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# TABLE OF CONTENTS

Preface ...................................................................................................................... v

Introduction ........................................................................................................... vii

**Neuroscience Discipline**

- Space Motion Sickness ....................................................................................... 3
- Vestibular Performance, Posture, and Motor Coordination ......................... 29
- Vestibular Physiology ......................................................................................... 61
- Central and Peripheral Nervous System Physiology ........................................ 83
- General Performance and Methodologies ....................................................... 93

General Physiology ................................................................................................ 99

Index of Principal Investigators ........................................................................... 115

Appendix: List of Principal Investigators and Addresses ................................... 119

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PREFACE

This bibliography contains publications resulting from research supported by the Neuroscience Discipline of the NASA Space Physiology and Countermeasures Program during the years 1980-1990. It is one of a series of four bibliographies being published in 1992 of the disciplines of the Space Physiology and Countermeasures Program. Others in this series include publications from the Regulatory Physiology, Cardiopulmonary, and Musculoskeletal Disciplines. Portions of this compilation have been published previously as part of a series of bibliographies of space biomedical research. Previous editions in this series cover the years 1980-1982 (NASA CR-3587), 1982-1983 (NASA CR-3739), 1983-1984 (NASA CR-3860), 1984-1986 (NASA CR-4184), and 1987-1988 (NASA CR-187840).

This bibliography is divided into six sections: Space Motion Sickness; Vestibular Performance, Posture, and Motor Coordination; Vestibular Physiology; Central and Peripheral Nervous System Physiology; General Performance and Methodologies; and General Physiology. Space Motion Sickness includes studies of the occurrence, etiology, treatments, and effects of space adaptation syndrome. Vestibular Performance, Posture, and Motor Coordination includes non-invasive studies of vestibular function and performance done in humans and animals. Vestibular Physiology includes invasive or experimental studies of vestibular function focusing on anatomy, physiology, and mechanisms of function on a structural level. Central and Peripheral Nervous System Physiology contains studies of nervous system anatomy and physiology not including vestibular function. General Performance and Methodologies contains a variety of publications regarding human performance and experiment, equipment, and technique performance. The last section, General Physiology, is included to provide the reader with additional, background material in space physiology research. NASA-funded investigators whose work resulted in these publications are identified by an asterisk. A principal investigator index of researchers conducting Neuroscience investigations, as well as a list of neuroscience investigators and their affiliations, is also included in the bibliography.

As part of our continuing interaction with the scientific and professional community, we are pleased to present this bibliography in an effort to stimulate an exchange of information and ideas among scientists working in this discipline. I would like to thank April Commodore Roy and Audrey Robin Brown for their technical assistance in the production of this bibliography.

Janis H. Stoklosa, Ph.D.
Manager, Space Physiology and Countermeasures Program
The Neuroscience Discipline is part of the Space Physiology and Countermeasures Program of the NASA Life Sciences Division. Space life sciences research was initiated in 1960 with the goal of enabling human survival in space. Now, in the late 20th century, the program is evolving to ensure human health and productivity on space missions: on the space shuttle in the 1990s, then on Space Station Freedom, and ultimately on the Moon and missions to Mars.

The goals of the Neuroscience Discipline are to understand the acute and long-term central and peripheral nervous system adaptation to space and to develop adequate physiological and performance countermeasures. The Neuroscience Discipline is comprised of several subdisciplines: Central Processing, Motion, Cognitive/Spatial Orientation, and Sensory Receptor. This multidisciplinary effort incorporates basic, applied, and operational research, both ground-based and in-flight. Research, conducted at NASA centers and in universities, includes human and animal (rats and non-human primates) subjects.

Specific objectives of the Central Processing subdiscipline are to understand the central neural mechanisms that contribute to spatial orientation; understand how signals from multiple senses related to gaze, body orientation, and motion are integrated at various sites in the central nervous system; understand the central processing that leads to space motion sickness; understand the neural basis for the adaptive responses to altered sensory environments; develop models of central processing that can be used as heuristic and productive tools for future experiments; implement pharmacological studies in order to provide a rational basis for developing drug therapies for space motion sickness; and develop, test, and validate countermeasures for neurosensory aberrations caused by exposure to microgravity. Research focuses on determining if there are changes in the processing of signals from the semicircular canals or otolith organs that occur with adaptation and if these changes take place within the vestibular nuclei, cerebellar structures, or other related brainstem and cortical structures.

Specific objectives of the Motion subdiscipline are to determine the characteristics of motor control of gaze, posture, and locomotion in altered gravity; determine how sensory inputs and coordination of muscular actions are organized before, during, and after spaceflight; determine changes in oculomotor, somatomotor, and autonomic systems in microgravity; and understand the neural circuits and physiological signals controlling motion in threedimensional space under normal conditions and in the context of adaptation to altered gravity. Research focuses on the characteristics of gaze stabilization and eye-head coordination with varying visual, vestibular, and somatosensory inputs, and how sensory inputs and coordination of muscular activities are organized for maintenance of posture and generation of locomotion before, during, and after flight.

Specific objectives of the Cognitive/Spatial Orientation subdiscipline are to understand how adaptive changes in the vestibular, proprioceptive, somatosensory, and visual systems lead to changes in spatial orientation; determine the perceptual processes, neurophysiological mechanisms, and cortical structures underlying the perception of space and self and surround motion; and determine the changes that occur in central nervous system activity during the process of adaptation to altered gravitational conditions. Research focuses on the psychophysical correlates and neural basis for perception of motion, and what psychophysical correlates can best be used to describe spatial orientation.

The specific objective of the Sensory Receptor subdiscipline is to understand the effect of different gravitational environments on the structure and function of sensory receptors.
Research focuses on determining the structure-function relationships of the otolith organs and semicircular canals, including development, plasticity, and degeneration, and the relevant sensors for posture, body movement, and spatial orientation, including the transduction process.

Janis H. Stoklosa, Ph.D.
Manager, Space Physiology and Countermeasures Program
SPACE MOTION SICKNESS
Baltzley, D.R.; Gower, D.W.; Kennedy*, R.S.; Lilienthal, M.G. 
Delayed effects of simulator sickness: Incidence and implications (Abstract). 

Baltzley, D.R.; Kennedy*, R.S.; Berbaum, K.S.; Lilienthal, M.G.; Gower, D.W. 
The time course of postflight simulator sickness symptoms. 
*Aviation, Space, and Environmental Medicine 60(11): 1043-1048, 1989. (GWU 11205)

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Isoperformance: Application of a system engineering model for motion sickness and other environmental stressors (Abstract). 
*Aviation, Space, and Environmental Medicine 60(5): 479, 1989. (GWU 14375)

Berbaum, K.S.; Kennedy*, R.S.; Welch, R.B.; Brannan, J.R. 
Orlando, FL: Essex Corporation, 95 p., 1985. (GWU 7820)

Blanford, C.L.; Oman*, C.M. 
Diagnostic classification of changes in the human electrogastrogram during motion sickness (Abstract). 

Bock, O.L.; Oman*, C.M. 
Dynamics of subjective discomfort in motion sickness as measured with a magnitude estimation method. 

Brizzee*, K.R. 
Mechanics of vomiting: A minireview. 

Brizzee*, K.R.; Igarashi*, M. 
Effect of macular ablation on frequency and latency of motion-induced emesis in the squirrel monkey. 
*Aviation, Space, and Environmental Medicine 57(11): 1066-1070, 1986. (GWU 7276)

Brizzee*, K.R.; Igarashi*, M. 
Effect of utricular and saccular macular ablation on frequency and latency of motion sickness-induced emesis in the squirrel monkey (Abstract). 

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The central nervous connections involved in the vomiting reflex. 

Phenotype and age differences in blood gas characteristics, electrolytes, hemoglobin, plasma glucose and cortisol in female squirrel monkeys. 

Brizzee*, K.R.; Ordy, J.M.; Mehler, W.R. 
Effect of ablation of area postrema on frequency and latency of motion sickness-induced emesis in the squirrel monkey. 

Brizzee*, K.R.; Ordy, J.M.; Mehler, W.R. 
Effects of lesions in lower brain stem and cerebellar vermis on motion sickness-induced emesis in the squirrel monkey (Abstract). 
*Society for Neuroscience Abstracts 6: 70, 1980. (GWU 2558)
Calkins, D.S.; Reschke*, M.F.
Empirically determined reliability of scores for several motion sickness susceptibility tests (Abstract).
In: Abstracts of Papers, Physiologic Adaptation of Man in Space, 7th International Man in Space Symposium, Houston, TX, February 10-13, 1986, 1 p. (GWU 7767)

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Reliability of provocative tests of motion sickness susceptibility.
Aviation, Space, and Environmental Medicine 58(9, Suppl.): A50-A54, 1987. (GWU 8680)

Cheung, B.S.K.; Money*, K.E.; Jacobs, I.
Motion sickness susceptibility and aerobic fitness: A longitudinal study.
Aviation, Space, and Environmental Medicine 61(3): 201-204, 1990. (GWU 9571)

Cintron*, N.M.
Assessment of drug pharmacodynamic changes induced by weightlessness (Abstract).
In: Abstracts of Papers, Physiologic Adaptation of Man in Space, 7th International Man in Space Symposium, Houston, TX, February 10-13, 1986, 2 p. (GWU 7780)

Cintron*, N.M.
Salivary cortisol levels during the acute phases of space flight.
In: Results of the Life Sciences DSOs Conducted Aboard the Space Shuttle 1981-1986 (Bungo, M.W., Bagian, T.M., Bowman, M.A., Levitan, B.M., Eds.). Houston, TX: NASA, Johnson Space Center, p. 31-34, 1987. (GWU 11226)

Cintron*, N.M.; Chen, Y.-M.
A sensitive radioreceptor assay for determining scopolamine concentrations in plasma and urine.

Cintron*, N.M.; Putcha, L.; Chen, Y.-M.; Vanderploeg*, J.M.
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Cintron*, N.M.; Putcha, L.; Vanderploeg*, J.M.
Inflight pharmacokinetics of acetaminophen in saliva.

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Inflight salivary pharmacokinetics of therapeutic agents (Abstract).

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Dynamics of scopolamine dosing in human subjects (Abstract).
Cohen, G.M.; Reschke*, M.; Homick*, J.
A study in motion sickness: Saccular hair cells in the adult bullfrog.

Corcoran, M.L.; Fox*, R.A.; Daunton*, N.G.
The susceptibility of rhesus monkeys to motion sickness.
Aviation, Space, and Environmental Medicine 61(9): 807-809, 1990. (GWU 11715)

Correia*, M.J.; Perachio*, A.A.; Eden, A.R.
Space motion sickness: Neural mechanisms of sensory conflict (Abstract).

Cowings*, P.S.
Autogenic-feedback training: A treatment for motion and space sickness.

Cowings*, P.S.; Malmstrom, F.V.
What you thought you knew about motion sickness isn't necessarily so.
Flying Safety February: 12-17, 1984. (GWU 7819)

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Cowings*, P.S.; Suter, S.; Toscano, W.B.; Kamiya, J.; Naifeh, K.
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Psychophysiology 23(5): 542-551, 1986. (GWU 7966)

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Autogenic-feedback training for vestibular symptomatology (Abstract).

Cowings*, P.S.; Toscano, W.B.
The relationship of motion sickness susceptibility to learned autonomic control for symptom suppression.
Aviation, Space, and Environmental Medicine 53(6): 570-575, 1982. (GWU 2914)

Cowings*, P.S.; Toscano, W.B.; Kamiya, J.; Miller, N.E.; Sharp, J.C.
Autogenic-feedback training as a preventive method for space adaptation syndrome on Space-Lab 3 (Abstract).
Aviation, Space, and Environmental Medicine 59(5): 481, 1988. (GWU 10239)

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Neurophysiology of motion sickness. 

Crampton*, G.H.; Daunton*, N.G. 
Evidence for a motion sickness agent in cerebrospinal fluid. 
*Brain, Behavior and Evolution* 23: 36-41, 1983. (GWU 5309)

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Neural mechanisms of motion sickness. 

Crampton*, G.H.; Daunton*, N.G. 
Systemic naloxone increases the incidence of motion sickness in the cat. 

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A stimulator for laboratory studies of motion sickness in cats. 

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Xylazine emesis, yohimbine, and motion sickness susceptibility in the cat (Abstract). 
In: *Abstracts of Papers, Physiologic Adaptation of Man in Space, 7th International Man in Space Symposium, Houston, TX, February 10-13, 1986*, 1 p. (GWU 7785)

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In: *Sensory-Motor Functions under Weightlessness and Space Motion Sickness* (Mitarai, G., Igarashi, M., Eds.). Nagoya, Japan: University of Nagoya Press, p. 139-149, 1985. (GWU 7105)

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Daunton*, N.G.; Fox, R.A. 
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Susceptibility of cat and squirrel monkey to motion sickness induced by visual stimulation: Correlation with susceptibility to vestibular stimulation. 
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*Brain, Behavior and Evolution* 23(1-2): 5-6, 1983. (GWU 5326)

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*Brain, Behavior and Evolution* 23(1-2): 1-80, 1983. (GWU 5307)

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Summary of motion sickness experience on 24 shuttle flights (Abstract).
*Aviation, Space, and Environmental Medicine* 59(5): 467, 1988. (GWU 9904)

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*Aviation, Space, and Environmental Medicine* 61(5): 484, 1990. (GWU 13179)

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*Aviation, Space, and Environmental Medicine* 60(5): 506, 1989. (GWU 14354)

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Motion sickness susceptibility and changes in vestibular function in a varying gravitoinertial force background (Abstract).

Elfar, S.; Brizzee*, K.; Fox, R.; Corcoran, M.; Daunton*, N.; Coleman, J.
Recovery of the vomiting reflex following area postrema ablation in squirrel monkeys (Abstract).

Changes in the dark focus of accommodation associated with simulator sickness (Abstract).

Fowlkes, J.E.; Kennedy*, R.S.; Lilienthal, M.G.; Dunlap, W.P.
Control of simulator sickness incidence by simulator usage, adaptation, and other means (Abstract).
*Aviation, Space, and Environmental Medicine* 60(5): 479, 1989. (GWU 14374)

Fox, R.; Daunton*, N.; Keil*, L.; Crampton*, G.; Lucot, J.
Vasopressin and motion sickness in the cat (Abstract).
In: *Abstracts of Papers, Physiologic Adaptation of Man in Space, 7th International Man in Space Symposium*, Houston, TX, February 10-13, 1986, 1 p. (GWU 7786)

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Changes in plasma vasopressin during motion sickness in cats (Abstract).

Fox*, R.A.
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Fox*, R.A.; Corcoran, M.; Brizzee*, K.R.
Conditioned taste aversion and motion sickness in cats and squirrel monkeys.

Fox*, R.A.; Daunton*, N.G.
Conditioned feeding suppression in rats produced by cross-coupled and simple motions.

Fox*, R.A.; Daunton*, N.G.; Coleman, J.
Susceptibility of the squirrel monkey to several different motion conditions (Abstract).

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*Aviation, Space, and Environmental Medicine* 58(9, Suppl.): A143-A147, 1987. (GWU 8087)

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Off-vertical rotation produces conditioned taste aversion and suppressed drinking in mice.

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Simulator sickness in U.S. Army and Navy fixed- and rotary-wing flight simulators.

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Graybiel*, A.; Cramer*, D.B.; Wood, C.
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*Aviation, Space, and Environmental Medicine* 53(8): 770-772, 1982. (GWU 2265)

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Experimental motion sickness: Efficacy of transdermal scopolamine plus ephedrine.

Graybiel*, A.; Lackner*, J.R.
Evaluation of the relationship between motion sickness symptomatology and blood pressure, heart rate, and body temperature.

Graybiel*, A.; Lackner*, J.R.
Motion sickness: Acquisition and retention of adaptation effects compared in three motion environments.

Graybiel*, A.; Lackner*, J.R.
A sudden-stop vestibulovisual test for rapid assessment of motion sickness manifestations.

Graybiel, A.; Lackner*, J.R.
Treatment of severe motion sickness with antimotion sickness drug injections.
Harm*, D.L.; Beatty, B.J.; Reschke*, M.F.
Transcutaneous oxygen as a measure of pallor (Abstract).

Harm*, D.L.; Parker*, D.E.
Mode A preflight adaptation trainer.

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Preliminary investigation of cardiovascular responses to parabolic flight in sick and non-sick individuals (Abstract).
*Aviation, Space, and Environmental Medicine* 60(5): 493, 1989. (GWU 14397)

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Transcutaneous oxygen changes during the progression of motion sickness (Abstract).

Harm*, D.L.; Stern, R.S.; Koch*, K.L.
Tachygastria during parabolic flight (Abstract).

Hayes, J.; Watson, T.; Homick*, J.; Reschke*, M.; Vanderploeg*, J.; Kutyna, F.
Assessment of motion sickness susceptibility in a selected group of gymnasts (Abstract).
*Aviation, Space, and Environmental Medicine* 57(5): 492, 1986. (GWU 8011)

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Vection and simulator sickness.

Hoffman, R.B.; Salinas, G.A.; Homick*, J.L.
Piracetam and fish orientation during parabolic aircraft flight.

Homick*, J.L.
Effects of space flight on the human vestibular system (Abstract).

Homick*, J.L.
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An evaluation of the time course of efficacy of transdermally administered scopolamine in the prevention of motion sickness.


Transdermal scopolamine in the prevention of motion sickness: Evaluation of the time course of efficacy.

*Aviation, Space, and Environmental Medicine* 54(11): 994-1000, 1983. (GWU 5138)

Prediction of susceptibility to motion sickness.


Prediction of space motion sickness (Abstract).


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Space adaptation syndrome: Incidence and operational implications for the space transportation system program.


The neurovestibular system.


Motion sickness adaptation: Changes in anxiety and sympathetic and parasympathetic nervous system activity (Abstract).

*Psychophysiology* 27: 539, 1990. (GWU 13729)

Electrical acustimulation relieves tachygastria and symptoms of vection-induced motion sickness (Abstract).


Effects of electrical acustimulation on electrogastrographic activity and the symptoms of motion sickness (Abstract).


Motion sickness and electrogastrographic activity as a function of speed of rotation of an optokinetic drum (Abstract).


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*Aviation, Space, and Environmental Medicine* 60(5): 411-414, 1989. (GWU 10670)
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*Sangyo Ika Daigaku Zasshi* 1(7, Suppl.): 228-236, 1985. (GWU 7144)

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Sodium concentration in saliva along the time course of experimental Coriolis sickness.

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How to evaluate the effect of medical treatment of vertigo.

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Etiological significance of equipment features and pilot history in simulator sickness.

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The relevance of studies of transfer of perceptual motor training for space adaptation syndrome (Abstract).
In: *Abstracts of Papers, Physiologic Adaptation of Man in Space, 7th International Man in Space Symposium*, Houston, TX, February 10-13, 1986, 1 p. (GWU 7760)

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*Aviation, Space, and Environmental Medicine* 58(9, Suppl.): A29-A33, 1987. (GWU 8936)
Kennedy*, R.S.; Fowlkes, J.E.; Berbaum, K.S.; Allgood, G.O.; Gower, D.W. 
Flight simulator sickness: Adaptation effects (Abstract).  
*Society for Neuroscience Abstracts* 15: 784, 1989. (GWU 13667)

Kennedy*, R.S.; Fowlkes, J.E.; Lilienthal, M.G. 
Recent developments in Navy flight simulator sickness studies.  

Kennedy*, R.S.; Frank, L.H.; McCauley, M.E.; Bittner, A.C., Jr.; Root, R.W.; Binks, T.A.  
Simulator sickness: Reaction to a transformed perceptual world. VI. Preliminary site surveys.  

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*Aviation, Space, and Environmental Medicine* 60(1): 10-16, 1989. (GWU 10784)

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*Aviation, Space, and Environmental Medicine* 61(7): 615-621, 1990. (GWU 13077)

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Gastric dysrhythmias and the current status of electrogastrography.  

Koch*, K.L.; Dwyer, A.; Jeffries, G.H.  
Dose-response effects of indomethacin and PGE2 on electromechanical activity of in vivo rabbit ileum.  

Koch*, K.L.; Stern, R.M.  
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*Gastroenterology* 99: 1219, 1990. (GWU 13411)

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Relationships between the onset of gastric dysrhythmias and motion sickness in man (Abstract).  

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Temporal relationships between tachygastria and symptoms of motion sickness (Abstract).  
*Gastroenterology* 92: 1473, 1987. (GWU 10877)

Koch*, K.L.; Stern, R.M.; Harrison, T.; Seton, J.; Dwyer, A.; Vasey, M.  
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*Gastroenterology* 92: 1474, 1987. (GWU 10878)

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*Digestive Diseases and Sciences* 35(8): 961-968, 1990. (GWU 13092)

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*Gastroenterology* 95: 875, 1988. (GWU 10876)
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Vasopressin responses in healthy subjects with vection-induced gastric dysrhythmias and nausea (Abstract). 
*Gastroenterology* 95: 875, 1988. (GWU 10875)

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Kohl*, R.L. 
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Kohl*, R.L. 
Effects of parabolic flight, nausea, emesis, and metoclopramide on serum levels of ACTH and AVP in man (Abstract). 
In: Abstracts of Papers, Physiologic Adaptation of Man in Space, 7th International Man in Space Symposium, Houston, TX, February 10-13, 1986, 1 p. (GWU 7781)

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*Aviation, Space, and Environmental Medicine* 56(12): 1158-1165, 1985. (GWU 6735)

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*Aviation, Space, and Environmental Medicine* 57(5): 509, 1986. (GWU 8027)

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*Aviation, Space, and Environmental Medicine* 58(9, Suppl.): A266-A269, 1987. (GWU 8104)

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(AIAA Paper 89-0509) (GWU 11253)
INDEX OF PRINCIPAL INVESTIGATORS
Anderson, D.J., 29, 37, 49, 50, 51, 54, 55
Bagian, J.P., 30
Bizzi, E., 29, 30, 42, 43, 55
Black, F.O., 30, 31, 38, 43, 44, 48, 49, 50, 52,
53, 61, 68
Blanks, R.H., 23
Blanks, R.H.I., 53, 67, 79, 88
Brizzee, K., 6, 7, 62
Brizzee, K.R., 3, 7, 8, 19, 21, 83, 84, 85, 89
Bullock, T.H., 88
Bussolari, S.R., 31, 32
Charles, J.B., 25
Cintron, N., 14
Cintron, N.M., 4, 7, 21, 22, 85
Cintron, N.M., 4, 21
Cintron-Trevino, N.M., 4, 10
Cohen, B., 32, 49, 50, 51, 52, 64, 68, 70, 75,
77, 78, 80
Cohen, M.M., 31, 32, 52, 54
Correia, M.J., 5, 29, 32, 42, 61, 62, 63, 64, 65,
70, 71, 74, 75
Cowings, P.S., 5, 6, 24
Cramer, D.B., 8
Crampton, G., 6, 7, 62
Crampton, G.H., 6, 8, 17, 18, 21
Crow, T., 63
Cutler, L., 76, 77
D’Amelio, F., 84
D’Amelio, F.E., 84
Daunton, N., 7, 19, 62, 64, 84
Daunton, N.G., 5, 6, 7, 8, 19, 23, 25, 33, 36,
37, 64, 66, 75, 93
Degioanni, J., 10
Degioanni, J.J., 7
DeRoshia, C.W., 32, 93, 95
Drusano, G.L., 21
Ellis, S., 87
Fox, R.A., 5, 7, 8, 93
Gallagher, J.P., 16, 66, 67, 68, 71, 75, 83, 85,
86, 87, 88, 89
Goldberg, J., 33, 61
Goldberg, J.M., 36, 46, 61, 66, 67, 68, 72, 78
Graybiel, A., 8, 15, 16, 24, 36, 41, 42
Graybiel, A.M., 83, 84, 85, 86
Harm, D.L., 7, 9, 16, 32, 36, 44, 46, 47, 50, 51
Held, R., 44, 55
Homick, J., 5, 9
Homick, J.E., 29
Homick, J.L., 9, 10, 11, 14, 15, 16, 22, 31, 38,
39, 40, 47, 50, 51, 55, 93, 95
Igarashi, M., 3, 11, 18, 37, 38, 39, 40, 50, 62,
66, 68, 69, 70, 71, 73, 78, 79, 80, 85
Johnson, P.C., Jr., 7
Keil, L., 7
Keil, L.C., 8
Kennedy, R., 93
Kennedy, R.S., 3, 4, 7, 8, 9, 11, 12, 16, 24,
93, 94, 95, 96
Kenyon, R.V., 39, 46, 48, 57
Koch, K.L., 9, 10, 12, 13, 22, 23, 24
Kohl, R., 18
Kohl, R.L., 11, 13, 14, 15, 16, 50
Kutyna, F., 15
Lackner, J., 40
Lackner, J.R., 7, 8, 15, 16, 34, 35, 37, 40, 41,
42, 44, 50, 95
Leach, C., 14
Leach, C.S., 10, 16, 71
Leigh, R.J., 36, 42, 43, 51, 52, 54
Lichtenberg, B., 15
Lichtenberg, B.K., 20, 21, 39, 43, 45, 46, 47,
48, 51, 57
Lim, D.J., 71, 74, 79
Llinás, R., 83, 88
Llinás, R., 83, 84, 85, 86, 88, 89
Llinás, R.R., 85
Logan, J.S., 7
Lucot, J.B., 17, 18
Mah, R.W., 43
Markham, C.H., 33, 34, 40, 43, 44, 45, 63, 64,
70, 72, 73, 77, 83
McCormack, P.D., 45
Mehler, W.R., 7, 64, 70, 77, 84, 86, 87
Miller, A.D., 18, 19, 23, 51, 72, 77, 78
Mohler, S., 95
Mohler, S.R., 45
Money, K., 45
Money, K.E., 4, 16, 19, 20, 21, 24, 34, 40, 45,
46, 54, 57
Money, K.Y., 15
Nicogossian, A.E.T., 45
Oman, C., 19
Oman, C.M., 3, 19, 20, 21, 22, 29, 35, 45, 46,
49, 50, 55, 57, 64, 74
Paige, G., 30
Paige, G.D., 32, 36, 46, 53, 67
Parker, D., 29, 47, 56
Parker, D.E., 9, 21, 32, 36, 44, 46, 47, 48, 50,
51, 52, 74, 95
Perachio, A.A., 5, 61, 62, 63, 65, 70, 71, 72,
73, 74, 75
Peterka, R.J., 31, 44, 48, 49, 61, 88
Philpott, D.E., 84
Pool, S., 53
Pool, S.L., 23, 52, 53
Reis, D.J., 87, 88
Reschke, M., 5, 9, 43
Reschke, M.F., 4, 7, 9, 10, 11, 15, 16, 17, 18,
21, 22, 29, 30, 31, 36, 37, 38, 39, 42, 43,
46, 47, 48, 50, 51, 52, 53, 55, 56, 71
Riley, D.A., 86, 87, 88
Ross, M., 76
Ross, M.D., 72, 76, 77
Schor, R.H., 39, 51, 55, 70, 73, 77, 78, 79
Shaw, J., 22
Steele, C.R., 43
Stone, L.S., 52
Sulzman, F.M., 55
Talbot, J.M., 23
Thornton, W.E., 23, 52, 53
Tomko, D., 75, 76
Tomko, D.L., 29, 32, 36, 40, 44, 46, 48, 51, 53, 61, 75, 76, 78, 79
Vanderploeg, J., 9, 23
Vanderploeg, J.M., 4, 7, 10, 14, 15, 21, 22, 50, 51
Wall, C., 79
Wall, C., III, 36, 44, 49, 53, 66, 74, 78, 79
Watt, D., 45, 54
Watt, D.G., 19, 34, 45
Watt, D.G.D., 24, 40, 45, 46, 54, 57, 66
Welch, R.B., 32, 54
Whitson, P.A., 85
Wilson, V.J., 18, 19, 37, 39, 55, 56, 61, 62, 65, 66, 70, 72, 73, 77, 78, 79
Wolfe, J.W., 55
Wood, C.D., 12, 18, 19, 23, 24, 25, 31
Young, L., 56, 93, 96
Young, L.R., 25, 29, 31, 32, 37, 39, 43, 45, 46, 48, 52, 56, 57, 93, 95, 96
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