



# ON THE WEB

COUNCIL ON UNDERGRADUATE RESEARCH

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# CUR Focus

## Raising Student Awareness of Research Opportunities at Georgia Gwinnett College

### Introduction

As the nation's first four-year public college established in the 21st century, Georgia Gwinnett College (GGC), located in Lawrenceville, Georgia, has grown from fewer than 200 students in 2006 to an enrollment of more than 9,500 in the fall of 2012. Since its inception, one of the college's guiding principles has been the innovative use of educational technology to enhance student learning (Kaufman 2007).

When the School of Science and Technology (SS&T) was established at GGC in 2006, faculty members were heavily engaged in curriculum and program development for majors in the sciences and technology. Because of this focus, few SS&T faculty members engaged in research from 2006 to 2008. Also during that period, only a handful of students had progressed far enough in their majors to participate in undergraduate research.

In an effort to codify the undergraduate research requirement for majors in the STEM (science, technology, engineering and mathematics) disciplines, a research course, STEC 4500, was developed and offered in the spring of 2009. This course was specifically intended to be multidisciplinary so that students majoring in any STEM discipline could conduct research as part of their undergraduate experience.

An initial challenge faced by the college was linking students with faculty members conducting research. During this early period, students had to search individual professors' web sites and Wiki pages to find out which faculty members were conducting research on topics that interested them. Faculty often had to solicit students from their classes for collaboration on research projects. While this informal system worked initially because of the relatively small number of students and faculty in SS&T, as student enrollment increased in the fall of 2009, it became evident that a more formal approach was necessary to raise student awareness of available research opportunities.

We will describe here four initiatives that the School of Science and Technology has undertaken to promote students' awareness of the undergraduate research opportuni-

ties available and to promote the growth of our undergraduate research program. These four initiatives include:

1. The establishment of robust web-based research resources,
2. Student-faculty "meet and greet" sessions,
3. The Science, Technology and Research Show (STaRS) that showcases the work of our undergraduates, and
4. Implementation of a four-year Undergraduate Research Experience that allows all SS&T students to be engaged in authentic research during all four undergraduate years.

These initiatives have served not only to improve students' interest in STEM research, but also have enabled better matching of student research interests to faculty research projects. Additionally, students are afforded the opportunity to present the results of their research efforts in a professional conference setting to their peers, future research students, graduate-school representatives, and faculty.

### Undergraduate Research Initiatives

**Web resources.** Beginning in fall 2009, the School of Science and Technology embarked on a plan to provide students easy access to all available research opportunities. The Undergraduate Research Committee, at the request of the dean, developed both open and limited-access web pages where faculty could post current and proposed research projects in which students enrolling in STEC 4500, the research course, could participate. The open web page, found at <http://www.ggc.edu/academics/schools/school-of-science-and-technology/faculty-student-research.html>, describes current undergraduate research projects. This page also contains the course syllabus, the student-faculty research agreement form, and a list of the research-active faculty along with a short description of their research interests, as well as a link to the limited-access web page. The limited-access web page has the same information, plus a list of future research

projects available for the following semester. Both web pages are continually updated so that students always have a current selection of research projects from which to choose. Whenever a faculty member develops a research program that will engage students in the STEC 4500 course, the project is added. Conversely, when faculty members' projects conclude, those projects are removed from the sites.

The limited-access web page, which is available to all Georgia Gwinnett students, staff, and faculty, contains the following information:

- STEC 4500 undergraduate research proposals, including faculty members' descriptions and requirements for student participation.
- STEC 4500 documents and research forms, including
  - The STEC 4500 undergraduate research syllabus. This general syllabus provides guidance to faculty and students engaged in research, including minimum course requirements and deliverables.
  - The students and faculty research agreement form. This document serves as the "contract" between students and their research advisors and specifies research tasks, responsibilities, and deliverables.
  - The faculty research proposal template.

The faculty proposal template includes:

- Project title
- Research advisor(s)
- Project description. Projects are described in enough detail to ensure that interested students have a good general idea about what the research will investigate.
- Research goals. The research faculty advisor outlines what constitutes the project's success.
- Expected outcomes. Research faculty members propose venues for likely presentation of the research, for example, the college's Science, Technology and Research Show (STaRS), conferences, and/or papers.
- Enrollment requirements for students. Course prerequisites and other requirements for students are provided.

- Conference and presentation opportunities. Local, regional and national venues for student presentations are listed.
- External research opportunities. Extramural opportunities for students to engage in research, such as internships and institutions that offer summer REU programs, are provided.

The goal is simple—to provide our students with a "one-stop shop" to familiarize themselves with research opportunities at GGC and enable them to locate potential faculty sponsors. Faculty also benefit from the ability to advertise their research plans and seek collaboration in a venue available to all students, not just those enrolled in their classes.

***Student-faculty "meet & greet" sessions.*** In the spring of 2011, SS&T initiated a student-faculty STEC research "meet and greet" session where students interested in undergraduate research could learn more about current faculty research initiatives. By 2012, the number of students and faculty participating in this event had nearly doubled. During these sessions, many students have commented that the SS&T research web page was very helpful in helping them select a faculty advisor and research project.

***Science, Technology and Research Show (STaRS).*** Beginning in 2008, the School of Science and Technology organized and sponsored a science show called the GGC Twitter, which featured poster sessions of student-faculty research. By 2009, SS&T leaders recognized that the breadth of student-faculty research required an annual research expo with broad public appeal. Thus in 2010, SS&T convened the first Science, Technology and Research Show (STaRS) to highlight both educational and STEM research activities engaged in by students and faculty. This event features formal student-led research talks in a conference-style setting, student-faculty research poster sessions, and participation by regional science and technology companies and graduate schools. Attendance has grown each year. STaRS is widely attended by GGC students and faculty, as well as by local high-school students interested in the STEM disciplines. It was estimated that more than 1,000 students attended the 2012 STaRS event.

STaRS 2012 also featured a table where students could obtain information about STEC 4500 research opportunities.

Students interested in a project could add their name, email, and other contact information. Student interest was high and more than 50 students signed up for various projects. The sign-up sheet was then distributed to faculty so that they could follow up with students.

**Four-Year Undergraduate Research Experience.** At GGC, all students majoring in science and technology are required to complete either undergraduate research or an internship in their junior and/or senior years. However, we recognized the need to introduce systematic investigation and research experiences much earlier in a student's educational career, in accordance with the current literature (Seymour, 2004; Wei, 2011) as well as many current reports by the American Association for the Advancement of Science and the National Research Council (see References). So in 2011, we developed a model (the Four-Year Undergraduate Research Experience) that allows all SS&T students to be engaged in authentic research during all four years of matriculation.

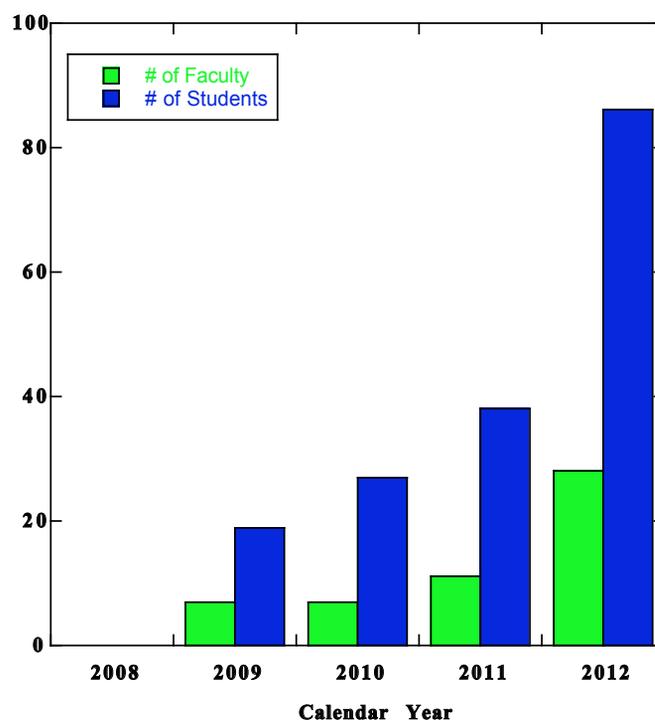
Our model utilizes course-embedded research that promotes critical-thinking skills and identifies the research skills to be developed in a variety of courses (Awong-Taylor 2012). In 2011 we redesigned and implemented authentic research experiences in 17 courses, nine of which were at the freshman and sophomore levels. Although this initiative is in its second year, we are seeing a few students continue to use some of the research from these courses as STEC 4500 projects. Course-embedded research allows students to engage in research-oriented experimentation, provides them with insight into how research is conducted, and, we hope, heightens their interest in STEM research. The four-year program was funded through a University System of Georgia STEM Initiative II Grant.

## Growth of Undergraduate Research

Due to our research initiatives and the tremendous growth in student enrollment at GGC, the number of students majoring in STEM fields has increased dramatically. In addition, the number of faculty members listing undergraduate research projects on the SS&T research web page doubled between the fall of 2009 through the fall of 2012. Figure 1 outlines the growth in STEC 4500 students and research-active faculty from 2008 (before the STEC 4500 course was

initiated) through the current academic year. Data for 2012 do not include projected numbers of STEC 4500 students and research-active faculty for the spring of 2013, but those numbers are expected to grow as we approach registration for the spring semester.

**Figure 1. STEC 4500 Student and Research-Active Faculty Growth at GGC**



Several trends are evident in Figure 1. As the data from 2008 to 2009 show, few students and faculty were involved in research prior to establishment of the STEC 4500 course and the SS&T research web resources in 2009. In spring 2009, three students were enrolled in STEC 4500 and since then the number of students participating in collaborative STEC 4500 research has grown more than 28-fold. During that same period, the number of faculty engaging in STEC 4500 research has increased four-fold. While it is still not clear whether the four initiatives described above played a direct role in such rapid growth, we are confident that some or all of these initiatives are contributing factors.

Students do have an option to either enroll in undergraduate research or participate in an internship. Table 1 shows enrollment data for internships and undergraduate research from 2008 to 2012. Enrollment data from 2008 to 2011 are fairly similar. However, in 2012 enrollment in the undergraduate research more than doubled compared to participation in internships, which actually decreased. Most of the initiatives described above were implemented in 2011. The missions of the institution and the School of Science and Technology did not change; the only difference that could account for the change in numbers for 2012 was implementation of the research-oriented initiatives. We believe that some of these initiatives did contribute to interest and growth in undergraduate research.

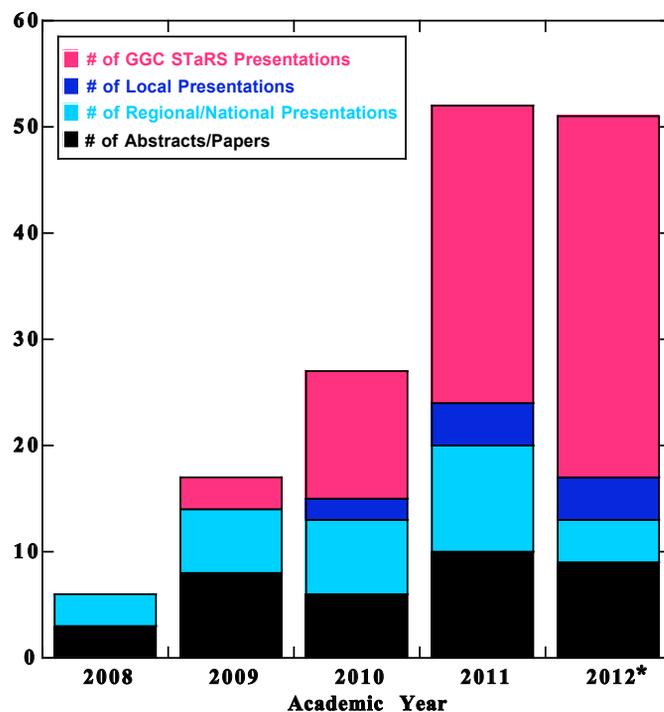
**Table 1. SS&T Internship and STEC 4500 Research Enrollment, 2008-2012**

Calendar Year	Students Enrolled in Internships	Students enrolled in Undergraduate Research
2008	3	0
2009	9	19
2010	29	27
2011	42	38
2012	37	86

An important consequence of the growth of the STEC 4500 research course has been a dramatic increase in the output of scholarly presentations, abstracts, and papers. See Figure 2.

Presentation venues range from those at GGC STaRS and local conferences to regional and national science conferences such as those of the American Chemical Society. As the data show, the GGC STaRS event has developed into a major venue for our students' STEC 4500 research results, with presentations tripling since 2010. Abstracts and papers published based on STEC 4500-related research include a mix of non-peer-reviewed and peer-reviewed conference proceedings and scientific journal articles. Note that the scholarly output reported for 2012 does not contain data for the spring semester of the 2012-2013 academic year; we do

**Figure 2. Growth of STEC 4500-Related Scholarly Output at GGC**



\*Summer and Fall data only

anticipate the publication of additional scholarly presentations and papers during the spring.

From the modest beginnings in 2009 when our research initiatives began, total scholarly output—including presentations and papers—has tripled in three years. As our program continues to develop, it will be important to expand presentation of research at more national conferences and publication in peer-reviewed journals. Given high faculty teaching loads and the relative youth of the college and program, however, we anticipate that publication in peer-reviewed journals will eventually increase as more research is collected and collated.

## Conclusion

Undergraduate research opportunities and activities in the STEM disciplines at GGC have increased steadily since the implementation of the SS&T student-faculty research web pages. The number of faculty and students conducting research has almost quadrupled since 2009, due in part to our increased enrollment, but also as a result of successfully leveraging our initiatives to improve student awareness of the research process both in the classroom and in the more traditional research setting. In addition, STEC 4500 research conducted at GGC has resulted in significant growth of the scholarly output of both students and faculty—an important trend if we are to spark and maintain our current and future students' interest in the STEM disciplines.

As our college grows, new STEM majors will be developed, new facilities will be built, and additional courses will be redesigned to embed research. With our four initiatives in place, we anticipate that STEC 4500 course-related research opportunities will double in the next three to five years. The next stage of our STEC research program must include ways to encourage and expand publication of research results in peer-reviewed journals.

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*Joseph C. Sloop is an assistant dean and associate professor of chemistry in the School of Science and Technology (SS&T) at Georgia Gwinnett College. He has more than 14 years teaching experience at the collegiate level and has taught courses in general chemistry, organic chemistry, and toxicology. Sloop is the author of *Succeeding in Organic Chemistry: A Systematic Problem-Solving Approach to Mastering Structure, Function and Mechanism* (Authorhouse, 2010), and has co-authored several undergraduate organic chemistry laboratory manuals. He has engaged more than thirty undergraduate students in research and has published numerous presentations and peer-reviewed scientific journal articles with undergraduate coauthors. He formerly chaired the SS&T Undergraduate Research Committee and presently serves as Editor-in-Chief of the *American Journal of Organic Chemistry*. He obtained his bachelor of science in chemistry from Davidson College and a doctorate in chemistry from North Carolina State University.*

*Judy Awong-Taylor is associate dean and professor of biology in the School of Science and Technology at Georgia Gwinnett College. Prior to joining GGC in 2010, she was a professor of biology at Armstrong Atlantic State University (AASU) for seventeen years and served as director of the University System of Georgia's STEM Initiative. She has more than twenty years of teaching*

*experience at the collegiate level. During her tenure at AASU, she was actively involved in undergraduate research (with more than 50 students on more than 35 projects), student-centered learning, and K-16 collaborative activities. She is the recipient of several teaching awards, including the University System of Georgia's Board of Regents' Teaching Excellence Award. She has authored and co-authored several lab manuals, received multiple grants, and made presentations with her students at numerous professional conferences. Her current academic interests include STEM education and environmental microbiology.*

*Thomas Mundie is professor of life science and founding dean of the School of Science and Technology at Georgia Gwinnett College. He has 28 years of experience in research and higher education. His current responsibilities include management of faculty and courses in the sciences, mathematics, and information technology. He received a bachelor of science in biochemistry from Mississippi State University, a master of science in strategic leadership from the U.S. Army War College and a doctorate in biomedical sciences from the Medical University of South Carolina. He spent nine years in research positions at the Walter Reed Army Institute of Research in Washington, D.C., and the Tripler Army Medical Center in Honolulu, Hawaii, and then became a professor of life science and biology at the United States Military Academy in West Point, N.Y. He has published more than 50 research articles.*

## First Australasian Conference of Undergraduate Research (ACUR) A Success

The one-day conference, a new initiative of Macquarie University, is being hailed as one of the highlights of the Australasian academic calendar. Over 200 undergraduate students in all disciplines and their supervisors and supporters met September 20, 2012, to present and hear about research carried out by undergraduates. Commenting on the presentations, delegates were astonished at the high quality of the research and the professional way students from universities across Australia and New Zealand presented it. This is the first time that an undergraduate research conference has been held in Australia.

Oral presentations and posters at the conference covered a broad spectrum of academic subjects, including some on film and drama. Topics ranged from medical research to ancient history. A range of papers addressed issues of climate change, and there were a number of fascinating presentations on planets and space. Literature was also well represented. For example, Blake's "Songs of Innocence and of Experience" were examined from an ecological perspective, and a number of social, identity and gender issues were addressed. Biology was also well represented, as was psychology, law, and much more.

A peer-review process at the conference resulted in prizes for the best poster and most interesting poster. The prizes were presented by Macquarie University's new vice-chancellor, Professor Bruce Dowton. In a short address to the delegates, he spoke of the work and achievements of Professor Adrian Lee, who donated the prize for the best paper, and he stressed the importance of integrating research and teaching.

This was a significant event in the life of Australasian higher education and has "touched a nerve". Students' appreciation for the conference is summed up in an email sent by of one of them: "As a first-year student, I was so honored to be given an opportunity to present my research to students and other visitors at a conference. I was also inspired by other presenters' enlightening presentations and have learnt some new information on different topics and methods of research I can apply to future research. This has been a significant highlight of my first year at university, and I would like to thank you for organizing and making possible this great conference."

It is hoped this will become an annual event. Plans are already under way for a conference next year.

## CUR RELEASES TWO PUBLICATIONS

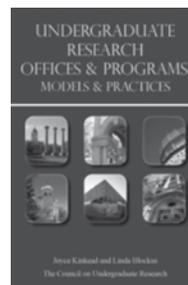
### How to Start an Undergraduate Research Journal

*D. Alexis Hart*



*How to Start an Undergraduate Research Journal* provides justifications and strategies for beginning and/or sustaining undergraduate research journals—whether institutionally, nationally, or internationally. This booklet also provides administrators, editorial boards, and teaching and research faculty members with advice about copyright and dual-publication

considerations, and offers suggestions about how to embed an undergraduate research journal into the broader curriculum. Furthermore, an entire chapter is devoted to advancing institutional assessment via undergraduate research journals. The fourteen "Best Practices" vignettes included in the appendix present a range of practical advice and reflections on the experience of faculty around the world who have developed journals of undergraduate research—in print and online. A second appendix provides a detailed list of undergraduate journals, including their content/mission statements.



### Undergraduate Research Offices & Programs: Models & Practices

*Joyce Kinkead and Linda Blockus*

This is the next-generation reference book and manual for those who are seeking to start or enhance existing undergraduate research programs, drawing on the wisdom and experience of more than 25 contributors.

Showcasing offices and programs of undergraduate research at a variety of institutional types at various points

of maturity, each of the model chapters is devoted to an institutional type and follows a template, thus making it easy for the reader to browse chapters and trace a particular theme: mission, resources, events, publications, and even challenges. The volume also offers pragmatic advice on assessment, special programs, and summer experiences. Sharing ideas and resources is a hallmark of the Council on Undergraduate Research, and it is in this spirit that *Undergraduate Research Offices and Programs: Models and Practices* was developed.

**To order this and other CUR publication visit:**  
<http://www.cur.org/publications.html>

## British Conference of Undergraduate Research Evolves

The British Conference of Undergraduate Research (BCUR) was founded in 2010 and held its first meeting at the University of Central Lancashire, Preston, in spring 2011, followed by a second conference at the University of Warwick in 2012. The University of Plymouth will host the third BCUR, April 15-16, 2013.

BCUR's main aim is to give undergraduate students from across the country (and beyond) the opportunity to present their work at an academic conference. The coalition of universities that founded BCUR believes passionately that research is an essential part of the learning process in higher education. However, it has been the students, rather than the organizing universities, who have really created BCUR. They have brought an energy and dynamism to the conference that I have never seen before at an academic conference. They know that they are pioneers and that students for years to come will benefit from the way in which these first conferences have explored the parameters of what an undergraduate conference is, and can be, in the UK context.

BCUR was directly inspired by the National Conference on Undergraduate Research in Missoula, Montana, in 2010. I and my colleague Mandy Dillon took a group of Central Lancashire students to NCUR, and we were impressed enough to plan a British version. We were delayed in Montana for two weeks when clouds of volcanic ash disrupted flights across Europe, and this gave us plenty of time to reflect on our experiences at NCUR and consider how a British conference could be established.

Our first conference surprised us. We gave very little notice and did virtually no advertising, so we expected only 50 students to apply—but over 200 did. Ultimately, 180 students from more than 40 universities arrived at the University of Central Lancashire to work together for two days. The range of topics was vast, but we did not have sufficient numbers to have discipline-themed oral presentations. Instead, we created interdisciplinary themes, carefully structuring each paper session so that papers from very different disciplines could be brought together. Warwick replicated this at our second conference in 2012, when student presenters numbered more than 200.

What began as a practical solution to a logistical problem has become a deeply embedded part of what BCUR is. It is not, and never will be, a series of disciplinary conferences held at the same time; it is a genuinely multi-disciplinary conference that encourages students to interact with and learn from their peers across the academy.

Besides creating academic opportunities, we wanted to include opportunities for a dynamic exchange of ideas to help create a sense of an undergraduate academic community. One of the highlights of the first conference was a debate held at the end of the conference. In Warwick this year, Professor Mike Neary (Lincoln) hosted a speed-networking event on the first day of the conference. When we started BCUR, we were concerned that students would not know what to do or how to behave at a conference. Most of us are inducted into established conferences and learn “conference etiquette” from experienced academics. Our fears were unfounded. In fact, students engaged with the conference sessions with more seriousness and passion than most academics at previous conferences I have attended.

At this year's conference in Warwick, all of the sessions were well-attended, with standing room only in some sessions. Students stayed for the entirety of the conference and asked smart, constructive questions. The poster exhibitions were lively, and all the social events had a genuine “buzz.” It helped that the quality of the undergraduate research was uniformly high. Some of the best papers were selected for publication in *Reinvention*, an undergraduate journal published by the University of Warwick, and a full archive of the second conference is available via links on our website, [www.bcur.irc.org](http://www.bcur.irc.org).

Many academics attending the Warwick conference told me that BCUR felt “like a real conference.” That is because BCUR is a real conference.

## 2012 Council on Undergraduate Research (CUR) Pre-ISSOTL Workshop

Building on the successful CUR workshops held prior to the annual meetings of the International Society for the Scholarship of Teaching and Learning (ISSOTL) in Liverpool (2010) and Milwaukee (2011), the Council on Undergraduate Research hosted a pre-conference workshop at the 2012 ISSOTL conference in Hamilton Ontario this past October. The theme of the workshop, “Undergraduate Research and Change in Higher Education,” attracted nearly 75 attendees from nine countries and five continents. Participants convened for a daylong exploration of how undergraduate research *effects* change in higher education and how a variety of changes in higher education *affect* undergraduate research.

The day’s activities were designed to engage participants in meaningful dialogue and in the collaborative development of strategies that will position them, as individuals and as a community of supporters of undergraduate research, to effectively navigate and instigate change in higher education. The morning session was devoted to understanding the changing landscape of undergraduate research and higher education, while the afternoon was focused on envisioning how to effect positive change at participants’ home institutions. Attendees worked collaboratively to develop strategies to tackle six specific opportunities or challenges:

- Students as change agents
- Undergraduate research generating transformative learning
- The role of undergraduate research in curriculum renewal
- The influence of technological changes on undergraduate research
- The influence of changing student demographics on undergraduate research
- Supporting and sustaining UR in times of times of fiscal challenge

The stage for the day’s work was set by keynote addresses from Angela Brew (Macquarie University, Australia) on “Undergraduate Research and Change in Higher Education”; Rachel Spronken-Smith (University of Otago, New Zealand) on “Instigating and Implementing Change in Higher Education”; and Philippa Levy (Higher Education Academy and University of Sheffield, United Kingdom) on “Embedding Undergraduate Research and Inquiry in An Institution.” Participants’ discussions were further informed by plenary discussions led by Mick Healey (higher education consultant and researcher, University of Gloucestershire, United Kingdom) and poster presentations exploring the six challenges that formed subthemes for the workshop.

The day’s work concluded with each self-selected group discussing the six subthemes and developing action plans and toolkits for change. A number of collaborative working groups were formed that are committed to continuing to work on strategies to support undergraduate research.

### **CUR/ISSOTL 2012 Planning Committee**

Kelly McConnaughay and  
Rachel Spronken-Smith, Co-conveners

Peter Felten

Susan Larson

Mick Healey

Beth Marquis

Sue Vajoczki

**Additional International Perspectives can be found here:**

**[http://www.cur.org/resources/institutions/international\\_perspectives/](http://www.cur.org/resources/institutions/international_perspectives/)**

# Meet the CURQ Editors



**Amy Buddie** became associate director for Graduate Student Support and Undergraduate Research/Creative Activity in Kennesaw State University's Center for Excellence in Teaching and Learning in 2011. In this position, she coordinates the Southeastern Conference on the Teaching of Psychology, as well as KSU's Symposium of Student Scholars. She is the faculty advisor for KSU's Undergraduate

Research Club, editor of the *Kennesaw Journal of Undergraduate Research*, and manages the funding awards for undergraduate research. She conducts workshops for both undergraduate researchers and their faculty mentors on topics such as getting started in undergraduate research and publishing undergraduate research. She supports graduate teaching assistants through workshops, classroom observations, and individual consultations. In 2010, she won the Kennesaw State University Distinguished Teaching Award.

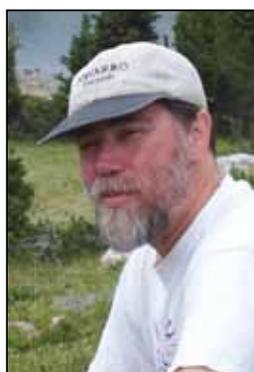
As a faculty member in the psychology department, she supervised dozens of undergraduate researchers on various projects, including research on alcohol and risky sexual behavior, attitudes about rape, consenting to unwanted sex, and attitude change resulting from coursework.

Buddie earned her MA in 1998 and her PhD in 2001 in social psychology from Miami University in Oxford, Ohio. She completed two years of postdoctoral training at the Research Institute on Addictions at the University of Buffalo before joining Kennesaw State University (KSU) in 2003.



**Suma Datta** is an associate professor of biochemistry and biophysics and executive director of honors and undergraduate research at the Texas A&M University flagship campus in College Station, Texas, where she has taught and conducted research since 1993. She teaches undergraduate courses in molecular biology, biochemistry, stem cells, and cooking chemistry, and

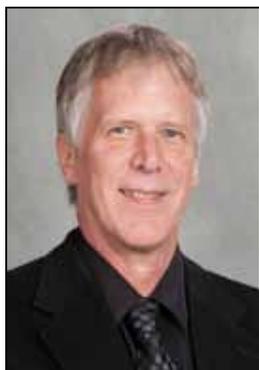
has mentored more than 50 undergraduates in her laboratory. She is a frequent speaker on mentoring, management, and communication skills. At the graduate level, Datta has taught classes in the molecular biology of development. She has served as a member of the campus Council of Principal Investigators and as assistant dean for undergraduate research. Datta has been active in the Undergraduate Research Program Directors (URPD) division of the Council on Undergraduate Research since 2010 and was elected a Councilor in 2011. She has served as a reviewer for the *CUR Quarterly* and is currently URPD division editor. Datta earned her PhD in biology from the University of California at San Diego as a National Science Foundation Graduate Fellow and did postdoctoral work at Yale as a Life Sciences Research Foundation Fellow. Her research interests ranged from the molecular genetics of stem cells in the developing brain to the role of aging and the extracellular matrix in prostate cancer progression from benign to metastatic status. She has published in *Development*, *Proceedings of the National Academy of Sciences*, *Developmental Biology*, and *Genetics*, among other publications. She is currently investigating why students choose not to become involved in undergraduate research.



**Lonnie J. Guralnick** is currently interim dean of the Feinstein College of Arts and Sciences and a professor of biology at Roger Williams University. He has been mentoring undergraduates in research since 1987. He has received numerous National Science Foundation awards to support his research and has published a number of articles with undergraduate authors.

Guralnick received a BA in biology (population biology) from the University of California, San Diego, an MS in biology (ecology) from San Diego State University, and a PhD in botany with a specialization in plant physiology from the University of California Riverside. He was department head of biology for four years and chair of the Natural Science & Mathematics Division for six years at Western Oregon University, where he received the Mario and Alma Pastega Excellence in Scholarship award in 2004. Guralnick also served a five-year term as chief examiner of

biology in the International Baccalaureate program. He has been a CUR biology Councilor for three years and recently was reelected to serve another three-year term. His main areas of teaching at Roger Williams include plant physiology, plant ecology, botany, biochemistry, genetics, introductory biology, and general education science. His research includes studying the ecological and evolutionary physiology of C<sub>4</sub> and CAM photosynthesis in the Portulacaceae, the role of photorespiration and anti-oxidant systems in CAM plants, and restoration of *Portulacaria afra* in the Spekboom Veld of South Africa and the possible consequences of global climate change.



**Stephen Heinemann** is an associate professor of music at Bradley University in Peoria, Illinois, where he has taught music theory, composition, and clarinet since 1991. He has been involved in CUR since 2006 when he was elected to the At-Large Division, becoming one of the first Councilors to represent the arts. He is a founding member of CUR's Arts and Humanities Division, has served

as divisional editor since the division's inception, and was the issue editor for the arts/humanities-focused edition of *CUR Quarterly* Winter 2008. Heinemann has incorporated musicological and music-theoretical research models into independent study projects and into classroom activities that have led to public presentations and performances. Heinemann earned his bachelor's and master's degrees at San Francisco State University and his doctorate at the University of Washington. His compositions have been performed in North America and Europe. He is a contributing author of *Elliott Carter Studies*, published in 2012 by Cambridge University Press, and his theoretical writings have appeared in, among other journals, *Music Theory Spectrum* and *Mitteilungen der Paul Sacher Stiftung*. He is also active as a clarinetist and jazz saxophonist.



**Christopher Kim** is associate professor of earth and environmental sciences at Chapman University and the current director of the Office of Undergraduate Research at Chapman. He conducts research with undergraduate students as head of the Chapman's Environmental Geochemistry Lab (<http://www.chapman.edu/envgeo>) and

teaches courses in geology and chemistry. Since he arrived at Chapman in 2004, Kim has mentored more than 40 undergraduates and nearly a dozen local high-school students in his lab. His research projects include the study of arsenic transport, speciation, and bioaccessibility in abandoned mine lands and the uptake/retention of dissolved metals onto iron oxyhydroxide nanoparticles. Kim received an NSF-CAREER award and a Henry Dreyfus Teacher-Scholar Award based on "accomplishment in scholarly research with undergraduates, as well as a compelling commitment to teaching." Kim spent the 2010–2011 academic year as a visiting research fellow at Harvard University. He received his AB from Princeton University and his PhD from Stanford University.



**Alex Norquist**, who is an assistant professor in chemistry at Haverford College, has supervised approximately 25 seniors' research theses since joining the faculty in 2003, and he has mentored several more undergraduate researchers. He has published approximately 65 research publications, on which 18 Haverford undergraduates appear as co-authors. Norquist was elected as

a Councilor to the chemistry division of CUR in 2010 and in 2012 became the division's editor for the *CUR Quarterly*. Norquist received a BS from Gustavus Adolphus College in 1996 and a PhD in chemistry from Northwestern University in 2000. He did postgraduate work at the University of

Oxford from 2001 to 2003. His current research is focused on the formation of functional organic-inorganic hybrid materials using low-temperature synthetic techniques. Specific attention is paid to the formation of low-symmetry solids using asymmetric building units, including second-order Jahn-Teller active cations and chiral organic amines. Recent work has explored the many influences that govern the formation of noncentrosymmetric vanadium tellurites, vanadates and gallium phosphates



**Elizabeth Perry-Sizemore** is assistant dean at Randolph College, where she is also an associate professor and chair of the Department of Economics and Business. She holds a PhD in economics from Virginia Tech. She is the past director of Randolph's Student/Faculty Summer Research Program and past chair of its Symposium of Artists and Scholars. As assistant

dean, she helped design and participate in the selection process for the Randolph Innovative Student Experience (RISE) program, which awards grants to students to pursue scholarly and creative endeavors. Perry-Sizemore advises independent and group undergraduate classroom research projects and also engages in student/faculty community-based research collaborations with students through paid summer research positions, independent studies, and internships. With several students she is currently examining the effects of a local non-profit's efforts to restore condemned residences in a neighborhood in Lynchburg, Virginia. Her students regularly present to the local community and at regional conferences. Perry-Sizemore is a Social Sciences Councilor with CUR and a faculty advisor to the student-refereed *Illinois Wesleyan Undergraduate Economic Review (IWUER)*. She is the student research module coordinator for *Starting Point: Teaching and Learning Economics*, a pedagogic portal project developed by economists in collaboration with the Science Education Resource Center of Carleton College (National Science Foundation, Grant DUE0817382, \$497,953, PIs: M. Maier, C. Manduca, K. McGoldrick, S. Simkins). *The American*

*Economist* article "Creating Quality Undergraduate Research Programs in Economics: How, When, Where (and Why)" with Steve DeLoach and Mary Borg.



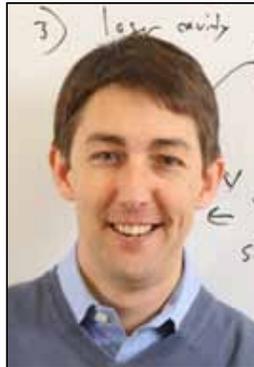
**Alan C. Utter** joined the faculty of Appalachian State University in 1995 and is currently a professor in the Department of Health, Leisure and Exercise Science. He also is director of the university's Office of Student Research and of the academic degree program in health promotion. Utter is a Fellow of the American College of Sports Medicine (ACSM), an ACSM-certified Exercise Specialist

for Preventive and Rehabilitative Exercise Programs, and an ACSM-registered Clinical Exercise Physiologist. His research focus is assessment of body composition, sport performance, and cardiovascular/metabolic/perceptual responses to exercise. Utter has more than 90 research publications in peer-reviewed journals, including *Medicine & Science in Sports & Exercise*, the *European Journal of Applied Physiology*, *Sports Medicine*, and the *American Journal of Clinical Nutrition*. He is a frequent presenter at regional, national, and international meetings. He serves as an associate editor of ACSM's *Medicine & Science in Sports & Exercise* and the *Journal of Strength and Conditioning Research*. He also is editor for the Health Science Division of the *CUR Quarterly*. He is a CUR Councilor for its Health Sciences Division, a past member of ACSM's Board of Trustees, past-president of the Southeast ACSM, and has served on the Sports Medicine Advisory Committee for the National Federation of State High School Associations. He consults regularly for the National Collegiate Athletic Association and the National Wrestling Coaches Association on weight-loss issues in wrestlers. Utter graduated from the University of Pittsburgh in 1995 with a PhD in exercise physiology and a master's of public health in epidemiology.



**Carl Wozniak** is an assistant professor in the School of Education at Northern Michigan University. He received a doctoral degree in higher education leadership from Western Michigan University, a master's in secondary education from Eastern Michigan University, and a bachelor's degree in communications from the University of Michigan. Wozniak also is

certified as a secondary teacher in Michigan in general science, biology, chemistry, and speech. In addition, he is a Gemological Institute of America-certified graduate gemologist. Prior to his work in the education school at Northern Michigan, Wozniak directed its Ronald McNair Post-baccalaureate Achievement and Freshman Fellowship undergraduate research programs. He has mentored undergraduate researchers and co-presented findings with students. His research interests include postsecondary options for high-school students, the role of undergraduate research in retention, recruitment, and learning, and technology in the classroom. Carl is married to Debra Morley, MD, PhD, a neurologist and human geneticist. They have two adult children; Ben, a senior at NMU, and Erica, a graduate student at Duke University.



**Hank Yochum** is director of the Margaret Jones Wyllie '45 Engineering Program and professor of physics and engineering at Sweet Briar College, a small liberal arts college for women in central Virginia. He frequently works with undergraduate research students from physics, engineering, and chemistry and encourages interested students to jump into research early in their

college experience. He is also active in elementary- and middle-school professional development for science teachers and directs a summer course, Exploring Engineering Design, for high-school women. He currently has research interests in experimental condensed matter physics and nanotechnology, with particular interest in the design and characterization of nanostructured optical devices. He has received funding from the National Science Foundation, the Jeffress Foundation, and the State Council on Higher Education of Virginia. He enjoys teaching a wide variety of courses in physics and engineering, including Technology and Society: A Global Perspective, in which students design and then deliver assistive tools for disabled clients in the developing world. He earned a PhD in physics from Wake Forest University and a BS in physics from the College of Charleston. Prior to joining Sweet Briar, he worked in the Optical Amplifier Development Group at Lucent Technologies/OFS Specialty Photonics in Somerset, New Jersey.

# UNDERGRADUATE RESEARCH Highlights

**Boucher HC, Kofos M.** The idea of money counteracts ego depletion effects. *Journal of Experimental Social Psychology*. 2012; 48:4:804-810. (Bates College)

Two experiments showed that activating the concept of money counteracts the ego depletion effect (whereby one act of self-control, by drawing on a limited resource, makes further self-control more difficult). Experiment 2 showed that this effect is due to the idea of money reducing both the subjective difficulty and effort required on subsequent self-control. Helen Boucher is an associate professor of psychology. Experiment 1 was conducted as Monthe Kofos' senior thesis, completed in 2010. He is a counselor in the inpatient unit of Marlborough UMASS Memorial Hospital.

**Ide J, Jones L.** Enumerating invariant subspace of  $R^n$ . *Linear Algebra and its Applications*. 2012; 437:7:1845-1853. (Shippensburg University)

We develop an algorithm to calculate the set of all integers  $m$  for which there exists a linear operator  $T$  on  $R^n$  such that  $R^n$  has exactly  $m$   $T$ -invariant subspaces. Moreover, the algorithm gives a method for the explicit construction of such a linear operator  $T$ . Lenny Jones is a professor of mathematics. This research resulted from an independent study in advanced linear algebra that Joshua Ide took with Dr. Jones. Joshua Ide is entering a graduate program in mathematics at SUNY-Binghamton in the fall of 2013. The research was funded in part by the Shippensburg University Foundation.

**Chapman MA, Tang S, Draeger D, Nambeesan S, Shaffer H, Barb JG, Knapp SJ, Burke JM.** Genetic analysis of floral symmetry in Van Gogh's "Sunflowers" reveals independent recruitment of CYCLOIDEA genes in the asteraceae. *PLoS Genetics*. 2012; 8:3:1-10. (University of Georgia, Athens, GA)

Species in the flowering plant family Asteraceae exhibit flower heads that can contain both bilaterally and radially symmetric flowers. In this study, we identify a CYCLOIDEA-like gene that is responsible for determining flower symmetry in the sunflower. Mis-expression of this gene causes a double-

flowered phenotype, similar to those captured in Vincent van Gogh's famous nineteenth century paintings, whereas loss of gene function causes radialization of the normally bilaterally symmetric ray florets. Interestingly, this gene is not orthologous to the CYCLOIDEA-like gene responsible for floral symmetry in other members of the Asteraceae, providing evidence of the parallel recruitment of different members of the same gene family for the same function. John M. Burke is professor of plant biology at the University of Georgia. Hunter Shaffer was employed in Dr. Burke's lab during his sophomore and junior years. During his senior year he participated in the research as part of a biochemistry independent research project. He graduated in May 2012 with a major in biochemistry and molecular biology and is currently employed full-time in Dr. Burke's lab. Hunter plans on working as an EMT before starting medical school in 2013. This work was funded by grants from the National Science Foundation and the Gloeckner Foundation.

**Schlewitz AJ, Fegel HL.** Una nueva oportunidad en la investigación del Ejército guatemalteco en el Archivo General de Centro América. *Mesoamérica*. 2012; 54:126-136. (Archivo General de Centro América)

This essay describes military documents that the Archivo General de Centro América made accessible to the public in 2009, which are largely administrative. The essay also discusses the challenges of working with this collection, as well as its promise for researchers interested in reconstructing an institutional history of the Guatemalan military. Andrew J. Schlewitz is assistant professor of Latin American Studies. Heidi L. Fegel is a senior majoring in Spanish and minoring in Latin American Studies. She worked with Dr. Schlewitz in the Archivo General de Centro América as a student summer scholar in 2011. She is currently finishing an honor's thesis based on this archival research. After graduating, she plans to earn an MA in Latin American Studies. Grand Valley State University's Student Summer Scholarship program and its Center for Scholarly and Creative Excellence funded Schlewitz and Fegel's two months of research in Guatemala.

**Ruble JF, Lefurgy ST, Cornish VW, Powers, RA.** Structural analysis of the Asn152Gly mutant of P99 cephalosporinase. *Acta Crystallographica Section D*. 2012; 68:1189-1193. (Grand Valley State University)

We determined the X-ray crystal structure of a point mutant of the antibiotic resistance enzyme, P99 beta-lactamase in an effort to elucidate the structural reasons for its extended-spectrum activity. Unexpectedly, we discovered the engineered histidine tag bound in the active site. From a drug design perspective, this structure may suggest potential binding sites that could be exploited to discover novel inhibitors for this enzyme. Rachel Powers is an associate professor of chemistry. Jim Ruble worked on this project during his last two years as an undergraduate student at Grand Valley. He was instrumental in advancing this project, which was conducted in collaboration with Virginia Cornish's group at Columbia University. He is currently a graduate student in pharmacology at the University of Washington. This research project was funded by a Cottrell College Science Award from Research Corporation and an NSF-Advance professional development grant, which were awarded to Rachel Powers.

**Moore J, Demchak TJ.** Treatment of fibromyalgia syndrome with low-level laser therapy: a case report. *International Journal of Athletic Therapy & Training*. 2012; 17:4:28-31. (Indiana State University)

Fibromyalgia syndrome is typically treated pharmacologically. Low-level laser could serve as a non-pharmacological treatment for fibromyalgia syndrome. The low-level laser therapy treatments decreased pain and increased function in our patient. Timothy Demchak is an associate professor in the Department of Applied Medicine and Rehabilitation at Indiana State University. He was affiliated with the athletic training program at the time the study was conducted. Currently, he is considered a faculty member in the Physician Assistant program. Jesse Moore completed an internship during the summer of 2011 with Dr. Demchak at the St. Ann Medical Center. The case study was from a patient that he evaluated and helped treat throughout the summer. Jesse is

currently a senior athletic training major and is assigned to ISU football for his clinical work. The internship was funded with an Indiana State University Community Engagement Grant.

**Barrett BS, Carrasco JF, Testino AP.** Madden-Julian Oscillation (MJO) modulation of atmospheric circulation and Chilean winter precipitation. *Journal of Climate*. 2012; 25:5:1678-1688. (U.S. Naval Academy)

The smaller cousin of El Niño, the Madden-Julian Oscillation, also affects weather around the world by modulating atmospheric circulation on intra-seasonal (30-day) time scales. Medium-range forecasts of rainfall in semi-arid regions, including Chile, benefit from knowledge of the ways in which different phases of the oscillation modify weather systems, and in turn, rainfall. This study found that two of the eight phases of the oscillation were associated with significantly above-normal rainfall in central Chile, and two were associated with significantly below-normal rainfall in central Chile. This finding is a promising first step toward improving medium-range (30-day) forecasts in those semi-arid regions. Bradford S. Barrett is an assistant professor in the Oceanography Department at USNA. Jorge F. Carrasco is a senior meteorologist with the Chilean National Weather Service in Santiago, Chile. Anthony Testino, an honors oceanography major at USNA, graduated in May 2012. He was named the American Meteorological Society Macelwane Award winner for the top undergraduate research paper in 2012. He oversaw data gathering from online data bases and wrote several hundred lines of MATLAB code to statistically compare rainfall to the Madden-Julian Oscillation. He is currently stationed at the Naval Nuclear Power Training Command in South Carolina. This work was supported by an internal grant from the U.S. Naval Academy Research Council and the Office of Naval Research.

**Martínez AK, Shirole NH, Murakami S, Benedik MJ, Sachs MS, Cruz-Vera LR.** Crucial elements that maintain the interactions between the regulatory TnaC peptide and the ribosome exit tunnel responsible for Trp inhibition of ribosome function. *Nucleic Acids Research*. 2012; 40:5:2247-2257. (University of Alabama in Huntsville)

This study examined the molecular factors involved in the recognition of newly synthesized proteins by the cellular protein-making machinery, the ribosome. Genetic and biochemical experiments were performed to reveal ribosomal molecules that affect the production of proteins and expression of genes. These results open future experiments involving the generation of antibiotics inhibitors of the protein synthesis and bacterial growth. Luis R. Cruz Vera is an assistant professor of biological sciences. Shino Murakami was an undergraduate student at the biological sciences at UAH where she performed part of the work published in this article. Shino is currently a doctoral candidate in the program of Genes and Development at the UT-Southwestern Medical Center. Shino's work was supported by the Research Experiences for Undergraduates program sponsored by University of Alabama in Huntsville and Alabama Space Grant Consortium.

**Demir M, Davidson I.** Toward a better understanding of the relationship between friendship and happiness: perceived responses to capitalization attempts, feelings of mattering, and satisfaction of basic psychological needs in same-sex best friendships. *Journal of Happiness Studies*. 2012; 13. DOI 10.1007/s10902-012-9341-7. (Northern Arizona University)

In this study the roles of perceived responses to capitalization attempts, perceived mattering to, and satisfaction of basic psychological needs in same-sex best friendships in happiness among men and women were investigated (n = 4,382). Findings showed that although all of the friendship variables were positively associated with happiness to varying degrees, basic needs satisfaction emerged as the strongest predictor of happiness. Additional analyses revealed that competence-need satisfaction was the most important need predicting happiness. Importantly, these findings were

gender invariant. Meliksah Demir is an assistant professor of psychology. Ingrid Davidson completed this study in 2012. She is attending Colorado State University, pursuing a M.Ed. in counseling and career development, with school and college counseling emphases. Ingrid received a grant from the NAU Hooper Undergraduate Research Award program to conduct this research.

**Shepherd TD, Koc MA, Molinero V.** The quasi-liquid layer of ice under conditions of methane clathrate formation. *Journal of Physical Chemistry*. 2012; 116:12172-12180. (University of Utah and Westminster College)

Experiments suggest that the quasi-liquid layer (QLL) at the surface of ice may play an important role in the nucleation of clathrate hydrates from ice. Molecular dynamics simulations were run to determine the structure of the QLL under conditions amenable to clathrate formation at various temperatures. These results are relevant for the understanding the mechanism of formation of hydrate clathrates from ice. Tricia D. Shepherd is an associate professor of chemistry at Westminster College. Valeria Molinero is a associate professor of chemistry at the University of Utah. Matthew A. Koc is currently a senior at Westminster College expecting to graduate with a B.S. in chemistry and physics. He participated in this research through the 2010 Gore Undergraduate Summer Research Experience. This research was supported by the National Science Foundation through the award CHE-1012651 (to V.M.) and the Westminster College Gore Math & Science Endowment (to T.D.S. and M.A.K.).

**Thomson AS, Summers PM.** The effect of monetary policy on real commodity prices: a re-examination. *The Journal of Economics (MVEA)*. 2012; 38:1:1-21. (Texas Tech University)

The paper re-evaluated a recent claim that expansionary monetary policy results in higher inflation-adjusted commodity prices. After addressing several econometric problems in the original study, we found very little evidence of such an effect. Peter M. Summers was an assistant professor in economics, and

is now at High Point University. Amanda Thomson was an honors student in economics and graduated in 2010. She is now a law student at the University of Texas at Austin. The research was supported by an undergraduate research fellowship from the Texas Tech University Honors College, awarded to Amanda.

**Kolawole AO, Sharma P, Yan R, Lewis KJ, Hostetler HA, Ashbourne Excoffon KJ.** The PDZ1 and PDZ3 domains of MAGI-1 regulate the eight exon isoform of the coxsackievirus and adenovirus receptor. *Journal of Virology*. 2012; 86:17:9244-54. (Wright State University)

This manuscript demonstrates that the eight exon isoform of CAR (CAR<sup>Ex8</sup>) and susceptibility to apical adenovirus (AdV) infection is differentially regulated by two different PDZ domains of the cellular scaffolding protein MAGI-1. Whereas PDZ3 sequesters CAR<sup>Ex8</sup> within the cell and reduces AdV infection, PDZ1 protects CAR<sup>Ex8</sup> from MAGI-1-mediated loss and rescues AdV infection. Katherine Excoffon is an assistant professor in the Department of Biological Sciences. Kyle Lewis was an undergraduate research assistant (2010-2011) and is currently a Ph.D. student at Baylor College of Medicine. This work was funded by National Institute of Allergy and Infectious Disease (NIH) 1R15AI090625-01 and a Wright State University Undergraduate Research Grant.

**Weidler BJ, Multhaup KS, Faust ME.** Accountability reduces unconscious plagiarism. *Applied Cognitive Psychology*. 2012; 26:626-634. (Davidson College)

Participants completed a Boggle task with a computer partner. Accountable participants were told that they would review their puzzle solutions with the researcher at the end of the session. Accountable participants plagiarized less than control participants. [This study was picked up by a *Wall Street Journal* blog: <http://blogs.wsj.com/ideas-market/2012/06/06/reducing-i-mixed-up-my-notes-plagiarism/>]. Kristi Multhaup is a professor of psychology. Mark Faust is an associate professor of psychology. Blaire Weidler is currently in a doctoral program in cognitive psychology at Washington University in St. Louis. This research was supported by an Abernethy grant (Davidson College) awarded to Blaire and a Faculty Study & Research grant (Davidson College) to Multhaup.

**Morrison-Smith S, Dighans S, Daniels T, Marmon C, Izurieta C.** Technical Debt Reduction Using a Game Theoretic Competitive Source Control Approach Paper. 2012. (Montana State University)

The management of technical debt and the use of productivity games are important aspects of developing software projects. A productivity game was created in the form of a competitive source control plug-in that rewards technical debt-reducing actions. The plug-in has potential practical applications in the management of technical debt in workplace environments. The approach described in this paper is promising, and in future work we plan to test the plug-in with a wider variety of existing projects. Additional research is also planned to investigate the impact on workplace productivity. Clemente Izurieta is an assistant professor in the Department of Computer Science. All the authors with the exception of Clemente Izurieta were students in the senior software engineering class. This project/research was conducted over the course of the semester, and the students worked with Professor Izurieta during the summer to make the work publishable. No funding was provided for the research. However, professor Izurieta will use funds from his start-up package to send Sarah Morrison-Smith to present the paper at the 25th International Conference on Computer Applications in Industry and Engineering, in New Orleans, LA.

**Hark RR, Remus JJ, East LJ, Harmon RS, Wise MA, Tansi BM, Shughrue KM.** Geographical analysis of “conflict minerals” utilizing laser-induced breakdown spectroscopy. *Spectrochim Acta B*. 2012; 74:131-136. (Juniata College)

Laser-induced breakdown spectroscopy (LIBS) offers a means of rapidly distinguishing different geographic sources for a mineral on the basis of a geochemical fingerprint. An application of this approach with potentially significant commercial and political importance is the spectral fingerprinting of “conflict minerals” such as columbite-tantalite (“coltan”). A geographically diverse set of 57 samples from 37 locations around the world was analyzed using a commercially available LIBS system. Partial Least Squares Discriminant Analysis (PLSDA) resulted in a correct place-

level geographic classification at success rates above 90%. The possible role of rare-earth elements (REE's) as a factor contributing to the high levels of sample discrimination was explored. RR Hark is in the Department of Chemistry at Juniata College. JJ Remus is in the Department of Electrical and Computer Engineering at Clarkson University. RS Harmon is a geochemist with the Department of Marine, Earth & Atmospheric Sciences at North Carolina State University. MA Wise is a geologist with the Smithsonian Institution. Ben Tansi did this research during the summer of 2011 and was involved in the project throughout the 2011-2012 academic year. Last summer East did an internship at the University of Massachusetts-Amherst in the field of polymer chemistry. Katrina (Katie) Shughrue did this work during the 2010-2011 academic year as part of her senior thesis on LIBS analysis of conflict minerals. She graduated in May 2011 and is now employed by an environmental consulting firm in the Philadelphia area. The research was supported by funding from the II-VI Foundation.