
  - Astrobiology Science and Technology for Exploring Planets (Chair), 2010
  - New Frontiers TMCO, 2009
  - Lunar Science Institute (Panel Chair), 2008
  - Etc.
- for NASA via the American Institute of Biological Sciences
  - Spacesuit Design and IVA/EVA Physiology, 1994–1995
  - NASA Specialized Centers of Research and Technology: Bioregenerative Life Support, Environmental Health, and Space Biology, 1995
- for the Canadian Space Agency
  - Canadian Analogue Research Network Competitions, 2007, 2008
- for the South Atlantic Alliance on NOAA's Regional Ocean Partnership, 2010
- for NOAA Sea Grant (Woods Hole Oceanographic Institution) 1994-1998

Research Field Experience:

Juan de Fuca Ridge, Pacific Ocean, R/V *Atlantis* w/ *Alvin*, Cruise AT-03 Leg 22, 1998  
Microbiology of Deep Sea Sediments at Flanges and Black Smokers at 2194 m depth

Field Experiments with Lesser Antillean *Anolis* Lizards, 1980-1982

St. Maarten, St. Eustatius, Anguilla, Barbuda, Nevis, Montserrat, Yucatan

Selected Publications:

- 2019 A strategy for sample selection on Mars based on the microbial ecology of terrestrial volcanic environments. In, *Role of Sample Return in Addressing Major Questions in Planetary Sciences*, M. Anand et al. (Eds.), *in press*.  
(with C. S. Cockell, S. McMahon, D. Lim, and A. Stevens)
- 2019 Planetary protection technologies for planetary science instruments, spacecraft, and missions: Report of the NASA Planetary Protection Technology Definition Team (PPTDT). *Life Sciences in Space Research*, *in press*.  
(with D.E. Pugel)
- 2019 From Planetary Quarantine to Planetary Protection: a NASA and international story. *Astrobiology* 19: 624–627.
- 2018 It's time to develop a new "Draft Test Protocol" for a Mars sample return mission (or two). *Astrobiology* 18: 377-380.  
(with G. Kminek)
- 2018 Inadvertently finding Earth contamination on Mars should not be a priority for anyone. *Astrobiology* 18: 108-115.  
(with C. Conley)
- 2017 Four fallacies and an oversight: searching for martian life. *Astrobiology* 17: 971-974.  
(with C. Conley)

## Selected Publications (cont.):

- 2017 *Aspergillus penicillioides* differentiation and cell division at 0.585 water activity. *Environmental Microbiology* 19: 687-697.  
(with A. Stevenson, P. G. Hamill, C. O'kane, G. Kminek, M. Voytek, J. Dijksterhuis, and J. E. Hallsworth)
- 2017 Glycerol enhances fungal germination at the water-activity limit for life. *Environmental Microbiology* 19: 947-96.  
(with A. Stevenson, P. G. Hamill, A. Medina, G. Kminek, J. Dijksterhuis, D. J. Timson, N. Magan, S. L. Leong, and J. E. Hallsworth)
- 2016 Advances in planetary protection ahead of the "Journey to Mars." ICES Paper ICES-2016-332.  
(with J. A. Spry, M. S. Race, B. Siegel and C. A Conley)
- 2015 Providing for Sustainable Exploration and Use of Outer Space Environments. Pages 139-147 in Cockell, Charles S., (ed.) *Human Governance Beyond the Earth: Implications for Freedom*. Springer, Switzerland.
- 2014 A New Analysis of Mars 'Special Regions,' Findings of the Second MEPAG Special Regions Science Analysis Group (SR-SAG2). *Astrobiology* 14: 887-968.  
(with D. W. Beaty, M. A. Jones, C. Bakermans, N. G. Barlow, P. Boston, V. Chevrier, B. Clark, J.-P. de Vera, R. V. Gough, J. E. Hallsworth, J. W. Head, V. J. Hipkin, T. L. Kieft, A. S. McEwen, M. T. Mellon, J. Mikucki, W. L. Nicholson, C. R. Omelon, R. Peterson, E. Roden, B. Sherwood Lollar, K. L. Tanaka, D. Viola, and J. J. Wray)
- 2013 Appropriate protection of Mars. *Nature Geosciences* 6: 587-588.  
(with C. A. Conley)
- 2013 Where no one has gone before – and back again: planetary protection provisions for future exploration missions. In *Proceedings of the 6th IAASS Conference: Safety is Not an Option*, ESA SP-715, ESA-ESTEC, Noordwijk, The Netherlands (CD-ROM).  
(with C. A. Conley)
- 2012 Ethical considerations for planetary protection in space exploration: a workshop. *Astrobiology* 12: 1017-1023. doi: 10.1089/ast.2012.0891  
(with M. S. Race, G. Horneck, and the Princeton Workshop Participants)
- 2012 Mars sample return backward contamination – strategic advice and requirements: report from the ESF-ESSC Study Group on MSR Planetary Protection Requirements. European Science Foundation, Strasbourg, 59 pp.  
(with W. Ammann, J. Barros, A. Bennett, J. Bridges, J. Fragola, A. Kerrest, K. Marshall-Bowman, H. Raoul, P. Rettberg, M. Salminen, E. Stackebrandt, and N. Walter)
- 2012 Toward a global space exploration program: a stepping stone approach. *Advances in Space Research* 49: 2-48.  
(with P. Ehrenfreund, C. McKay, B. Foing, C. Neal, T. Masson-Zwaan, M. Ansdell, N. Peter, J. Zarnecki, S. Mackwell, M. A. Perino, L. Billings, and J. Mankins)

## Selected Publications (cont.):

- 2011 Planetary protection as a crosscutting consideration in human missions and technologies beyond low Earth orbit. ICES Paper AIAA 2011-5093. DOI: 10.2514/6.2011-5093.  
(with M. S. Race, C. A. Conley, and P. D. Stabekis)
- 2010 In situ biological contamination studies of the Moon: implications for planetary protection and life detection missions. *Earth, Moon, and Planets* 107: 87-93.  
(with D. P. Glavin, J. P. Dworkin, M. Lupisella, D. R. Williams, and G. Kminek)
- 2010 Report of the COSPAR Mars special regions colloquium. *Advances in Space Research* 46: 811-829.  
(with G. Kminek, C. S. Cockell, R. Atlas, N. Barlow, D. Beaty, W. Boynton, M. Carr, S. Clifford, C. A. Conley, A. F. Davila, A. Debus, P. Doran, M. Hecht, J. Heldmann, J. Helbert, V. Hipkin, G. Horneck, T. L. Kieft, G. Klingelhofer, M. Meyer, H. Newsom, G. G. Ori, J. Parnell, D. Prieur, F. Raulin, D. Schulze-Makuch, J. A. Spry, P. E. Stabekis, E. Stackebrandt, J. Vago, M. Viso, M. Voytek, L. Wells, and F. Westall)
- 2010 The integration of planetary protection requirements and medical support on a mission to Mars. *Journal of Cosmology* 12: 3834-3841.  
(with M. S. Race, C. A. Conley, and D. R. Liskowsky)
- 2010 Planetary protection for human exploration of Mars. *Acta Astronautica* 66: 792-797.  
(with C. A. Conley)
- 2010 Synergies of Earth science and space exploration. *Advances in Space Research* 45: 155-168.  
(with S. Y. Chung, P. Ehrenfreund, and N. Peter)
- 2009 Special regions in Mars exploration: problems and potential. *Acta Astronautica* 64: 1293-1297.
- 2008 Planetary protection and humans on mars: NASA/ESA workshop results. *Advances in Space Research* 42: 1128-1138.  
(with M. Race and G. Kminek)
- 2008 Planetary protection for humans in space: Mars and the Moon. *Acta Astronautica* 63: 1025-1030.  
(with C. Conley)
- 2007 Planetary protection: microbial tourism and sample return. Chapter 25 in Sullivan, W. and J. Baross (eds.), *Astrobiology: Planets and Life*, Cambridge University Press, Cambridge University Press, 604pp.
- 2006 Got life? Hours of boredom followed by moments of sheer terror (and that's just with the press). *Acta Astronautica* 59: 1160-1162.  
(with M. Race)
- 2006 Life Support and Habitation and Planetary Protection Workshop. NASA/TM 2006-213485, National Aeronautics and Space Administration.  
(with J. Hogan, M. Race, J. Fisher, and J. Joshi)

## Selected Publications (cont.):

- 2006 Results summary of the Life Support & Habitation and Planetary Protection workshop. ICES Paper 2006-01-2007, SAE Technical Paper Series, Society of Automotive Engineers, Warrendale, Pennsylvania (SAE Transactions 3/07).  
(with J. Hogan, M. Race, J. Fisher, and J. Joshi)
- 2006 Preventing the forward contamination of Mars: concerns, questions, and required actions. IEEE Aerospace Conference Paper #1605.
- 2005 Technical challenges in meeting the next decade's planetary protection requirements. IEEE Aerospace Conference Paper #1583.
- 2004 Biological contamination studies of lunar landing sites: implications for future planetary protection and life detection on the Moon and Mars. *International Journal of Astrobiology* 3: 265-271 .  
(with D. P. Glavin, J. P. Dworkin, M. Lupisella, and G. Kminek)
- 2004 Mars, Europa, and beyond: understanding the potential for life in the solar system. Pages 413-443 in P. Ehrenfreund et al. (eds.), *Astrobiology: Future Perspectives*, Astrophysics and Space Science Library Series, Vol. 305. Springer, The Netherlands.
- 2004 Issues in planetary protection: policy, protocol and implementation. *Space Policy* 20(2004): 49-54.  
(with L. Billings)
- 2003 Planetary protection issues in the human exploration of Mars. ICES Paper 2003-01-2523, Society of Automotive Engineers, Warrendale, Pennsylvania.  
(with M. S. Race and M. Criswell)
- 2002 A draft test protocol for detecting possible biohazards in martian samples returned to Earth. NASA/CP-2002-211842.  
(ed. with M. Race, D. L. DeVincenzi, P. J. Schad, P. D. Stabekis, M. Viso, and S. Acevedo)
- 2002 Report of the COSPAR/IAU Workshop on Planetary Protection, COSPAR, Paris, France, 2002.  
(with the COSPAR Planetary Protection Panel)
- 2002 COSPAR's planetary protection policy: a consolidated draft. *Advances in Space Research* 30(6): 1567-1571.  
(with P. D. Stabekis, D. L. DeVincenzi, and J. B. Barengoltz)
- 2002 Seeking an international consensus in planetary protection: COSPAR's Planetary Protection Panel. *Advances in Space Research* 30(6): 1573-1575.
- 2002 Planetary quarantine: policy and practical issues. Pages 93-98 in Space Studies Board, National Research Council (ed.), *Signs of Life: CD-ROM Supplement*. National Academy Press, Washington, D.C.
- 2002 Mars sample handling protocol workshop series: Workshop 4 proceedings and final report. NASA/CP-2001-211841.  
(ed. with M. Race, D. L. DeVincenzi, and S. Acevedo)



## Selected Publications (cont.):

- 2001 Mars sample handling protocol workshop series: Workshop 3 proceedings and final report. NASA/CP-2001-211388.  
*(ed. with M. Race, K. H. Neilson, and S. Acevedo)*
- 2001 Mars sample handling protocol workshop series: Workshop 2a proceedings and final report. NASA/CP-2001-210924.  
*(ed. with C. W. Bruch and R. B. Setlow)*
- 2001 Mars sample handling protocol workshop series: Workshop 2 proceedings and final report. NASA/CP-2001-210923.  
*(ed. with M. Race, G. T. A. Kovacs, and S. Acevedo)*
- 2001 Planetary exploration in the time of astrobiology: Protecting against biological contamination. *Proceedings of the National Academy of Sciences* 98(5): 2128-2131.
- 2000 Life Sciences: Planetary Protection; Ozone and UVB Radiation Effects. *Advances in Space Research* 26(12).  
*(ed. with A. Debus, G. Hörneck, and P. Rettberg)*
- 2000 Implementing planetary protection requirements for sample return missions. *Advances in Space Research* 26(12): 1893-1899.
- 2000 Mars sample handling protocol workshop series: Workshop 1 proceedings and final report. NASA/CP-2000-209624.  
*(ed. with M. Race)*
- 2000 NASA's astrobiology program: An overview. Pages 19-21 in Lemarchand, G. and K. Meech (eds.), *Bioastronomy '99: A New Era in Bioastronomy*. Astronomical Society of the Pacific Conference Series 213, San Francisco, California.  
*(with M. A. Meyer)*
- 1999 Mars sample quarantine protocol workshop. NASA/CP-1999-208772.  
*(ed. with D. L. DeVincenzi, J. Bagby, and M. Race)*
- 1998 Scientific issues regarding the release of extraterrestrial materials collected by spaceflight missions. *Advances in Space Research* 22(3): 383-389.
- 1996 Planning for Mars sample return: implementing planetary protection protocols in the face of scientific uncertainty. *Origin of Life and Evolution of the Biosphere*: 26: 512.  
*(with M. Race)*
- 1996 A consensus approach to planetary protection requirements: recommendations for Mars lander missions. *Advances in Space Research* 18(1/2): 317-321.  
*(with M. A. Meyer)*
- 1995 Planetary protection provisions for Mars missions. *Advances in Space Research* 15(3): 249.

## Selected Publications (cont.):

- 1995 Life Science and Space Research XXV(4), Planetary Biology and Origins of Life. *Advances in Space Research* 15(3).  
(*ed. with J. M. Greenberg, J. Oró, A. Brack, D. L. DeVincenzi, A. Banin, E. I. Friedmann, F. Raulin, C. P. McKay, H. Baltascheffsky, A. W. Schwartz, M. Schidlowski, and K. Roessler*)
- 1994 Searching for intelligent life in the universe: NASA's High Resolution Microwave Survey. *Advances in Space Biology and Medicine* 4: 189-224.  
(*with G. R. Coulter, M. J. Klein, and P. R. Backus*)
- 1994 Human expeditionary missions - systems engineering considerations and virtual environment technologies AIAA 94-4574. AIAA Space Program and Technologies Conference, Chapter DOI: 1994, 10.2514/6.1994-4574  
(*with W. Smith*)
- 1994 Planetary surface exploration: recent results and analog environments. ICES Paper 932246, SAE Technical Paper Series, SAE Transactions, Society of Automotive Engineers, Warrendale, Pennsylvania.  
(*with W. Smith*)
- 1993 A survey of current control approaches for plant growth systems used in life support systems. ICES Paper 932280, SAE Technical Paper Series, Society of Automotive Engineers, Warrendale, Pennsylvania.  
(*with A. C. McCormack*)
- 1993 Exobiology. Pages 195-228 in J. D. Rummel, V. A. Kotelnikov, and M. V. Ivanov (eds.), *Space and Its Exploration*. AIAA, Washington, D.C. and Nauka, Moscow, USSR.
- 1993 *Space and Its Exploration*. Vol. I of Gazenko, O. and A. Nicogossian (eds.), *Space Biology and Medicine*. AIAA, Washington, D.C. and Nauka, Moscow, USSR, 328pp.  
(*ed. with V. A. Kotelnikov and M. V. Ivanov*)
- 1992 SETI in the future: Toward Other Possible Searches. *Acta Astronautica*, Volume in preparation (J. Billingham and P. Backus, eds.).
- 1992 Exobiology: the NASA program. Pages 263-271 in Carle, G., D. Schwartz, and J. Huntington (eds.), *Exobiology in Solar System Exploration*. NASA SP-512.  
(*with L. Harper and D. Andersen*)
- 1992 Early SEI milestones - underwater habitats and Antarctic research outposts as analogs for long duration spaceflight and lunar and Mars outposts. AIAA 92-1367. AIAA Space Program and Technologies Conference, Chapter DOI: 10.2514/6.1992-1367  
(*with R. Wharton, D. Andersen, and C. McKay*)
- 1992 Towards a Mars base: critical steps for life support on the Moon and beyond. ICES Paper 921288, SAE Technical Paper Series, Society of Automotive Engineers, Warrendale, Pennsylvania.

## Selected Publications (cont.):

- 1992 Life support for exploration applications. Pages 337-341 in Crump, W. J., S. Doll, and W. R. Humphries (eds.), Proceedings of the First International Conference on Life Support and Biospherics. The University of Alabama at Huntsville.
- 1992 Testing a Mars science outpost in the Antarctic dry valleys. *Advances in Space Research* 12(5): 205-209.  
(with D. Andersen, C. McKay, and R. Wharton)
- 1992 Planetary protection policy (USA). *Advances in Space Research* 12(4): 129-131.
- 1992 Development of life support requirements for long-term space flight. *Advances in Space Research* 12(1): 351-353.
- 1992 Development of countermeasures for medical problems encountered in space flight. *Advances in Space Research* 12(1): 329-337.  
(with A. Nicogossian, L. Leveton, and R. Teeter)
- 1992 Long term effects of microgravity and possible countermeasures. *Advances in Space Research* 12(1): 281-284.  
(with J. W. Wolfe)
- 1991 Antarctic analogs as a testbed for regenerative life support technologies. IAA-91-631. Proceedings of the 42nd International Astronautical Federation.  
(with D. Roberts, D. Andersen, C. McKay, and R. Wharton)
- 1991 Bioregenerative life support: The initial CELSS reference configuration. ICES Paper 911420, Pages 1-5 in *Regenerative Life Support Systems and Processes*, SAE SP-873, Society of Automotive Engineers, Warrendale, Pennsylvania.  
(with M. Averner)
- 1991 Fourth Symposium on Chemical Evolution and the Origin and Evolution of Life. NASA Conference Publication 3129.  
(ed., with R. A. Wharton, D. T. Andersen, and S. E. Bzik)
- 1990 Exobiology and SETI from the lunar farside. Pages 99-106 in Mumma, M. J. and H. J. Smith, (eds.), *Astrophysics from the Moon*, AIP Conference Proceedings 207, American Institute of Physics, New York.  
(with J. Tarter)
- 1990 An Antarctic research outpost as a model for planetary exploration. *Journal of the British Interplanetary Society* 43: 499-504.  
(with D. Andersen, C. McKay, and R. Wharton)
- 1990 Life sciences and Mars exploration. AIAA 90-3793. AIAA Space Program and Technologies Conference, Chapter DOI: 10.2514/6.1990-3793  
(with F. Sulzman, L. Leveton, and R. Teeter)

## Selected Publications (cont.):

- 1990 Long term life support for space exploration. ICES Paper 901277, Pages 67-73 *in* Behrend, A. F. and R. P. Reysa, (eds.), *Advanced Environmental Control and Life Support Systems*, SAE SP-831, Society of Automotive Engineers, Warrendale, Pennsylvania.
- 1990 Cosmic Dust Collection Facility: Scientific Objectives and Programmatic Relations (ed. by F. Hörz). NASA Johnson Space Center.  
(with D. Brownlee, T. Bunch, D. Grounds, E. Grün, F. Hörz, W. Quaide, and R. Walker)
- 1989 Planetary protection policy overview and application to future missions. *Advances in Space Research* 9(6): 181-184.
- 1989 Transpiration during life cycle in controlled wheat growth. *Advances in Space Research* 9(8): 61-64.  
(with T. Volk)
- 1989 Life sciences interests in Mars missions. Pages 287-294 *in* Stoker, C., (ed.), *Case for Mars III: Strategies for Exploration - General Interest and Overview*. Univelt, San Diego.  
(with L. Griffiths)
- 1989 Planetary protection and back contamination control for a Mars Rover Sample Return mission. Pages 259-263 *in* Stoker, C., (ed.) *Case for Mars III: Strategies for Exploration - General Interest and Overview*. Univelt, San Diego.
- 1989 The case for cellulose production on Mars. Pages 87-94 *in* Stoker, C., (ed.), *Case for Mars III: Strategies for Exploration - Technical*. Univelt, San Diego.  
(with T. Volk)
- 1987 Controlled Ecological Life Support System: Design, Development, and Use of Ground-based Plant Growth Module. NASA Conference Publication 2479.  
(ed.. with R. D. MacElroy and D. Smernoff)
- 1987 A modular BLSS simulation model. *Advances in Space Research* 7(4): 59-68.  
(with T. Volk)
- 1987 Mass balances for a biological life support system simulation model. *Advances in Space Research* 7(4): 141-148.  
(with T. Volk)
- 1986 Mass and energy dynamics, reservoir sizes, and scaling relationships for lunar life-support ecosystems. *Proceedings of the First Lunar Development Symposium*.  
(with T. Volk)
- 1986 CELSS science needs. Pages 280-284 *in* MacElroy, R. D., Smernoff, D. T., and N. Martello, (eds.), *Controlled Ecological Life Support System: CELSS '85 Workshop*. NASA TM-88215.

## Selected Publications (cont.):

- 1985 A theory of faunal buildup for competition communities. *Evolution* 39: 1009–1033.  
(with J. Roughgarden)
- 1985 Effects of reduced perch-height separation on competition between two *Anolis* lizards. *Ecology* 66: 430–444.  
(with J. Roughgarden)
- 1984 Strong present-day competition between the *Anolis* lizard populations of St. Maarten (Neth. Antilles). Pages 203–220 in Shorrocks, B. (ed.), *Evolutionary ecology*. Blackwell, Oxford.  
(with J. Roughgarden and S. Pacala)
- 1983 Some differences between invasion-structured and coevolution-structured competitive communities: a preliminary theoretical analysis. *Oikos* 41: 477–486.  
(with J. Roughgarden)
- 1983 A technique for enclosing *Anolis* lizard populations under field conditions. *Journal of Herpetology* 17: 94–97.  
(with S.W. Pacala and J. Roughgarden)
- 1983 Experimental evidence of strong present-day competition between the *Anolis* populations of the Anguilla Bank — a preliminary report. Pages 499–506 in Rhodin, A., and K. Miyata (eds.), *Advances in Herpetology and Evolutionary Biology: Essays in Honor of Ernest E. Williams*. Harvard University Press, Cambridge, Massachusetts.  
(with J. Roughgarden and S.W. Pacala)

Workshop/Working Group Reports:

- 2017 Planetary Protection Technologies for Planetary Science Instruments, Spacecraft, and Missions: Report of the Planetary Protection Technology Definition Team (PPTDT). NASA Headquarters, Washington, DC.  
*(with B. Pugel, P. Beauchamp, N. Carosso, M. Casey, P. Doran, R. Lorenz, D. Steinfeld, G. Suarez, M. Meyer, and Q.-V. Nguyen)*
- 2016 Meeting report: COSPAR Panel on Planetary Protection Colloquium, Bern, Switzerland, September 2015. *Space Research Today* 195: 42-51.  
*(with G. Kminek, G., V.J. Hipkin, A.M. Anesio, J. Barengoltz, P.J. Boston, B.C. Clark, C.A. Conley, A. Coustenis, E. Detsis, P. Doran, O. Grasset, K. Hand, Y. Hajime, E. Hauber I. Kolmasová, R.E. Lindberg, M. Meyer, F. Raulin, G. Reitz N.O. Rennó, P. Rettberg, M.P. Saunders, G. Schwehm, B. Sherwood, D.H. Smith, P.E. Stabekis, and J. Vago)*
- 2009 COSPAR Workshop on Ethical Considerations for Planetary Protection in Space Exploration, Princeton University, Princeton, New Jersey, USA, 8-10 June 2010.  
*(with M.S. Race and G. Horneck)*
- 2009 COSPAR Workshop on Planetary Protection for Titan and Ganymede, Caltech, Pasadena, California, USA, 9-10 December 2009  
*(with F. Raulin and P. Ehrenfreund)*
- 2009 COSPAR Workshop on Planetary Protection for Outer Planet Satellites and Small Solar System Bodies, European Space Policy Institute (ESPI), Vienna, Austria, 15-17 April 2009.  
*(with P. Ehrenfreund and N. Peter)*
- 2002 COSPAR/IAU Workshop on Planetary Protection, Williamsburg, Virginia, USA, 2-4 April 2002.

Book Forewords (cont.):

- 2011 *When Biospheres Collide: A History of NASA's Planetary Protection Program*, by Michael Meltzer. NASA History Series (SP-4234), Washington, DC.
- 2007 *Soil Biology*, by Patrice Dion and Chandra Shekhar Nautiyal (Eds.). Springer-Verlag, Berlin Heidelberg.

Book Reviews:

- 2015 Review of *Why Mars: NASA and the Politics of Space Exploration*, by W. Henry Lambright. *The American Review of Public Administration* 45, 5:629-631. (with P. Ehrenfreund)
- 2004 Review of *Lonely Planets: The Natural Philosophy of Alien Life*, by David H. Grinspoon. *Astrobiology* 4(3): 404-405.
- 1998 Review of *Deep Ocean Journeys* by Cindy Lee Van Dover. In *HMS Beagle* (<http://hmsbeagle.com/hmsbeagle/1998/24/booksoft/review.htm>), Issue 24 (Jan. 30).
- 1997 Review of *The Biological Universe: The Twentieth Century Extraterrestrial Life Debate and the Limits of Science*, by Steven J. Dick. *Icarus* 127(1): 263

Popular Articles / Book Chapters / Roundtables / Opinions / History:

- 2018 Planetary Protection in Planetary Exploration Missions. *In press*, Victoria Meadows, Ed., *Planetary Astrobiology*. Space Science Series, Lunar and Planetary Institute, Houston, Texas.
- 2018 It's time to develop a new "Draft Test Protocol" for a Mars sample return mission (or two....). *Astrobiology* 18:377-380. (with G. Kminek)
- 2017 Selling Lunar Resources for Fun, Profit, and Export: A Test That the OST Cannot Pass? In Maria Manoli & Sandy Belle Habchi, Eds., *Monograph Series V - Conflicts in Space and the Rule of Law*, McGill University Press, Montréal.
- 2017 One Small Step for a Man, One Giant Leap for My Real Estate Broker: Taking the Next Steps in Space Governance. In Tanveer Ahmad & Jinyuan Su, Eds., *Monograph Series IV: NewSpace Commercialisation and the Law*, McGill University Press, Montréal.
- 2017 "Due Regard" in Space Activities: Avoiding Harmful Contamination in the Exploration and Use of Outer Space. In Tanveer Ahmad & Jinyuan Su, Eds., *Monograph Series IV: NewSpace Commercialisation and the Law*, McGill University Press, Montréal.
- 2016 Space Environmental Issues. Chapter 18 In R. Jakhu and J. Pelton, eds., *Global Space Governance: An International Study*, pages 435-477. Springer International.

## Popular Articles/Book Chapters/Roundtables/Opinions/History (cont.):

- 2015 The Next Steps for Space Resources. *Space News*, December 7, 2015 p. 19.
- 2015 Nearly Forty Years after Viking: Are We Ready for a New Life-Detection Mission? (A Roundtable Discussion) *Astrobiology* 15: 413–419.  
(with D. Schulze-Makuch, S. A. Benner, G. Levin, V. Parro, and S. Kounaves)
- 2014 Carl Woese, Dick Young, and the Roots of Astrobiology. *RNA Biology* 11: 207–209.
- 2011 A Funny Thing Happened to Me on the Way to the Universe: A Dread-Pirate-Roberts Job? *Astrobiology* 11: 1054-1055.
- 2010 Interplanetary Spaceflight Regulatory Environment: Planetary Protection. Pages 3481-3492 in R. Blockley and W. Shyy (eds.), *Encyclopedia of Aerospace Engineering*, John Wiley & Sons, Ltd., Chichester, UK.
- 2008 Discovery of Deep-Sea Hot Springs, the Origin of Life on Earth, and the Search for Life in the Universe. Pages 42-55 in C. L. Van Dover (ed.), *Beyond the Edge of the Sea*, Muscarelle Museum of Art, Williamsburg, Virginia.
- 2006 Planetary Protection. Pages 809-811 in L. J. Mix, J. C. Armstrong, A. M. Mandell, A. C. Mosier, J. Raymond, S. N. Raymond, F. J. Stewart, K. von Braun, and O. Zhaxybayeva (eds.), *The Astrobiology Primer: An Outline of General Knowledge—Version 1, 2006*. *Astrobiology* 6: 735-913.  
(with M. Race, L. Billings)
- 2005 Planetary Protection. In *Encyclopedia of Life Sciences*, John Wiley & Sons, Ltd.  
*Updated* (Published online at <<http://www.els.net>>).
- 2015 (with P. D. Stabekis and L. Billings)
- 2004 All of the Planets, All of the Time: Planetary Protection at NASA. In *Space Times* (January/February 2004): 12-15.  
(with L. Billings)
- 2004 Issues in Planetary Protection: History, Policy, Prospects. *COSPAR Information Bulletin* 160: 31-36.
- 2002 Planetary Protection. Pages 125-127 in P. Dasch (ed.), *Macmillan Space Sciences, Volume 4: Our Future in Space*.  
(with M. S. Race)
- 2002 A Sense of Place: Planetary Protection's Role in Astrobiological Exploration. *Ad Astra* 14(1): 28-31.  
(with M. S. Race)
- 2001 Life in NASA and the rest of the universe: new scientific opportunities. *BioScience* 51: 317.  
(with L. Margulis)
- 2000 A Case for Caution. (Reply to Bob Zubrin) *Planetary Report XX*: 6/4-5.



## Popular Articles/Book Chapters/Roundtables/Opinions/History (cont.):

- 1999 A new era in the search for life in the universe. *Bioastronomy News* 11(3): 1-2.  
(with K. Meech)
- 1999 Protecting Earth. Opinion. *Space News* 11 (8 March 1999): 15.
- 1999 Bring 'em back alive—or at least carefully. *Ad Astra* 11: 37-40.  
(with M. S. Race)
- 1998 Exobiology. Article for Encarta®, the Microsoft® CD-ROM Encyclopedia.
- 1997 Report on 1997 Gordon Conference on Origin of Life. *ISSOL Newsletter* 24: 4-5.
- 1997 Something's out there, somewhere. Letter to the Editor. *The Wall Street Journal* (31 July 1997): A19.
- 1996 Biomedical credibility gap. Opinion. *Space News* 8 (5-11 August 1996): 25.
- 1994 Where no one has gone before...What is planetary protection, anyway?  
*Planetary Report XIV*: 5/23-  
(with M. A. Meyer)

## Conference and Public Presentations:

- 2018 *Life in Space: the Science, the Challenges, and the Broad Horizon*. Moderator and Organizer, Global Networking Forum, International Astronautical Congress, Bremen, Germany.
- 2018 Lead-Off Speaker, *New Challenges for Planetary Protection*, Special Session, International Astronautical Congress, Bremen, Germany.
- 2018 *The Moon Village Association*. 42nd COSPAR Assembly, Pasadena, California.
- 2018 *Roles for COSPAR PPP and PEX in future space resources governance activities*. 42nd COSPAR Assembly, Pasadena, California.
- 2018 *It is time to update the biohazard test protocol for a Mars sample return mission*. 42nd COSPAR Assembly, Pasadena, California.
- 2018 *Implementing planetary protection measures for commercial space missions: international standards and national legislation*. 42nd COSPAR Assembly, Pasadena, California.
- 2018 *Don't Forget About... Factoring in Everything for Successful Mars Exploration: Planetary Protection*. Presentation to the International Conference on Environmental Systems, Albuquerque, New Mexico.
- 2018 *Light in the Thermal Environments of an Ocean World: Groveling for Photons, or Living It Rich?* Ocean Worlds 3, Houston, Texas, USA.

## Conference and Public Presentations (cont.):

- 2018 *An Astrobiology and Planetary Protection Perspective on Sample Returns: Restricted, Unrestricted, and 'Natural' Missions.* ISSI Workshop on the Role of Sample Return in Addressing Major Outstanding Questions in Planetary Sciences, Bern, Switzerland.
- 2018 *It's Time to Develop a New "Draft Test Protocol" for a Mars Sample Return Mission (Or Two).* 2nd International Mars Sample Return Conference Berlin
- 2017 *Protecting our Planet from Extraterrestrial Life: Safe Solar System Exploration.* 51st ESLAB Symposium, ESTEC, Noordwijk, The Netherlands.
- 2017 *Planetary Protection in Service to Astrobiology, Earth Safety, and the Future Development of Outer Space.* 33rd American Society for Gravitational and Space Research Conference, Southport, Seattle, Washington, USA.
- 2017 *Potential Scientific, Practical, and Cultural Implications of Discovering Life in Our Solar System.* In *Astrobiology and Exploration*, International Astronautical Congress, Adelaide, Australia.  
(with G. Kminek)
- 2017 *COSPAR's Planetary Protection Policy: Updating a Consensus Standard.* In 60th IISL Colloquium on the Law of Outer Space (E7), Joint IAF / IISL Session on Legal Framework for Collaborative Space Activities, International Astronautical Congress, Adelaide, Australia.  
(with G. Kminek)
- 2017 *Planetary Protection is Good for You! – An International and Individual Consensus.* Astrobiology Science Conference, Mesa, Arizona, USA.
- 2017 *Water On Mars: A Status Report and Suggestions for Future Study.* Lunar and Planetary Science Conference, The Woodlands, Texas.  
(with C. P. McKay)
- 2017 *Risk and Benefit in the Astrobiological Exploration of Other Worlds* (Organizer and Moderator). American Association for the Advancement of Science Annual Meeting, Boston, Massachusetts, USA.
- 2017 *"Be Careful What You Wish For": The Scientific, Practical, and Cultural Implications of Discovering Life in Our Solar System.* Planetary Science Vision 2050 Workshop, NASA Headquarters, Washington, DC, USA.
- 2016 *Exploration of Icy Moons in the Outer Solar System: Updated Planetary Protection Requirements for Missions to Enceladus and Europa.* AGU Fall Meeting, San Francisco, California, USA  
(with Margaret Race)
- 2016 *It's Alive! (But is it Local)? Searching for Life Across Space and Time: A Workshop,* Irvine, California, USA.

## Conference and Public Presentations (cont.):

- 2016 *Planetary Protection (Is Good for You)*. Viking at 40 Symposium: From NASA's First Soft Landing to Humans on Mars, NASA Langley Research Center, Hampton, Virginia, USA.
- 2016 *Selling Lunar Resources for Fun, Profit, and Export: A Test That the OST Cannot Pass?* 4<sup>th</sup> Manfred Lachs International Conference on Conflicts in Space and the Rule of Law, Montréal, Québec, Canada.
- 2016 *Steps Toward a New International Understanding on Space Governance: From Planetary Protection to Planetary Resources*. ASTRO-16, Ottawa, Ontario, Canada.
- 2016 *Planetary Protection for Human Missions: Options and Implications*. IEEE Aerospace Conference, Big Sky, Montana, USA.
- 2016 *Tiny Houses: Planetary Protection-centric Materials Selection for Spaceflight Hardware Surfaces*. IEEE Aerospace Conference, Big Sky, Montana.  
(with D. E. Pugel and C. A. Conley)
- 2016 *To search for life, do it right!* IEEE Aerospace Conference, Big Sky, Montana.  
(with D. E. Pugel and C. A. Conley)
- 2016 *Unanswered Questions in the Development of Planetary Protection Policy and Implementation for the Human Exploration of Mars*. IEEE Aerospace Conference, Big Sky, Montana.  
(with J.A. Spry, M.S. Race, and C. A. Conley)
- 2015 *Protecting the Planets from Biological Contamination: The Strange Case of Mars Exploration*. PA33B-2184, AGU Fall Meeting 2015, San Francisco, California.  
(with C. A. Conley)
- 2015 *Planetary Protection Considerations in the Selection of Landing Sites for Human Mars Missions*. First Landing Site / Exploration Zone Workshop for Human Missions to the Surface of Mars, Houston, Texas.  
(with C. A. Conley, G. Kminek, and J.A. Spry)
- 2015 *Is It Contamination or Extraterrestrial Life? A Black and White Decision, or 50 Shades of Gray*. AbSciCon 2015, Chicago, Illinois.  
(with C. A. Conley)
- 2015 *Understanding and Locating "Special Regions" on Mars: The Second MEPAG Special Regions Science Analysis Group (SR-SAG2)*. AbSciCon 2015, Chicago, Illinois.  
(with D.W. Beaty, M.A. Jones, N.G. Barlow, V. J. Hipkin, and the SR-SAG2 Team)
- 2015 *Due Regard" in Space Activities: Avoiding Harmful Contamination in the Exploration and Use of Outer Space*. 3<sup>rd</sup> Manfred Lachs International Conference on Newspace Commercialization and the Law, Montréal, Quebec, Canada.
- 2015 *One Small Step for a Man, One Giant Leap for My Real Estate Broker: Taking the Next Steps in Space Governance*. 3<sup>rd</sup> Manfred Lachs International Conference on Newspace Commercialization and the Law, Montréal, Quebec, Canada

## Conference and Public Presentations (cont.):

- 2014 *Updating Our Understanding of Special Regions on Mars: The Second MEPAG Special Regions Science Analysis Group (SR-SAG2)*. P21D-3959. AGU Fall Meeting, San Francisco, California, USA.  
(with D.W. Beaty, M.A. Jones, C. Bakermans, N. Barlow, P. Boston, V. Chevrier, B. Clark, J.-P. de Vera, R. Gough, J. E. Hallsworth, J. Head, V. Hipkin, T. Kieft, A. McEwen, M. Mellon, J. Mikucki, W. Nicholson, C. Omelon, R. Peterson, E. Roden, B. Sherwood Lollar, K. Tanaka, D. Viola, and J. Wray)
- 2014 *Implications of Special Regions to Conducting Human Activities on Mars*. P31D-4019. AGU Fall Meeting, San Francisco, California, USA.  
(with N. G. Barlow, D. W. Beaty, M. A. Jones, and V. J. Hipkin)
- 2014 *You Wouldn't Go Into the Field with Dirty Sampling Gear, Would You?* P21D-3947. AGU Fall Meeting, San Francisco, California, USA.  
(with M. Voytek and V. J. Hipkin)
- 2014 *Providing for Sustainable Exploration and Use of Outer Space Environments*. IAC-2014-E7,2.13. 65th International Astronautical Congress, Toronto, Canada.  
(with P. Ehrenfreund)
- 2014 *In Situ Resource Development on the Moon, Mars and Beyond: Considerations for Their Appropriation and Use*. IAC-2014-E3,2.11. 65th International Astronautical Congress, Toronto, Canada.  
(with V.J. Hipkin)
- 2014 *Planetary Protection Considerations and Constraints in Commercial Spaceflight Beyond Earth Orbit*. IAC-2014-A3,1.4. 65th International Astronautical Congress, Toronto, Canada.  
(with C.A. Conley)
- 2014 *A Place for SETI Research and Observations in the NASA Astrobiology Roadmap*. IAC-2014-A4,1.4. 65th International Astronautical Congress, Toronto, Canada.
- 2014 *An updated understanding of "Special Regions" on Mars*. 40th COSPAR Scientific Assembly, Moscow, Russia.  
(with D.W. Beaty, M.A. Jones, and the SR-SAG2 Team)
- 2014 *Report from the COSPAR 2014 Mars Special Region Workshop Special regions, locations and resource relationships*. 40th COSPAR Scientific Assembly, Moscow, Russia.  
(with V. Hipkin and C. Conley)
- 2014 *Overview of COSPAR Planetary Protection Activities and Prospects for the Future*. 40th COSPAR Scientific Assembly, Moscow, Russia.
- 2014 *Essential Elements of a Framework for Future Space Exploration and Use: the Role of Science*. 40th COSPAR Scientific Assembly, Moscow, Russia.  
(with P. Ehrenfreund)
- 2014 *Providing for Sustainable Exploration and Use of Outer Space Environments*. Extraterrestrial Liberty II: Human Governance Beyond the Earth, British Interplanetary Society, London, United Kingdom.

## Conference and Public Presentations (cont.):

- 2014 *An International Framework for the Governance of the Use and Protection of Outer Space Environments*. 2<sup>nd</sup> Manfred Lachs International Conference on Global Space Governance, Montréal, Quebec, Canada.
- 2014 *COSPAR's Experience with, and the Current Status of, Biological Planetary Protection Measures Related to OST Article IX*. 2<sup>nd</sup> Manfred Lachs International Conference on Global Space Governance, Montréal, Quebec, Canada.
- 2014 *Providing for Sustainable Exploration and Use of Outer Space Environments*. IAA Space Exploration Conference, Washington, DC.  
(with P. Ehrenfreund)
- 2013 *Biological Planetary Protection for Safe Solar System Exploration Missions, Conducted Either by Robots or Humans or Both*. 6th IAASS International Space Safety Conference, Montréal, Quebec, Canada.
- 2013 *Tell 'Em Early and Often: Communicating About Mars Sample Return Containment and Biohazard Testing*. American Geophysical Union Fall Meeting, San Francisco, California.  
(with M. Race)
- 2013 *Planetary Protection Provisions for the Mars 2020 Mission: Enabling Discovery by Constraining Contamination*. American Geophysical Union Fall Meeting, San Francisco, California.  
(with C. A. Conley)
- 2013 *From Exobiology to Astrobiology in the Dry Valleys (ASAP, Too!): NASA, Bob, et al.* ASLO Aquatic Sciences Meeting 2013 (R.A. Wharton Special Session), New Orleans, Louisiana.
- 2012 *Climate Change and Migration along the Albemarle and Pamlico Sounds, North Carolina*. AGU Fall Meeting, San Francisco, California.  
(with D.C. Griffith, D.G. Kimmel, C.E. Landry, and B.E. Montz)
- 2012 *Preparing for the Human Exploration of Mars: Health Care and Planetary Protection Requirements and Practices*. International Astronautical Congress, Naples, Italy.  
(with C. Conley)
- 2012 *NASA Mars Exploration Planning: Program Remediation Planetary Protection Requirements*. International Astronautical Congress, Naples, Italy.  
(with C. Conley)
- 2012 *Protecting Solar System Environments for Science and to Allow for Space Development*. COSPAR 2012, Mysore, India.  
(with P. Ehrenfreund)
- 2012 *Proposed Updates to the COSPAR Planetary Protection Policy, 2012*. COSPAR 2012, Mysore, India.

## Conference and Public Presentations (cont.):

- 2012 *Extending the Outer Space Treaty: Protecting Planetary Environments While Enabling Commercial Use of Outer Space.* IAA Global Space Exploration Conference (GLEXP), Washington, DC.
- 2012 *Planetary Protection: All of the Planets, All of the Time.* Celebrating a Life in Science: In Memory of Lynn Margulis (a symposium), Amherst, Massachusetts.
- 2011 *Advanced Robotics for Mars Sample Handling and Analysis: On Earth! Now!* American Geophysical Union Annual Meeting, San Francisco, California  
(with Carlton C. Allen)
- 2011 *Planetary Protection and Mars: Requirements and Constraints on the 2016 and 2018 Missions, and Beyond.* EPSC-DPS Joint Meeting 2011, Nantes, France.  
(with G. Kminek and C. Conley)
- 2011 *Microbial Contamination in Planetary Environments: Life, Death and the Unknown.* 18th IAA Humans in Space Symposium, Houston, Texas.  
(with M. Race)
- 2011 *A Microbe on the Moon? Surveyor III and Lessons Learned for Future Sample Return Missions.* The Importance of Solar System Sample Return Missions to the Future of Planetary Science, The Woodlands, Texas.  
(with J. Allton and D. Morrison)
- 2011 *Planetary Protection Overview: The Role of COSPAR in International Missions.* Symposium on “Planetary Protection and Space Exploration” for the Scientific and Technical Subcommittee of the United Nations Committee on the Peaceful Uses of Outer Space (COPUOS), Vienna, Austria.
- 2011 *We lost Pluto!? Future Steps in Preserving Planets, Satellites, and Small Solar System Bodies.* Symposium on “Planetary Protection and Space Exploration” for the Scientific and Technical Subcommittee of the United Nations Committee on the Peaceful Uses of Outer Space (COPUOS), Vienna, Austria
- 2010 *Mitigate, Adapt, or Suffer? Preparing North Carolina’s Coasts for a Changing Climate.* Planet Ocean Seminar Series, University of North Carolina, Wilmington, North Carolina.
- 2010 *Protecting Lunar and Martian Environments for Scientific Research: COSPAR’s Record in Biological Planetary Protection.* COSPAR 2010, Bremen, Germany.
- 2010 *Proposed Updates to the COSPAR Planetary Protection Policy, 2010.* COSPAR 2010, Bremen, Germany.
- 2010 *Exobiology: The Program’s First 50 Years of Productivity.* AbSciCon 2010, League City, Texas.
- 2010 *Going Coastal – Or is It Coming to Us? Shoreward Lessons for a Changing Planet.* Sigma Lecture, Hampton, Virginia.

## Conference and Public Presentations (cont.):

- 2010 *Exobiology to Astrobiology: Science at the Edge*. AAAS Annual Meeting, San Diego, California.
- 2009 *Updating (or Revising?) Policies for Scientific Exploration and Protection in Outer Space: Borrowing from Antarctic Treaty Experiences*. Workshop on “History of International Spaces,” The Antarctic Treaty Summit, Washington, DC.  
(with M. Race)
- 2009 *The Coast of North Carolina: Coming Soon, to a Community Near You!* East Carolina University Centennial Convocation, Greenville, North Carolina.
- 2008 *A Small Payloads Program for Astrobiology*. International Astronautical Congress, Glasgow, Scotland.  
(with P. Ehrenfreund)
- 2008 *Overview of the 2008 COSPAR Planetary Protection Workshop*. COSPAR 2008, Montreal, Canada.
- 2008 *Protecting the Moon*. COSPAR 2008, Montreal, Canada.  
(with C. Pieters)
- 2008 *NASA’s ASTEP Program*. AbSciCon 2008, Santa Clara, California.
- 2008 *Planetary Protection for Astrobiology and Life: Tools and Perspectives*. AbSciCon 2008, Santa Clara, California.
- 2007 *Astrobiology Science and Technology for Exploring Planets Programmatic Preparations for Europa Exploration*. AGU Fall Meeting 2007, San Francisco, California.  
(with K. S. McBride)
- 2006 *Special Regions in Mars Exploration: Problems and Potential*. International Astronautical Congress, Valencia, Spain.
- 2006 *A Bimodal Strategy for Future Life Support System Development*. International Astronautical Congress, Valencia, Spain.
- 2006 *Astrobiological Exploration and Human Missions: First Steps*. International Astronautical Congress, Valencia, Spain.
- 2006 *Extreme Microbial Tourism? Safe Solar System Exploration*. Society for Industrial Microbiology (Annual Meeting), Baltimore, Maryland
- 2006 *NASA Responses to PREVCOM Recommendations*. COSPAR 2006, Beijing, China.
- 2006 *Planetary protection issues in the preparation and planning of sample return missions*. COSPAR 2006, Beijing, China.
- 2006 *Life, the Universe, and Everything? Planetary Protection in Solar System Exploration*. National Science Olympiad, Indiana University, Bloomington, Indiana.

## Conference and Public Presentations (cont.):

- 2005 *Planetary Protection and Human Mars Exploration: Precursor and Analogue Studies.* International Astronautical Congress, Fukuoka, Japan.
- 2005 *On the Wings of Copernicus: Further Implications of Discovering Life in the Solar System?* International Astronautical Congress, Fukuoka, Japan.
- 2005 *Planetary Protection: Keeping it Clean in Solar System Exploration.* Association for Politics and the Life Sciences, Washington, DC.
- 2005 *Planetary Protection and Mars Exploration: An Essential Way-of-Life for Human Missions.* 15th Humans in Space Symposium of the International Academy of Astronautics, Graz, Austria.
- 2005 *New horizons in planetary protection: controlling interplanetary biological contamination on robotic and human exploration missions (Poster).* General Assembly of the European Geosciences Union, Vienna, Austria.  
(with M. Viso)
- 2005 *Planetary Protection Challenges in Visionary Exploration.* NASA Astrobiology Institute Biannual Meeting, Boulder, Colorado.
- 2005 *Technical Challenges in Meeting the Next Decade's Planetary Protection Requirements.* IEEE Aerospace Conference, Big Sky, Montana (conference publication/talk).
- 2004 *Forging Planetary Protection Requirements for the Next Decade: Policies and Discoveries (Poster).* American Geophysical Union Fall Meeting, San Francisco, California.
- 2004 *What Should We Know, and When Can We Know It? Planetary Protection Precursors (Lunar and Elsewhere) to Human Mars Exploration.* 55<sup>th</sup> International Astronautical Congress, Vancouver, Canada.  
(with M. S. Race)
- 2004 *Got Life? Hours of Boredom Followed by Moments of Sheer Terror (and that's just with the Press).* 55<sup>th</sup> International Astronautical Congress, Vancouver, Canada.
- 2004 *All the Special Places—The Search for Life in the Solar System.* Plenary Talk, Special Topic Session: The Search for Life in the Solar System; The Norwegian Research & Technology Forum in the U.S. / Canada, Third Annual Meeting and Conferences, Washington, D.C.
- 2004 *A Planetary Protection Roadmap for the Moon and Mars.* COSPAR 2004, Paris, France.
- 2004 *Emerging Issues in COSPAR's Planetary Protection Policy.* COSPAR 2004, Paris, France.  
(with P. D. Stabekis)
- 2004 *Challenges in Astrobiology: Preserving the Record of Life (or not) in the Solar System.* Bioastronomy 2004: Habitable worlds, Reykjavík, Iceland.  
(with M. S. Race)



## Conference and Public Presentations (cont.):

- 2004 *Strep, Lies(?), and 16mm Film: Did S. mitis Survive on the Moon? Should Humans be Allowed on Mars? Microbes on the Moon and the human exploration of space.* AbSciCon 2004, Moffett Field, California.
- 2004 *Planetary Protection Considerations For Future Exploration.* IEEE Aerospace Conference, Big Sky, Montana (conference publication/talk).  
(with S. L. Bergstrom)
- 2003 *Planetary Protection: A Major Challenge in the Exploration of Life in the Solar System.* American Geophysical Union Fall Meeting, San Francisco, California.
- 2003 *Planetary Protection Policy for Future Mars Missions: The Role of COSPAR and Contributions from the European Exo/Astrobiology Network.* The 3rd European Workshop on Exo/ Astrobiology, Madrid, Spain.
- 2003 *NASA's ASTEP Program: Astrobiology Science and Technology for Exploring Planets.* 53<sup>rd</sup> International Astronautical Congress, Bremen, Germany.
- 2003 *Planetary Protection: History and Current Issues.* Annual Meeting, American Society for Microbiology, Washington, D. C.
- 2002 *Preserving the Record of Life in the Solar System (Poster).* American Geophysical Union Fall Meeting, San Francisco, California.
- 2002 *An Updated Planetary Protection Policy for COSPAR.* World Space Congress, Houston, Texas.
- 2002 *Planetary Protection Considerations for Sample Return Missions.* World Space Congress, Houston, Texas.
- 2002 *Life, the Universe, and Everything: 4.5 Billion Years of Evolvable Hardware.* 2002 NASA/DOD Conference on Evolvable Hardware.
- 2002 *Mars Sample Handling for Planetary Protection.* American Geophysical Union Spring Meeting, Washington, D.C.
- 2002 *Exobiology, the Solar System, and a Mars Sample Return Mission: TNPLH?* NASA Environmental Management and Energy Conference, Norfolk, Virginia.
- 2002 *NASA Space Missions and Astrobiology.* Astronomy in Catalonia and California 2001-2002, Barcelona, Spain.
- 2001 *Planning for a Mars Sample Return: Development of a Sample Analysis Protocol for Planetary Protection.* 52<sup>nd</sup> International Astronautical Congress, Toulouse, France.
- 2001 *Planetary Protection & Issues Regarding Sample-Return Missions.* Crystal Mountain Astrobiology Conference, Crystal Mountain, Washington.

## Conference and Public Presentations (cont.):

- 2001 *Astrobiology Science & Technology: A Path to Future Discovery (Poster)*. 32<sup>nd</sup> Lunar and Planetary Science Conference, Houston, Texas.  
(with M. A. Meyer and D. B. Lavery)
- 2001 *Solar System Exploration, Astrobiology, and Sample Return Missions: A Challenge for Science Communications (Poster)*. Annual Meeting, American Association for the Advancement of Science, San Francisco, California.  
(with M. S. Race and S. M. Dawson)
- 2001 *Possible Biological Contamination from Space Missions*, COSPAR/IAF Symposium on Terrestrial Hazards from Outer Space Objects and Phenomena, for the United Nations Committee on the Peaceful Uses of Outer Space, Vienna, Austria.
- 2000 *Exploring a Living Planet: Geophysics, Geology, Geochemistry, and Life (Poster)*. RIDGE Exploratory Studies Workshop, Nashville, Tennessee.  
(with C. L. Van Dover)
- 2000 *NASA's Planetary Protection Program: Lessons from Earth for Safe Solar System Exploration (Poster)*. RIDGE Theoretical Institute on the Deep Subsurface Biosphere, Big Sky, Montana.
- 2000 *Seeking an International Consensus in Planetary Protection: COSPAR's Planetary Protection Panel*. COSPAR 2000, Warsaw, Poland.
- 2000 *COSPAR's Planetary Protection Policy: A Consolidated Draft (Poster)*. COSPAR 2000, Warsaw, Poland.  
(with P. D. Stabekis, D. L. DeVincenzi, and J. B. Barengoltz)
- 2000 *NASA's Astrobiology Program: Accessing Extreme Environments on Earth and in Space (Poster)*. 5<sup>th</sup> Deep Sea Biology Meeting, Galway, Ireland.  
(with M. A. Meyer and D. B. Lavery)
- 2000 *Preventing Premature Panspermia—A Planetary Protection Roadmap*. First Astrobiology Science Conference, Ames Research Center, California.
- 1999 *Planetary Protection Issues in Astrobiology*. American Geophysical Union Fall Meeting, San Francisco, California.
- 1999 *Astrobiology*. African Summit on Science and New Technologies, Libreville, Gabon.
- 1999 *NASA's Programs in the Space and Life Sciences: Benefits on Earth and Beyond*. African Summit on Science and New Technologies, Libreville, Gabon.
- 1999 *Shedding Some Life on the Possibility of European Life*. 12<sup>th</sup> International Conference on the Origins of Life, La Jolla, California.  
(with C. L. Van Dover)

## Conference and Public Presentations (cont.):

- 1998 *Novel microbial diversity in Juan de Fuca hydrothermal vent samples (Poster)*. American Geophysical Union Fall Meeting, San Francisco, California.  
(with A. L. Foster, S. C. Dawson, A. Kappler, K. Hanselmann, B. Paster, A. Salyers, and E. Leadbetter)
- 1998 *Exploration of Arctic Ocean Hydrothermal Vent Systems: Preparing for a European Ocean (Poster)*. InterRidge Workshop: Mapping and Sampling the Arctic Ridges, Hannover, Germany.
- 1998 *Interplanetary Exchange of Microorganisms in Space Exploration*. In Colloquium—Prospecting for Extraterrestrial Microorganisms and the Origin of Life: An Exercise in Astrobiology (organized with Mitchell Sogin). Annual Meeting, American Society for Microbiology, Atlanta, Georgia.
- 1998 *Policies and Technologies to Implement Planetary Protection Requirements in Solar System Exploration*. In Symposium organized with Margaret S. Race—Mars Sample Return Missions: Scientific, Technical, and Social Challenges. Annual Meeting, American Association for the Advancement of Science, Philadelphia, Pennsylvania.
- 1997 *MBL Outreach and Educational Programs*. Annual Meeting, Association of Independent Research Institutes, Seattle, Washington.
- 1997 *A Context for the Origin of Life*. 1997 Gordon Conference on Origin of Life, Henniker, New Hampshire.
- 1996 *Life in the Universe: Looking Through a Mirror at Space Science Education*. COSPAR '96, Birmingham, England.
- 1996 *Scientific Issues Regarding the Release of Extraterrestrial Materials Collected by Spaceflight Missions*. COSPAR '96, Birmingham, England.
- 1996 *Planning for Mars Sample Return: Implementing Planetary Protection Protocols in the Face of Scientific Uncertainty*. 11th International Conference on the Origins of Life, Orléans, France. Poster and Oral Presentation. Abstract published in *Origins of Life and Evolution of the Biosphere* 26: 512.  
(with Margaret Race)
- 1994 *Introduction to Planetary Protection for Future Mars Missions*. 30th COSPAR, Hamburg, Germany.
- 1993 *Planetary Surface Exploration: Recent Results and Analog Environments*. 23rd International Conference on Environmental Systems, Colorado Springs, Colorado.
- 1993 *Future NASA Plans for Exobiology and Solar System Exploration*. 10th International Conference on the Origin of Life, Barcelona, Catalonia, Spain.

## Conference and Public Presentations (cont.):

- 1993 *Does Life in the Universe Have a Pulse?: NASA's High Resolution Microwave Survey.* Journées Maxwell, Bordeaux, France. Abstract published in *Annales des Journées Maxwell II*: 171 (ed. J. F. Eloy).  
(with Jill Tarter)
- 1992 *Planetary Protection Provisions for US Mars Missions.* XXIXth COSPAR/ World Space Congress, Washington, DC.
- 1992 *SETI In the Future: Toward Other Possible Searches.* 43rd IAF/XXIXth COSPAR (Joint Session)/World Space Congress, Washington, DC.
- 1992 *Towards a Mars Base: Critical Steps for Life Support on the Moon and Beyond.* 22nd International Conference on Environmental Systems, Seattle, Washington.
- 1992 *Life Support for Exploration Applications.* International Conference on Life Support and Biospherics, Huntsville, Alabama.
- 1991 *Antarctic Space Analogs for SEI.* IDEAA-One: The First International Design for Extreme Environments Assembly, Houston, Texas.
- 1991 *Life Support for Lunar and Mars Missions.* 21st Intersociety Conference on Environmental Systems, San Francisco, California.
- 1991 *Bioregenerative Life Support: The Initial CELSS Reference Configuration.* 21st Intersociety Conference on Environmental Systems, San Francisco, California.
- 1990 *Long Term Life Support for Space Exploration.* 20th Intersociety Conference on Environmental Systems, Williamsburg, Virginia.
- 1990 *Long Term Effects of Microgravity and Possible Countermeasures.* XXVIIIth COSPAR, The Hague, The Netherlands.
- 1990 *Planetary Protection Policy (USA).* XXVIIIth COSPAR, The Hague, The Netherlands.
- 1990 *Development of Countermeasures for Medical Problems Encountered in Space Flight.* XXVIIIth COSPAR, The Hague, The Netherlands.
- 1990 *Development of Life Support Requirements for Long-Term Space Flight.* XXVIIIth COSPAR, The Hague, The Netherlands.
- 1990 *Life Support for Solar System Exploration.* 61st meeting of the Aerospace Medical Association, New Orleans, Louisiana.
- 1990 *Exobiology and SETI from the Lunar Farside.* Workshop on Astrophysics from the Moon, Annapolis, Maryland.
- 1990 *Applications of Closed Ecological Systems.* Joint US/USSR Symposium on Artificial Biospheres and Closed Ecological Systems, Krasnoyarsk, USSR.

Conference and Public Presentations (cont.):

- 1990 *Computer Simulations of Closed Life-Support Systems.* Joint US/USSR Symposium on Artificial Biospheres and Closed Ecological Systems, Krasnoyarsk, USSR.
- 1989 *Medical Considerations for Space Exploration.* University of Central Florida Space Policy Symposium, Orlando, Florida.
- 1988 *The NASA-CELSS Initial Reference Configuration.* XXVIIth COSPAR, Helsinki, Finland.
- 1988 *Planetary Protection Policy and Application to Future Missions.* XXVIIth COSPAR, Helsinki, Finland.
- 1987 *Life Science Issues for Mars Exploration.* Case for Mars III, Boulder, Colorado.
- 1987 *Planetary Protection and Back Contamination Control for a Mars Sample Return Mission.* Case for Mars III, Boulder, Colorado.
- 1987 *NASA's Exobiology Program.* Space Life Sciences Symposium: Three Decades of Life Science Research in Space, Washington, D.C.
- 1987 *Modelling a Modular Controlled Ecological Life Support System.* Space Life Sciences Symposium: Three Decades of Life Science Research in Space, Washington, D.C.
- 1986 *A Modular BLSS Simulation Model.* XXVIth COSPAR, Toulouse, France.
- 1986 *A Theory of Faunal Buildup for Competition Communities.* Annual Meeting of the Ecological Society of America, Minneapolis, Minnesota.