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TITLE: In Vivo Measurement of Drug Efficacy in Breast Cancer

PRINCIPAL INVESTIGATOR: Dr. Randy J. Giedt

CONTRACTING ORGANIZATION: MASSACHUSETTS GENERAL HOSPITAL
   BOSTON, MA 02114-2621

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TYPE OF REPORT: Annual

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   Fort Detrick, Maryland 21702-5012

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   Distribution Unlimited

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1. REPORT DATE  
October 2015

2. REPORT TYPE  
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30 Sep 2014 - 29 Sep 2015

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In Vivo Measurement of Drug Efficacy in Breast Cancer

5a. CONTRACT NUMBER  
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W81XWH-14-1-0386

5c. PROGRAM ELEMENT NUMBER

5d. PROJECT NUMBER

5e. TASK NUMBER

5f. WORK UNIT NUMBER

6. AUTHOR(S)  
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MASSACHUSETTS GENERAL HOSPITAL  
55 FRUIT ST  
BOSTON MA 02114-2621

8. PERFORMING ORGANIZATION REPORT NUMBER
The focus of this project is to understand how how nano-encapsulated formulations of common chemotherapies work in vivo by developing and utilizing intravital methods for studying drug and nanoparticle function in mouse breast cancer models. We hypothesize that, firstly, we can develop longitudinal breast cancer specific methods of imaging common chemotherapies and their nanoparticle equivalents. Secondly, we hypothesize that encapsulated drugs will be more effective in terms of specific cell responses as they achieve longer exposure times than unencapsulated drugs. Overall, this work will result in the creation of a breast cancer centered platform for drug development and analysis. At the clinical level, this study will result in pertinent data regarding several agents currently in clinical trials. At the basic science level, we will work to understand the heterogeneity of cell responses to drug treatments. Thus, we believe this project has potential impact in both the near and long term for breast cancer treatment.
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</tbody>
</table>
1. INTRODUCTION
The focus of this project is to understand how nano-encapsulated formulations of common chemotherapies work in vivo by developing and utilizing intravital methods for studying drug and nanoparticle function in mouse breast cancer models. We hypothesize that, firstly, we can develop longitudinal breast cancer specific methods of imaging common chemotherapies and their nanoparticle equivalents. Secondly, we hypothesize that encapsulated drugs will be more effective in terms of specific cell responses as they achieve longer exposure times than unencapsulated drugs. Overall, this work will result in the creation of a breast cancer centered platform for drug development and analysis. At the clinical level, this study will result in pertinent data regarding several agents currently in clinical trials. At the basic science level, we will work to understand the heterogeneity of cell responses to drug treatments. Thus, we believe this project has potential impact in both the near and long term for breast cancer treatment. During Year 1, this project has focused on goals including setting up and optimizing imaging and image processing methodologies in anticipation of conducting drug testing in year 2 of the project.

2. KEYWORDS
Breast Cancer, Intravital Imaging, Nanoparticles, Pharmacokinetics/Pharmacodynamics, Chemotherapy, Drug Distribution

3. ACCOMPLISHMENTS
What were the major goals of the project?
The major goals of this project for year 1 have focused on the setup of mouse models, tumor cell genetic reporters, fluorescent drugs, and imaging algorithms. Specific SOW goals for Year 1 and their percentages of accomplishment are shown in Table 1.

Table 1: Specific Tasks for Grant Aim 1

<table>
<thead>
<tr>
<th>Specific Aim 1: Create and validate a breast cancer centered single cell PK/PD Platform</th>
<th>Months</th>
<th>GSU</th>
<th>% Complete</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subtask 1a-1: Optimize Imaging Models. (5-20 mice).</td>
<td>3-9</td>
<td>Dr. Giedt</td>
<td>100%</td>
</tr>
<tr>
<td>Subtask 1a-2: Creation of breast cancer reporter cell lines: MDA-MB-231, MDA-MB-436, HCC1395, HCC1937, HCC38, MCF-7, SKBR3. Source: ATCC.</td>
<td>1-6</td>
<td>Dr. Giedt</td>
<td>100%</td>
</tr>
<tr>
<td>Subtask 1b: Development of image processing techniques</td>
<td>3-12</td>
<td>Dr. Giedt</td>
<td>100%</td>
</tr>
<tr>
<td>Subtask 1c: Development of mathematical models</td>
<td>9-12</td>
<td>Dr. Giedt</td>
<td>100%</td>
</tr>
</tbody>
</table>

Milestone Achieved: Creation of a breast cancer specific PK/PD platform

What was accomplished under these goals?
1. Breast Cancer Reporter Cell Lines (100% Complete):
This goal encompassed two tasks: Firstly, understanding which of the described cell lines in the grant would function as suitable orthotopic models in nude mice, and 2. Creating reporter cell lines with the suitable cells discovered. We therefore began this goal by testing the growth of 6
common breast cancer cell lines in mammary fat pad injections in nude mouse models. Growth results are presented in Table 2:

Table 2: Breast Cancer Cell Line Growth

<table>
<thead>
<tr>
<th>Cell Line</th>
<th>Growth Characterization</th>
</tr>
</thead>
<tbody>
<tr>
<td>MDA-MB-231</td>
<td>Excellent Growth</td>
</tr>
<tr>
<td>MDA-MB-436</td>
<td>Average Growth</td>
</tr>
<tr>
<td>HCC-1395</td>
<td>Slow Growth</td>
</tr>
<tr>
<td>HCC38</td>
<td>Slow Growth</td>
</tr>
<tr>
<td>MCF-7</td>
<td>Slow Growth, estradiol supplement necessary</td>
</tr>
<tr>
<td>SKBR3</td>
<td>Average Growth, metastasis noted</td>
</tr>
</tbody>
</table>

Following viability studies of these cell lines, we worked to create fluorescent reporter versions of breast cancer specific cell lines for downstream nanoparticle drug use. As many of the proposed drugs function as cell cycle or DNA damage inhibitors, we focused on reporters for these specific functions. Figure 1 below shows imaging examples of these fluorescent reporters in newly created cell lines.

To briefly describe the most critical PD reporters:

**53-BP-1**: To develop an in vivo single-cell pharmacodynamic assay to measure DSBs following olaparib treatment, we chose 53BP1 as a DSB reporter, which has previously been used to measure DNA damage in live cells. Specifically, we fused a truncated portion of 53BP1 (amino acids 1220-1711) to Apple fluorescent protein (53BP1trunc-Apple). Apple fluorescent protein was used for in vivo imaging due to its increased brightness over mCherry, which is critical for successful imaging in live tissue. The truncated version of 53BP1 retains its ability to bind to sites of DSBs, but lacks the known functional domains of 53BP1. Moreover, we show that 53BP1trunc-Apple localizes to sites of double-strand breaks with an antibody targeting the
canonical marker of double-strand breaks, γH2A.X. For additional information please see Yang et. al. 2015.

**FUCCI:** Fluorescent ubiquitination-based cell cycle indicator (Fucci) is a sophisticated technology which can determine G1 and/or S/G2/M phases of the cell cycle. The technology analyzes living cells in a spatio-temporal manner using a dual color scheme of orange and green. Fucci was successfully established by intelligently utilizing ubiquitin-proteasome protein degradation system. For additional information see Sakaue-Sawano et. al. 2008.

In addition to these PD reporters, we have created a variety of breast cancer cell lines expressing localization reporters such as H2B-Apple, Membrane-Apple, and Actin-Apple, which we anticipate will prove valuable for applications such as drug localization studies.

2. Development of image processing techniques and Mathematical models (100% Complete)

Image processing for this project will utilize modified versions of Matlab code (Giedt et. al. PLoS One, 2012) and recently designed programming designed for automatically measuring pharmacodynamic output (Yang, Sci. Reports, 2015) that was developed over the course of this year. Our goal is to be able to combine outputs of drug distribution (pharmacokinetics, PK),

![Figure 2](image-url)

Figure 2: In vivo quantification of the fold change in foci formation in HCC1937 53BP1-Apple cells grown in nude mice. a) The fold change in the number of foci was determined relative to day 0 of treatment with 100 mg/kg olaparib. Error bars represent the standard error of the mean for n=2 mice. (b) Olaparib-Bodipy FL nuclear uptake in a nu/nu mouse with an HCC1937 tumor. The 53BP1trunc-Apple reporter (red nuclei, left) was imaged 2 hrs after IV administration of olaparib-Bodipy FL (green, center). Images from the 53BP1trunc-Apple (red) channel and the olaparib-Bodipy FL (green) channel were overlaid (merge, right) to show that olaparib-Bodipy FL accumulates in all HCC1937 tumor cell nuclei. Scale bar = 20 μm.
which will be monitored via fluorescent tags attached to either drugs, nanoparticles or both, with fluorescent reporters of single cell response (pharmacodynamics, PD) as described. Cell response reporters such as FUCCI for cell cycle inhibitors or 53BP1 for DNA damage (Figure 1) are ideal for the drugs proposed in this grant.

To this end, we have designed optimized codes over this year for analysis of these targets. Figure 2 displays recently published output generated from 53BP1 in breast cancer cells imaged in vivo, and analyzed automatically utilizing Matlab code developed in Year 1 of this grant. As shown, treatment with olaparib in vivo resulted in a quantifiable increased in 53BP1 puncta verifying the efficacy of this system for analyzing single cell evaluation of breast cancer tumor cell response to DNA damaging agents such as Olaparib (proposed in Aim 3 of the initial grant). Similarly, FUCCI cells both in vitro and in vivo proved efficacious for follow on studies in a breast cancer model.

Work on drug distribution analysis is based on the published work found in Giedt et. al. PLoS one with minor modifications (Figure 3). Briefly, this code functions by first, acquiring in vivo serial fluorescent images of the distribution of fluorescently labeled drugs injected IV in mice expressing fluorescent marked tumors. Following user inputs for initial values for thresholding, images are run through a brief filtering algorithm to enhance image contrast and...
then thresholding. Thresholding for in vivo imaging is conducted by an algorithm based on Ray’s method (see Ray N, Saha BN (2009) Edge Sensitive Variational Image Thresholding. ICIP) in which local areas are thresholded without regard to their surrounding environment. Thresholding conducted in this manner has several advantages for in vivo imaging analysis. Firstly, microscope areas with heterogeneous fluorescence are normalized without artifacts from such a methodology. Secondly, cells at varying heights can be either analyzed or not in a binary fashion based on a quick thresholding analysis in a reliable manner with such a method. Finally, this thresholding allows for fully automated image analysis with extremely limited user input, allowing for statistically significant analysis.

Following thresholding, a basic erosion/dilation method was applied to filter any speckling artifacts found in images, and objects were labeled. Utilizing labeled objects has allowed us to adapt tracking code from a collaborators group (see Jaqaman et. al., Nature Methods 5, pp. 695 - 702 (2008)) to be able to gain information at individual cell level of drug uptake, despite moving cells found in vivo. Analysis of drug uptake in cells is conducted by simple overlay of cell boundaries found from thresholded images onto drug distribution images. While this technique can suffer from possible imaging/ quantification artifacts from Z-plane differences in drug levels, we anticipate verifying drug/ NP concentrations via serial blood draws from mice during the course of experiments during Year 2. In testing this system in vivo with breast cancer models, we were able to successfully segment images and derive drug uptake from fluorescently labeled Olaparib. Work is ongoing for Year 2 to create further fluorescently labeled drug agents.

What opportunities for training and professional development has the project provided?

Table 3: SOW Goals for training and professional development.

<table>
<thead>
<tr>
<th>Major Task 1: Training and educational development in breast cancer research</th>
<th>Months</th>
<th>GSU</th>
<th>% Complete</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subtask 1: Attend bi-weekly scientific talks at MGH focusing on cancer biology.</td>
<td>1-36</td>
<td>Dr. Giedt</td>
<td>100</td>
</tr>
<tr>
<td>Subtask 2: Attend monthly scientific talks focusing on apoptosis and cancer (Harvard Medical School - Longwood)</td>
<td>1-36</td>
<td>Dr. Giedt</td>
<td>100</td>
</tr>
<tr>
<td>Subtask 3: Attend tri-monthly scientific “T-32 Trainee” scientific talks focusing on cancer biology.</td>
<td>1-36</td>
<td>Dr. Giedt</td>
<td>100</td>
</tr>
<tr>
<td>Subtask 4: Attend and present at yearly cancer/ breast cancer meetings (e.g. AACR, ASCO, others).</td>
<td>1-36</td>
<td>Dr. Giedt</td>
<td>100</td>
</tr>
<tr>
<td>Subtask 5: Attend breast cancer conferences at the DF Harvard Cancer center (and others if available, e.g. at MSKCC) and present data/posters</td>
<td>1-36</td>
<td>Dr. Giedt</td>
<td>100</td>
</tr>
<tr>
<td>Subtask 6: Present ongoing project results for feedback in weekly lab meetings.</td>
<td>1-36</td>
<td>Dr. Giedt</td>
<td>100</td>
</tr>
<tr>
<td>Subtask 7: Weekly meetings with mentor and co-mentor</td>
<td>1-36</td>
<td>Dr. Giedt</td>
<td>100</td>
</tr>
</tbody>
</table>
This project has provided numerous opportunities for professional development, consistent with the training plan established in the accepted grant proposal. Specific numbers of lecture sessions attended in the MGH/ Harvard community is presented in Table 4 summarizing relevant scientific discussions. Briefly, these lectures focused on Breast Cancer to the extent possible, cancer in general, and new technologies and animal manipulation methods which are directly applicable to project goals.

Table 4: Number of Lectures attended for required educational opportunities.

<table>
<thead>
<tr>
<th>Lecture Series</th>
<th>Location</th>
<th>Number of Lectures Attended</th>
</tr>
</thead>
<tbody>
<tr>
<td>Center for Systems Biology Scientific Talks</td>
<td>Mass General, Simches, 3rd Floor</td>
<td>9</td>
</tr>
<tr>
<td>Mass General Hospital Cancer Center Grand Rounds</td>
<td>Mass General, Simches, 3rd Floor</td>
<td>~ 20</td>
</tr>
<tr>
<td>NIH T32 Post-doctoral Fellow Lectures</td>
<td>Mass General, Haber Auditorium, Blake 1</td>
<td>4</td>
</tr>
<tr>
<td>Harvard Department of Systems Biology Apoptosis Meeting</td>
<td>Harvard Medical School, 563 Warren Alpert</td>
<td>11</td>
</tr>
<tr>
<td>Mass General Hospital Responsible Conduct of Research Lectures</td>
<td>Mass General, Variable</td>
<td>4</td>
</tr>
<tr>
<td>Mass General Hospital Office of Career Development Lectures</td>
<td>Mass General, Variable</td>
<td>3</td>
</tr>
<tr>
<td>MGH Systems Biology Lab Meetings</td>
<td>Mass General, Simches, 5th Floor</td>
<td>~ 40</td>
</tr>
<tr>
<td>JAX Onsite Animal Training</td>
<td>Mass General, Simches 3rd Floor</td>
<td>2</td>
</tr>
</tbody>
</table>

In addition to regular lectures, this grant also enabled travel to one American Association for Cancer Research Meeting (held jointly with the Society of Nuclear Medicine and Molecular Imaging), titled “State of the Art Molecular Imaging in Cancer Biology and Therapy”. The focus of this meeting was highly relevant to the grant aims presented here, as sessions included a
focus on molecular imaging along with emerging treatment and therapeutic methods across a wide spectrum of cancer research.

**How were the results disseminated to communities of interest?**
Thus far preliminary results from this project have been discussed in weekly lab group lab meetings. Primary results from this project will be published with the completion of imaging experiments. Dissemination of peripheral work for this project (imaging methods, math models) took place at a joint conference between AACR-SNMMI with a poster presentation titled, “Automated analysis of drug distribution in intravital imaging” as well as publications noted below.

**What do you plan to do during the next reporting period to accomplish the goals?**
During the next reporting period, we plan to focus on drug and Nanoparticle development for several firstling drugs (taxol, cisplatin, PARP inhibitors, potentially vineblastine and other chemotherapy agents as described in the initial grant) and testing results in mouse breast cancer models. Work is currently ongoing focused on generation of fluorescently labeled versions of common chemotherapy agents which will be combined with fluorescent nanoparticles described in the initial grant application.

4. **IMPACT**

**What was the impact on the development of the principal discipline(s) of the project?**
Nothing to report.

**What was the impact on other disciplines?**
Nothing to report.

**What was the impact on technology transfer?**
Nothing to report.

**What was the impact on society beyond science and technology?**
Nothing to report.

5. **CHANGES/ PROBLEMS**

**Changes in approach and reasons for change?**
We anticipate the approach will remain the same as described in the original award.

**Actual or anticipated problems or delays and actions or plans to resolve them?**
No delays or problems were encountered during this reporting period.

**Changes that had a significant impact on expenditures?**
There were no changes to expenditures.

**Significant changes in use or care of human subjects, vertebrate animals, biohazards, and/ or select agents?**
There are no changes to report in the use of animals, biohazards or select agents.

6. PRODUCTS

Journal publications
Due to this training award, PI was published on the following papers during this funding period:
Published Papers:

Submitted Papers:

Books or other non-periodical, one-time publications
Nothing to report.

Other publications, conference papers, and presentations
Conference Presentation:
“State of the Art Molecular Imaging in Cancer Biology and Therapy” - AACR Meeting

Websites or other Internet site(s)
Nothing to report.

Technologies or techniques
Nothing to report.

Inventions, patent applications and/or licenses
Nothing to report.

Other products
Nothing to report.
7. PARTICIPANTS & OTHER COLLABORATING ORGANIZATIONS

What individuals have worked on the project?

<table>
<thead>
<tr>
<th>Name</th>
<th>Randy J Giedt</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Role</td>
<td>PI/ Research Fellow</td>
</tr>
<tr>
<td>Researcher Identifier</td>
<td>ORCID 0000-0001-8327-6069</td>
</tr>
<tr>
<td>Nearest person month worked</td>
<td>12</td>
</tr>
<tr>
<td>Contribution</td>
<td>Dr. Giedt is the PI of this post-doctoral Fellowship and as such has conducted all research on this grant as well as attending required trainings as described in the original application.</td>
</tr>
<tr>
<td>Funding Support</td>
<td>DOD BCRP Post-doctoral Fellowship</td>
</tr>
</tbody>
</table>

Has there been a change in the active other support of the PD/PI(s) or senior/ key personnel since the last reporting period?

No changes have occurred in the PIs funding for this project.

What other organizations were involved as partners?

Nothing to report.

8. SPECIAL REPORTING REQUIREMENTS

Quad Chart:

In Vivo measurement of drug efficacy in breast cancer

**BCRP-132081**

**PI:** Giedt, Randy J  
**Org:** Massachusetts General Hospital/ HMS  
**Award Amount:** $516K

**Study/Product Aim(s)**

- Training and educational development in breast cancer research
- Create and validate breast cancer PK/PD platform
- Investigate targeted nanofomulations for drug delivery
- Measure PK/PD of a model PARP inhibitor in breast cancer

**Approach**

The focus of this project is to understand how nano encapsulated formulations of common chemotherapies work in vivo by developing and utilizing intravital methods for studying drug and nanoparticle function in mouse breast cancer models. We hypothesize that, firstly, we can develop longitudinal breast cancer specific methods of imaging common chemotherapies and their nanoparticle equivalents. Secondly, we hypothesize that encapsulated drugs will be more effective in terms of specific cell responses as they achieve longer exposure times than unencapsulated drugs. Overall, this work will result in the creation of a breast cancer centered platform for drug development and analysis. At the clinical level, this study will result in pertinent data regarding several agents currently in clinical trials. At the basic science level, we will work to understand the heterogeneity of cell responses to drug treatments. Thus, we believe this project has potential impact in both the near and long term for breast cancer treatment.

**Timeline and Cost**

<table>
<thead>
<tr>
<th>Activities</th>
<th>CY 15</th>
<th>CY 16</th>
<th>CY 17</th>
</tr>
</thead>
<tbody>
<tr>
<td>Training in Breast Cancer</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Create/Validate PK/PD platform</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Investigate targeted Nanoform</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Measure PK/PD of Parp</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Estimated Budget ($K)</td>
<td>$172k</td>
<td>$172K</td>
<td>$172K</td>
</tr>
</tbody>
</table>

**Updated:** (10-26-2015)

**Goals/Milestones**

- **CY15 Goal – Create Validate PK/PD Platform**
- **Demonstrate new methods and analysis software in mouse model**
- **CY16 Goals – Investigate targeted Nanoformulations**
- **Test common chemotherapy agents in NP formulations**
- **CY17 Goal – Measure PK/PD of Parp inhibitors**
- **PK/PD Drug Response Measurements**
- **Comments/Challenges/Issues/Concerns**
  - N/A
Randy James Giedt

EDUCATION
The Ohio State University
Columbus, OH
  Doctor of Philosophy, Biomedical Engineering
  June 2012

The Ohio State University
Columbus, OH
  Master of Science, Biomedical Engineering
  June 2009

South Dakota State University
Brookings, SD
  Bachelor of Science, Mechanical Engineering, Cum Laude
  May 2007
  • Minor degree, Biology

RESEARCH EXPERIENCE
Massachusetts General Hospital, Harvard Medical School
  Boston, MA
  Post-doctoral Fellow/ Research Fellow
  August 2012 – Current

The Ohio State University, Davis Heart and Lung Research Institute
  Columbus, OH
  Graduate Research Associate
  2007 - 2012

Hub City Manufacturing, Engineering Department
  Aberdeen, SD
  Engineering Intern
  Summers 2005, 2006

TEACHING EXPERIENCE
The Ohio State University, Department of Biomedical Engineering
  Columbus, OH
Graduate Teaching Assistant
2009-2010
• Assisted with courses including Numerical Simulations in BME, Biomaterials, Biotransport and Introduction to Matlab.

The Ohio State University, Department of Mechanical Engineering
Columbus, OH
Graduate Teaching Assistant
Fall 2007
• Instructed engineering Measurements Lab (Signal processing, pressure measurement, and fluid flow measurement).

Fellowship and Grant Support
   Role: PI

2. 2011-2012 American Heart Association Pre-doctoral Fellowship . Role: PI

AWARDS AND HONORS
1. 2011 Best Overall Presentation, The Ohio State University Biomedical Engineering Department Research Conference.

2. 2010 1st Place: The Ohio State University Edward F. Hayes Graduate Research Forum, Science and Technology Poster Division.

3. 2009 Travel Award from the Biomedical Engineering Society (BMES).

4. 2009 Best Poster Presentation under the “Molecular, Cellular, & Tissue Engineering” track, The Ohio State University Biomedical Engineering Department Research Conference.

PEER REVIEWED PUBLICATIONS


* Denotes Equal Project Effort.

**BOOK CHAPTERS**


**MANUSCRIPT REVIEWS**

Ad hoc peer reviewer for manuscripts submitted to:

1. *Molecular Pharmaceutics*

**SELECTED PRESENTATIONS**


• **Giedt RJ**, Pfeiffer DR, Matzavinos A, Kao CY, Alevriadou BR. Image analysis of dynamic changes in mitochondrial motion and shape inside living vascular endothelial cells: Role of bioenergetics. Presented at the Davis Heart and Lung Research Day, October 2011 (Columbus, OH).

• **Giedt RJ**, Pfeiffer DR, Matzavinos A, Kao CY, Alevriadou BR. Image analysis of dynamic changes in mitochondrial motion and shape inside living vascular endothelial cells: Role of bioenergetics. Presented at the Ohio State University Biomedical Engineering Conference, September 2011 (Columbus, OH).


• **Giedt RJ**, Yang C, Matzavinos A, Praetorius-Ibba M, Zweier JL, Alevriadou BR. Mitochondrial network morphology changes, mechanisms and consequences in postischemic vascular endothelial cells. Presented at the Ohio State University Biomedical Engineering Conference, September 2010 (Columbus, OH).


• **Giedt RJ**, Matzavinos A, Alevriadou BR. Analysis of mitochondrial morphology in postischemic vascular endothelial cells. Presented at the American Heart Association 2010 Young Researchers Reception, April 2010 (Columbus, OH).

• **Giedt RJ**, Jones CI, Alevriadou BR. Mitochondrial superoxide radical generation in endothelial cells exposed to hemodynamic forces. Presented at the Biomedical Engineering Society (BMES) Annual Meeting, October 2009 (Pittsburgh, PA).

• **Giedt RJ**, Jones CI, Galbraith VK, and B.R. Alevriadou. Real-time detection of mitochondrial superoxide radicals in endothelial cells exposed to ischemia/reperfusion injury. Presented at the Ohio State University Biomedical Engineering Conference, May 2009 (Columbus, OH).
Giedt RJ, Jones CI, Galbraith VK, Alevriadou BR. Mitochondrial superoxide levels in endothelial cells exposed to changes in flow and oxygen tension. Presented at The Ohio State University Conference “Engineering and Medicine: The Prescription for an Aging Population”, November 2008 (Columbus, OH).

Giedt RJ, Jones CI, Galbraith VK, Alevriadou BR. Mitochondrial superoxide levels in endothelial cells exposed to changes in flow and oxygen tension. Presented at the Davis Heart and Lung Institute Research Day, November 2008 (Columbus OH).

Giedt RJ, Jones CI, Galbraith VK, Alevriadou BR. Mitochondrial superoxide levels in endothelial cells exposed to changes in flow and oxygen tension. Presented at the BMES Annual Meeting, October 2008 (St. Louis, MO).

SERVICE

- 2011 Assistant at University Community Health Care Day – University Hospital East (assisted persons without health care coverage in getting free screenings).
- 2010 Ray Travel Award Judge (Examined graduate student research applications for merit to determine graduate school allocations of travel funds).
- 2007 Brookings County Youth Mentorship Program (Mentored at risk community youth).

PROFESSIONAL MEMBERSHIPS

- 2008 Biomedical Engineering Society.
- 2005 Tau Beta Pi (Engineering Honor Society, awarded to top 1/8 of Junior Class).
- 2004 Pi Tau Sigma (Mechanical Engineering Honor Society, awarded to top 1/4 of Junior Class).
- 2002 American Society of Mechanical Engineers (ASME).