

## THOMAS JOHN GOODWIN, PhD, FAcadTM Curriculum Vitae

<http://www.thomasjgoodwin.com/>

Thomas J. Goodwin, PhD – NASA cellular physiologist (Retired), pioneer and authority in 3D biology, tissue engineering, bioelectromagnetic field effects, and synthesized tissue growth. Dr. Goodwin was the Manager of the Disease Modeling and Tissue Analogues Laboratory at the NASA Johnson Space Center and Lead Scientist for the Oxidative Stress and Damage research discipline for more than 15 years. Known for 30 years of work in 3D tissues for study of human physiology and tumor biology, 3D models as microbial hosts for infectious disease, and research into effects of ultra-low frequency electromagnetic fields on human tissues. Dr. Goodwin is Honorary President and Chair of the Personalized Medicine panel of the European Society of Translational Medicine (EUSTM). He holds adjunct positions at the University of Texas Medical School, Galveston Texas, Dept. of Surgery, Division of Cardiothoracic Surgery, the University of Houston, Dept. of Health and Human Performance, and is an Adjunct Scientist at the Texas Biomedical Research Institute and the Southwest National Primate Research Center which is sponsored by the National Institutes of Health. He has authored or co-authored over 58 peer review articles, four book chapters on three-dimensional biology and personalized spaceflight medicine, has been awarded 21 U.S. patents, on 3D biology and human physiology, and is the recipient of more than 70 NASA Scientific and Technical awards.

Dr. Goodwin's research focuses on cell physiology and organ tissue bioengineering, development of *ex vivo* physiological 3D systems, and the three-dimensional biology of human and animal cells. Complex recapitulated tissues may serve as surrogates for studies of tumour physiology, viral, and bacterial infectivity, genomic responses to a myriad of cellular conditions including genomic modulation and regulation due to chemical, physical, and environmental stimuli such as may be seen on the Earth and in the microgravity environment and as a platform to study man-machine interfaces. Recent papers include the co-authorship of Personalized Medicine in Human Space Flight: Using Omics Based Analyses to Develop Individualized Countermeasures that Enhance Astronaut Safety and Performance, published in the journal *Metabolomics* in 2013, Three-Dimensional Normal Human Neural Progenitor Tissue-Like Assemblies: A Model of Persistent Varicella-Zoster Virus Infection", *PLoS Pathogens* 2013, and 3D Tissue-like Assemblies: A Novel Approach to Investigate Virus-Cell Interactions, *Methods* 2015. See his **Research Gate** page for additional information.

### PROFESSIONAL AFFILIATIONS

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European Society for Translational Medicine

American Association for the Advancement of Science

American Physiological Society

International Federation for the Advancement of Genetic Engineering and Biotechnology

Sigma XI The Scientific Research Society

Society for In Vitro Biology

## EDUCATION

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- 2002      Doctor of Philosophy  
The Union Institute and University  
Physiology and Bioengineering Science  
Field Studies: University of Michigan/Bioengineering, Ann Arbor, MI.  
and NASA Johnson Space Center, Houston, TX.
- 1983      Master of Arts in Neuroscience  
University of Houston
- 1974      Bachelor of Arts in Biology  
St. Mary's University

## PROFESSIONAL EXPERIENCE

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- Dec. 2017—Pres.      Alpha Space, Consulting Space Tissue Engineering and Systems Physiology and Oxidative Damage
- Mar.2016-- Pres.      Sovaris Aerospace, Consultant in Space Biomedicine, Translational Medicine and Research
- Sept. 2015-Pres.      Honorary President of the European Society for Translational Medicine (EUSTM)  
<https://eutranslationalmedicine.org/boards>
- Aug. 2014—Pres.      Associate Editor, “*New Horizons in Translational Medicine*”  
<http://www.journals.elsevier.com/new-horizons-in-translational-medicine/editorial-board>
- July 2014- Feb.2016      Acting Branch Chief, Biomedical Projects Branch
- June 2014-Feb. 2016      Chair, NASA JSC Institutional Animal Care and Use Committee (IACUC)
- May 2013-Pres.      European Society for Translational Medicine Chair, Personalized Medicine Expert Panel  
Scientific Advisory Board <http://eutranslationalmedicine.org/thomas-j-goodwin/>
- June 2012-Pres.      Co-Chair, Advanced Pattern Analysis and Countermeasures Group  
Colorado State University
- Jan. 2012-Pres.      *Ad Hoc* Reviewer for Southwest National Primate Research Center (SNPRC) NIH Pilot  
Studies Program
- Dec. 2011- Pres.      Adjunct Assistant Professor, Dept. of Health and Human Performance, University of  
Houston, Houston Texas.
- Oct. 2011- Feb.2016      Discipline Lead Scientist, Oxidative Stress and Damage (OSaD)
- June 2006 -Feb 2016      US Federal Security Clearance (SF86) Classification

## PROFESSIONAL EXPERIENCE continued)

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June 2011-Feb. 2016 NASA Manager and Sponsor of the Decompression Sickness (DCS) Data Safety Management Board (DSMB) reporting to the Committee for the Protection of Human Subjects (CPHS)/ Institutional Review Board (IRB)

Nov. 2009-Pres. Adjunct Scientist, Southwest National Primate Research Center (SNPRC) Dept of Immunology and Virology

Oct. 2009- Dec 2011 Project Manager/Scientist, Non Exercise Physiological Countermeasures Project (NxPCM)

July 2008-Present Adjunct Assistant Professor, Department of Surgery, Division of Cardiothoracic Surgery, School of Medicine, University of Texas, Galveston, Texas.

June 2007-Present Ad Hoc Reviewer for Journal of Tissue Engineering

Feb.2007-Dec 2011 Project Scientist, Non Exercise Physiological Countermeasures Project (NxPCM)  
[http://lsda.jsc.nasa.gov/scripts/personnel/pers.aspx?per\\_id=3041&string=goodwin&CURRENT\\_STRING2=goodwin](http://lsda.jsc.nasa.gov/scripts/personnel/pers.aspx?per_id=3041&string=goodwin&CURRENT_STRING2=goodwin)

Feb. 2003 -Feb. 2016 Manager, Disease Modelling/Tissue Analogues Laboratory

Feb. 2005-Aug. 2007 Deputy Project Manager, Non Exercise Physiological Countermeasures Project (NxPCM)

Feb. 2005-Oct. 2005 Project Scientist Integrated Cell Science Project

May 2003-Present Human Adaptations and Countermeasures Div. Representative to the NASA Biosafety Committee chaired by Dr. Duane Pierson.

Dec. 2000 - 2005 Chief Scientist for the Cellular Biotechnology Facility for ISS

Dec. 2000 - 2002 Project Manager/Scientist for Commercial Space Flight Office StelSys Experiment  
<http://www.nasa.gov/centers/marshall/news/background/facts/stelsys.html>

Oct. 2000 - Feb. 2016 Project Manager/Scientist for the ARCTIC Freezer System for the International Space Station (ISS) <http://www.nasa.gov/centers/marshall/news/background/facts/arctic.html>

Aug. 1999 – 2003 Project Manager/Scientist for MRPO STS107/BDS-05 Experiment for ISS/Columbia  
[http://ebot.gmu.edu/bitstream/handle/1920/2048/107\\_BDS05.pdf](http://ebot.gmu.edu/bitstream/handle/1920/2048/107_BDS05.pdf) .

June 1999 – Feb. 2016 NASA Chief Scientist for the Minus Eighty Freezer MELFI, Cryogenic Freezer CRYO and Glacier systems for International Space Station

Sept. 1997 – 2005 Co-Director of the Tulane University Environmental Astrobiology Center under the NASA Space Act Agreement.

Sept. 1996 - 2006 Special appointments as Adjunct Instructor in the Departments of Physiology and Medicine at the Tulane University Medical Center, New Orleans, LA.

March 1993 - 2000 National Aeronautics and Space Administration (NASA) Biotechnology Flight Definition/Cell Biology Manager at Johnson Space Center (JSC).

- Sept. 1991 - March 1993 Biotechnology Laboratories Manager for the Biomedical Research Section of KRUG Life Sciences Division.
- June 1987 - Aug. 1991 Research Cell Biologist for the Biomedical Research Section of KRUG's Life Science Division.
- Sept. 1985 - June 1987 Research Associate and Laboratory Supervisor in the Department of Surgery at The University of Texas Health Science Center-Houston.
- Dec. 1979 - Sept. 1985 Research Associate and Laboratory Supervisor at The University of Texas Medical School at Houston in the Department of Surgery, Division of Organ Transplantation.
- Oct. 1973 - Dec. 1979 Assistant Research Scientist at the Southwest Foundation for Research and Education in San Antonio, Texas.

## **AWARDS**

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- 2018 Member of NASA Inventors Hall of Fame
- 2017 NASA Technical Brief Space Act Award for the Patent, Using Electromagnetic Time-Variance Magnetic Fields to Generate and Re-grow Cartilage US patent 8795147.
- 2015 NASA Performance Award In Recognition Of Excellence of The Performance Of Assigned Duties, NASA Time-Off Award
- 2014 NASA Performance Award In Recognition Of Excellence of The Performance Of Assigned Duties, NASA Time-Off Award
- 2013 NASA Time-Off Award In Recognition Of Excellence in the Performance Of Assigned Duties
- 2012 NASA Exceptional Level Space Act Award for the scientific contribution entitled "Methods For Growing Tissue-Like 3D Assemblies (TLA) Of Human Bronchio-Epithelial Cells". Signed by the NASA Administrator
- 2012 NASA Honours Team Award for US Patent 7,972,821
- 2012 NASA Performance Award In Recognition Of Excellence In The Performance Of Assigned Duties
- 2011 NASA Performance Award In Recognition Of Excellence In The Performance Of Assigned Duties
- 2011 Patent Application Award: Modifying the Genetic Regulation of Bone and Cartilage Cells and Associated Tissue by EMF Stimulation Fields and uses Thereof, MSC-24541-1
- 2011 NASA Certificate of Recognition for your disclosure entitled " Electromagnetic Time-Variance Magnetic Fields (TVMF) to generate, and re-grow Cartilage Cells by a Noninvasive Method", MSC-24541-1.
- 2010 NASA Performance Award In Recognition Of Excellence In The Performance Of Assigned Duties
- 2009 NASA Performance Award In Recognition Of Excellence In The Performance Of Assigned Duties
- 2008 NASA Certificate Of Recognition For The Disclosure Of An Invention Titled "Improved Three Dimensional Cell To Tissue Development Process:" MSC-23983-1

## AWARDS (Continued)

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- 2008 NASA Performance Award In Recognition Of Excellence In The Performance Of Assigned Duties
- 2008 NASA Certificate Of Recognition For The Disclosure Of An Invention Titled” Natively Glycosylated Mammalian Biological Molecules Produced By Electromagnetically Stimulating Living Mammalian Cells.” MSC-23979-1
- 2008 NASA Certificate Of Recognition For The Disclosure Of An Invention Titled “Apparatus For Enhancing Tissue Repair In Mammals:.” MSC-23981-1
- 2008 NASA Technical Brief Space Act Award for the Patent, Methods For Growing Tissue-Like 3D Assemblies (TLA) Of Human Broncho-Epithelial Cells MSC-24164-1
- 2008 NASA Space Act Award for the Patent, “Three- Dimensionally Engineered Normal Human Bronchio-Epithelial Tissue Like Assemblies: Targets for Human Respiratory Viral Infections”, MSC-24164-1
- 2007 NASA Performance Award In Recognition Of Excellence In The Performance Of Assigned Duties
- 2006 NASA Performance Award In Recognition Of Excellence In The Performance Of Assigned Duties
- 2005 NASA Certificate Of Recognition For The Patent Award Of An Invention Titled “Production Of Functional Proteins: Balance Of Shear Stress And Gravity.”
- 2005 NASA Performance Award In Recognition Of Excellence In The Performance Of Assigned Duties
- 2005 **NASA Group Achievement Award** For Untiring Dedication To The NASA Cell Science And Tissue Engineering Program, Which Has Been Recognized By The Science Community As Fostering Outstanding Development In Basic, Applied, And Exploration Research Using Cellular Systems.
- 2004 NASA Space Act Award For The Patent “Growth Stimulation Of Biological Cells And Tissues By Electromagnetic Fields And Uses Thereof “.
- 2004 NASA Performance Award In Recognition Of Excellence In The Performance Of Assigned Duties
- 2003 NASA Performance Award In Recognition Of Excellence In The Performance Of Assigned Duties
- 2002 **Superior Achievement Award As Chief Scientist For The Development Of The Arctic System And The Other Freezer Systems For ISS.**
- 2002 NASA Performance Award In Recognition Of Excellence In The Performance Of Assigned Duties.
- 2002 NASA Superior Accomplishment Award For The Exceptional Accomplishment Of A Special Effort That Significantly Benefited The Lyndon B. Johnson Space Center
- 2002 NASA Special Space Flight Team Achievement Award For Exemplary Effort And Technical Achievement In The Successful Delivery Of The Arctic Freezer To The ISS Aboard STS-110/8a.
- 2002 NASA Special Space Flight Individual Achievement Award For Exemplary Effort And Technical Achievement In The Successful Delivery Of The Arctic Freezer To The ISS Aboard STS-110/8a.
- 2001 NASA Performance Award In Recognition Of Excellence In The Performance Of Assigned Duties.
- 2000 NASA Certificate Of Recognition For The Disclosure Of An Invention Titled “ Growth Stimulation Of Biological Cells And Tissues By Electromagnetic Fields And Uses Thereof.

## AWARDS (Continued)

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- 2000 NASA Performance Award In Recognition Of Excellence In The Performance Of Assigned Duties.
- 1999 **NASA Group Achievement Award.** Outstanding Contributions To The Mir Phase I Space Station Program
- 1999 NASA Performance Award In Recognition Of Excellence In The Performance Of Assigned Duties
- 1998 NASA Certificate Of Recognition For The Disclosure Of An Invention Titled "Production Of Functional Proteins: Balance Of Shear Stress And Gravity."
- 1998 NASA Certificate Of Recognition For The Creative Development Of A Technical Innovation Which Has Been Proposed For Publication As A NASA Technical Brief Titled "Production Of 1-25dih Vitamin D3, Erythropoietin And Other Products."
- 1998 NASA Performance Award In Recognition Of Excellence In The Performance Of Assigned Duties.
- 1997 NASA Performance Award In Recognition Of Excellence In The Performance Of Assigned Duties.
- 1996 NASA Certificate Of Recognition For The Creative Development Of A Technical Contribution Which Has Been Determined To Be Of Significant Value In The Advancement Of The Space And Aeronautical Activities Of NASA, And Is Titled: "Recombinant Protein Production And Insect Cell Culture And Process."
- 1996 NASA Certificate Of Recognition For The Disclosure Of An Invention Titled "Recombinant Protein Production And Insect Cell Culture And Process."
- 1996 NASA Certificate Of Recognition For The Disclosure Of An Invention Titled "A Method For Producing Non-Neoplastic, Three-Dimensional Mammalian Tissue And Cell Aggregates Under Microgravity Culture Conditions And The Products Produced Therefrom."
- 1996 NASA Performance Award In Recognition Of Excellence In The Performance Of Assigned Duties.
- 1996 NASA Certificate Of Recognition For The Disclosure Of An Invention Titled "Pathogen Propagation In Cultured Three-Dimensional Tissue Mass."
- 1995 NASA Certificate Of Recognition For The Creative Development Of A Technical Innovation Which Has Been Proposed For Publication As A NASA Tech Brief Titled "Electrically Potentiated Growth Of Mammalian Neuronal Tissue Facilitated By Rotating Wall Vessel Culture".
- 1995 NASA Certificate Of Recognition For The Creative Development Of A Technical Innovation Which Has Been Proposed For Publication As A NASA Tech Brief Titled "Three Dimensional Optic Tissue Culture And Process."
- 1995 NASA Certificate Of Recognition For The Disclosure Of An Invention Titled "Three Dimensional Optic Tissue Culture And Process."
- 1995 NASA Certificate Of Recognition For The Creative Development Of A Technical Innovation Which Has Been Proposed For Publication As A NASA Tech Brief Titled "A Novel Process System For Insect-Cell Cultivation And Recombinant Protein Production."
- 1994 NASA Performance Award In Recognition Of Excellence In The Performance Of Assigned Duties.

## AWARDS (Continued)

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- 1994 NASA/Johnson Space Center Gem Award “Going The Extra Mile.”
- 1994 NASA Certificate Of Recognition For The Creative Development Of A Technical Innovation Which Has Been Proposed For Publication As A NASA Tech Brief Titled “A Process For Developing High-Fidelity Three-Dimensional Tumor Models Of Human Prostate Carcinoma.”
- 1994 NASA Certificate Of Recognition For The Creative Development Of A Technical Innovation Which Has Been Proposed For Publication As A NASA Tech Brief Titled “Horizontal Rotating-Wall Vessel Propagation Of *In Vitro* Human Tissue.”
- 1994 NASA Certificate Of Recognition For The Creative Development Of A Technical Innovation Which Has Been Proposed For Publication As A NASA Tech Brief Titled “A Process For Developing High-Fidelity Three-Dimensional Tumor Models Of Human Bladder Carcinoma.”
- 1994 NASA Certificate Of Recognition For The Creative Development Of A Technical Innovation Which Has Been Proposed For Publication As A NASA Tech Brief Titled “A Process For Three-Dimensional Culture Of Mammalian Cartilage.”
- 1994 NASA Certificate Of Recognition For The Disclosure Of An Invention Titled “Multi-Cellular, Three-Dimensional Living Mammalian Tissue (As Amended).”
- 1994 NASA Certificate Of Recognition For The Disclosure Of An Invention Titled “Cultured High-Fidelity Three-Dimensional Human Urogenital Track Carcinomas And Process.”
- 1993 NASA/Johnson Space Center Gem Award “Going The Extra Mile”
- 1993 NASA Certificate Of Recognition For The Creative Development Of A Technical Innovation Which Has Been Proposed For Publication As A NASA Technical Brief Titled “A Process For Complex Three-Dimensional Co-Culture Normal Human Small Intestine.”
- 1993 NASA Certificate Of Recognition For The Disclosure Of An Invention Titled “Cultured Normal Mammalian Tissue And Process.”
- 1993 **NASA Johnson Space Center Inventor Of The Year For Three-Dimensional Co-Culture Process U.S. Patent 5,153,132.**
- 1993 **NASA Group Achievement Award.** In Recognition Of Outstanding Determination, Performance, And Accomplishments In Bioreactor Engineering And Tissue Culture Research And The Creation Of New Knowledge In Medicine And Biology.
- 1992 Nominated For The **NASA Group Achievement Award For The Successful Flight Of DSO-316** On STS-44
- 1991 Space Act Award For The Creative Development Of A Scientific Contribution Which Has Been Determined To Be Of Significant Value In The Advancement Of The Aerospace Technology Program Of NASA And Is Titled “Three-Dimensional Coculture Process.
- 1990 NASA Certificate Of Recognition For The Creative Development Of A Technical Innovation Which Has Been Selected For Publication Titled “Biological Active Factors Produced By Multicellular Co-Cultivation.”
- 1990 NASA Certificate Of Recognition For The Creative Development Of A Technical Innovation Which Has Been Selected For Publication Titled “Three-Dimensional Co-Culture Process.”

- 1990 San Antonio Commissioners Court Award For Outstanding Scientific Achievement.
- 1990 San Antonio Mayor's Citation For Outstanding Achievement In A Scientific Field.
- 1989 **1988 Melbourne W. Boynton Award.** Awarded By The American Astronautical Society For Outstanding Contributions To Biomedical Aspects To Spaceflight.
- 1989 **NASA Group Achievement Award-Space Bioreactor Program, Bioreactor Engineering** And Cell Science Research Team. In Recognition Of Outstanding Accomplishments In The Field Of Bioreactor Engineering And Tissue Culture Research

## **DISCLOSURES AND PATENTS**

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- 2018 **US Patent 9,914,920**  
**Goodwin TJ, et al.**, Alternating Ionic Magnetic Resonance (AIMR) Multiple-Chambered Culture Apparatus
- 2018 **US Patent 9,896,681**  
**Goodwin TJ et al.**, Modifying the genetic regulation of bone and cartilage cells and associated tissue by EMF stimulation fields and uses thereof
- 2014 MSC-24541-2, “Electromagnetic Time Variance Magnetic Fields (TVMF) To Generate And Regrow Cartilage By A Non- Invasive Methods”
- 2014 **US Patent 8,795,147**  
**Goodwin TJ et al.**, Modifying the genetic regulation of bone and cartilage cells and associated tissue by EMF stimulation fields and uses thereof
- 2013 MSC-25633-1, Goodwin, TJ et al.; “Methods for Culturing Cells in an Alternating Ionic Magnetic Resonance (AIMR) Multiple Chambered Culture Apparatus”
- 2013 MSC-25545-1, Goodwin, TJ et al.; “AIMR Multiple-Chambered, Apparatus For The Culture Of Cells, Tissues, And Organoid Bodies And Methods Of Use”
- 2012 **US Patent 8,338,114**  
**Goodwin, T.J.** “Engineered Human Bronchio-Epithelial Tissue-like Assemblies”
- 2011 **US Patent 7,972,821**  
**Goodwin, T.J. et al.** “Production Of Functional Proteins: Balance Of Shear Stress And Gravity”
- 2010 MSC-24949-1, Goodwin; “Regenerative Physiology and Bio-Engineered Tissue Systems for Development of a Viral Vaccine Platform for Human Vaccine Development”
- 2009 **US Patent 7,601,114**  
**Goodwin, T. J. et al** “Apparatus for enhancing tissue repair in mammals”
- 2008 **US Patent 7,456,019**  
**Goodwin, T. J. et al.** “Three-Dimensional Cell to Tissue Development Process”
- 2008 MSC-24541-1, “Electromagnetic Time Variance Magnetic Fields (TVMF) To Generate And Regrow Cartilage By A Non- Invasive Method”



## DISCLOSURES AND PATENTS

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- 2007      **US Patent 7,198, 947**  
**Goodwin, T.J. et al.** “Production Of Functional Proteins: Balance Of Shear Stress And Gravity ”
- 2007      **US Patent 7,179,217**  
**Goodwin, T. J. et al.** Apparatus for enhancing tissue repair in mammals
- 2006      **MSC-23981-1 PCT**, Apparatus for Enhancing Tissue Repair In Mammals
- 2006      **MSC-23983-1 PCT**, Improved Three-Dimensional Cell To Tissue Development Process
- 2006      **MSC-24164-1**, Three- Dimensionally Engineered Normal Human Bronchio-Epithelial Tissue Like Assemblies: Targets for Human Respiratory Viral Infections.
- 2005      **US Patent 6,946,246**  
**Goodwin, T.J. et al.** “ Production Of Functional Proteins: Balance Of Shear Stress And Gravity ”
- 2005      **MSC-23979**, Natively Glycosylated Mammalian Biological Molecules Produced by Electromagnetically Stimulating Living Mammalian Cell
- 2005      **MSC-23980**, Interchangeable Sleeve For Enhancing Proliferation of Cells In a Rotating Bioreactor
- 2005      **MSC-23981**, Apparatus for Enhancing Tissue Repair In Mammals
- 2005      **MSC-23982**, Apparatus For Enhancing Proliferation Of Cells In A Small-Scale Cell Culturing Container
- 2005      **MSC-23983**, Improved Three-Dimensional Cell To Tissue Development Process
- 2004      **US Patent 6, 730, 498**  
**Goodwin, T.J. et al.** “ Production Of Functional Proteins: Balance Of Shear Stress And Gravity ”
- 2004      **US Patent 6,673,597**  
Wolf, D.A. and **Goodwin, T.J.** “Growth Stimulation of Biological Cells and Tissue by Electromagnetic Fields and Uses Thereof”
- 2003      **MSC-23679**: “Virally Induced Cell Control via Synthetically Produced Nano-Viruses”
- 2003      **MSC-23691-1** “Modular Rotating Bioreactor”
- 2002      **US Patent, 6,485,963, B1**  
Wolf, D.A. and **Goodwin, T.J.** “Growth Stimulation of Biological Cells and Tissue by Electromagnetic Fields and Uses Thereof”
- 2000      **U.S. Patent, 6,117,674**  
**Goodwin, T. J. et al.** “Pathogen Propagation in Cultured Three-Dimensional Tissue Masses”
- 1999      **U.S. Patent, 5,962,324**  
**O’Connor, K.C., Goodwin, T. J. et al.** “**Three Dimensional Optic Tissue Culture and Process**”
- 1999      **U.S. Patent, 5,858,783**  
**Goodwin, T.J. et al.** “Production of normal mammalian organ culture using a medium containing MEM-alpha, Leibovitz L-15, glucose galactose fructose.”

## DISCLOSURES AND PATENTS

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- 1998      **U.S. Patent, 5,851,816**  
**Goodwin, T.J. et al.** “Cultured High Fidelity Three-Dimensional Human Urogenital Tract Carcinomas and Process.”
- 1998      **U.S. Patent 5, 846, 807**  
**Goodwin, T.J.,** “Media compositions for three-dimensional mammalian tissue growth under microgravity culture conditions.”
- 1997      **U.S. Patent 5,637,477** Spaulding, G.F., **Goodwin, T.J., et al** “Recombinant Protein Production and Insect Cell Culture and Process.”
- 1997      **U.S. Patent 5,627,021**  
**Goodwin, T. J. et al.,** Multi-Cellular, “Three-Dimensional Living Mammalian Tissue.”
- 1996      **U.S. Patent 5,496,722**  
**Goodwin, T. J. et al.,** “Cultured Normal Mammalian Tissue and Process.”
- 1995      MSC-22633-1: “Electrically Potentiated Growth of Mammalian Neuronal Tissue Facilitated by Rotating Wall Vessel Culture.” (**Notice to Issue March 2001**)
- 1994      **U.S. Patent 5,308,764**  
**Goodwin, T. J. et al.,** “Multi-Cellular Three-Dimensional Living Mammalian Tissue.”
- 1993      MSC-21984-1: “Cultured Normal Mammalian Tissue and Process.” U.S. Patent Pending.
- 1992      **U.S. Patent 5,153,132**  
**Goodwin, T. J. et al.,** “Three-Dimensional Coculture Process
- 1992      MSC-22118-1: “A Process for Three-Dimensional Culture of Mammalian Cartilage”
- 1992      MSC-22120-1: “A Process for Developing High-Fidelity Three-Dimensional Tumor Models of Human Bladder Carcinoma”
- 1992      MSC-22122-1: “Horizontal Rotating-Wall Vessel Viral Propagation in *In Vitro* Human Tissue Models”
- 1990      GTSF-2: “Media Designed for Coculture in the Rotating-Wall Vessel”
- 1989      MSC-21575-1: “Biologically Active Factors Produced by Multi cellular Cocultivation’
- 1989      MSC-21653-1: GTSF-1: “A Serum-Free Medium Designed for the Space Bioreactor System”

## PUBLICATIONS

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### Books and Chapters

- Schmidt, MA., **Goodwin, T.J.\***, Cuttino, M., Personalized Medicine in Space Flight, Part I: The Space Context and Standard Clinical Approaches: In Principles of Gender-Specific Medicine 3rd ed., MJ. Legato (Ed), Elsevier, Academic Press, San Diego, CA.2017.
- Schmidt, MA., **Goodwin, T.J.\***, Cuttino, M., Personalized Medicine in Space Flight, Part II: Personalized Precision Medicine Approaches: In Principles of Gender-Specific Medicine 3rd ed., MJ. Legato (Ed), Elsevier, Academic Press, San Diego, CA.2017.

Vertrees, RA., JM Jordan, T. Solley, **TJ Goodwin\***. Tissue Culture Models In: Basic Concepts of Molecular Pathology, Vol. 2, TC. Allen and PT. Cagel (Eds), Springer Science and Business Media, LLC. New York, NY. 2009.

Vertrees, RA., **TJ Goodwin\***, JM Jordan, JB Zwishenberger. Tissue Culture Models In: Molecular Pathology Of Lung Diseases, DS Zander, HH Popper, J Jagirdar, AK Haque, PT. Cagel and R Barrios (Eds), Springer Science and Business Media, LLC. New York, NY. 2008.

## **PUBLICATIONS**

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### **Scientific Articles Refereed**

**Goodwin, T.J.**; Christofidou-Solomidou, M. Oxidative Stress and Space Biology: An Organ-Based Approach. *Int. J. Mol. Sci.* 2018, 19, 959.

Alwood, J. S., Roncal, A. E., Mains, R. C., Shelhamer, M. J., Smith, J. D., **Goodwin, T. J.**; (2017); From the bench to exploration medicine: NASA life sciences translational research for human exploration and habitation missions; *npj Microgravity* 3:5 ; doi:10.1038/s41526-016-0002-8

Pietrofesa, R. A., Velalopoulou, A., Lehman, S. L., Arguiri, E., Solomides, P., Koch, C. J., **Goodwin, TJ** Christofidou-Solomidou, M. (2016). Novel Double-Hit Model of Radiation and Hyperoxia-Induced Oxidative Cell Damage Relevant to Space Travel. *International Journal of Molecular Sciences*, 17(6), 953. <http://doi.org/10.3390/ijms17060953>

Schmidt, MA, **Goodwin, TJ**, Pelligra, R., (2016), Incorporation of omics analyses into artificial gravity research for space exploration countermeasure development, *Metabolomics*, DOI 10.1007/s11306-015-0942-0

**Goodwin T J**, McCarthy M, Cohrs RJ, Kaufer BB (2015), 3D Tissue-like Assemblies: A Novel Approach to Investigate Virus–Cell Interactions, *Methods* doi:10.1016/j.ymeth.2015.05.010

**Goodwin TJ**, McCarthy M, Osterrieder N, Cohrs RJ, and Kaufer BB (2013) “Three-Dimensional Normal Human Neural Progenitor Tissue-Like Assemblies: A Model of Persistent Varicella-Zoster Virus Infection”. **PLoS Pathogens** 9(8): e1003512. doi:10.1371/journal.ppat.1003512

Schmidt, MA and **Goodwin, TJ**, (2013) “Personalized medicine in human space flight: using Omics based analyses to develop individualized countermeasures that enhance astronaut safety and performance” **Journal of Metabolomics**, 2013, DOI 10.1007/s11306-013-0556-3

Deatly, AM., YH. Lin, M. McCarthy, W. Chen, LZ. Miller, J. Quiroz, BM. Nowak, RA. Lerch, SA. Udem **T J. Goodwin**, “Paramyxovirus Infection Mimics In Vivo Cellular Dynamics in Three-Dimensional Human Bronchio-Epithelial Tissue-Like Assemblies”; **NASA/TP–2012-217363, 2012.**

**Goodwin**, T.J. Tissue-like 3D Assemblies of Human Broncho-Epithelial Cells, **Medical Design Briefs**, p. 24-25, March 2010.

Vertrees, R.A., M. McCarthy, T. Solley, V. L. Popov, J. Roaten, M. Pauley, X. Wen and **T.J. Goodwin.** “Development Of A Three-Dimensional Model Of Lung Cancer Using Cultured Transformed Lung Cells”, *Cancer Biology and Therapy*, 8:4, February 2009.

**Goodwin, T.J.**, M. McCarthy, Y.H. Lin, A.M. Deatly. “Three-Dimensionally Engineered Normal Human Lung Tissue-Like Assemblies: Target Tissues for Human Respiratory Viral Infections”, **NASA Technical Paper-TP-2008-214771**, March 2008.

**Goodwin, T.J.**, M. McCarthy, Y.H. Lin, A.M. Deatly. “Three-Dimensionally Engineered Normal Human Lung Tissue-Like Assemblies: Target Tissues for Human Respiratory Viral Infections”, **NASA Technical Paper-TP-2008-214771**, March 2008.

## **PUBLICATIONS**

### **Scientific Articles Refereed**

- Vertrees, R.A., J.B., Zwischenberger, P.J.Boor, V.Popov, M. McCarthy, T.N. Solley, and **T.J. Goodwin**; “Cellular Differentiation In Three-Dimensional Lung Cell Cultures”, **Cancer Biology and Therapy**, 7:3, March 2008.
- Suderman, M.T.; McCarthy, M.; Mossell, E.; Watts, D.M.; Peters, C.J.; Shope, R.; and **Goodwin, T.J.\*** “Three-Dimensional Human Bronchial-Tracheal Epithelial Tissue-Like Assemblies as Hosts For Severe Acute Respiratory Syndrome-CoV Infection”, **NASA Technical Paper-TP –2006–213723**, July 2006
- Ho`ner Kerstin zu Bentrup, Rajee Ramamurthy, C. Mark Ott, Kamal Emami, Mayra Nelman-Gonzalez, James W. Wilson, Emily G. Richter, **Thomas J. Goodwin**, Steven J. Alexander, Duane L. Pierson, Neal Pellis, Kent L. Buchanan, Cheryl A. Nickerson. “Three-dimensional organotypic models of human colonic epithelium to study the early stages of enteric salmonellosis” **Microbes and Infection**,8 (7) 1813-25, June, 2006.
- Vertrees, RA, Das GC, Popov VL, Coscio AM, **Goodwin TJ**, Logrono R, Zwischenberger, JB, Boor PJ. "Synergistic interaction of hyperthermia and gemcitabine in lung cancer," **Cancer Biology and Therapy**, 1:4 (10) Oct. 2005.
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## INVITED PRESENTATIONS

- Schmidt, M.A. and **T.J. Goodwin**, Next Generation Sub Orbital Researchers Conference “Optimizing DNA Stability Prior to Entering Space Radiation Environments?; June 2013
- Schmidt, M.A. and **T.J. Goodwin**, Next Generation Sub Orbital Researchers Conference “Three Dimensional Human Tissues as Surrogates for Assessing Radiation Effects on Humans Undergoing Repeated Suborbital Exposures” Feb. 2012
- BioConference/Labroots “Bio-Engineered Regenerative Technology To Study Human Lung Viral Infections” - PACE Course 538-107-10, Oct. 2010
- Next Generation Sub Orbital Researchers Conference “Three Dimensional Human Tissues as Surrogates for Suborbital & Orbital Research into Human Cellular Genomics, Proteomics, and Metabolomic Tissue Responses During Transitional Space Flight” Feb.2010”
- Sputnik Observatory Interview <http://blog.sptnk.org/2009/07/>
- The Feist-Weiller Cancer Center’s Spring 2007 Seminar Series, “Three Dimensional Oncology Models: Tissue Engineering Systems for Improved Cancer Treatment” Shreveport LA., February 6, 2007.
- Society of Industrial Microbiology Three-Dimensionally Engineered Normal Human Broncho-epithelial Tissue-Like Assemblies: Target Tissues for Human Respiratory Viral Infections. Annual Meeting, Baltimore MD., July 30, 2006.
- Grand Rounds at University of Washington, Dept of Neurosurgery. Tissue Engineering/Molecular Genetics and Cellular Regeneration Using TVEMF, April 12, 2006

## FUNDING FOR 13-YEAR PERIOD (2000-2017)

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### **NASA Research Announcement Award- 2014-2017**

**PI-**Brian Crucian, PhD

**Co-I: Science PI-** Thomas J Goodwin, PhD.

**Study Title:** "Deep Space Exploration Atmosphere Effects on Hematologic, Immunologic, and Oxidative Stress and Damage Parameters in Astronauts: An ISS Flight Study" Short title "**HIOS**"

**Funding:** ~ \$400, 000/yr.

### **Innovation CIF Research Grant 2010-2011**

**PI:** Thomas J. Goodwin, Ph.D

**Study Title: Development of the NTReS System**

**Funding:** \$100,000

### **NIH-PO1 AG032958-01- PI- Gilden, Donald H., MD. Years- 2009-2013**

**Co-I Thomas J. Goodwin, Ph.D.**

**Study Title:** "The Molecular Pathogenesis of Varicella Zoster Virus Infection"

**Funding:** \$150,000/year

## **Innovation Partnership Program**

### **NASA PI Thomas J. Goodwin, Ph.D.**

**Study Title:** "Ambient-Stable Thioaptamer Assays to Survey Human Biological Samples for Research and Medical

Markers of Disease and Trauma" Physician Point-of-Care.

**Funding:** \$50,000 FY09

### **NASA PI Thomas J. Goodwin, Ph.D.**

**Study Title:** "Ambient-Stable Thioaptamer Assays to Survey Human Biological Samples for Research and Medical

Markers of Disease and Trauma" Physician Point-of-Care.

**Funding:** \$150,000 FY2008

## **Reimbursable Space Act Agreements (Sponsored Research agreements)**

### **Reimbursable Space Act Agreement Orthofix Inc.**

**PI: Thomas J. Goodwin, Ph.D.**

Research Covers Analyses, Development and Exposure Of Human Cells To PEMF To Bone Cartilage And Vascular Tissue

Funded Two Year Extension 2008-2010

Funding ~ \$290, 000/year.

Total: \$ 577,280

### **Reimbursable Space Act Agreement Orthofix Inc.**

**PI: Thomas J. Goodwin, Ph.D.**

Research Covers Analyses, Development and Exposure Of Human Cells To PEMF To Bone Cartilage And Vascular Tissue

Funded Two Years 2007-2008

Funding \$340, 000/year.

Total: \$ 685,000

**Reimbursable Space Act Agreement Regenotech Inc.**

**PI Thomas J. Goodwin, Ph.D.**

Research covers the expansion and implementation of Adult Stem Cells to regenerate including, but not limited to, human liver, skin, prostate, cartilage, and pancreas.

Funded Four years 2003-2005

Approximately 250,000/year

**Reimbursable Space Act Agreement Wyeth Vaccines**

**PI Thomas J. Goodwin, Ph.D.**

Wyeth PI Anne Deatly, Ph.D.

Research Covers Development of clinically relevant models of human lung and neural tissue to accomplish predictive applications and new vaccine development

Funded Four years 2001-2005

Approximately 250,000 /year

**NASA-Johnson Space Center - Center Director's Discretionary Fund Grants:**

“Electrically Potentiated Growth of Mammalian Neuronal Tissues Facilitated by Rotating-Wall Vessel Culture” - Funded for 4 years \$200,000 starting 1998-2001.

**Principal Investigator: Thomas J. Goodwin, Ph.D.**

“Development of an Immune Monitoring Strategy to Reflect Toxicological Insult: A Study in Marine Mammal Physiology Facilitated by Rotating-Wall Vessel Culture” - Funded for 4 years \$200,000 starting 1998-2001. Principal Investigator: Richard M. Linnehan, D.V.M., Astronaut Office;

Co- Principal Investigator: **Thomas J. Goodwin, Ph.D.** 1998-2001

**NRA Research Announcement (NRA) 00-HEDS-03**

“Molecular Basis of Salmonella Enteropathogenesis”

Principal Investigator: Cheryl Nickerson, Ph.D.: Tulane University Medical School,

Funded for 3 years 2001-2004

**Co-investigator Thomas J. Goodwin, M.A**

**NRA Research Announcement (NRA) 00-HEDS-03**

“Transcription Factors Mediating Rotating Wall Vessel Induced Gene Expression Changes”

Principal Investigator: Timothy G. Hammond M.D., Tulane University Medical School,

Funded for 3 years 2001-2004,

**Co-Investigator Thomas J. Goodwin, M.A**

**PROGRAM BRIEFINGS**

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The Honorable George Brown, U.S. House of Representatives, CA; May, 1992

Supported the Space Station Briefing presented to Committee Chairman Richard Durbin, U.S. House of Representatives, IN; May, 1992

Supported the Space Station Briefing presented to the U.S. House of Representatives Space Subcommittee. Present were members of the Texas Delegation including Ralph Hall, Rockwall, TX; Jim Chapman, Sulphur Springs, TX;

Mike Andrews, Houston, TX; Tom Delay, Houston (Clear Lake City), TX and others. Testimony was presented by Texas Governor Ann Richards; Dr. Michael DeBakey, chancellor of Baylor College of Medicine; and Dr. Charles LeMaistre, president of M.D. Anderson Cancer Center.

## NATIONAL ARTICLES

“Prostate Modeling Experiment Success Becomes Part of Legacy of Shuttle Astronauts” Journal of the National Cancer Institute, Vol. 95, No. 7, 505-507, April 2, 2003. <http://jnci.oxfordjournals.org/cgi/content/full/95/7/505>

“Genes in Microgravity” Discover Magazine, September 01, 2001 <http://discovermagazine.com/2001/sep/featgenes>

“Microgravity and Gene Expression: Early Results Point to Relationship” The Scientist, Vol. 13, No. 18, September 13, 1999 [http://www.the-scientist.com/yr1999/nov/research\\_991122.html](http://www.the-scientist.com/yr1999/nov/research_991122.html)

“New Horizons for Stem Cell Bioreactors.” Biotechnology, Vol. 10, October 1992

“NASA Ready to Attempt Human Cell Growth in Space.” Aviation Week and Space Technology, July 6, 1992

“NASA/JSC Inventor of the Year.” NASA Tech Briefs, Vol. 16, No. 3, March 1992

“Shear Bliss.” Scientific American, February 1992

“NASA Completes Tissue Model in a Microgravity Bioreactor” by Patricia Diamond. Genetic Engineering News, April 1991

“NASA Allies Tout Biomedical Spinoffs.” Journal of NIH Research, Vol. 3, December 1991

## ADDITIONAL RESEARCH ACTIVITIES

Adjunct Professor; Dept. of Health and Human Performance, University of Houston. Houston, Texas.

Adjunct Scientist Southwest National Primate Research Center (SNPRC) San Antonio, Texas 2009-present

Visiting Scientist, U.S. Department of Wildlife Management Arctic Research Facility, North Slope Borough, Barrow, AK., 1996-2000.

## SPACE SHUTTLE and ISS FLIGHT EXPERIMENTS

STS-44: DSO-316, Successful flight in November, 1991  
Principal Investigator: Glenn F. Spaulding, M.D.  
Co-Investigator: Y. David Tsao, Ph.D.

STS-54: DSO-316A, Scheduled flight in January, 1993  
Principal Investigator: Neal R. Pellis, Ph.D.  
Co-Investigators: **Thomas J. Goodwin, M.A.**  
Glenn F. Spaulding, M.D.

STS-56: DSO-322, Scheduled flight in April, 1993  
Principal Investigator: Glenn F. Spaulding, M.D.  
Co-Investigators: **Thomas J. Goodwin, M.A.**

Y. David Tsao, Ph.D.

STS-57: ASPECS Payload, Scheduled flight in June, 1993

Principal Investigator: Glenn F. Spaulding, M.D.

Co-Investigator: **Thomas J. Goodwin, M.A.**

STS-62: BDS; BSTC Payload, Scheduled flight in January 1994

Principal Investigator: **Thomas J. Goodwin, M.A.**

STS-70: BDS, EDU #1 Payload, Scheduled Flight in July 1995

Principal Investigator Phase I - J. Milburn Jessup, M.D. and NASA Tech. Manager, **Thomas J. Goodwin, M.A.**

Principal Investigator Phase II - Stanley Kleis, Ph.D. and NASA Tech. Monitor, Rafael Garcia

STS-79/Mir3:BTS/CART, Bovine cartilage, Scheduled Flight September 1996

Principal Investigator - Lisa E. Freed, M.D., Ph.D. and NASA Tech. Manager, **Thomas J. Goodwin, M.A.**

STS-85:EDU-1R, Scheduled Flight August 7, 1997

Principal Investigator - J. Milburn Jessup, M.D. and NASA Tech. Manager, **Thomas J. Goodwin, M.A.**

STS-86/Mir6:Bio-3D, Scheduled Flight September 25, 1997

Principal Investigators - T.G. Hammond, **T. J. Goodwin M.A.**, P.I. Lelkes.

STS-89Mir7:BTS/Co-Cult, Scheduled Flight January 22, 1998

Co-Principal Investigators - Elliot Levine, M.D., and NASA **Thomas J. Goodwin, M.A.**

STS-90 Neurolab: BSTC, May 1998

Principle Investigators- T.G. Hammond, J. Kaysen, **T.J. Goodwin M.A.**

STS-106 P6 Truss and Array Mission: **CGBA Molecular Genetics In Space** September 2000

Principle Investigators: T.G. Hammond and **T. J. Goodwin, M. A.**

STS-105 Cellular Biotechnology Operating System (CBOSS)

**Thomas J. Goodwin, PhD, Project Manager/ Scientist**

STS-108 Cellular Biotechnology Operating System (CBOSS)

**Thomas J. Goodwin, PhD, Project Manager/ Scientist**

STS-110/8A First Freezer System, ARCTIC #1, To Space Station for preservation of biological samples

**Thomas J. Goodwin, PhD, Project Manager/ Scientist**

STS-111/UF-2 First Freezer System, ARCTIC #2, To Space Station for preservation of biological samples

**Thomas J. Goodwin, PhD Project Manager/ Scientist**

STS-111/UF-2 Commercial Payload Experiment StelSys for the study of Human Liver Toxicity in Space (CGBA)

**Thomas J. Goodwin, PhD Project Manager/ Scientist**

\*\*STS-107 Space Hab Mission for Human Health- Prostate Carcinoma Experiment –BDS-05, January 2003

PI: Leland W. Chung, Ph.D. Co- I and Project Scientist/ Manager: **Thomas J. Goodwin, Ph.D.**