

2007
Annual Report



Life Sciences
Education and Research
@ MichiganTech

Yet another Successful Year!!

We are glad to present this progress report of the Biotechnology Research Center (BRC) for the year 2006-2007 during which the BRC continued to grow in membership, productivity and initiatives. The Faculty membership has now reached to 23 spanning 3 Colleges/Schools and 7 departments. Several major federal agencies, including NSF, NIH, DOE, EPA, USDA and various foundations and industries, have funded projects submitted by the BRC members, totaling over **\$11 million**. The BRC research expenditures were also on the rise, totaling over **\$3 million** in FY07, and ranking fifth among similar centers on Michigan Tech Campus. Collectively, the BRC faculty mentored **61** graduate students, **82** undergraduate students, **16** high school students or interns, and **23** research scientists/associates. BRC also sponsored **12** graduate student and post-doc Travel Awards, and co-sponsored the Annual Graduate Student Research Forum for the third time in-a-row and presented **3** Poster Awards. The BRC faculty hosted its **second** annual Biotechnology Open House in March 2007 showcasing various research activities and promoting research interactions among the campus community members. In addition, a 2-year **\$90K** initiative for infrastructure improvement was launched in 2006, and so far BRC has committed **\$89K** match toward equipment purchase with a total value of over **\$235K**. These investments have already helped to strengthen biotechnology infrastructure on Michigan Tech campus. Dr. Chung-Jui Tsai who successfully led the center since 2003 has completed her term and I am elected as the next Director of the Center. We are looking forward to continuation of this success story in the next year with the help of all BRC members.

Sincerely yours,

Shekhar Joshi

Chandrashekhar P. Joshi
Director



BRC 2007 at a Glance

23 Faculty members
49 Ph.D. students
12 M.S. students
82 Undergraduate students
10 High school students
6 Summer Interns
23 Research scientists/associates
63 Peer-reviewed publications
36 Active research projects
\$1,899,804 New research funding
\$11,205,942 Total research funding
\$3,064,010 Total research expenditures

New BRC Members

An important goal of the Biotechnology Research Center is to continue to grow its membership from the Michigan Tech community whose research interests in the life sciences match the mission of the BRC. We welcomed three new members to BRC: **Rupak Rajachar**, *Biomedical Engineering*, **Haiying Liu**, *Chemical Sciences* and **Jacqueline Grant**, *School of Forest Resources and Environmental Science*. **Total Members: 23**

Current BRC Members:

Susan Bagley	Professor, Biological Sciences
Victor Busov	Assistant Professor, SFRES
Huann-Sheng Chen	Associate Professor, Mathematical Sciences
Seth Donahue	Associate Professor, Biomedical Engineering
Ryan Gilbert	Assistant Professor, Biomedical Engineering
Jeremy Goldman	Assistant Professor, Biomedical Engineering
Jacqueline Grant	Assistant Professor, SFRES
Michael Gretz	Professor, Biological Sciences
Scott Harding	Research Associate Professor, SFRES
Tammy Haut Donahue	Associate Professor, ME-EM
Patricia Heiden	Associate Professor, Chemical Sciences
Chandrashekhar Joshi	Director, Associate Professor, SFRES
Haiying Liu	Assistant Professor, Chemistry
Pushpalatha Murthy	Professor, Chemistry
Keat Ghee Ong	Assistant Professor, Biomedical Engineering
Rupak Rajachar	Assistant Professor, Biomedical Engineering
David Shonnard	Professor, Chemical Engineering
Martin Thompson	Assistant Professor, Chemistry
Chung-Jui Tsai	Professor, SFRES
Leah Vucetich	Research Assistant Professor, SFRES
Ramakrishna Wusirika	Assistant Professor, Biological Sciences
Heather Youngs	Assistant Professor, Biological Sciences
Shuanglin Zhang	Associate Professor, Mathematical Sciences
Mary Tassava	Staff Assistant

Faculty Member Honors

Shuanglin Zhang, Outstanding Research Award, Department of Mathematical Sciences, Michigan Technological University, 2006

Students and Researchers Supported

In FY07, the BRC continued its strong commitment to our graduate and undergraduate students by offering excellent research opportunities and providing financial support through scholarships and fellowships to 61 graduate students currently participating in the BRC activities at Michigan Technological University. The BRC faculty members also mentored over 80 undergraduate students who demonstrate an interest in research in biotechnology areas. BRC faculty members continue to sponsor REU and high school student interns as well volunteering in outreach activities and Summer Youth Programs. The BRC members are encouraged to reach out to both graduate and undergraduate students who are interested in the research being conducted at the Center.

High School Students

NSF Plant Genome Summer Youth Programs
(Tsai and Harding)

Jacob Hand (Bullock Creek High School, Midland, MI)
Terrence Martin (Creston High School, Grand Rapids, MI)
Mengya Li (Houghton High School, Houghton, MI)
Dan Friedrich (Houghton High School, Houghton, MI)
Kelly Suvanto (Houghton High School, Houghton, MI)
Sydney Pea (Lewis Cass Technical High School, Detroit, MI)
Alejandra Romero (Lewis Cass Technical High School, Detroit, MI)
Alicia Romero (Lewis Cass Technical High School, Detroit, MI)
Michael Outinen (Marquette Senior High School, Marquette, MI)
Forrest Sherman (Marquette Senior High School, Marquette, MI)



Outreach/Summer Interns:

Jesus Glaus, University of Sonora (Thompson)
Anna Polso, Grand Valley State University (Tsai)
Ayushi Kawatra, University of Michigan (Joshi)
Lee Ries, REU, University of Rochester, Chemical Engineering (Shonnard)
Sourabh Khan, IIT Kharagpur (Heiden)
Dan Graham, MTU/SFRES (Grant)

Undergraduates (82 students)

Anwar Aglan, Chemical Engineering (Shonnard)
Heather Aho, MEEM (Haut Donahue)
Kelsey Aird, Biological Sciences (Busov)
Lindsay Barlow, Biomedical Engineering (Donahue)
Benjamin Baer, Chemistry (Tsai)
Nate Bowersock, FRES (Vucetich)
Holly Burger, Biological Sciences (Gretz)
Erin Brandt, Biological Sciences (Grant)
Joshua Brinks, FRES (Vucetich)
Katrina Bugielski, Chemistry (Thompson)
John Buzzo, Biological Sciences (Busov/Youngs)
Marcus Carli, Biological Sciences (Gretz)

Heather Chaillier, Chemical Engineering (Shonnard)
Jared Cregg, Biomedical Engineering (Gilbert)
Andrew Delvaux, Biomedical Engineering (Gilbert)
Stephanie Drake, Biomedical Engineering (Tsai)
Josh Dykla, Biomedical Engineering (Gilbert)
Katie Elicerio, Biomedical Engineering (Ong)
Bryna Fahrner, Biomedical Engineering (Donahue)
Justine Farina, Biomedical Engineering (Ong)
Christian Fenton, Biomedical Engineering (Gilbert)
Kristina Flesher, Forestry (Joshi)
Elaan Fox, Biological Sciences (Youngs)
Robin Fu, Biomedical Engineering (Wusirika)
Garrett Gibbons, Chemistry (Murthy)
Sara Gibbs, Biomedical Engineering (Goldman)
Idaliza Gomez, Biology (Tsai)
Justin Gray, Chemistry (Murthy)
Sarah Gray, Biomedical Engineering (Donahue)
Elizabeth Haibel, Chemical Engineering (Youngs)
Jesse Hansen, Civil Engineering (Harding)
Tara Hansen, Biological Sciences (Haut Donahue)

Richard Heglund, Biomedical Engineering (Rajachar)
Brock Horton, Biomedical Engineering (Ong)
Tendeukai Hungwe, Biological Sciences (Gretz)
Samantha Jang-Stewart, Biomedical Engineering (Rajachar)
Logan Janka, Biomedical Engineering (Rajachar)
Karen Jarvey, MEEM, (Haut Donahue)
Brett Jenkins, Biomedical Engineering (Donahue)
Brandon Johnson, Biomedical Engineering (Gilbert)
Rebecca Klank, Biomedical Engineering (Gilbert)
Eric Koronka, Forestry (Joshi)
Michael Korrer, Biological Sciences (Youngs)
Christopher Kupitz, Chemistry (Thompson)
Katie Kruger, Biological Sciences (Wusirika)
Kevin Kruse, Biomedical Engineering (Gilbert/Ong)
Amanda Kudwa, Chemical Engineering (Shonnard)
Danny Latusek, Forestry (Joshi)
Kyle Lewis, Chemistry (Bagley)
Katie Lindahl, Chemical Engineering (Shonnard)
Emily Mantilla, Biomedical Engineering (Donahue)
Benton Martin, Biomedical Engineering (Gilbert)
Nicolas Mastricola, Biomedical Engineering (Rajachar)
Katie McKeown, Biomedical Engineering (Goldman)
Megan McQuillan, Biology (Joshi)
Evan Milton, Biological Sciences (Youngs)

Adam Mix, Chemical Engineering (Shonnard)
Marie Mooney, Biology (Tsai)
Brandon Pereles, Biomedical Engineering (Ong)
Alisha Raehl, Biomedical Engineering (Goldman)
Melissa Robokoff, Chemistry (Murthy)
Jill Recla, Biology (Joshi)
Michelle Riccio, Biological Sciences (Gretz)
Chris Rivet, Biomedical Engineering (Gilbert)
Kacie Scholl, Biological Science (Bagley)
Kevin Sharkey, Chemistry (Heiden)
Jessica Sherman, Biology (Tsai)
Kirsten Simoni, Biomedical Engineering (Donahue)
Samantha Stam, Chemistry (Thompson)
Danielle Stoll, Biomedical Engineering (Donahue)
Rachael Sturtevant, Biological Sciences (Busov/Youngs)
Talisha Sutton, Chemistry (Thompson)
Tara Swanson, MEEM (Haut Donahue)
Kate (Hwee Chi) Tay, Biological Science (Youngs)
Kyle Tourni, Biomedical Engineering (Rajachar)
Matthew Trombley, Biomedical Engineering (Gilbert)
Emily Umlor, Biology (Tsai)
Tiffany Wilson, Biomedical Engineering (Tsai)
Sherri Wiseman, Biomedical Engineering (Gilbert)
Samantha Wodja, Biomedical Engineering (Donahue)
Michela Young, Chemistry (Harding)
Kassidy Yatso, Forest Resources and Environmental Science (Tsai)

Non-degree Seeking Students

Chien-Fu Chen, Visiting Graduate Student from ChaoYang University of Technology, Taiwan (Tsai), summer 2007

Graduate Students (49 Ph.D. and 12 M.S. students)

Biological Sciences

Abass Abdullahi (Ph.D., Gretz)
Melba Apoya-Horton (Ph.D., Gretz)
Brent Bellinger (Ph.D., Gretz)
Surendar Reddy Dhadi (Ph.D., Wusirika)
Yan Ding (M.S., Youngs)
Robert Donofrio (Ph.D., Bagley)
Sara Kiemle (Ph.D., Gretz)
Nicholas Krom (Ph.D., Wusirika)
Kefeng Li (Ph.D., Wusirika)
Maara Paackalen (M.S., Bagley)
Ratul Saha (Ph.D., Bagley)
Prashant Swamy (Ph.D., Youngs)



Kate (Hwee Chi) Tay, (M.S., Youngs)
Zijun Xu (Ph.D., Wusirika)

Biomedical Engineering

Matt Barron (Ph.D., Donahue/Goldman)
Rachel Bradford (Ph.D., Donahue)
Megan Killian (Ph.D., Haut Donahue)
Meghan McGee (Ph.D., Donahue)
Eric Minner (Ph.D., Gilbert)
Melissa Roberts (Ph.D., Goldman)
Ee Lim Tan (Ph.D., Ong/Rajachar)
Hanbing Wang (Ph.D., Gilbert)

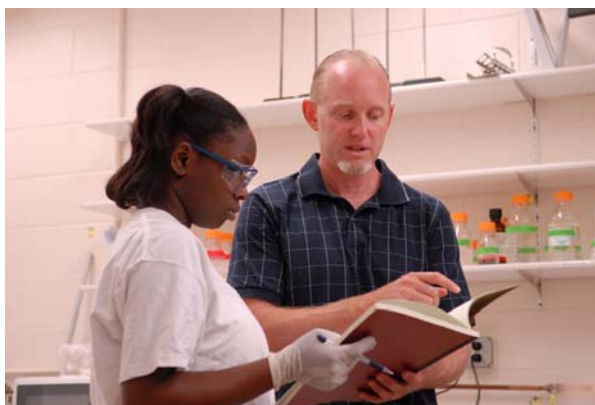


Chemical Engineering

Michael Brodeur Campbell (Ph.D., Shonnard)
Jill Jensen (Ph.D., Shonnard)
Ken Koers (M.S., Shonnard)
Juan Morinelly (M.S., Shonnard)

Chemistry

Ganesh Arumugam, Ph.D. (Heiden)
Feifei Cai (M.S., Liu)
Zhen Chen (Ph.D., Liu)
Venkat R. Donuru (Ph.D., Liu)
Qi Gao (Ph.D., Liu)
Stephen Johnson (Ph.D., Murthy)
Deepak Kumar (Ph.D., Thompson)
Jon Maxwell (Ph.D., Thompson)
Singaravelu Velayudham (Ph.D., Liu)
Mimi Yang (Ph.D., Murthy)



Mathematical Sciences

Xiaoqi Cui (Ph.D., Chen)
Sapna Kumari (Ph.D., Chen)
Xiao Lu (Ph.D., Chen)
Rui Tang (Ph.D., Zhang)
Xuexia Wang (Ph.D., Zhang)
Huaizhen Qin (Ph.D., Zhang)
Zhan Ye (Ph.D., Zhang)

Forest Molecular Genetics & Biotechnology

Edward Anino (Ph.D., Tsai/Harding)
Han-Yi Chen (M.S./Ph.D., Tsai)
Trisha Colling (M.S., Busov)
Meagan Harless (Ph.D., Grant)
Chamini Illangasinghe (Ph.D., Busov)
Nicholas Jensen (M.S., Grant)
Rajinikanth Mohan (Ph.D., Tsai)
Rodney Oakley (Ph.D., Tsai)
Raja S. Payyavula (Ph.D., Tsai)
Shaik John Saida (M.S., Joshi)
Shiv Thammannagowda (Ph.D., Joshi)
Lindsey Tuominen (Ph.D., Tsai)
Chao Wang (M.S., Grant)



Fuyu Xu (Ph.D., Joshi)
Christine Zawaski (Ph.D., Busov)

Mechanical Engg-Engg Mechanics

Karen Hauch (M.S., Donahue)
Duane Morrow (Ph.D., Haut Donahue)
Diego Villegas (Ph.D., Haut Donahue)

Research Scientists/Associates (17 Ph.D.-level scientists and 6 associates)

Dr. Jennifer Adams, Postdoctoral Scientist (Vucetich)
Dr. Benjamin Babst, Postdoctoral Scientist (Tsai)
Dr. Tao Feng, Postdoctoral Fellow (Zhang)
Dr. Jiqing Gou, Postdoctoral Scientist (Busov)
Dr. Changyu Hu, Postdoctoral Scientist (Tsai)
Sandra Hubscher, Research Associate (Tsai)
Michelle Jarvie, Research Associate (Tsai)
Rama Joshi, Research Associate (Tsai)
Dr. Keming Luo, Postdoctoral Scientist (Harding)
Dr. Yunxia Liu, Postdoctoral Scientist (Joshi)
Matthew Nelsen, Research Associate (Donahue/Haut-Donahue/Tsai)
Dr. Alexander Raskind, Postdoctoral Scientist (Harding)
Dr. Umme Salma, Postdoctoral Scientist (Heiden)
Karena Schmidt, Research Associate (Vucetich)
Dr. Abdur Sikder, Postdoctoral Scientist (Tsai)
Dr. Ramesh Thakur, Assistant Research Scientist (Joshi)
Dr. Minsheng Wu, Postdoctoral Scientist (Busov)
Jingwei Yin, Research Associate (Tsai)
Dr. Jordan Jordanov, Postdoctoral Scientist (Busov)
Dr. Elena Jordanova, Postdoctoral Scientist (Busov)
Dr. Yinan Yuan, Postdoctoral Scientist (Tsai)
Dr. Zhaogong Zhang, Postdoctoral Fellow (Zhang)
Dr. Cuihua Xue, Postdoctoral Scientist (Liu)



Other Student Activities and Honors received

Sara Gibbs, Biomedical Engineering, summer work was funded by Summer Undergraduate Research Fellowship (SURF), *Goldman*.

Karen Hauch, MEEM, received a DeVlieg Fellowship, *Haut Donahue*.

Rebecca Klank, Biomedical Engineering, summer work was funded by Summer Undergraduate Research Fellowship (SURF), *Gilbert*.

Katie Kruger, Biological Sciences, summer research fellowship recipient (SURF), *Wusirika*.

Ratul Saha, Biological Sciences, received a Student Research Excellence Award from the Michigan Branch of the American Society for Microbiology, *Bagley*.

Katy Smith, Chemistry, SFI NEU summer student, *Heiden*.

Sherri Wiseman, Biomedical Engineering, summer work was funded by Summer Undergraduate Research Fellowship (SURF), *Gilbert*.

Research Projects

Active Research Projects in FY 07: 36 grants totaling \$11,205,942 in research funds

The Biotechnology Research Center continues to encourage its members to write new proposals for research funding which is demonstrated by 42 new proposals submitted during FY07. As a result, BRC research funding has increased in FY07 with New Research funding of \$1,899,804. While new grants were awarded in FY07, many previous awards also continued during the fiscal year covering an expanding number of research areas.

National Science Foundation

Joshi

\$741,877; 03/03 - 02/09

CAREER: Cellulose Biosynthesis in Aspen Trees

Tsai, Harding, Zhang

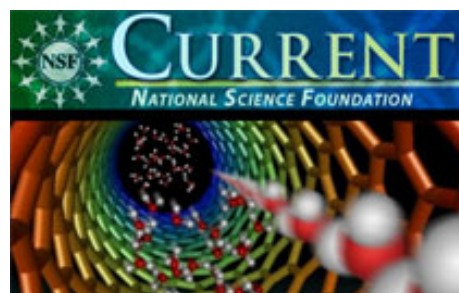
\$2,114,091; 11/04 – 12/08

Plant Genome: A Functional Genomics Approach to Investigate Regulation of Phenolic Glycoside Metabolism in Populus

Tsai

\$24,596; 05/06 – 12/08

Research Experiences for Undergraduates



National Institute of Health

Donahue

\$313,986; 03/04 – 04/09

Black Bear Bone Mechanics

Chen, Zhang

\$620,149; 09/04 – 07/08

Mapping Complex Disease Genes Incorporating Age-at-Onset

Haut Donahue

\$244,551; 02/05 – 01/08

Structure and Function of Meniscal Horn Attachments

Goldman

\$271,672; 09/05-09/08

Mechanical Stretch and Vein Graft Intimal Hyperplasia

Goldman

\$186,201; 09/06 – 08/08

Augmentation of Lymphangiogenesis by Increased Fluid Channeling in Mouse Skin

Zhang, Chen, Jiang, Dong

\$700,000; 08/05 – 07/08

Statistical Methods for Mapping Complex Disease Genes

Zhang, Sha, Chen

\$228,000; 09/05 – 08/08

Statistical Methods for Admixture Mapping



United States Department of Agriculture

Busov

\$342,514; 9/04-8/08

NRI: Efficiency of Activation Tagging for Functional Gene Discovery in Populus

Busov (with Oregon State)

\$167,466; 02/05-02/09

Field Evaluation of Semi-Dwarfism Transgenes for Biosafety of Transgenic Woody Plants

Busov

\$28,000 10/03-09/07

McIntire Stennis: Tree Biotechnology for Enhanced Productivity and Wood Quality

Joshi

\$303,477; 12/04-11/08

NRI: Genetic Engineering of Cellulose Biosynthesis in Hardwood and Softwood Trees

Joshi

\$35,000 10/02-09/07

McIntire Stennis: Molecular Genetics of Cellulose Biosynthesis in Aspen

Liu, Yap, Murthy, Thompson

\$121,816; 01/07 – 12/08

Carbon Nanotube Arrays for Bacteria

Tsai

\$35,000 10/03-09/07

McIntire Stennis: Cryopreservation of Tree Germplasm

Tsai, Harding

\$204,422 11/02-11/07

NRI: Molecular Dissection of Alpha-tubulins during Microfibril Deposition of Wood Formation

Wusirika

\$100,000 07/07-06/09

Identification and Characterization of Bidirectional promoters in the Rice Genome



U.S. Department of Energy

Busov

\$218,740; 08/05 – 08/08

Genetic Modification of Gibberellic Acid Signaling to Promote Carbon Sequestration in Tree Roots and Stems

Busov

\$275,342; 11/05 – 11/08

Genome-Enabled Modification of Poplar Root Development for Increased Carbon Sequestration

Harding, Tsai, Lindroth (UW-Madison)

\$1,386,389; 08/05-08/08

A Genomics Investigation of Partitioning Into and Among Flavonoid-Derived Condensed Tannins for Carbon Sequestration in Populus.

Joshi, Chiang, Li

\$1,370,842; 11/02 – 10/08

Agenda 2020: Improved Wood Properties through Genetic Manipulation of Lignin Genes



The Consortium for Plant Biotechnology Research, Inc.

Busov (with ArborGen)

\$56,355; 09/04-08/07

Modification of Gibberellin Metabolism to Enhance Productivity, Wood Quality, and Biosafety

Tsai, Harding (with ArborGen)

\$280,002; 09/06-08/08

Protein Engineering for Manipulation of Phenylpropanoid Metabolism

Joshi (with ArborGen and DOW)

\$200,472; 01/06-03/08

Modulation of Cellulose Crystallinity in Transgenic Trees



Mayo Foundation for Medical Education and Research

Haut Donahue, Odegard

\$105,000; 07/05 – 06/07

Microsensor for Intramuscular Pressure Measurement

Haut Donahue

\$63,190; 11/06 – 06/08

Project M – Contact Mechanics in the Human Knee Joint



Michigan Technological University

Neumann, Gilbert, Goldman

\$49,782; 07/06 – 08/07

Acquisition of an ApoTome Microscope for Three-dimensional Fluorescence Visualization

Ong

\$42,785; 07/07–12/08

In Vivo Tracking of Human Body fluid pH with a wireless, passive sensor implant

Tsai

\$34,125; 05/07-05/08

Acquisition of an Infrared Fluorescence Imaging System for Life Sciences Research



South Florida Water Management District

Gretz

\$27,600; 10/06 – 10/07

Role of Extracellular Polymers in Everglades Periphyton dominated Biofilms



USDA-UVB Board (Utah State University)

Tsai

\$10,000; 09/06 – 06/07

Analysis of UV-B Response in *Populus*

General Motors

Shonnard, Bagley, Heiden, Youngs

\$275,000; 05/07-05/09

A Systems Approach to Improve Processing Efficiency of Forestry Biomass for Co-Production of Biofuels and Biopolymers



NIWAR/NZ

Gretz

\$25,000; 05/06-10/06

Harmful Algae Blooms: Extracellular Polymer Production by An Invasive Diatom in New Zealand

Michigan Space Grant Consortium

Haut Donahue

\$2,500; 05/07-05/08

Spaceflight on Knee Joint Meniscus



BRC Travel Grants

The Biotech Research Center continued to offer travel grants to assist Michigan Tech graduate students and post-docs who presented their research at national or international conferences during FY07 with their travel expenses. Additionally, in 2007 the BRC members elected to accept applications from undergraduate students who were presenting their research at national or international conferences. Twelve awards were presented totaling **\$5,750** (Biomedical Engineering – three; Physics – two; FRES – four; ME-EM – one; Chemical Engineering – two).

2006-2007 Travel Award Recipients

- * **Abraham Martin Garcia** (\$500), 2006 AIChE Meeting; November, 2006 (Chem Engg)
- * **Shiv Thammannagowda** (\$500), 2006 Annual ASPB Meeting; August, 2006 (FRES)
- * **Fuyu Xu** (\$500), 2006 Annual ASPB Meeting; August, 2006 (FRES)
- * **Shu Chiang Yat** (\$500), 2006 AIChE Meeting; November, 2006 (Chem Engg)
- * **Tara Hansen** (\$500), ASME Summer Bioengineering Conference; June, 2006. (MEEM)
- * **Aaron Maki** (\$500), 30th Annual American Society of Biomechanics Conference; September, 2006. (Biomed)
- * **Benton Martin** (\$500), Biomedical Engineering Society 2006 Annual Fall Meeting; October, 2006. (Biomed)
- * **Parimal Kar** (\$250), From Computational Biophysics to System Biology Conference; June, 2007. (Physics)
- * **Meghan McGee** (\$500), 53rd Annual Meeting of the Orthopedic Research Society; February, 2007. (Biomed)
- * **Rodney Oakley** (\$500), ASPB 2007 Conference; July, 2007. (FRES)
- * **Yanjie Wei** (\$500), From Computational Biophysics to System Biology Conference; June, 2007. (Physics)
- * **Benjamin Babst** (\$500), Gordon Research Conference: Plant Herbivore Interactions; Feb. 200. (FRES)

ESC/BRC Graduate Research Forum

The Biotechnology Research Center and the Ecosystem Science Center co-sponsored the Third **Annual Graduate Research Forum** in February, 2007. A total of 13 BRC graduate students submitted abstracts and posters highlighting their research.

2007 BRC Graduate Research Forum Winners

\$500 Grand Prize: Shivegowda Thammannagowda

\$100 Merit Awards: Chamini Illangashinghe, Raja Payyavula, Han Bing Wang

BRC Open House

In March, 2007, the Biotechnology Research Center (BRC) invited MTU faculty, researchers and students to join BRC members to its **second** annual open house and poster presentations. The BRC faculty and their associates were available to discuss their work, answer questions and explore collaboration (for faculty and researchers) or training (for students) opportunities. Nineteen posters were displayed.

Invited Speakers

The BRC along with its affiliated faculty members or academic units continued to co-sponsor invited speakers for guest seminars which explored many areas of research. BRC members also made a strong commitment to encourage more research oriented guests to the MTU campus by establishing and funding an Invited Speakers Series to begin in 2008. Invited Speakers in 2007 included:

Dr. Hsin-Sheng Tsay, Professor, Dean of College of Science and Engineering and Director of Institute of Biotechnology, ChaoYang University of Technology (CYUT), Taiwan, presented a seminar titled "Commercial Application of Plant Tissue Culture Technology in Taiwan" on September 5, 2006.

Dr. Hannah Carey, Professor from the University of Wisconsin presented a seminar, "Mammalian Hibernation: Natural Resistance to Stress and Traumatic Injury," on October 27, 2006.

Dr. Richard Meilan, Associate Professor in the Department of Forestry and Natural Resources and the USFS Hardwood Tree Improvement and Regeneration and the Associate Director of the NSF I/UCRC Center for Tree Genetics at Purdue University gave a seminar, "From Emerald Ash Borer Control to Heartwood Formation: Molecular Tree Physiology Research at Purdue" on November 28, 2006.

Dr. Stephen DiFazio, Assistant Professor of Biology at the Eberly College of Arts and Sciences at West Virginia University and former research scientist at Oak Ridge National Laboratory, presented a seminar titled "Populus Hybrid Zones as Natural Functional Genomics Laboratories" on March 29, 2007.

Dr. Julie Hasenwinkel, Assistant Professor in the Department of Biomedical and Chemical Engineering at Syracuse University, presented a seminar "Bioengineering Approaches to Nerve Regeneration After Spinal Cord Injury: Understanding and Manipulating the Environment" in March, 2007.

Dr. Upendra Dwivedi, Professor in the Department of Chemistry at Lucknow University in India, gave a seminar titled "Genetic Manipulation of Lignin for Biotechnological Applications with Special Reference to *Leucaena leucocephala*" on May 18, 2007.

Dr. Kyung-Hwan Han, Professor in the Department of Forestry, Genetics Graduate Program, and Plant Breeding and Genetics at Michigan State University, presented the seminar "What Makes a Tree a Tree? A Step Toward Optimizing Lignocellulosic Feedstock for Biofuel Productivity and Processing" on October 4, 2007.

Dr. Alison W. Roberts, Professor in the Department of Biological Sciences at the University of Rhode Island, presented a seminar "Physcomitrella as a Heterologous Expression System for Investigating the Function of Cellulose Synthase-Like Genes" on October 19, 2007.

Dr. Edward G. Kirby, Professor of Plant Biology in the Department of Biological Sciences at Rutgers University gave the seminar "Shifting the balance: The role of ectopic expression of glutamine synthetase in growth and development of hybrid poplar" on November 15, 2007

BRC Monthly Seminar

The BRC Seminars continued into FY07. Graduate students and post-docs were offered the opportunity to present their research results in a seminar setting.

Other Notable Activities by the BRC members

Susan Bagley, Professor (Biology) was on sabbatical during part of FY07.

Michael Gretz, Professor, (Biology) was on sabbatical during FY07.

Patricia Heiden, Associate Professor (Chemistry) was on sabbatical at the University of Waterloo in Ontario, Canada during FY07. She also visited several universities in India.

Chung-Jui Tsai, Professor (SFRES) helped establishing an agreement between Michigan Tech and Chaoyang University of Technology, in Taiwan, that will expand opportunities for students and faculty at both institutions. Possible areas of collaboration include joint undergraduate programs; faculty and student exchanges; graduate education; and research. She also participated in MTU's meeting with the Michigan Economic Development Corporation in March, 2007 which focused on the Wood-to-Wheels research.

BRC Sponsored Initiatives

New PhD finishing Fellowships

During FY07, members charged executive committee to develop criteria for a BRC Ph.D. Finishing Fellowship program. The program was established to provide financial support to Ph.D. students who have been supported by BRC affiliated external research grant for at least three years. The applicants must also be in the final year of their program. Funding was set at \$10K per year and was set to begin with the Fall, 2008 semester. Two fellowships per year are expected to be awarded.

Ongoing Initiative of Seed Grants for Infrastructure Improvement

A two-year BRC Seed Grant Initiative of \$90K was established in FY06 which required a 100% match from other funding sources. It was open to all departments represented by members in the center and about **\$89K** have been awarded that resulted in purchase of new equipments worth **\$237,387**. The remaining designated funds were rolled over to the next cycle of requests for proposals based on the input from BRC members.

Grant	Total Value	BRC Actual Cost	Department	Member
ApoTome Microscope for Three-Dimensional Fluorescence Visualization	\$93,328	\$19,855	Biomed Biology ME-EM	Gilbert Goldman Bagley Haut Donahue
Peptide synthesizer	\$30,000	\$15,000	Chemistry	Thompson
Computer: Cluster Machine	\$19,853	\$10,000	Math	Zhang Chen
HPTLC Scanner for Phenolic Compound Analysis	\$26,250	\$10,000	SFRES	Harding, Tsai
GeneSpring Software License for genomics studies	\$14,188	\$7,145	SFRES	Busov, Joshi, Harding, Tsai
Thermo Cyclers	\$5,976	\$2,988	SFRES	Busov, Joshi
Orbital Shakers	\$5,115	\$2,563	SFRES	Joshi Harding/Tsai
Autoclave	\$5,127	\$2,563	SFRES	Joshi
-80 Freezer	\$9,961	\$4,471	SFRES	Busov
Camera and filter for a Leica microscope	\$9,005	\$4,140	Biology	Youngs Wusurika
Olympus SZX16	\$18,584	\$10,000	Biomed	Goldman

Financial Report

FY 07 Budget Report

The Biotechnology Research Center continued to generate overhead dollars through external research grants. FY07 witnessed a significant increase in the overhead amount. As per the BRC charter, the collected overhead return was distributed among the Center (20.7%), PIs (20%, including the standard 6% incentive return), and the PI's home Department (12%) and College (7.3%). In FY07, BRC affiliated projects generated \$753,017 in overhead return as compared to \$523,414 in FY 06 (**44 % increase over last year**). Because of the increased revenue, the BRC was able to initiate many new funding initiatives. The distribution by academic unit is listed in the following table.

Table: Distribution of BRC Overhead Returns by the Unit in FY 07:

Unit	Total Overhead generated from FY07 Report	19.3% Returned to dept/college/school	20.7% Returned to the BRC	20% Returned to the PIs
Biology	\$9,113	\$1,759	\$1,886	\$1,823
Biomedical				
Engineering	\$107,489	\$20,745	\$22,250	\$21,498
Mathematics	\$113,184	\$21,845	\$23,429	\$22,637
Physics	\$1,401	\$270	\$290	\$280
ME-EM	\$48,795	\$9,417	\$10,101	\$9,759
SFRES	\$473,035	\$91,296	\$97,918	\$94,607
Grand total	\$753,017	\$145,332	\$155,874	\$150,603

The BRC Funds: Total expenses from BRC funds in FY 07 were **\$102,159**. Major categories included staff salary (29.39%), seed grants (43.55%), equipment match/service/repair (14.7%), office support (2.69%) and travel awards/speakers (11.12%).

The PI Funds: Total expenditures from the PI funds in FY 07 were **\$82,046.10**. The PI Funds continued to strengthen and grow individual research programs. Major expenses in FY 07 included categories such as faculty support, graduate student support including stipends, tuition and fees, research staff salaries (with F/B), undergraduate support, equipment purchase and repairs, research supplies, and other scholarly activities (travel/meetings/subscriptions).

Research Expenditures: The Office of the Vice President for Research reports that BRC FY 07 research expenditures totaled **\$3,064,010**, and ranked No. 5 among research centers and institutes on campus, after the Ecosystem Science Center, the Keweenaw Research Center, the Michigan Tech Transportation Institute and Michigan Tech Research Institute.

Peer-reviewed Publications in 2007 (The BRC PIs are indicated in Bold)

1. **Busov VB** and **Tsai CJ** (2007) Perennial challenges and opportunities, *New Phytologist*. 176: 3-6.
2. **Busov VB**, Brunner AM, Strauss SH (2007) Genes for control of plant stature and form, *New Phytologist*. 177: 587-607.
3. Cai F, Xue C and **Liu H** (2007) Ultrasensitive fluorescent responses of highly water-soluble Zwitterionic Boronic acid-Bearing regioregular head-to-tail polythiophene to biological species, *V Chemistry A European Journal*, *in press*.
4. Chandrasekaran R and **Thompson M** (2007) Polybromo-1 bromodomains bind histone H3 at specific acetyl-lysine positions, *Biophys. Biochem. Res. Comm.* 355: 661-666.
5. Chandrasekaran R., and **Thompson M** (2007) Thermodynamic analysis of the acetylation dependence of bromodomain-histone interactions, *Analytical Biochemistry*, *in press*.
6. Domozych D.S., Serfis A., Kiemle S.N. and **Gretz M.R.**, (2007) The structure and biochemistry of charophycean cell walls. I. Pectins of *Penium margaritaceum*, *Protoplasma* 230:99-115.
7. Domozych D.S., Elliot L, Kiemle S.N. and **Gretz M.R.** (2007) *Pleurotaenium trabecula*, a desmid of wetland biofilms: The extracellular matrix and adhesion mechanisms, *Journal of Phycology* 43:1022-1038.
8. Feng T, **Zhang SL**, Sha Q (2007) A method dealing with a large number of correlated traits in a linkage genome scan, *BMC Genetics*, 1(Suppl 1):S84.
9. Feng T, **Zhang SL**, Sha Q (2007) Two-Stage Association Tests for Genome-wide Association Studies Based on Family Data with Arbitrary Family Structure, *European Journal of Human Genetics*, 15: 1169–1175.
10. Festucci-Buselli RA, Otoni WC and **Joshi CP** (2007) Structure, organization and functions of cellulose synthase complexes in higher plants, *Brazilian Journal of Plant Physiology* 19 (1): 1-17.
11. Godin LM, Suzuki S, Donahue HJ, Jacobs CR and, **Donahue SW** (2007) Calcium fingerprints in bone cell mechanotransduction. *Biomechanics and Modeling in Mechanobiology*, 6(6): 391-8.
12. **Goldman J**, Conley KA, Raehl A, Bondy DM, Pytowski B, Swartz MA, Rutkowski JM, Jaroch DB, and Ongstad EL (2007) Regulation of lymphatic capillary regeneration by interstitial flow in skin, *Am J Physiol Heart Circ Physiol.*, 292: H2176-H2183.
13. **Goldman J**, Rutkowski JM, Shields JD, Pasquier MC, Cui Y, Schmökel HG, Hicklin DJ, Pytowski B, and Swartz MA (2007) Cooperative and redundant roles of VEGFR-2 and VEGFR-3 signaling in adult lymphangiogenesis, *FASEB J.*, 21(4): 1003-1012.
14. **Goldman J**, Zhong L, and Liu SQ (2007) Negative Regulation of Vascular Smooth Muscle Cell Migration by Blood Shear Stress, *Am J Physiol Heart Circ Physiol.* 292(2): H928-38.
15. Gorantla M, Babu P, Reddy Lachagari V, Reddy A, **Wusirika R**, Bennetzen JL, and Reddy AR (2007) Identification of stress-responsive genes in an indica rice (*Oryza sativa* L.) using ESTs generated from drought-stressed seedlings, *Journal of Experimental Botany* 58: 253-265.
16. **Grant JB** and Evans JA (2007) A technique to collect and assay adhesive-free skin secretions from ambystomatid salamanders. *Herpetological Review* 38(3): 301-305.
17. **Grant JB**, Lawler JJ, Nelson CR, Olden JD, Silliman B (2007) Academic institutions in the United States and Canada ranked according to performance in the field of Conservation Biology. *Conservation Biology* 21(5): 1139-1144.

18. **Grant JB** (2007) Ontogenetic colour change and the evolution of aposematism: a case study in panic moth caterpillars. *Journal of Animal Ecology* **76**(3): 439-447.
19. Gupta T, Zielinska B, McHenry J, Kadmiel M, **Haut Donahue TL** (2007) IL-1 and iNOS gene expression and NO synthesis in the superior region of meniscal explants is dependent on magnitude of compressive strains, Osteoarthritis and Cartilage. *in press*.
20. **Joshi CP**, Brunner A, Busov V, Meilan R, Thammanagowda S, Tsai C.: Transgenic poplars. In: *The Transgenics: A Reference Compendium on Plants*. C. Kole and T. Hall (Eds), (2007) Blackwell Publishing, Malden, USA. *in press*.
21. **Joshi CP** and Mansfield SD (2007) The cellulose paradox: simple molecule, complex biosynthesis, *Current Opinion in Plant Biology*. 10: 220-226.
22. **Joshi CP** (2007) Genomics of wood development, In Aluizio Borém (Ed) *Forest Biotechnology*. Universidade Vicosa, Brazil, PP 273-295 (in Portuguese).
23. Kalnes T, Marker T, and **Shonnard DR** (2007) Green diesel: A second generation biofuel, *International Journal of Chemical Reaction Engineering*, 5 (article A48), <http://www.bepress.com/ijcre/vol5/A48>.
24. Kaur P, Yue H, Wu M, Liu M, Treece J, Waldeck DH, Xue C and **Liu H** (2007) Solvation and aggregation of polyphenyleneethynylene based Anionic polyelectrolytes in dilute solutions, *Journal of Physical Chemistry B*. 111(29): 8589-8596.
25. Kaur P, Wu M, Anzaldi L, Waldec DH, Xue C and **Liu H**. (2007) Dependence of polyphenyleneethynylene polyelectrolyte's fluorescence quenching on the electrostatic and hydrophobic properties of the quencher, *Langmuir*, 13203-13208.
26. Kiemle S.N., Domozych D.S. and **Gretz MR**(2007) The exopolymers of desmids: Chemistry, structural analysis and implications in wetland biofilms, *Phycologia* 46: 617-627.
27. Krom N, Recla J, **Ramakrishna W** (2007) Analysis of genes associated with retrotransposons in the rice genome, *Genetica*, *in press*.
28. Lin J, Gunter LE, **Harding SA**, Kopp RF, McCord R., **Tsai CJ**, Tuskan GA, Smart LB (2007) Development of AFLP and RAPD markers linked to a locus associated with twisted growth in corkscrew willow (*Salix matsudana* 'Tortuosa'), *Tree Physiology* 27: 1575-1583.
29. **Liu H** (2007) Pathogenic Bacterial Sensors Based on Carbohydrates as Sensing Elements In "Handbook of bacterial detection; biosensors, recognition receptors and Microsystems" by M. Zourob and T. Turner, Springer, *in press*.
30. Lu S, Li L, Xiaoping Yi, **Joshi CP** and Chiang VL (2007) Differential expression of three eucalyptus secondary cell wall- related cellulose synthase genes in response to tension stress, *Journal of Experimental Botany*, *in press*.
31. Martin LJ, Woo JG, Avery CL, **Chen HS**, North KE, Multiple Testing in the Genomics Era: Findings from GAW 15, Group 15, (2007) *Genetic Epidemiology*, *in press*.
32. Martin-Garcia AR, **Shonnard DR**, Pannuri S, and Kamat S (2007) Characterization of Free and Immobilized (S)-Aminotransferase for Acetophenone Production, *Applied Microbiology and Biotechnology*, 76(4): 843-851.
33. McGee ME, Magic KW, Miller DL, Maki AJ, and **Donahue SW** (2007) Despite annual periods of disuse (hibernation), cortical bone porosity decreases and ash fraction, cross-sectional properties, and mechanical properties increase with age in black bear femurs, *Engineering Fracture Mechanics*, 74: 1942-1952.
34. McGee ME, Miller DL, Auger JH, Black L, and **Donahue SW** (2007) Black bear femoral geometry and cortical porosity are not adversely affected by aging despite annual periods of disuse (hibernation), *Journal of Anatomy*, 210: 160-169.
35. **Murthy PPN** (2007) Identification of inositol phosphates by NMR spectroscopy: unraveling structural diversity, In *Proceedings of the Bouyoucos conference on*

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 39. **Rajachar RM**, Tung E, Trung AQ, Giachelli CM (2007) Role of carbonic anhydrase 2 (CAR2) in ectopic calcification. *Cardiovascular Pathology. in press.*
 40. Rajinikanth M, **Harding SA**, **Tsai CJ** (2007) The glycine decarboxylase complex multienzyme family in *Populus*, *Journal of Experimental Botany* 58: 1761-1770.
 41. Roy SC, **Ong KG**, Zeng K and Grimes CA (2007) Quantification of blood clotting kinetics II: Thromboelastograph analysis and measurement of erythrocyte sedimentation rate using magnetoelastic sensors, *Sensor Letters*, 5: 432 – 440.
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