AGATA K. ZUPANSKA, PhD

Permanent Resident of the USA
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ACADEMIC EMPLOYMENT HISTORY

OCTOBER 2021-PRESENT

Principal Investigator and Research Scientist

The SETI Institute

Courtesy Assistant Professor

University of Florida
Department of Biology
McDaniel's Lab
https://mcdaniellab.biology.ufl.edu/

Lead on the NASA project aimed to detect how the effects of combined simulated chronic deep space **cosmic ionizing radiation** and sequential spaceflight microgravity (**ISS**) differ from those of cosmic ionizing radiation or microgravity alone on live **moss** growth, development and physiology, as reflected by changes in **gene expression**; to identify molecular response and physiological adaptation to these environments. Live *Ceratodon purpureus* colonies are exposed to high and low energy ion beams at NASA Space Radiation Laboratory (NSRL) at Brookhaven National Lab (BNL) followed by launch to the ISS and growth in orbit.

APRIL 2017 – APRIL 2018

Research Assistant Scientist

University of Florida
Materials Science and Engineering Department

Allen's Lab
http://allen.mse.ufl.edu/

Participation in two NASA projects to study human endothelial cells in microgravity. The **NASA/CASIS and STaAR project** focused on launching various vascular cell types on microcarrier beads to the **ISS**: primary endothelial cells (HUVEC), smooth muscle cells (HASMC) and endothelial cells differentiated from the blood circulating stem cells (CSC) obtained from donors. The second **GeneLab project** focused on the Rotator Wall Vessel (**RWV**) rotation of various cell types co-cultured on microcarrier beads or membranes. The effects of altered gravity environment were assessed in various assays including the **transcript expression**.

NOVEMBER 2014 – APRIL 2017

Research Assistant Scientist

University of Florida
Horticultural Sciences Department

UF Space Plants Lab
http://ufspaceplants.org/

Participation in multiple PLANTS SPACE BIOLOGY RESEARCH projects with primary focus on changes in **gene expression in microgravity** (experiments onboard **ISS**) or in other altered gravity environments (**parabolic flight, starfighter flight, clinorotation**). Studies on tissue culture cells on solid media (hardware: PDFU in BRIC), also on whole plant, root, hypocotyl, leaf tissue (hardware: ABRS-Advanced Biological Research System; VEGGIE-The Vegetable Production System; KFT- The Kennedy Space Center Fixation Tube). The gene expression assays included **microarrays, RNA-seq and RT-qPCR** analysis.

JANUARY 2010 – NOVEMBER 2014

Postdoctoral Associate

University of Florida
Horticultural Sciences Department

UF Space Plants Lab
http://ufspaceplants.org/

Participation in multiple PLANTS SPACE BIOLOGY RESEARCH projects with primary focus on changes in **gene expression in microgravity** (experiments onboard **ISS**) or in other altered gravity environments (**parabolic flight, starfighter flight, clinorotation**). Studies on tissue culture cells on solid media (hardware: PDFU in BRIC), also on whole plant, root, hypocotyl, leaf tissue (hardware: ABRS-Advanced Biological Research System; KFT- The Kennedy Space Center Fixation Tube). The gene expression assays included **microarrays** and **RT-qPCR** analysis.

JUNE 2006 – JULY 2008

Postdoctoral Associate

University of Florida
College of Veterinary Medicine

Allred's Lab

Study of the ves1alpha **gene family expression** in *Babesia bovis*, primarily using the **single-cell** RT-PCR approach.

EDUCATION

DOCTORATE (PhD)
NOVEMBER 2000 – DECEMBER 2004

The Nencki Institute of Experimental Biology
Cell Biology Department
Transcription Regulation Laboratory
Polish Academy of Science
Supervisor: Prof. Bozena Kaminska-Kaczmarek

Ph.D. thesis title:
"The transcriptional regulation of the cell cycle inhibitor p21WAF1/Cip1 in human T98G glioblastoma cells treated with Cyclosporin A".

MASTER OF SCIENCE (MS)
OCTOBER 1995 – JUNE 2000

Warsaw University
Biology Department
Institute of Genetics and Biotechnology
Supervisor: Prof. Piotr Weglenski

Study of the gene structure and gene expression in microorganisms isolated from ice samples collected in Antarctica.

SCIENTIFIC CAREER

List of Publications

1. Root Skewing-Associated Genes Impact the Spaceflight Response of Arabidopsis thaliana.
Brandon Califar, Natasha J. Sng, Agata K. Zupanska, Anna-Lisa Paul, Robert J. Ferl
Front Plant Sci. **2020** Mar 4; 11, 239. (PMID: 32194611)

2. HSFA2 Functions in the Physiological Adaptation of Undifferentiated Plant Cells to Spaceflight.
Agata K. Zupanska, Collin LeFrois, Robert J. Ferl, Anna-Lisa Paul
IJMS Special Issue Adaptation of Living Organisms in Space: From Mammals to Plants. **2019** Jan 17: 20(2), 390:1-36. (PMID: 30658467)

3. ARG1 functions in the physiological adaptation of undifferentiated plant cells to spaceflight.
Agata K. Zupanska, Eric R. Schultz, JiQiang Yao, Natasha J. Sng, Mingqi Zhou, Jordan B. Callaham, Robert J. Ferl, Anna-Lisa Paul
Astrobiology. **2017** Nov 17(11): 1077-1111. (PMID: 29088549)

4. Patterns of Arabidopsis gene expression in the face of hypobaric stress.
Anna-Lisa Paul, Mingqi Zhou, Jordan B. Callaham, Matthew Reyes, Michael Stasiak, Alberto Riva, Agata K. Zupanska, Mike A. Dixon, Robert J. Ferl
AoB PLANTS. **2017** July 07: 9(4):1-19.

5. Genetic dissection of the Arabidopsis spaceflight transcriptome: Are some responses dispensable for the physiological adaptation of plants to spaceflight?
Anna-Lisa Paul, Natasha J. Sng, Agata K. Zupanska, Aparna Krishnamurthy, Eric R. Schultz, Robert J. Ferl
PLoS One. **2017** Jun 29;12(6). (PMID: 28662188)

6. Dissecting Low Atmospheric Pressure Stress: Transcriptome Responses to the Components of Hypobaria in Arabidopsis.
Mingqi Zhou, Jordan B. Callaham, Matthew Reyes, Michael Stasiak, Alberto Riva, Agata Zupanska, Mike A. Dixon, Anna-Lisa Paul, Robert J. Ferl
Front Plant Sci. **2017** Apr 10;8:528. (PMID: 28443120)

7. Skewing in Arabidopsis roots involves disparate environmental signaling pathways.
Eric R Schultz, Agata Zupanska, Anna-Lisa Paul, Robert J Ferl
BMC Plant Biol. **2017** Feb 1;17(1):31. (PMID: 28143395)

8. Organ-specific remodeling of the Arabidopsis transcriptome in response to spaceflight.
Paul AL, Zupanska AK, Schultz ER, Ferl RJ
BMC Plant Biol. **2013** Aug 7;13:112. (PMID: 23919896)

9. Spaceflight engages heat shock protein and other molecular chaperone genes in tissue culture cells of Arabidopsis thaliana.
Zupanska AK, Denison FC, Ferl RJ, Paul AL
Am J Bot. **2013** Jan;100(1):235-48. (PMID: 23258370)

10. Testing the Bio-compatibility of Aluminum PDFU BRIC Hardware.
Eric R Schultz, Agata K Zupanska, Susan Manning-Roach, Jose Camacho, Howard Levine, Anna-Lisa Paul, Robert J Ferl
Gravitational and Space Biology. **2012** Oct; 26(2):48-63.

11. 14-3-3 phosphoprotein interaction networks - does isoform diversity present functional interaction specification?
Paul AL, Denison FC, Schultz ER, Zupanska AK, Ferl RJ
Front Plant Sci. **2012** Aug;3;190:1-14. Hypothesis and Theory Article. (PMID: 22934100)

12. Spaceflight transcriptomes: unique responses to a novel environment.
Paul AL, Zupanska AK, Ostrow DT, Zhang Y, Sun Y, Li JL, Shanker S, Farmerie WG, Amalfitano CE, Ferl RJ
Astrobiology. **2012** Jan;12(1):40-56. (PMID: 22221117)

13. 14-3-3 proteins in plant physiology.
Denison FC, Paul AL, Zupanska AK, Ferl RJ
Semin Cell Dev Biol. **2011** Sep;22(7):720-7. Review. (PMID: 21907297)

14. Performance of KSC Fixation Tubes with RNALater for orbital experiments: a case study in ISS operations for molecular biology.
Ferl RJ, Zupanska A, Spinale A, Reed D, Manning-Roach S, Guerra G, Cox D, Paul A-L
Adv Space Res. **2011** Jul;48(1):199-206.

15. Universal primers suitable to assess population dynamics reveal apparent mutually exclusive transcription of the Babesia bovis ves1alpha gene.
Zupańska AK, Drummond PB, Swetnam DM, Al-Khedery B, Allred DR
Mol Biochem Parasitol. **2009** Jul;166(1):47-53. (PMID: 19428672)

16. Alternative pathway of transcriptional induction of p21WAF1/Cip1 by cyclosporine A in p53-deficient human glioblastoma cells.
Zupanska A, Adach A, Dziembowska M, Kaminska B
Cell Signal. **2007** Jun;19(6):1268-78. (PMID: 17321721)

17. Cross-talk between Smad and p38 MAPK signalling in transforming growth factor beta signal transduction in human glioblastoma cells.
Dziembowska M, Danilkiewicz M, Wesolowska A, Zupanska A, Chouaib S, Kaminska B
Biochem Biophys Res Commun. **2007** Mar 23;354(4):1101-6. (PMID: 17276399)

18. Cyclosporine a induces growth arrest or programmed cell death of human glioma cells.
Zupanska A, Dziembowska M, Ellert-Miklaszewska A, Gaweda-Walerych K, Kaminska B
Neurochem Int. **2005** Nov;47(6):430-41. (PMID: 16087277)

19. The diversity of p53 mutations among human brain tumors and their functional consequences.
Zupanska A, Kaminska B
Neurochem Int. **2002** Jun;40(7):637-45. Review. (PMID: 11900859)

Other published articles

1. Elevating the Use of Genetic Engineering to Support Sustainable Plant Agriculture for Human Space Exploration
A **Topical White Paper for Submission to the Biological and Physical Sciences in Space Decadal Survey 2023-2032.** Natasha Haveman N, A. Mark Settles, Agata Zupanska, Thomas Graham, Bruce Link.

List of Abstracts

Published

1. Heat Shock Proteins in Response to the Spaceflight Environment- Arabidopsis thaliana in SPACE- a seminar at the Plant Molecular and Cellular Biology (PMCB) annual workshop, Daytona Beach, May 2011

2. Zupanska A., Drummond P., Al-Khedery B. and Allred D.R. (2007) Conserved structural motifs within the antigenically variant CKRD domain of the VESA1 protein of *Babesia bovis*.- poster and abstract, the MPM XVIII 2007 Wood Hole, MA, USA; Abstract #270C;

3. Zupanska A, Dziembowska M. and Kaminska B. (2003) ERK1/2 and c-Jun role in Cyclosporin A-induced p53 independent *p21waf1* expression. 16th IGB Meeting, Molecular Biology, Genetics and Pathology of AP-1 Transcription Factors, Capri, Italy Supplement; 74;

4. Zupanska A., Dziembowska M. and Kaminska B. (2002) The diversity of molecular mechanisms of cell death induced in human glioblastoma cells by cyclosporin A. *Glia* Abstracts Fifth European Meeting on Glial Cell Function in Health and Disease (Euroglia 2002) Supplement 1 May 2002; S21;

Areas of expertise: molecular biology

I. RNA and gene expression

1. RNA, totalRNA, smallRNA, picoRNA extractions from various biological specimens: plant cells, roots, hypocotyls, leaves, whole plant, mammalian cells, human cells, bacterial cells.
2. RNA preparations for microarray and RNAseq (spaceflight, parabolic flight, starfighter flight samples).
3. Microarrays, RNAseq, smallRNA arrays and SAGE data analysis.
4. RT-qPCR, TaqMan and SYBRGreen chemistry, RT-qPCR primer design, absolute quantification and ddCT method of transcript abundance calculations.
5. Website based tool kits for gene expression analysis: familiarity with multiple on-line available tools for gene expression analysis: gene ontology, functional categorization, co-expression networks, co-interaction.

II. DNA

6. DNA isolation, cloning, vector design and construction, transformation, transfection.
7. Semi-qPCR, inverse PCR.
8. Southern and Northern hybridization.
9. ChIP-chromatin immunoprecipitation.

III. cell culture

10. plant tissue culture cells.
11. eukaryotic cell culture (human and mammalian cell lines, intra-erythrocytic parasites cultures).
12. cell cultures on microcarrier beads, on transwell membranes.
13. bacterial cell culture.

IV. protein biochemistry

14. Western blotting, ELISA immunoassay, measurement of enzyme activity.

V. microscopy

15. basics: phase contrast microscopy, fluorescent imaging.

VI. stem cell isolation

16. isolation of the blood derived circulating stem cells (CSC) from the peripheral blood mononuclear cell (PBMC) fraction of adult human whole blood using density gradient centrifugation.

Most interesting flight experiments where actively participated

I. Spaceflight Experiments, flights to ISS onboard space shuttle (NASA) or Dragon space vehicle (SpaceX)

1. **BRIC-16**
   (STS-131, NASA space shuttle Discovery, April 2010)
   BIOLOGY: Tissue culture cells and etiolated seedlings, 12d 20hrs on orbit, in-flight fixed in RNAlater.

OBJECTIVE: molecular responses of the dedifferentiated cells to microgravity environment.
RESPONSIBILITIES: RNA extraction and microarray data analysis, ground-based complementary studies, writing research paper, submitting microarray experiment to the public databases: ArrayExpress and GEO.

2. **APEX-01/ABRS/TAGES**
(STS-129, NASA space shuttle Atlantis, November 2009 (Run 1B)
STS-130, NASA space shuttle Endeavour, February 2010 (Run 3A)
STS-131 NASA space shuttle Discovery April 2010 (Run 2A))
BIOLOGY: whole Arabidopsis thaliana plants, germinated on orbit, grown under light for 12 days on ISS in ABRS hardware, in-flight fixed in RNAlater.
OBJECTIVE: plant growth, transcriptome investigation in microgravity and tissue specific plant response to microgravity.
RESPONSIBILITIES: RNA extraction from whole plant or plant tissue, microarrays data analysis, ground-based complementary studies, submitting microarray experiment to the public databases: ArrayExpress and GEO.

3. **BRIC-17** (CRS-2, SpaceX space vehicle Dragon, March 2013)
BIOLOGY: tissue culture cells wild type and knockout lines, 10 days on orbit, in-flight fixed with RNAlater.
OBJECTIVE: investigating the spaceflight response in various tissue cell culture lines, the effects of disabling Arg1 gene, hypothesized to participate in gravity signal transmission and HsfA2 gene believed to be a master transcription factor for the execution phase of the response to microgravity, on dedifferentiated culture cells in microgravity.
RESPONSIBILITIES: knockout lines selection, experimental design and ground testing, SVT, PVT, setting up actual flight experiment, RNA extraction, microarray data analysis, writing two research papers.

4. **CARA** (CRS-3, SpaceX space vehicle Dragon, April 2014)
BIOLOGY: Arabidopsis thaliana plants of various genotypes, germinated on orbit, grown with or without light or for 11 days, in-flight fixed in RNAlater.
OBJECTIVE: investigation of how root senses the directional gravity and it grows when gravity is absent.
RESPONSIBILITIES: SVT, PVT sample analysis, RNA extraction from plant tissue.

5. **APEX-03** (CRS-5, SpaceX space vehicle Dragon, January 2015)
BIOLOGY: Arabidopsis thaliana plants of various genotypes, germinated on orbit, grown under light for 11, 8 or 5 days in VEGGIE hardware, in-flight fixed in RNAlater.
OBJECTIVE: investigation of molecular responses to the microgravity environment in knockout plants.
RESPONSIBILITIES: SVT, PVT sample analysis, RNA extraction from plant tissue, RNAseq data analysis.

6. **BS3** (CRS-17, SpaceX space vehicle Dragon, March 2019)
BIOLOGY: Human umbilical vein endothelial cells (HUVECs), Human Aortic Smooth Muscle Cells (HAOSMC), Endothelial Progenitor Cells grown on Cytodex-1 microcarrier beads in the EC hardware (Kryser, Italia), cultured in microgravity for 5 days or 8 days, in orbit in-flight fixed in RNAlater.
OBJECTIVE: investigation of molecular responses to the microgravity environment in different types of vascular cells.
RESPONSIBILITIES: experimental design and set up, ground testing and culture optimization, samples integration into the payload hardware, optimization of RNA extraction from fixed cells on the beads.

II. Parabolic Flight Campaign

7. February **2014** NASA Flight Opportunities sponsored **Parabolic Flight Campaign** at Johnson Space Center (JSC) on the Zero-G Corporation's (Arlington, Virginia, USA) Boeing 727 aircraft.
RESPONSIBILITIES: dual responsibilities with biology and the newly developed imaging system UF GIS Flex two units: "Bullwinkle" and "Rocky"; biology: experimental design, transportation to Johnson Space Center in Houston, in-flight harvesting activities including simplify version

of Kennedy Fixation Tubes (KFTs); samples and data analysis; imaging system: familiarizing with MaxIm DL Pro5 software and Relay Timer, programming imaging scenarios and sequences, photographing various GFP expressing plant genotypes during the parabolic flight.

8. September **2011** NASA Flight Opportunities sponsored **Parabolic Flight Campaign** at Johnson Space Center (JSC) on the Zero-G Corporation's (Arlington, Virginia, USA) Boeing 727 aircraft.
   RESPONSIBILITIES: experimental design, transportation to Johnson Space Center in Houston, in-flight harvesting activities; samples and data analysis.

9. May **2007** a **Parabolic Flight Campaign** at the NASA JSC Reduced Gravity Office on the NASA C9 aircraft.
   RESPONSIBILITIES: partial post-flight samples and data analysis.

III. Starfighter F104

10. April 2014, NASA Kennedy Space Center (KSC), **Starfighter F-104** aircraft: partial responsibilities with experimental design, post-flight harvesting activities; samples and data analysis.

The simulated microgravity experiments

I. 2-D Clinorotation

Plant Tissue Culture cells
BIOLOGY: Arabidopsis thaliana tissue culture cells on solid media, rotated up to 21 days.
OBJECTIVE: molecular responses of the dedifferentiated cells to the randomized gravity vector.
RESPONSIBILITIES: preparation, execution, RNA extraction and RT-qPCR transcripts abundance analysis.

II. 3-D Bioreactor (the Rotary Cell Culture System, Synthecon, NASA)

Human cell cultures
BIOLOGY: Endothelial Cells (ECs) (Human Umbilical Vein Endothelial Cells, HUVEC; Smooth Muscle Cells (SMCs) (Human Aortic Smooth Muscle Cells, HAOSMC); Endothelial Progenitor Cells (EPC) obtained from the Blood Circulating Stem Cells, on Cytodex-1 microcarrier beads, rotated in the STLV (Slow Turning Lateral Vessels) up to 21 days.
OBJECTIVE: molecular responses of the various vascular cell types to the randomized gravity vector.
RESPONSIBILITIES: preparation, execution, RNA extraction and RT-qPCR transcripts abundance analysis, and secreted protein ELISA assays.

MIAME-compliant data submissions to Public Data Repository

Gene Expression Omnibus (**GEO**, NCBI)

1. Series GSE95620 32 RNAseq (1280 fastq files) March 2017
2. Series GSE95582 32 RNAseq (1280 fastq files) March 2017
3. Series GSE95388 16 arrays (6 CEL files) February 2017
4. Series GSE95373 32 RNAseq (1280 fastq files) February 2017
5. Series GSE94983 36 RNAseq (462 fastq files) February 2017
6. Series GSE87905 consisting two subseries: GSE87903 34 arrays and GSE87904 72 arrays (106 CEL files) October 2016
7. Series GSE87869 consisting two subseries: GSE87867 33 arrays and GSE87868 9 arrays (42 CEL files) October 2016
8. Series GSE81442 18 arrays (18 CEL files) April 2016
9. Series GSE56658 24 arrays (24 CEL files) April 2014
10. Series GSE56659 36 arrays (36 CEL files) April 2014

ArrayExpress (EMBL-EBI)

11. E-MTAB-1009 24 arrays (24 CEL files) August 2012
12. E-MTAB-1264 36 arrays (36 CEL files) September 2013

GeneLab (NASA)

13. all abovementioned datasets

Membership

American Society for Gravitational and Space Research (ASGSR) 2013, 2015

Most Interesting Workshops

1. **May 2021** Quantitative Genomics of Space Biology Workshop, NASA's Biological and Physical Sciences, virtual meeting
2. **September 2015** RNA-Seq from Library Prep to BaseSpace Analysis, Illumina, University of Florida, ICBR
3. **April 2015** Gene Expression Profiling and 16s Sequencing, Illumina, University of Florida, ICBR
4. **May 2010, 2011 (speaker), 2012, 2013** PMCB Annual Workshops, Daytona Beach, Florida
5. **October 2012** Plant Phosphorylation Workshop Keystone, Colorado

Symposiums and Conferences

1. **November 2015** Florida Genetics Symposium, Gainesville, Florida
2. **November 2015** American Society for Gravitational and Space Research (ASGSR) Annual Meeting, Alexandria, Virginia
3. **October 2014** Florida Genetics Symposium, Gainesville, Florida
4. **November 2013** American Society for Gravitational and Space Research (ASGSR) Annual Meeting, Orlando, Florida
5. **October 2013** Florida Genetics Symposium, Gainesville, Florida

Grants and Fellowships

1. 22nd of **October 2021**- NASA Space Biology Program E.9; Grant Number: 80NSSC22K0208; Proposal Name: From Antarctica to Space: molecular response and physiological adaptation of moss to simulated deep space cosmic ionizing radiation and spaceflight microgravity.
2. 29th of **October 2008**- the distinction of excellence from Polish Academy of Science for the series of research on molecular mechanisms of invasiveness and vitality regulation in tumor cells (research series conducted during PhD studies).
2. **January 2004- December 2005** two years grant supported by State Committee for Scientific Research Grant.
3. **May 2002-April 2003**, one year grant supported by State Committee for Scientific Research.
4. Fellowship for participation in "V European Meeting on Glial cell Function in Health and Disease", **2002**, Roma, Italy.

Reviewer for Scientific Journals

American Journal of Botany, Asia Pacific Journal of Molecular Biology & Biotechnology, Astrobiology, BMC Plant Biology, Ecotoxicology, Genomics Data, Gravitational and Space Biology, Life Sciences in Space Research, Plant Physiology, Plant Physiology and Biochemistry, Planta, Planta Cell Reports

Reviewer for Research Grants Councils

1. **November 2011** The National Science Foundation, Unit: IOS - ORGANISM-ENVIRO INTERACTIONS (co-reviewer)
2. **May 2011** Division of Life Science, The Hong Kong University of Science and Technology

Other Reviewer Assignments

1. March 2013 LPI 360 Online assessment of the leadership behaviors for Prof. Anna-Lisa Paul
2. December 2012 Letter of recommendation for Prof. Kevin Folta candidacy to UF Postdoctoral Mentoring Award

Science Outreach Programs

November 2014 She's A Scientist: A Girl Scout Exploration Florida Museum of Natural History, Gainesville, Florida

Leadership Training Courses

UF Training & Organizational Development
1. Inspiring Trust (UF_SCS055_ILT), April 2016
2. Communication for Managers (UF_SCS014_ILT) April 2016
3. Surviving Problem Employees (UF_SCS300_ILT) April 2016

Other scientific related occupations

July 2005- April 2006 The Managing Editor position in Central European Journal of Biology (CEJB); Responsibilities: establishing and coordination of a newly launched scientific journal; Editorial Advisory Board and Editorial Board organization; authors invitations; journal promotion.

Languages

Polish- native
English – fluent
French - basic

Personal interests

I am a space nerd, I have read hundreds of books on the Universe, our solar system, dark matter and dark energy, search for other planets as well as on particle physics and quantum mechanics.
I love nature, wildlife, and the outdoors. I adore dogs and enjoy their companionship; I observe with utmost delight how they perceive or rather sense the world around them.
I am very active, and my favorite sport activities include daily hikes with the dogs, yoga, tennis, swimming, skiing.
In my leisure I preferably do jig-saw puzzles with my friends.