

SIXTEENTH ANNUAL MEETING

AMERICAN SOCIETY FOR GRAVITATIONAL AND SPACE BIOLOGY

ASGSB-CSA-ELGRA Combined Meeting
October 25-28, 2000
Montréal, QC, Canada

SHORT PROGRAM

Wednesday, October 25

15:00 Registration Opens
19:00 Student Mixer
19:30 ASGSB Governing Board Meeting

Thursday, October 26

07:30 Registration Opens
08:30–08:45 Opening Remarks and Welcome
08:45–10:15 Symposium I – Consequences of Contamination of the Spacecraft Environment
10:15–10:45 Break
10:45–12:15 Symposium I, *cont.*
12:15–14:00 Lunch and Committee Meetings
14:00–15:30 Concurrent Posters – Session I
 A. Space Life Sciences Training Program
 Undergraduate Student Poster Competition
 B. Graduate Student Poster Competition
15:30–17:00 Concurrent Posters – Session II
 A. Space Life Sciences Training Program
 Undergraduate Student Poster Competition
 B. Graduate Student Poster Competition
19:00–21:00 Reception

PROGRAM – 2000 ANNUAL MEETING

Friday, October 27

- 09:00–10:30 Symposium II – Psychosocial Issues in Long-Term Space Flight
- 10:30–11:00 Break
- 11:00–12:30 Symposium II, *cont.*
- 12:30–14:00 Lunch and Committee Meetings
- 14:00–16:00 Concurrent Oral Sessions
- I. Animal Development, Physiology and Gravity Sensing
 - II. Advanced Life Support and Biotechnology
- 16:00–17:30 Concurrent Posters – Session III
- C. Animal Development, Physiology and Gravity Sensing
 - D. Cell Biology
 - E. Plant Development, Physiology and Gravity Sensing
 - F. Advanced Life Support and Biotechnology
 - G. Spaceflight Experiment Results
 - H. Spaceflight Physiology and Medicine
- 18:30–21:00 Banquet and Keynote Speaker; Business Meetings
- 21:00 ASGSB Governing Board Meeting

Saturday, October 28

- 08:30–10:30 Concurrent Oral Sessions
- III. Space Flight and Space Medicine
 - IV. Plant Development and Physiology
- 10:30–11:00 Break
- 11:00–13:00 Concurrent Oral Sessions
- V. Spaceflight Results
 - VI. Cell Biology
- 13:00–14:00 Lunch
- 14:00–15:30 Concurrent Posters – Session IV
- C. Animal Development, Physiology and Gravity Sensing
 - D. Cell Biology
 - E. Plant Development, Physiology and Gravity Sensing
 - F. Advanced Life Support and Biotechnology
 - G. Spaceflight Experiment Results
 - H. Spaceflight Physiology and Medicine
- 15:30–17:00 Minisymposium – Current Ground-Based Models

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19:30 ASGSB Governing Board Meeting

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08:30 Opening Remarks and Welcome

Symposium I Consequences of Contamination of the Spacecraft Environment

08:45 –12:15 Moderator: Richard Wassersug

Time		Page
08:45	Microbiological Contamination of Spacecraft. Duane L. Pierson, R.J. Bruce, T.O. Groves, N.D. Novikova and A.N. Viktorov. [1]	4
09:30	Contamination of Spacecraft Environment: Immunological Consequences. William T. Shearer. [2]	4
10:15	Break	

PROGRAM – 2000 ANNUAL MEETING

Time		Page
10:45	Individual Variation in Human DNA Repair Genes: Consequences for the Space Traveler. Barry W. Glickman, M. Khaidakov and A. Mortimer. [3]	4
11:30	Plants, Plant Pathogens and Microgravity—A Deadly Trio. Jan Leach. [4]	4
12:15	Lunch and Committee Meetings	

Concurrent Posters I

14:00 – 15:30

NOTE: Presenters are to be next to their posters the entire time.

**A. Space Life Sciences Training Program
Undergraduate Student Poster
Competition**

Poster #		Page
A01	A Novel Red-Light-Based Photosensory System That Mediates Positive Phototropism in <i>Arabidopsis</i> Roots. N.J. Ruppel, R.P. Hangarter and J.Z. Kiss. [5]	6
A03	Molecular Evolutionary Patterns in Microbial Natural Product Biosynthetic Gene and Enzyme Sequences: Search for Adaptive Significance. H.E. Page, C.L. Peterson and J.V. Lopez. [6]	6
A05	The Effects of Modified Biological Research in a Canister (Bric) Spaceflight Hardware on the Survivability and Development of the Tobacco Hornworm (<i>Manduca sexta</i>). M.R. Inzunza, K. Anderson and O. van den Ende. [7]	6
A07	Synaptic Innervation in Rat Utricular Macula. A. Chu and A. Lysakowski. [8]	6
A09	Three-Dimensional Reconstruction and Analysis of Root Cap Statolith Distribution in <i>Arabidopsis thaliana</i> . R. Ehsanian, D.K. Bruck and J.D. Smith. [9]	7

PROGRAM – 2000 ANNUAL MEETING

Poster #		Page
A11	Pesto Ground Control Experiments: A Gas Exchange System for Measuring Photosynthesis and Evapotranspiration. T. T. Tran, O. Monje and G.W. Stutte. [10]	7
A13	Molecular Profiling of Planktonic and Biofilm Microbial Communities in Hydroponic Growth Systems. E. Nunez, J.L. Adams and M.S. Roberts. [11]	7
A15	The 16 th Annual Spaceflight and Life Sciences Training Program at Kennedy Space Center, Florida. S. Potter, W. Hill, P. Currier, G. Koerner, J. Rebmann and A. Schlundt. [12]	7

B. Graduate Student Poster Competition

Poster #		Page
B01	The Effect of Plastid Mutations on Gravitropism of Roots, Hypocotyls, and Inflorescence Stems of <i>Arabidopsis</i> . K. Yamamoto and J. Z. Kiss. [13]	9
B03	Gauging the Internal Gas Content of <i>Brassica rapa</i> Siliques Grown in Space. K.L. Wilsen, J. Blasiak and M.E. Musgrave. [14]	9
B05	Stress Response to Magnetic Levitation (Low-Gravity) and High Magnetic Fields in Transgenic <i>Arabidopsis</i> . A.N. Morgan, J. Yowtak, R.J. Ferl, J.S. Brooks, A.-L. Paul and M.W. Meisel. [15]	9
B07	Changes in Osteoprogenitor Proliferation in the Rat Skeleton Due to Mechanical Unloading. N. Basso, Y. Jia, C.G. Bellows and J.N.M. Heersche. [16]	9
B09	???Tropism: When a Primary Root Encounters a Barrier to Downward Growth. G.D. Massa and S. Gilroy. [17]	10
B11	Rapid Discrimination among Individual DNA Molecules in Microliter Volumes. W. Vercoutere, S. Winters-Hilt, H. Olsen, D. Deamer, D. Haussler and M. Akeson. [18]	10
B13	Maternal Behaviour Under Hypergravity Conditions in CD-1 Mice. M. Simeoni, D. Santucci and E. Alleva. [19]	10
B15	Contribution of Sympathetic Activity to Lypolysis during Exposure to Increasing Hypergravity Loads. M.M. Moran, T.P. Stein and C.E. Wade. [20]	10

PROGRAM – 2000 ANNUAL MEETING

Poster #		Page
B17	Starch Conversion to Sucrose at Night. S.E. Weise and T.D. Sharkey. [21]	11

Concurrent Posters II

15:30 – 17:00

NOTE: Presenters are to be next to their posters the entire time.

**A. Space Life Sciences Training Program
Undergraduate Student Poster
Competition**

Poster #		Page
A02	Magnetic Levitation as a Low Gravity Environment. J. Yowtak, A.N. Morgan, R.J. Ferl, J.S. Brooks, A.-L. Paul and M.W. Meisel. [22]	13
A04	Molecular Mapping of the Lazy-2 Gravitropic Response Gene of Tomato. J. Well, A. Madlung, K. Krutovskii, R. Meyer, T.J. White and T.L. Lomax. [23]	13
A06	The Stability of Liquid Water in Porous Rocks in a Mars-like Environment. C. Paty, C. McKay, D. Catling and J. Heldmann. [24]	13
A08	Changes in Statocyte Structure and Amyloplast Starch in <i>Arabidopsis thaliana</i> Columella Cells after Growth under Hypergravity Conditions. S.D. Hopkins and J.D. Smith. [25]	13
A10	Carbohydrate Deposition in <i>Raphanus sativus</i> L. cv. Cherry Belle Shoots: Preliminary Ground Studies for the Rasta Spaceflight Experiment. H.N. Goldsmith, E.C. Stryjewski, G.W. Stutte, W. McLamb and D. Reed. [26]	14
A12	Soil Water Potential Affects Crop Growth Rate of Wheat Trough Changes in Leaf Area, Not Photosynthesis. H.-T. Wang, O. Monje and G.W. Stutte. [27]	14
A14	Development of Defined Media for Rapid Physiological Profiling of Microbial Communities. F.R. Perez, J.L. Garland and M.S. Roberts. [28]	14

PROGRAM – 2000 ANNUAL MEETING

Poster #		Page
A16	SLSTP 2000, Controlled Biological Systems Group, Student Research Projects Support NASA's Bioregenerative Life Support Program. D. Muhlestein and G. Koerner. [29]	14

B. Graduate Student Poster Competition

Poster #		Page
B02	Chimeric Calcium/Calmodulin-Dependent Protein Kinase: Role of the Neural Visinin-like Domain in Regulating Autophosphorylation and Calmodulin Affinity. P.V.Sathyannarayanan, C.R.Cremo, W.F.Siems and B.W.Poovaiah. [30]	16
B04	Development of the Nervous System and its Control of Gravity-Dependent Behaviours in Larvae of Bivalve Molluscs. J.T. Plummer, D.L. Jackson and R.P. Croll. [31]	16
B06	Innervation of Rat Vestibular Maculae in Hypergravity: an <i>In Vivo</i> and <i>In Vitro</i> Study. S. Gaboyard, E.Scarfone, J. Lehouelleur and A. Sans. [32]	16
B08	A Putative Role for the Cerebellum in Avian Vestibular Responses to Linear Translation. S. Irons-Brown, S.M. Jones and T.A. Jones. [33]	16
B10	Effects of Short-Duration Microgravity on <i>Drosophila melanogaster</i> (Fruit Fly) Activity. M.S. Miller and T.S. Keller. [34]	17
B12	Long-Term <i>In Vivo</i> Delivery of Recombinant Human Insulin-like Growth Factor-1 by Tissue-Engineered Skeletal Muscle Implants for Treating Disuse Muscle Atrophy in Mice. P.H.U. Lee, X.Y. Wang and H.H. Vandenberg. [35]	17
B14	Mechanical Stress and Wounding Elicit Nitric Oxide Production in <i>A. thaliana</i> Wild-Type and Nitrate Reductase Mutants. H. Garcês, D.J. Durzan and M.C. Pedroso. [36]	17
B16	Kinetics and Location of Phototropism in <i>Zea mays</i> L. Roots. C. Wolverton, J.L. Mullen, H. Ishikawa and M.L. Evans. [37]	17
B18	Video Capture of Green Fluorescent Protein Reporting <i>In Vivo</i> , Real Time Gene Expression. M.S. Manak, A-L. Paul, P.C. Sehnke and R.J. Ferl. [38]	18
19:00	Reception	

Friday, October 27

Symposium II
Psychological Issues in Long-Term
Space Flight

09:00 –12:30 Moderator: Gerry Sonnenfeld

Time		Page
09:00	Psychosocial Issues in Long-Term Space Flight: Overview. Larry Palinkas. [39]	20
09:45	Psychosocial Adaptation, Social Interaction Processes and Performance of Crews During SFINCSS Isolation Study: Cultural, Gender and Personal Factors. Judith Lapierre. [40]	20
10:30	Break	
11:00	Psychosocial Issues in Space: Results from Shuttle/Mir. Nick Kanas, V. Salnitskiy, E. Grund, D.S. Weiss, V. Gushin, O. Kozerenko, A. Sled and C.R. Marmar. [41]	20
11:45	Issues for the Future. Gro Sandal. [42]	20
12:30	Lunch and Committee Meetings	

Concurrent Oral Sessions I and II

Oral Session I
 Animal Development, Physiology
 and Gravity Sensing

14:00 – 16:00 Moderator: Michael Wiederhold

Time		Page
14:00	(Micro-)Gravity Actions as Identified from Developmental Biology Experiments in Space and Their Interpretation. H.-J. Marthy. [43]	22
14:15	The Effects of Microgravity on the Swimming Behaviour of Starfish Larvae. B.J. Crawford and D.L. Jackson. [44]	22
14:30	A Critical Period for Vestibular Development in Zebrafish (<i>Danio rerio</i>). S.J. Moorman, R. Cordova and S.A. Davies. [45]	22
14:45	Functional Changes in Central Vestibular Relay Circuits Following 2g Centrifugation. S.M. Jones, L. Warren, R. Shukla, A. Browning, C.A. Fuller and T.A. Jones. [46]	22
15:00	Tests to Determine the Adequacy of NASA's Rodent Food Bars for Use in Long-Term Space Flight Experiments. J.E. Barrett, D.S. Yu and B.P. Dalton. [47]	23
15:15	POMC and Endorphine Are Induced by Hypergravity in Rat Brain. Y. Kumei, H. Shimokawa, R. Shimokawa, M. Terasawa, B. Linsuwanont and K. Ohya [48]	23
15:30	Early and Late Effects of Perinatal Hyper-Gravity Exposure on the Developing CNS. E.M. Sajdel-Sulkowska, L.A. Baer, G.-H. Li, G.M. Sulkowski, A.E Ronca and C.E. Wade. [49]	23
15:45	Gravitaxic Behavior in <i>Drosophila melanogaster</i> . J.D. Armstrong, M.J. Texada, E.L. Carter, E.S. Kuo, C.M. Nadorff and K.M. Beckingham. [50]	23

Oral Session II
Advanced Life Support
and Biotechnology

14:00 – 16:00 Moderator: Charles Barnes

Time		Page
14:00	Programmable Plants: Development of an <i>In Planta</i> System for the Remote Monitoring and Control of Plants for Long-Term Life Support. C.S. Brown. [51]	25
14:15	Boundary Layers around Plant Leaf and Root Tissues Depend on Gravity. O. Monje, D.M. Porterfield and G.W. Stutte. [52]	25
14:30	Genetic and Environmental Influences on the Nutritive Quality of Spinach: A NASA ALS Candidate Crop. C.F. Johnson, R.W. Langhans, L.D. Albright, R.M. Welch, G.F. Combs, R.P. Glahn and R.M. Wheeler. [53]	25
14:45	Tissue Engineering in Zero Gravity. A. Cogoli. [54]	25
15:00	Use of the Rotating Bioreactor to Study Skeletal Mutations: Hereditary Multiple Exostosis. P.J. Duke, D. Montufar-Solis and J.T. Hecht. [55]	26
15:15	Fluid Handling and Management Experiment (FHAME). T.M. Crabb, R.C. Morrow and T.K. Klemp. [56]	26
15:30	Shear Forces and the Proper Control. J.J.W.A. van Loon, E. Folgering, J.P. Veldhuijzen and C.V.C. Bouten. [57]	26
15:45	Advanced Versatile Tools for Life Sciences Research in Space. P. Todd, J. Vellinger, A. Sharpe, R. Ormsby, H. Platt, K. Barton and M. Deuser. [58]	26

Concurrent Posters III

16:00 – 17:30

NOTE: Presenters are to be next to their posters the entire time.

**C. Animal Development, Physiology
and Gravity Sensing**

Poster #		Page
C01	Microgravity Effects on Fertilized Eggs Have No Incidence, after Landing, on the Further Larval Development and Reproduction in the Amphibian <i>Pleurodeles</i> Walzl. H. Membre, A. Bautz, D. Durand, C. Aimar, A.M. Bautz and C. Dournon. [59]	28
C03	Microgravity-Induced Malformations of the Body Correlate with the Depression of the Static Vestibuloocular Reflex. E. Horn. [60]	2 8
C05	Gravity Stimulation Changes Withdrawal Reflex in Rats. K. Toda, Y. Kawauchi, Y. Kumei, F.H. Nasution and K. Makita. [61]	2 8
C07	Hindlimb-Suspension, Water Deprivation and Salt-Loading Affect Angiotensin-Converting Enzyme (Ace) Expression in Rat Choroid Plexus. E. Vila-Porcile, C. Carcenac, C. Maseguin, J.-M. Gasc and J. Gabrion. [62]	2 8
C09	Lack of Vestibular Otolith Participation in Human Orthostatic Blood Pressure Control. D.E. Watenpugh, A. Cothron, S.L. Wasmund, W.L. Wasmund, R. Carter III, N.K. Muentner and M.L. Smith. [63]	2 9
C11	Regional and Muscle Specific Effects of a β -Adrenergic Agonist in Hindlimb Suspended Rats. D.A. von Deutsch, I.K. Abukhalaf, L.E. Wineski, S.A. Pitts, R. Roper, L.D. Kataria, D.C. Jackson, D.E. Potter and D.F. Paulsen. [64]	2 9

D. Cell Biology

Poster #		Page
D01	Vitamin D Production in the Rotating Wall Vessel (RWV). F. Lewis, E.N. Benes, X.-C. Wang, P.L. Allen, T.G. Hammond and L.A. Cubano. [65]	31
D03	L-Nmma Suppresses Nitric Oxide Production and Apoptosis in <i>Taxus brevifolia</i> Cells. M.C. Pedroso and D.J. Durzan. [66]	31
D05	Altered Gravity Increases PGE ₂ Production through Activation of COX-2 mRNA Expression in Mouse Osteoblast Like MC3T3-E1 Cells. A. Sato, M. Fujita, M. Kanematsu, M. Narato, H. Kumagai, S. Kamigaichi and M. Takaoki. [67]	31
D07	The Effect of Microgravity on Cytoskeleton Architecture and Proliferation of Human Breast Cancer Cell Line MCF-7. J. Vassy, S. Portet, D. Schoevaert, M. Beil, G. Millot, G. Gasset and F. Fauvel-Lafève. [68]	31
D09	Clinostat Rotation Culture Modulates Gene Expression of Osteoclastogenesis-Regulating Factors via a Cyclic-Amp Dependent Mechanism. M. Kanematsu, H. Takai, M. Takaoki and A. Sato. [69]	32
D11	Human Osteoblast Differentiation Is Expedited in Culture in a Magnetic Field. L. Yuge, T. Kumagai, I. Hide, S. Hiyama, M. Kanno, Y. Kumei, S. Takeda, Y. Ikuta, M. Sugiyama and K. Kataoka. [70]	32
D13	Gravity Sensitivity of T-Cell Activation: The Actin Cytoskeleton. B.B. Hashemi, J.E. McClure and D.L. Pierson. [71]	32
D15	Development of a Microgravity Cell Culture Platform for the Study of Bone Cell Metabolism onboard the NASA Shuttle. L. Misener, D. Sindrey, T. Smith, S. Pugh, D. Kusljic and P. Kwong. [71A]	32

E. Plant Development, Physiology
and Gravity Sensing

Poster #		Page
E01	Oxygen Effects on Pollen Germination and Tube Orientation. J. Blasiak, D. Mulcahy and M. Musgrave. [72]	34
E03	Changes in Cotyledon Cell Ultrastructure during <i>Brassica rapa</i> Seed Development in Microgravity. A. Kuang and M. E. Musgrave. [73]	34
E05	Effects of Lithium Ions on Elongation and Gravitropic Responses of Primary Roots of Maize. T. J. Mulkey. [74]	34
E07	The Actin Network in Lentil Root Statocytes. D. Driss-Ecole and G. Perbal. [75]	34
E09	Microscopic Analysis of Sweetpotato Root Tips Propagated from Stem Cuttings Maintained in Either Vertical or Horizontal Clinorotation. C.S. Williams, D.G. Mortley, C.E. Morris, C.F. Davis, S.D. Gamble and J.W. Williams. [76]	35
E11	Ultrastructure of <i>P. patens</i> Tip Caulonemata Cells: Untreated, Cold Grown, Severed, Oryzalin Treated, UV-A Treated. E. B. Tucker, V. Sookhdeo and L Yin. [77]	35
E13	The <i>rib1</i> Mutant Is Resistant to Indole-3-Butyric Acid, an Endogenous Auxin in <i>Arabidopsis Thaliana</i> . C.S. Waddell and J. Poupart. [78]	35

F. Advanced Life Support and Biotechnology

Poster #		Page
F01	Regenerable Seed Plugs from Formed Plant Fiber. R.C. Morrow, C.J. Ehle and T.M. Crabb. [79]	37
F03	Evapotranspiration by Salad Crops in Controlled Environments. D.E. Ciolkosz and G.D. Goins. [80]	37
F05	Astrium – A New Name in Space Life Sciences. P. Kern and U.M. Kuebler. [81]	37

PROGRAM – 2000 ANNUAL MEETING

Poster #		Page
F07	IBIS: An Instrument Dedicated to Perform Biological Experiments in Microgravity. D. Thierion, G. Gasset, D. Chaput, A. Labarthe, B. Eche and M. Viso. [82]	37

G. Spaceflight Experiment Results

Poster #		Page
G01	Expression of Fas/CD95 in Spaceflown Lymphocytes (Jurkat). L.A. Cubano and M.L. Lewis. [83]	39
G03	Are There Two Mechanisms Underlying Space Motion Sickness? D.G.D. Watt. [84]	39
G05	Payload Late Access Survey Preliminary Results. C. Martin-Brennan and R.C. Morrow. [85]	39
G07	Effect of Microgravity on Root Regeneration, Ultrastructures, and Carbohydrate Content of Sweetpotato Stem Cuttings. D.G. Mortley, C.S. Williams, C.F. Davis and J.W. Williams. [86]	39

H. Spaceflight Physiology and Medicine

Poster #		Page
H01	Long-Term Effects of Microgravity on Human Sleep, Cytokine, and Endocrines. H. Moldofsky, F. Lue, J. MacFarlane, C.-G. Jiang, L. Poplonski, I. Ponomoreva, I. Larina and R. Gorczynski. [87]	41
H03	Dose and Dose Rate Effects of Proton Radiation on Lymphocyte Populations in Blood and Spleen. D.S. Gridley, M.J. Pecaut and G.A. Nelson. [88]	41
H05	Cytokine Synthesis by T Cells Collected from Apheresis Donors Receiving G-CSF. B.-N. Lee, M. Korbling, W.T. Shearer and J.M. Reuben. [89]	41
H07	The Adrenal/Gonadal Response to a 5-Hour HDT Is Prompter in Men Than in Women. F. Strollo, G. Spera, E.V. Cosmi, M. Morè, A. Mambro and G. Rioldino. [90]	41
18:30	Banquet and Keynote Speaker; Business Meetings	
21:00	ASGSB Governing Board Meeting	

Saturday, October 28

Concurrent Oral Sessions III and IV

Oral Session III
Space Flight and Space Medicine

08:30 – 10:30 Moderator: Stephen Keith Chapes

Time		Page
08:30	Effects of Spaceflight and Hindlimb Suspension Unloading on Rat Neuromuscular Development. D.A. Riley, B.L. Huckstorf, G.R. Slocum, J.L.W. Bain, P.M. Reiser, F.R. Sedlak, W. Liebl and M.T.T. Wong-Riley. [91]	43
08:45	Scientific Outcome of the Russian/French Cooperation on the Bion Flights. M. Viso. [92]	43
09:00	Muscle Collagen Gene Expression and Protein Adaptation Following 14 Days of Spaceflight in BION 11 Rhesus Monkeys (<i>Macaca mulatta</i>). D.A. Martinez, V.R. Edgerton, R.E. Grindeland, D.E. Gallagher, J.D. Tanksley, K.M. Shea and A.C. Vailas. [93]	43
09:15	Developing Protocols for Recombinant Adeno-Associated Virus-Mediated Gene Therapy in Space. S. Ohi, A. Aguilar and B.C. Kim. [94]	43
09:30	Evidence for a Th2 Shift Associated with Spaceflight: Immune Modulation by Stress Hormones. R.P. Stowe, D.L. Pierson, C.F. Sams and A.D.T. Barrett. [95]	44
09:45	Effects of Low Dose Proton Irradiation on Three Models of Behavior. M.J. Pecaut, A.L. Smith, E.D. Zendejas, C.N. Zuccarelli, P. Haerich and G.A. Nelson. [96]	44
10:00	Neurobehavioral Effects of Hypergravity Conditions in CD1 Mouse Strain. D. Santucci, G. Corazzi, N. Francia, A. Antonelli, L. Aloe and E. Alleva. [97]	44
10:15	Effects of Simulated Microgravity on Nitric Oxide Synthase Expression and Nitrate/Nitrite Content in Different Arteries of the Rat. J. Ma, C.I. Kahwaji, N.D. Vaziri, Z. Ni and R.E. Purdy. [98]	44
10:30	Break	

<p>Oral Session IV Plant Development and Physiology</p>
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08:30 – 10:30 Moderator: Mary Musgrave

Time		Page
08:30	Functional Characterization of the ARG1 Gene Family in <i>Arabidopsis thaliana</i> . K. Boonsirichai, E. Rosen, J. Sedbrook and P. H. Masson. [99]	46
08:45	Gravitropism: Cross-Talk between Calcium/Calmodulin and Hormone Mediated Signaling. B.W. Poovaiah and T. Yang. [100]	46
09:00	Gravisensitivity in Space Grown Lentil Seedling Roots. G. Perbal and D. Driss-Ecole. [101]	46
09:15	The Gypsi Mutants: A New Group of Gravity Mutants in <i>Arabidopsis</i> . S.E. Wyatt, A. Rashotte, G. Muday and D. Robertson. [102]	46
09:30	Reduced Gravity Response in the <i>Arabidopsis</i> Mutant <i>RCN1</i> Is Due to Increased Levels of Auxin Transport. A.M. Rashotte and G.K. Muday. [103]	47
09:45	InsP ₃ Signaling During Plant Gravitropism. I.Y. Perera, I. Heilmann, W.F. Boss and P.B. Kaufman. [104]	47
10:00	PH Signaling in the Gravitropic Response of <i>Arabidopsis</i> Roots. S. Gilroy, J.M. Fasano, R. Hirsch, P. Minnich and S.J. Swanson. [105]	47
10:15	Use of a Gravity Clamp to Reveal a Multiphasic Motor Response in Maize Root Gravitropism. M.L. Evans, J.L. Mullen, C. Wolverson and H. Ishikawa. [106]	47
10:30	Break	

Concurrent Oral Sessions V and VI

**Oral Session V
Spaceflight Results**

11:00 – 13:00 Moderator: Alan Mortimer

Time		Page
11:00	Sleep and Circadian Rhythms in Space—Short-Term Versus Long-Term Missions. T.H. Monk. [107]	49
11:15	Testosterone Excretion during and after Space Flight on the Shuttle. T.P. Stein and M.D. Schluter. [108]	49
11:30	Residual Acceleration on Space Laboratories: Characterization, Effects on Fluid Flows and Implications for Microbiology. E.S. Nelson and K. Jules. [109]	49
11:45	Reporter Gene Expression during Spaceflight and in Controlled Inductive Environments. R.J. Ferl, M.S. Manak, C.J. Daugherty and A-L. Paul. [110]	49
12:00	Composition and Physical Properties of Starch in Microgravity-Grown Plants. K.H. Hasenstein, O.A. Kuznetsov, C.S. Brown, W.C. Piastuch and H.G. Levine. [111]	50
12:15	Locomotor Behaviour of Bivalve Larvae in the Absence of Gravity. D.L. Jackson and R.K. O'Dor. [112]	50
12:30	Rootzone Hypoxic Responses Result from Inhibition of Gravity Dependent Oxygen Transport in Microgravity. D.M. Porterfield, O. Monje, W. Stutte and M. E. Musgrave. [113]	50
12:45	Germination and Elongation of Flax in Microgravity. H.G. Levine, K. Anderson, A. Boody, D. Cox, O.A. Kuznetsov and K.H. Hasenstein. [114]	50
13:00	Lunch	

Oral Session VI
Cell Biology

11:00 – 13:00 Moderator: Augusto Cogoli

Time		Page
11:00	The Tension-Driven Gating Transition in the Bacterial Mechanosensitive Channel, MscL. S. Sukharev, M. Betanzos, C.-S. Chiang and H.R. Guy. [115]	52
11:15	Spectrin-like Proteins Associate with the Actin-Organized Endoplasmic Reticulum Aggregate in the Spitzenkörper of Gravitropically Tip-Growing Cells. M. Braun and A. Sievers. [116]	52
11:30	Microgravity-Induced Inhibition of Apoptosis in Peripheral Blood Mononuclear Cells and Changes in PKC Isoforms. D. Risin, A. Sundaresan and N.R. Pellis. [117]	52
11:45	The Effect of Gravitational Perturbation on the Expression of Genes Regulating Growth and Metabolism in a Human Lymphoblastoid Cell Line (Jurkat Cells). K. Singh, L. Cubano and M. Lewis. [118]	52
12:00	Expression of Structural and Metabolic Stress Genes in Human Leukemic Lymphocytes Subjected to Glucose Deprivation and Vibrational Stress. N. Myers. [119]	53
12:15	Reciprocal Trophic Interactions between Human Retinal Precursors and Retinal Pigment Epithelium (RPE) and its Physiologic Relevance in Tissue Replacement. K. Dutt, R. Lawrence, R. Kumar and T. Lindsay. [120]	53
12:30	Preliminary Studies in Support of a Space Shuttle Flight Experiment Evaluating the Ability of rhIGF-1 to Attenuate Space Flight-Induced Skeletal Muscle Atrophy. B.C. Creswick, J. Shansky, P.H.U. Lee, X.Y. Wang and H.H. Vandenberg. [121]	53
12:45	Effect of Microgravity on the Cytoskeleton of Cultured Nervous Cells. B. Uva, M.A. Masini, M. Sturla, P. Prato and G. Tagliaferro. [122]	53
13:00	Lunch	

Concurrent Posters IV

14:00 to 15:30

NOTE: Presenters are to be next to their posters the entire time.

**C. Animal Development, Physiology
and Gravity Sensing**

Poster #		Page
C02	Effects of Hypergravity on the Development of the Motor System in Crickets (<i>Acheta domesticus</i>). S. Böser and E. Horn. [123]	55
C04	Factors Influencing the Susceptibility of Anurans to Motion Sickness. R.J. Wassersug, T. Naitoh and M. Yamashita. [124]	55
C06	Hypergravity Induces Fos and CRH Expression in Rat Hypothalamus. R. Shimokawa, H. Shimokawa, M. Terasawa, B. Linsuwanont, Y. Kumei and K. Ohya. [125]	55
C08	Effects of Gender and Hindlimb Unloading on Bone Histomorphometry in Adult Rats. G.L. Evans, S. Lotinun, T. Hefferan, E. Morey-Holtan and R.T. Turner. [126]	55
C10	A Non-Invasive Analysis of Musculoskeletal Collagen Metabolism from Urine of Rhesus Monkeys during 14 Days of 2g Hypergravity. A.C. Vailas, T. Hoban-Higgins, C.A. Fuller, R.E. Grindeland, K.M. Shea and D.A. Martinez. [127]	56
C12	Effects of Hypergravity and Adrenalectomy on Total Body Bone Mineral Content in Male Rats. B. Girtten, M. Moran, L. Baer, S. Pruitt, C. O'Brien, S. Arnaud and C. Wade. [128]	56

D. Cell Biology

Poster #		Page
D02	Nuclear Translocation of Nuclear Factor Kappa B (NF- κ B) and Vitamin D Receptor During Rotating Wall Vessel Culture of Human Renal Cells. X-C. Wang, P.L. Allen, E.N. Benes, L.A. Cubano and T.G. Hammond. [129]	58
D04	Antibiotic Resistance in Bacteria Exposed to Simulated Spaceflight Environments. M.A. Juergensmeyer and E.A. Juergensmeyer. [130]	58
D06	The Effects of Hypergravity on the Expression of Nitric Oxide Synthase by Endothelial Cells: Role of the F-Actin Cytoskeleton and c-jun N-Terminal Kinase. F.N. Bosah, G.L. Sanford and S. Harris-Hooker. [131]	58
D08	Locomotory Function in Lymphocytes Is Affected by Microgravity-Induced Signal Transduction Lesions Involving Protein Kinase C. A. Sundaresan, D. Risin and N.R. Pellis. [132]	58
D10	<i>Pleurochrysis carterae</i> Is an Excellent Model to Study Biomineralization and Gravitaxis in Space. D. Montufar-Solis and P.J. Duke. [133]	59
D12	3D-Clinostat Drives P38 MAPK Cascade in Cultured Human Osteoblasts. K. Kataoka, L.Yuge, T. Kumagai, I. Hide, S. Hiyama, M. Kanno, Y. Kumei, S. Takeda, Y. Ikuta and M. Sugiyama. [134]	59
D14	Acoustic Wave Biosensor Technology for Probing the Effects of Gravity on Transcription. C. N. Jayarajah and M. Thompson. [135]	59

E. Plant Development and Gravity Sensing

Poster #		Page
E02	Alteration of Orchardgrass Embryogenesis from Leaf Segments under Hypergravity and Clinorotation. J.K. McDaniel, Z. Tomaszewski and B.V. Conger. [136]	61
E04	Differential Tissue-Specific Expression of a Western Red Cedar Dirigent Multigene Family in <i>Arabidopsis</i> : Phenolic Radical Coupling in Vascular Plants. M. Kim, J.-H. Jeon, L.B. Davin and N.G. Lewis. [137]	61

PROGRAM – 2000 ANNUAL MEETING

Poster #		Page
E06	Gravitropic Sensitivity Can Be Restored in Starch-Deficient Mutants of <i>Arabidopsis</i> by Hypergravity. K.J. Fitzelle, R.E. Edelman and J.Z. Kiss. [138]	61
E08	Plant Circumnutations in Space: A Reappraisal of Time Sequences from the Spacelab-1 Experiment HEFLEX. T. K. Bardal, A. Johnsson and D.K. Chapman. [139]	61
E10	Analysis of the Gravisensing System of <i>Chara</i> by Intracellular Magnetophoresis. O. A. Kuznetsov and K. H. Hasenstein. [140]	62
E12	Effect of Slowly Rotating Clinostat on the Root System Development in Rapeseed (<i>Brassica napus</i>) Seedlings. J. Aarouf, P. Coulomb and G. Perbal. [141]	62

F. Advanced Life Support and Biotechnology

Poster #		Page
F02	Starch Partitioning in <i>Raphanus sativus</i> : Preliminary Ground Studies for the Rasta Spaceflight Experiment. G.K. Tynes, I. Eraso, E.C. Stryjewski and G. W. Stutte. [142]	64
F04	MEXSY—A Modular Tool Kit for Life Science Experiments in Space. U.M. Kuebler and P. Kern. [143]	64
F06	Evaluation of Nutrient Delivery System Design Concepts for Microgravity Using KC-135 Parabolic Flights. E.C. Stryjewski, I. Eraso, O. Monje, W.T. McLamb, D.W. Reed, R.N. Stuckey and G.W. Stutte. [144]	64

G. Spaceflight Experiment Results

Poster #		Page
G02	Reserve Utilisation in Seeds of <i>Arabidopsis thaliana</i> Germinated in Microgravity. L.G. Briarty and E.P. Maher. [145]	66

PROGRAM – 2000 ANNUAL MEETING

Poster #		Page
G04	The Effects of Microgravity on Bone Marrow Stromal Cell Cultures <i>In Vitro</i> . P.M. Loomer, B. Sukhu, M. Grynypas and H.C. Tenenbaum. [146]	66
G06	A Critical Period for Gravitational Effects on the Formation of Otoliths in Swordtail Fish. M.L. Wiederhold, J. L. Harrison and K.A. Parker. [147]	66
G08	Human Parathyroid Hormone (1-84) Stimulates Bone Formation in Rat Bone Marrow Cultures During Spaceflight. D.R. Sindrey, D. Kusljic and P.C. Kwong. [148]	66

H. Spaceflight Physiology and Medicine
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Poster #		Page
H02	Effects of Confinement on <i>In Vitro</i> Immune Reactions and Its Endocrine Regulation. P.N. Uchakin, B.W. Tobin, C.F. Sams, B.E. Crucian and I.M. Larina. [149]	68
H04	Immunophenotype of Lymphocytes in Peripheral Blood of Apheresis Donors Mobilized by Granulocyte Colony-Stimulating-Factor (G-CSF). J.M. Reuben, B.-N. Lee, M. Korbling and W.T. Shearer. [150]	68
H06	Effects of Lower Body Suction (LBNP) with Synchronous Graded Head- Down Tilting. H.G. Hinghofer-Szalkay, B. Haditsch and P. Pilz. [151]	68

Minisymposium Current Ground-Based Models

15:30 – 17:00 Moderator: Marianne Cogoli-Greuter

Time		Page
15:30	Clinostats and Bioreactors. David M. Klaus. [152]	70
16:00	Human and Rodent Models. Didier Schmitt. [153]	70
16:30	Limitations of Models. Neal Pellis. [abstract unavailable]	