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A Partnership for the Future: Undergraduate Research's Mutual Benefits for Students and Administrators

Over the past twenty-five years, numerous stakeholders have called for greater accountability in higher education, particularly for public institutions. As a result, assessment of educational outcomes has increased at both the departmental and institutional levels. Most recently, national disciplinary associations have taken an active role, assisting members with internal assessment by providing departments with more information and recommendations about various assessment metrics (Young and Crews 2012). Many of these disciplinary associations encourage departments to promote undergraduate research as a means of accomplishing two separate but intertwined goals: (1) pushing students to complete Bloom's Taxonomy, a foundational classification of learning objectives culminating in a student's ability to analyze and to evaluate information, by creating new knowledge and (2) creating feedback that faculty and administrators can use for internal assessment purposes (Young and Crews 2012). Thus, students can benefit from the experience of conducting independent research and from the direct feedback from mentors and other reviewers, while departments and institutions can utilize the students' performances as feedback for internal purposes, using undergraduates' research competency to revise programs to prepare the next wave of students to produce stronger independent work.

In this article, I propose the integration of undergraduate research into the broader undergraduate curriculum as a means of addressing some of the key lingering obstacles to meaningful assessment regimes, particularly within major research universities. After reviewing the relevant literature on assessment and the benefits of undergraduate research, I offer as support some data derived from the assessment program at Truman State University that show a promising link between students' participation in undergraduate research and achievement of key undergraduate learning outcomes.

Assessment and Undergraduate Research

The benefits of undergraduate research for student learning outcomes are well documented. In general, there is a broad consensus that undergraduate research achieves five important goals: (1) providing experience in the research process; (2) increasing disciplinary knowledge; (3) encouraging exploration of students' interests; (4) preparing students for academia/graduate school; and (5) forming relationships between students and faculty mentors (Ishiyama 2002, 372). There is empirical evidence showing a positive relationship between participation in undergraduate research and achievement of improved abilities in analysis and logical thinking, ability to synthesize information, and competency as an independent learner (371).

In spite of this literature, research from the National Institute for Learning Outcomes Assessment (NILOA) shows that undergraduate research is an under-utilized metric in departmental assessment programs. In 2010, NILOA conducted a survey in which individuals responsible for student learning outcomes assessment within their undergraduate departments or programs were asked about their assessment criteria. Roughly 45 percent of respondents indicated that all undergraduate students in their academic department's degree program complete a final research project as part of the degree program's assessment framework, and only about 55 percent reported that "most" students complete such projects (Ewell, Paulson, and Kinzie 2011, 9). At the same time, more than 40 percent of respondents reported that more faculty involvement in assessment would help the assessment program, while two-thirds of university chief academic officers reported that greater faculty involvement would aid assessment programs.

Assessment personnel have long sought greater faculty involvement in assessment. Within the past few years, leading authorities on assessment have tried to promote faculty involvement through a series of recommendations that include: building assessment around the regular, ongoing work of teaching and learning; reframing assessment as scholarship; and involving students in the process of assessment (Hutchings 2010, 13-16). Taken together with other information, it becomes clear that adding undergraduate research as one metric used in assessment programs measuring student outcomes presents an opportunity to facilitate the faculty involvement that proponents of assessment have desired for so long.

The Problem and the Solution

At this point, it is important to make sense of what the literature is saying about undergraduate research and its role in program assessment. A compelling body of research suggests that undergraduate research promotes learning. NILOA data indicate that the number of academic programs requiring final projects leaves substantial room for growth. Yet the number of programs requiring a capstone course is high (approximately 70 percent of undergraduate department program heads reported that “most” students complete a capstone, while roughly 60 percent reported that all students participate) (Ewell, Paulson, and Kinzie 2011, 9).

The problem is this: There is increasing demand for institutional accountability to various stakeholders that can be satisfied by a comprehensive assessment program, but some institutions, whether due to lack of resources or other factors, continue to resist the implementation of such programs. The solution, however, is quite simple—encourage those institutions to integrate a research project into the already-prevalent capstone requirements and use these projects as a means of improving student learning outcomes, then use student competency with these projects as a metric in the assessment program.

Recall that independent assessment experts recommend increasing faculty involvement in the process, in part, by building assessment around teaching and learning, reframing assessment as scholarship, and involving students in the process of assessment (Hutchings 2010, 13-16). Undergraduate research, as part of an assessment program, fulfills each

of these recommendations. By integrating undergraduate research into the normal curricular requirements, faculty members can use the classroom experience and regular office hours to accomplish academic objectives while gaining a deeper understanding of exactly what their students know about the research process and their discipline’s methodologies and paradigms. In suggesting that assessment ought to be reframed as scholarship, Hutchings intends that the collection and analysis of student data be viewed by faculty as part of their duty as scholars investigating the phenomena surrounding learning (15). This recommendation is rooted in the assumption that faculty have a firm commitment to the pursuit of knowledge and understanding.

Thus, it follows that this recommendation can be expanded to encompass faculty members’ working along with undergraduates on research projects. Such a unified research effort serves the purposes of internal assessment by giving insight into student learning, and it expands on the benefits of undergraduate research by creating the possibility that students can leave their undergraduate experiences having contributed to published work, having presented research at a major conference, or having developed a meaningful relationship with a faculty mentor. Indeed, this seems especially promising for major research institutions, where faculty members are expected to publish extensively but where undergraduate research programs have consistently lagged behind liberal arts institutions in terms of assessment.

Finally, using undergraduate research as one component of an assessment process fulfills the recommendation that faculties involve students in the assessment process. There is perhaps no better means of accomplishing this goal than by using an intensive student-initiated or student-assisted research project to help measure peers’ learning outcomes.

To sum up, the benefits of undergraduate research for university administrators and undergraduate academic department heads are clear. Major higher-education institutions need meaningful assessment regimes to fulfill stakeholders’ demands for accountability. Multiple disciplinary associations endorse the use of undergraduate research projects as a metric in assessment (Young and Crews 2012). Moreover, undergraduate research is a step toward increasing faculty engagement in the assessment process, an outcome that both chief academic officers and assessment directors desire

(Ewell, Paulson, and Kinzie 2011, 11-12). By incorporating undergraduate research into the curriculum, faculty gain a relatively easy method of assessing learning outcomes, and the information gained can easily be used to retool courses that emphasize methodologies and/or research processes. For departments or programs that lack the capacity to require full-scale independent research projects from all students, a comparable substitute (for assessment purposes) could be student research teams working together or simply requiring the submission of independent research designs sufficient to demonstrate a student's understanding of the research process and a conceptual mastery of methodologies. However the specifics work out in individual departments and programs, the key is that the faculty get a deeper understanding of how their students approach complex problem-solving and employ critical college-level skills.

New Support for the Benefits of Undergraduate Research

While the body of empirical data supporting the positive link between participation in undergraduate research and achievement of key learning outcomes is robust, there is always room to add a bit more support. I can do this by presenting some small-scale findings based on publicly available assessment data from Truman State University (Truman). In 2002, Ishiyama published findings based on survey data collected at Truman from the College Student Experiences Questionnaire (CSEQ) (Ishiyama 2002, 371). This research demonstrated a positive link between participation in undergraduate research and gains in students' abilities in analysis, synthesis of information, and independent learning (371). I have built on this research by updating the data to include assessment scores for several years following Ishiyama's research and by applying a modified statistical test.

Truman is a recognized leader in undergraduate academic assessment, having demonstrated a serious commitment to implementing a "culture of assessment" since the early days of calls for greater accountability (Magruder, McManis, and Young 1997, 17). The university makes substantial amounts of assessment data available for public viewing, including summarized reports from the College Student Experiences Questionnaire, which is administered at the end of each semester (fall, spring, and summer) to juniors enrolled in a

mandatory interdisciplinary seminar course. This questionnaire asks students to rank various educational experiences at their university on a scale of 1 to 4. Among the questions are some asking students to indicate the extent of their participation in undergraduate research and the extent of their perceived intellectual growth in several areas during their time in college.

Using the results of 15 questionnaires from Truman, I compiled a small data set of the university's mean scores in four areas: participation in undergraduate research, quantitative analytical ability, ability to synthesize information, and independent learning ability. In addition, I created an index score to capture the combined effects of these abilities. These indicators of learning outcomes also were used in the Ishiyama study upon which this research builds (Ishiyama 2002, 374), and these are fundamental college-level learning outcomes identified by several national disciplinary associations as elements of a strong academic program (Young and Crews 2012). Using the participation in undergraduate research score as my dependent variable, I ran a simple linear regression analysis for each of the remaining scores to assess the impact of undergraduate research on analytical, synthesis, and independent learning abilities. The results are displayed in Table 1.

Table 1

Variable	Beta	Significance	R square
Index Score	.177	.0001	.0885
Quantitative Analysis	.223	.0001	.0963
Synthesis	.196	.0001	.1219
Independent Learning	.112	.0001	.0249

It is important to acknowledge certain caveats to my findings. Due to limits on data availability, I was only able to construct a test using mean scores as opposed to the raw survey data. As a result, the number of participants used for this study is too low to support any sweeping conclusions. Moreover, the sample consists only of juniors attending a public liberal arts and sciences institution, and these participants are self-reporting their beliefs about their learning

gains. Thus, the survey population does not fully represent the characteristics of the national population of college students, and there is certainly room to question the validity of self-reported measures. However, with limited data available, self-reporting gives us at least some clues about students' intellectual growth. Moreover, when these results are taken together with the whole body of research reported in the literature, they warrant consideration. Finally, this research serves as a pilot test that can be expanded in the future as more data become available, preferably including data derived from faculty-driven assessment, such as reviews of student academic portfolios, a common assessment metric (Young and Crews 2012).

The data, on the whole, show promise. There is a statistically significant positive relationship between the dependent variable and each independent variable. While the R-square values are low across the board, this is not unexpected, as learning outcomes are surely shaped by far more than just one element of an undergraduate experience, such as participation in research. The beta scores, while low, are promising when one considers their ramifications. If universities or undergraduate academic departments adopt a policy requiring all students to have at least some exposure to undergraduate research, the mean scores for the dependent variable will increase dramatically and, as a result, so will mean scores in the key learning areas involved in this test. Overall, however, this data supports what scholars and proponents of undergraduate research have long known: The link between research participation and key learning outcomes is solid.

Conclusion

As the need for meaningful undergraduate assessment grows, major research universities, particularly those publicly funded, will need to find effective ways to satisfy stakeholders' demands for accountability. The consistent link between undergraduate research participation and achievement of key learning outcomes for students—together with undergraduate research as a means of facilitating faculty involvement in assessing students' learning outcomes—indicate that undergraduate research can serve the interests of both students and administrators. Through research participation, students gain both tangible and intangible intellectual and professional growth. At the same time, undergraduate

research can provide faculty members, chief academic officers, and other administrators with insights into the strengths and weaknesses of their undergraduate academic programs, allowing for meaningful revisions of curricula that will better prepare each subsequent wave of students.

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Adam Crews

University of Virginia, agc5zv@virginia.edu

Adam Crews graduated from Truman State University in 2012 with a BS summa cum laude in political science. He currently attends the University of Virginia School of Law. As an undergraduate, his research focuses included American electoral behavior and the role of disciplinary associations in undergraduate academic assessment. From 2011 to 2012, he worked as a research assistant for Candace C. Young, chair of the American Political Science Association's Teaching & Learning Committee.

CURQ Vignettes Spring 2013



Introduction to the Web Vignettes of the Student-Themed CUR Quarterly

Research can be a valuable tool in an undergraduate's career, but the majority of students do not employ it. For the few who undertake the task, however, it will be an unforgettable experience that may help to shape

their professional futures. This student-themed issue of the *CUR Quarterly* provides a glimpse into some of the questions, challenges, and experiences of undergraduate research from those who have experienced it first-hand.

Marissa Carmello and Kazlin Mason of the State University of New York-Fredonia provide an overview of undergraduate research, with a detailed explanation of the steps involved in research that culminate in an undergraduate research article. This traditional approach to undergraduate research can be taken by any student who has the desire to find answers to the questions their courses are raising. The article also discusses the importance of a mentor and explains the mentor-mentee relationship that develops during the process of undergraduate research.

Adding to this overview, Rita Ally Martin of the University of Alabama provides her ground rules for undergraduate research for a first-generation college student. These rules, in fact, are useful for anyone involved in undergraduate research. Martin's discussion of the assumptions students may make about undergraduate research doesn't only apply to those who are first-generation students; it also applies to any student who hasn't previously been involved in research. Common misconceptions about undergraduate research can deter a student from becoming involved, and this article helps to clear up some of them.

Jaime Antonio Castillo of the University of Wisconsin-Oshkosh continues the theme of research from the point of view of a first-generation college student. Castillo's experi-

ence of research in a virology laboratory conveys a detailed understanding of how research can affect a student's future and develop into a graduate thesis and perhaps even a career. Castillo also mentions the McNair Scholars program, introducing funding options for undergraduate research.

It is important to note that undergraduate research doesn't simply apply to those students who sport lab coats and protective goggles. Research is a multifaceted experience that can be obtained by any individual with the heart to take on the challenge.

Julie S. Allstrom of George Mason University focuses on undergraduate research opportunities for students who are returning to school as adults. Adults who have the responsibilities of a family and career may feel that they are too busy to become involved in undergraduate research. However, Allstrom outlines the reasons these students should consider research and some steps to ease the process for them.

Amber Gibson of the University of Alabama also discusses some non-traditional areas of undergraduate research. Going beyond what many students assume research is about, she shows that students from any background can accomplish undergraduate research, as long as they have the drive and seek to answer a question. Gibson explains her experience with research in theater, laying out her roadmap to provide an example of how research works in a performing-arts major.

Erin Smith of the University of Alabama explains research from her background in anthropology. This vignette provides an overview of Smith's research and its many satisfying opportunities, encouraging others to involve themselves in such projects.

Amber Anderson and Bradley Celestin of Bethel College expand the research process to include other venues, in particular that of the research conference. Research that is compiled for an article can easily transfer to a poster or conference presentation, and Anderson and Celestin provide several examples. They discuss three different conferences, allowing readers to consider a variety of options. Additionally, Celestin and Anderson show that research creates community because it requires several people to create a successful project.

Nancy Abrego of Molloy College continues this idea of the research conference with a vignette discussing conference posters and tips for preparing them. Her experience at the New England Science Symposium fueled the seven tips, presenting excellent ideas and advice for any conference presenter.

Undergraduate research can also provide students with exciting new experiences in an international setting. John Turiano from Fordham University, whose research took him to Kyrgyzstan in Central Asia, provides a list of tips and tricks to excel in such an environment. Turiano distills his advice into several points and applies them to his own research experience to show how these tricks can be used by other students in their own international lines of study. Paula Adler of the University of Ottawa also discusses the experience of international undergraduate research and provides a list of tips. Both of these articles are helpful, because students in an international study-abroad program find themselves in a whole new world, not only in their research and studies, but also in their physical and cultural surroundings.

Melissa Gutworth of the College of New Jersey provides perspective on another helpful research option: summer research. These programs can prove to be an extremely successful avenue of undergraduate research because students are not carrying other academic obligations then, and such programs do not require the financial commitment that may be required for international study. Gutworth draws from her own experience to present several great reasons to become involved with summer research programs.

The experiences of all these authors provide a strong sample of the positive aspects of undergraduate research and why more students should be involved.

Finally, Maria Brun of the University of California- Davis, discusses the psychological and intellectual demands of research. She talks about some of the stress points that young students may face in pursuit of undergraduate research and offers suggestions on how to ease issues that may arise during the research process.

The articles in this themed issue of the *CUR Quarterly* provide glimpses into the world of undergraduate research, addressing some of the misconceptions about research and presenting some examples of programs that students may pursue. It is important to remember that undergraduate research can be conducted by every student in every major and that there are several avenues of research that may fit the needs of an individual student.

Whether seeking a future in the worlds of research, the arts, non-profit organizations, banking, or sports medicine, any student has the ability to become a part of undergraduate research. This issue of the *CUR Quarterly* may be just the thing to help more students get started.

Cat Bradley

*University of Central Florida (undergraduate)
and University of Oregon (graduate school)
Cbradle2@uoregon.edu*

DISCIPLINARY

Undergraduate Research in Anthropology

Erin Smith, *University of Alabama, ecsmith5@crimson.ua.edu*

When I heard about undergraduate research opportunities being available in college, I automatically thought of science-related studies. As a history major, I was initially concerned that there weren't many opportunities for research within my field of study. Somehow, though, before I knew it, I was sitting in an archaeology lab analyzing lithic, or stone, artifacts. Participating in undergraduate research in anthropology has been the most rewarding experience of my college career.

My passion for history led me to discover anthropology. While there are many facets to the field, I was immediately drawn to archaeology, the study of the material remains of past societies. When I was searching for a challenging research opportunity, I imagined myself participating in an excavation, but I was excited when the chance arose to analyze lithic artifacts from a Native American site in a Mississippi river valley. I initially was hesitant about my role, though, because I knew little about Native American tools. The amount that I had to learn to understand the project seemed daunting. With an abundance of reading materials and help from the professor I was working with, however, I learned what characteristics to look for in an artifact in order to determine what type of tool I was analyzing. Participating in archaeological research is entirely different than observing scientific occurrences or crunching numerical data. Anthropological research is a study of the past, rather than a gateway toward the discovery of new things. Holding and interpreting an artifact that was once an integral part of somebody's life never ceases to impress me. I try to envision myself as one of the Native Americans; I speculate as to what my life would have been like. The lithic artifacts that I was studying were once used as tools and, without those tools, a society would never have been able to survive.

At the end of the semester, I had the opportunity to present my research at the Undergraduate Research & Creative Activity Conference, an annual event at the University of Alabama. I prepared a poster compiling data, photos, and analysis of the artifacts and created a research report detailing my work, which I shared and discussed with

judges, professors, and other students. Presenting findings is an essential component of participating in undergraduate research, as it offers the chance to receive feedback on your work and to further understand your project as you respond to questions.

By the end of the semester, the knowledge that I had accumulated vastly surpassed my expectations. Participating in undergraduate research as a freshman is an opportunity that many students should pursue. Research offered me a great chance to apply my anthropological studies and interests in a professional setting, and this is an aspect of college that I would encourage every student to pursue.

A Rehearsal in Research

Amber A. Gibson, *University of Alabama, aagibson1@crimson.ua.edu*

I feel as though actors in academia are rarely given their due. While some majors require many hours in the library researching the Founding Fathers or standing in a lab examining a petri dish, actors face very different challenges in conducting research.

Plays are microcosms unto themselves. In order to properly perform a role, actors must first understand the rules of the "world" they will inhabit on the stage, because they must simultaneously perceive and create that world for an audience. Doing this takes no small amount of skill. When performing a period piece—a play that strongly evokes a historical era—it is essential for an actor to research the year or period in which the play is set. Questions that have to be asked include: What was the political climate of the time? What were the social norms for both men and women? What did class divides look like?

These questions are very important because they do not simply affect the world of the play; they also influence one's character a great deal. To embody a role, an actor must know every part of the character he or she is playing—the "back story," the character's mental state, and the character's opinion on any given action in the play. Research into the world and period of the play are helpful in determining these things. However, an immense amount of creativity also must go into "role" research. It's very rare that characters are given a complete "back story" by a playwright. It is essential, however, for actors to fill in missing details for themselves.

As an example, in Shakespeare's *King Lear* we know almost nothing of Lear's youngest daughter, Cordelia, at the start of the play. During the "love test," arguably the most important and iconic scene in the play, Lear asks each of his daughters to tell him how much she loves him; in exchange he gives them land. While Cordelia's sisters, Goneril and Regan, flatter Lear, Cordelia refuses to do so; this results in Lear disowning her. Refusing to flatter Lear is an incredibly strong action for a character we know relatively little about. As an actor going into this scene, it is important for the person playing Cordelia to determine what her relationships are like with both her sisters and with Lear himself. Why does she publicly humiliate Lear? Why doesn't she simply "go along" with the "love test" like her sisters do?

The beauty of theatre is that these questions don't have solid, objective answers. The answers will be different for each person who plays the role, and that's what gives us diversity and keeps plays that are centuries old, fresh. Leaving such questions unanswered, however, would be devastating to the role. While the research required to answer these questions doesn't always involve hours at a library pouring through multiple resources, it is just as crucial to a good performance as that library time is to a successful thesis.

Student Research: The Rewards and Responsibilities

Marissa Carmello and Kazlin Mason, *SUNY Fredonia*,
carm0580@fredonia.edu, masonk@fredonia.edu

Research is an essential part of every field's ability to develop a greater knowledge base, investigate questions, and promote personal and professional development. It leads to better treatment, education, understanding, and applications to daily life. While this endeavor is a big time commitment, undergraduate research allows students to become involved in the practical aspects of their fields and provides students the opportunity to make unique contributions to them.

For undergraduate students considering participating in research, understanding the responsibilities involved is a crucial first step. In preparation, students need to set time aside with their mentors, develop an agenda, and follow through accordingly. This involves weekly or bi-weekly

meetings, a plan for when work will be submitted, and a thorough literature review.

A great project can arise from an idea, a passion, or a topic in need of further study. Research begins when a student has questions and takes the initiative to find the answers. Answering these questions can make significant contributions to, for example, the health-sciences fields and the well-being of others. In the field of speech-language pathology or any medically based field, it is vital to answer questions that will be beneficial to clients and will help provide them with more accurate, evidence-based practice.

After the student researcher poses a question, it is important to find a mentor who is well-versed in the topic to be studied. The mentor will help the student through the entire research experience—from formulating a question to presentation and publication. It is vital for the student to keep open lines of communication with the mentor because the student-mentor relationship will quickly become a team of two equals working together to answer and solve the underlying question. Working with a professor who is doing research in the student's area of interest provides the student researcher an opportunity to obtain research experience without having to take exclusive responsibility for each aspect of the study. This model of apprenticeship leads students through the research process and allows students to use the knowledge, guidance, and support of their mentors to progressively increase their own skills.

The research question directs the review of literature. The student and mentor then develop the methodology. The student researcher may need to ask several questions, such as, are the resources needed to complete this project readily available? How many subjects will be used? Answering questions such as these before beginning data collection will help set the stage for a well-organized and balanced project.

Once data collection begins, organization and time management are key. Working with human subjects can be time-consuming and difficult due to the fact that the subjects may have different schedules and priorities than those of the researchers. Recruitment of subjects also takes time. Following data collection, the student can analyze and interpret the results. This is an exciting part of the project because everything begins to come together.

One of the most exhilarating experiences that student research offers is the ability to share the results, whether in a journal article, a research exposition, or a presentation at a statewide convention. Communicating your results to other professionals in the field is vital. It allows others to provide feedback on the study, give suggestions for future research, and discuss how the findings may be useful in the field. Although this may be an intimidating aspect of student research, it is an experience that will allow the student researcher to grow personally and professionally.

Over all, the experience of undergraduate research can be very rewarding, allowing students to expand their knowledge base outside of the classroom and gain crucial experiences that will give them a head start for all future endeavors.

SITUATIONS

Conducting Research While Studying Abroad: Lessons from Central Asia

John Turiano, *Fordham University*, Jturiano@fordham.edu

Conducting undergraduate research in a study-abroad program presents students with a unique set of demanding challenges. While abroad, undergraduates are not only removed from on-campus research support and mentoring, but also must learn to balance their research project with the constant tug of exotic distractions. In the summer of 2011, I contended with such challenges while studying and researching abroad in the Central Asian state of Kyrgyzstan. The trip itself focused primarily on intensive study of the Russian language. However, in my time outside of class I also chose to pursue a political-science research topic. Reflecting on this research experience, four critical practices bore me successfully to the study's conclusion. Thus I urge other undergraduates to:

Prepare and decompress: Schedule time dedicated purely to research. Before departure, use such time to solidify your research question and methodology, complete a literature review for the selected topic, and devote extensive thought to developing a timeline for research activities during your time in-country. Ideally, your limited time abroad should be solely occupied by the study's fieldwork. After returning from study abroad, allot time for decompression, analysis,

and synthesis of findings. Including these periods of preparation and decompression in the scheduled research timeline allows in-country time to be used most effectively and lends you breathing room to identify the strongest conclusions from the work completed abroad.

Engage with the local environment: No matter how much you have read about your intended destination, there is no substitute for first-hand experience to acquire local knowledge. Therefore, participate in local daily life, verify the conclusions put forth in other publications, if possible travel within the country itself, and ask research-related questions even outside the context of formal interviews.

Communicate with your research mentor and program leaders: Study-abroad programs often employ local guides and translators who can be integral to a student's ability to complete a research project because they offer logistical knowledge and helpful perspectives. Make sure your study-abroad program is aware of any research plans. Communication with your mentor can be critical to keeping research progress on track. A regular check-in, whether via email or video conference, lends accountability to your research timeline and grants you the opportunity to get answers to your pressing questions.

Break the foreign student bubble: Foreign students in an unfamiliar environment often form a tight-knit community. While this community can be helpful for support and camaraderie, it is important to remember the overarching purpose of your time abroad. Therefore, strive to make social inroads with local peers, teachers, or administrators. These in-country contacts can be tremendously useful for later consultation and verification of facts.

By following the suggestions above, the exciting experience of studying abroad can also allow you to complete a research project. Given the largely independent nature of research during study abroad, the intimate engagement with real-world phenomena can instill an unmatched sense of empowerment and achievement in undergraduate students. In the long run, this feeling of accomplishment will improve the education and confidence of participating students.

Undergraduate Research Abroad: A World of Opportunities

Paula Adler, *University of Ottawa, padle085@uottawa.ca*

Imagine that you are a student living far from the university at which you study, that you are, in fact, in a foreign country with different people and surroundings,—and that you are engaged in cutting-edge research. For many undergraduate students, the opportunity to conduct research in an international context is one that should not be missed. Developing research skills, experiencing a different culture first-hand, and discovering the sights of another country are just a few of the several benefits that accompany a research experience abroad. The following are tips for succeeding in an undergraduate research experience in a foreign country, while thriving as an active member of a research group.

Stand out by getting involved. Lend a helping hand and volunteer to take on extra tasks whenever the opportunity arises. Being involved in many areas of research is one of the best ways of creating a positive and lasting impression on a supervisor or professor, in addition to enhancing one's critical-thinking abilities and learning new practical skills. While abroad, take advantage of the chances to learn about research being conducted at other institutions by attending symposiums and lectures by guest speakers, and, if possible, present your own research at a seminar or poster competition.

Create a global picture of the project. Take a step back after learning the specific aim of your own project to see where it fits into the long-term goal of your group's project. Being aware of the small portion that one's research will contribute to the overall project's goal helps put one's work into perspective.

Learn things right the first time. Mistakes will be allowed the first time you do most things, but you should try your best not to repeat them, as this would demonstrate you did not take the time to learn the procedure correctly. If you are unsure or feel that you do not adequately understand a certain aspect of a procedure, you should not hesitate to ask for clarification from someone who has the relevant experience and knowledge.

Generate your own deadlines. Get the paperwork necessary for traveling and living abroad, as well as reports and pre-

sentations, finished as early as possible by setting your own deadlines. Creating deadlines encourages you to prioritize, ultimately allowing you more time to appreciate the research experience.

Say "Yes" to (nearly) everything. Remain open-minded, including towards the new research environment, cuisine, music, and cultural practices. You certainly will be offered novel and rich experiences. Do not forget to travel around and enjoy your host country: You may not have the chance to do so again anytime soon.

Conducting research in another country is a unique and unforgettable experience, one that can be extremely rewarding, particularly using the tips outlined above. The opportunities to learn new things, create new experiences, and explore new cultures are endless, so learn, create, explore—and imagine.

Tips for a Successful Conference Poster

Nancy Abrego, *Molloy College, nm.abrego@gmail.com*

I presented my research on mesenchymal stem cells for the first time at the New England Science Symposium (NESS) held at Harvard University in March of 2011. This symposium hosts undergraduate students, along with doctoral candidates, postdoctoral researchers, doctors of osteopathic medicine, and MDs.

As the setting for my first research and presentation experience, this was a daunting venue. I would like to help other undergraduates preparing to present their research to benefit from my experience. Thus, I offer several tips and explain my rationales.

Tip #1: *Don't let the size of the conference overwhelm you; let it motivate you.*

My very first science conference was held at Molloy College, and I was nervous because of the number of students who were presenting their research—although the number now seems tiny compared to NESS. Most of the students around me had previous experience with presenting their research. However, I was determined to present my research as if I had presented multiple times before and was just as experienced as all the other students. At the end of the day I found out that I was one point away from getting third place in my

category. Although I did not receive an award that day, I felt like I earned first place!

Tip #2: *Keep in mind that you know your research better than anyone else.*

My mentor, Dr. Jodi Evans, gave me that advice because, initially, whenever I practiced my presentation in front of her, I would become frustrated and panicky because I couldn't remember every bit of information in my research. She would always tell me the judges don't care about every little detail and that I had to focus on mentioning key points. She reminded me that the judges weren't the ones in the lab for hours doing my research and that I knew my information better than anyone else, because I was the one who had done all the work. I went to my conferences with that mentality, and it truly helped.

Tip # 3: *Take comfort in knowing that you are not the only one who is nervous and new to the experience.*

Although it felt like I was surrounded by students who had extensive experience with presenting their research, I found that just as many students were first timers who were just as nervous as I was. You should always remember that even the students who have previous experience were once nervous first-timers like you.

Tip #4: *Take time to look around and see all of the interesting work being presented.*

Whenever I had any free time at a conference, I always walked around and looked at what others presented. Seeing what other students are interested in can give you great ideas to expand your own research.

Tip #5: *Don't be afraid of the judges. They don't bite—at least they didn't bite me.*

The most intimidating part of conferences for me was always the judges. Yet they weren't the mean judges I sometimes envisioned. They were all extremely friendly and even gave me advice on what I could do to improve my presentations in the future.

Tip # 6: *If the first run-through before a judge goes poorly, don't give up. Use it as a warm-up for the second judging.*

I remember at NESS when my first judge approached me my mind went completely blank! I couldn't seem to remember anything and jumbled up all of my information. I kept forgetting to mention certain things that were key points in my research. It was a perfect example of what not to do during a presentation. When my judge asked me if that was my first

time presenting because he said it showed, I was mortified! He told me not to worry, that everyone has one of those moments and that I could only get better.

When my second judge came up to me, I nailed it! He even complimented me, with the following exact words that I will never forget: "It's great to see a student doing such noble work!" I was thrilled and so proud of myself that I didn't care that I didn't get an award. I proved to myself that I was capable of presenting my research and that I could rebound from doing so poorly on my first try to explain my project.

Tip #7: *Enjoy yourself!*

Research presentations can be a great experience, and you will do much better with a positive attitude.

How to Succeed in a Summer Research Program

Melissa Gutworth, *The College of New Jersey*,
melissa.gutworth@gmail.com

During the summer between my junior and senior years of college, I participated in The College of New Jersey's Mentored Undergraduate Summer Experience (MUSE), which allows undergraduates to conduct research with professors during the summer. By participating in this type of program, students are able to focus on building specific research skills without other academic obligations. These programs often focus on the students' ability to construct, conduct, and present research projects. Additionally, many summer programs focus not only on goals that can be achieved during the program, but also strive to prepare students for continued research and education.

To make the most of this opportunity, there are some key steps that students can take. First, it is important to have an initial student/faculty meeting before the start of the summer program. This meeting will allow mentors and mentees to discuss the details of the program and mutually agree upon goals and objectives. While the faculty members can discuss the schedule and what they expect to accomplish throughout the program, students can also help shape the summer session by providing input about personal goals they want to achieve or skills they hope to improve on. In most cases, it is possible for faculty mentors to tailor the program to students' needs. By having this initial meeting,

students and faculty can work together to ensure that the program is mutually beneficial.

Another great aspect of summer research programs is that they often include students conducting research in a variety of disciplines. During the academic year, it is easy for students to become deeply entrenched in their own work and lose sight of how much can be learned from other fields. The diversity of projects that can be found in summer research programs enables students to learn not only from their faculty mentors, but also from fellow students. Some programs have open research talks in which students can present their work and learn from each other. I highly encourage students to attend these sessions in order to capitalize on these opportunities.

Finally, students will inevitably find themselves with some free time outside of the working hours set by their programs. Some programs have scheduled activities for students after hours such as sports, trips, movie nights, or other social gatherings. Participating in these events will help students meet new people with similar interests. Additionally, students should take advantage of being in the academic environment over the summer by preparing for the graduate school application process and/or any standardized tests that are required. I was able to complete the majority of my graduate school prep work during my program and was grateful when I had less stress about applications during the school year. Overall, summer undergraduate research programs are great opportunities for faculty and students alike.

Presenting Undergraduate Research at National Events

Amber Anderson and Bradley Celestin, *Bethel College*
amberand@bethelks.edu, bradcelestin@gmail.com

At any educational level, developing motivation for learning is just as critical as comprehension of information. The undergraduate level provides the most opportune time for developing students' intrinsic curiosity and intellectual hunger since this is the time students are able to choose the direction of their education on their own. This opportunity manifests itself most fully in undergraduate research, in which students communicate their unanswered questions

to their professors, collaborate to form hypotheses, and, finally, complete and present the research.

We think that interactions between students and professors foster not only curiosity, but also important relationships. There is nothing quite like the experience of mutual discovery under the guidance of a professor who is as passionate about the research topic as the student is. Thus, undergraduate research cultivates a community of people who are personally invested in the success of a project.

Events such as the National Conference on Undergraduate Research (NCUR), the Faculty for Undergraduate Neuroscience (FUN) poster session, and the Posters on the Hill (POH) event sponsored by the Council on Undergraduate Research provide real and meaningful opportunities for students to share their research with others and to explore research conducted by their peers. These events function as a material finish line—a common goal—toward which students and professors unite their efforts. For the authors, engaging in events such as NCUR, FUN, and POH has resulted in a strong sense of reward and accomplishment, both educationally and personally. The different events provide different benefits to presenters.

At NCUR, students discover a large number of student researchers involved in a broad variety of projects. Following acceptance to NCUR, presenters also have the opportunity to submit a paper to the *NCUR Proceedings*. If published (the fortunate outcome for one of us), the paper adds an important element to one's research portfolio that can be viewed and appreciated by anyone, including prospective graduate school professors and employers.

The FUN poster session, though focused on neuroscience, shows the student the striking variety within this interdisciplinary area, especially in the context of the vast Society for Neuroscience conference of which it is a part.

POH provides yet another perspective on undergraduate research, involving a much smaller, select group of students. Students at POH also learn about federal funding of research, advocacy for science and higher education, and careers in government agencies.

We both learned from these conferences that “research” doesn't necessarily involve laboratory coats and goggles; instead, we found that, at the undergraduate level, research

can stem from any basic question and be followed by creative methods to answer this question.

The work leading up to the conferences was demanding, but we feel that the enthusiastic response to our posters by attendees at the conferences made the effort worthwhile. The curiosity that led us to these conferences was rewarded in a way that makes us eager for similar opportunities in the future.

Trapped Between Learning Paradigms: The Psychological Challenges of Transitioning to Research

Maria Brun, University of California, Davis, mcbrun@ucdavis.edu

The intellectual demands of research pose formidable challenges for young students. However, the psychological challenges—feelings of frustration, of being overwhelmed, doubt, and even stupidity—can be even more detrimental to the educational nature of undergraduate research partnerships when they lead to unproductive expenditure of valuable time and early burnout. Though many of students' frustrations are related to the technical and theoretical aspects of research, based on my experience and on anecdotes related by peers across the social sciences, an underlying cause of these psychological stresses appears to be the transition itself from classroom learner to learning through research.

When undergraduates participate in research for the first time, they are accustomed to the process of classroom learning in which passing one course indicates a certain level of accomplishment, as indicated by one's grade. A lifetime in research is not necessary for one to realize that, in contrast to this short-term, merit-based experience of learning, the process of developing the skills needed to conduct meaningful, interesting projects is a continual experience throughout one's career. Moreover, research lacks the structure of classroom learning. Students find themselves, often for the first time, without the safety net of textbooks, study guides, and, particularly in the social sciences and humanities without a solid footing based on equations, laws, and accepted theories. This ambiguity can be a primary source of anxiety, frustration, and hours wasted attempting to wade through pages of journal articles without the skills needed to determine the most useful source material.

Even the system of measuring one's progress is not straightforward. Unlike classroom learning in which progress is easily accessed through homework assignments and exams with letter grades determined by faculty and teaching assistants, assessing progress and level of proficiency on a research paper or project is subjective and based more on feedback actively solicited from the academic community. Lacking a clear measure of progress and not knowing to continually seek feedback from peers and more experienced researchers, young researchers can become anxious and fail to make meaningful progress; they may become either over-confident or constantly second-guess their abilities.

Thus there are aspects of research that are not only technically challenging but that also are distinct and incompatible with the classroom-learning paradigm. As a result, recognizing that students are transitioning to a new style of learning is key to assuaging some of the mental stumbling blocks that arise. To assist students with the transition, it would help if mentors and programs added more emphasis on developing a skill set over time, encouraging students to seek out others with research expertise to help them fill in the gaps when they find their skills lacking. Students also should be encouraged to actively solicit feedback, beyond set times for conferences, when a project is near completion so they have realistic expectations. These steps can improve the educational experience of undergraduate researchers and better prepare future generations of scholars.

POPULATIONS

Five Ground Rules of Research for First-Generation Students

R. Ally Martin, University of Alabama, ramartin1@crimson.ua.edu

After spending three years at a public land-grant research university, it is easy to name the many initiatives in place to get undergraduates involved in research and research programming. However, as the first in my family to attend college, I was not very knowledgeable about them during the first months of my undergraduate career.

In the beginning, I understood research as a lofty notion that only an elite few of the student body participated in.

It involved safety goggles, lab benches, and countless hours of hard work. This somewhat misguided understanding of what undergraduate research is arose from images in movies, television, and university-made paraphernalia.

Whether they realize it or not, first-generation students and their families rely solely on public opinion and popular media for a glimpse of what undergraduate life is like prior to experiencing it first-hand. From my experience, the only aspect of my initial idea of research that has survived until today is this: hard work. Based on what I've learned, I suggest the following ground rules for undergraduate researchers—whether or not they are first-generation college students.

First and foremost, understand that research can be done by anyone who is willing to do it. First-generation students should know that they should not be intimidated by research. As long as there is a willingness to commit to a common goal, there will be an available position on a project.

Second, research is a respectable career. At most universities, faculty members are called not only to teaching, but also to research and service. Academic research is also a key tool utilized by many private firms and organizations. As with any career choice, there are certain benchmarks that, if reached, can jump-start a career in research.

Third, research extends beyond the fields of the hard sciences, engineering, and math. Anyone with any major or any interest can perform research, which can also take the form of creative activities, study-abroad experiences, and historical inquiries.

Next, research involves teamwork. Whether working across campus or across the globe, the most successful researchers are knowledgeable about the other experts in their fields and work diligently to foster constructive relationships with other scholars.

Finally, success in research at the undergraduate level depends almost solely on faculty support. First-generation students should see faculty members as approachable, helpful people. They are a gateway to success in research and will provide priceless mentorship and wisdom for ideas and projects.

Advice for Older Students: Pursue Research Opportunities

Julie S. Allstrom, *George Mason University*, jallstro@gmu.edu

I returned to college after a job layoff, intending to complete an undergraduate degree I had abandoned decades before. I thought a bachelor's credential would improve my prospects for new employment, and it has done so. But what has made the biggest difference for my emerging career is the research I conducted as an undergraduate. The research experiences enabled me to develop expertise in a new field, broaden my base of contacts, and contribute to a growing body of knowledge. Most importantly, my research experiences have been the best part of returning to college.

The potential advantages of becoming engaged in research may not be apparent to most nontraditional-aged students. I was usually the oldest—and the only student over age 25—in most of my undergraduate endeavors. Career and family responsibilities, added to the demands of coursework, can fill every waking moment of an adult student's life. Participation in events on campus often is not possible, precluding opportunities available to traditionally aged, residential students. However, I suggest two simple steps that make it easier for older undergraduates to pursue research opportunities and reap the benefits:

Become an expert. At my institution, George Mason University, the adult degree-completion program requires a three-credit course entitled The Research Process. Many academic disciplines offer similar undergraduate research-process or methods classes, and I recommend that students take the appropriate course as early as possible. It will provide an invaluable framework for achievement in subsequent courses. It can even help in acquiring and successfully completing “stretch” assignments at work. Managers value employees of any age who can apply proven processes and methods to unfamiliar tasks.

In addition to developing expertise in the research process, become a content authority. Select a narrow focus in your discipline and learn all you can about the topic, making it your specialty. Ask each professor for permission to perform research and write about your topic for assignments and projects.

I extended this approach to elective courses as well. It became a strategy that enabled me to effectively and confidently present findings on my specialty to student colleagues and faculty members in other disciplines.

Expand your professional network. I have benefitted greatly by providing information about my research activities to a wide range of interested individuals. I send short emails to former professors, classmates, and colleagues with updates on my progress. One of those contacts led, after a series of introductions, to a prestigious internship, and from the internship, to a paid contract.

My network also has provided new avenues for research. My faculty mentor suggested a program unfamiliar to me, leading me to investigate the opportunity and to submit an application. Subsequently, I received an Undergraduate Research Scholars Program Award through George Mason's Office of Scholarship, Creative Activities, and Research (OSCAR). My network now includes the OSCAR faculty administrators and other student researchers with whom I worked.

These two steps can considerably enhance the experiences of undergraduate researchers. Older students, particularly, may find them essential in obtaining graduate research opportunities and developing new careers.

Finding Success and Confidence in the Virology Laboratory

Jaime Antonio Castillo, *University of Wisconsin Oshkosh,*
Castilloj34@gmail.com

Many young adults my age are content with a high-school diploma or with well-paying physical jobs, but I am not. I wanted to make a difference and challenge myself in the hopes of finding success somewhere along the way. I had already overcome so many obstacles throughout high school that being accepted to the University of Wisconsin Oshkosh was by far one of my proudest moments ever. My parents came to this country more than twenty years ago in search of a better future for their children. We all worked long, hard hours on a potato farm to make ends meet, making less than minimum wage. However, I have always been proud of the fact that my parents showed me what life would be like if I did not continue my studies, by exposing me to the

field work that would await me. Many traditional Hispanic families depend on the males to be the breadwinners and to be head of the household. A husband and father, I deviated from my traditional role to become a full-time college student. Higher education and participating in undergraduate research are securing a future for my family and me.

As a first-generation, low-income student from a close-knit Hispanic community in Fond du Lac, Wisconsin, I initially never thought about doing research and going on to graduate school. However, the McNair Scholars Program, a TRIO program funded by the U.S. Department of Education, has given me opportunity to engage in undergraduate research in a virology laboratory. My research involves reading scholarly literature, writing grant proposals and research papers, and analyzing data. As a student researcher, I find that being able to design and discuss research in a clear and thorough manner are very important skills. Many such skills are needed to become successful in any job, and especially in graduate school. Raising a family in the process of going to college has helped me learn how to balance and manage my time, especially during the academic year.

My research consists of screening samples of pomegranate seed extracts for their inhibitory effects against different viruses (vaccinia, influenza, poliovirus, herpesvirus and parainfluenza) grown in tissue cultures. I have also examined the effects of other fruits such as cranberries and cherries in conjunction with pomegranates. This type of research is important because it could lead to the possible development of a "nutraceutical" and a shift from synthetic pharmaceuticals to more natural, holistic types of medicine. My next goal is to publish my research in a peer-reviewed journal and gain acceptance into a doctoral program in microbiology or biomedical sciences. Undergraduate research has shaped me into a better student, scientist, and role model, not just for other Hispanic or Latino students, but also for the rapidly growing multicultural community on campus as well. *La palabra convence, pero el ejemplo arrasa* (Words may convince, but example is overwhelming.)

UNDERGRADUATE RESEARCH Highlights

Fernando S, Correa J. Quasinormal modes of Bardeen black hole: scalar perturbations. *Physical Review D*. 2012; 86: 064039-064052. (Northern Kentucky University)

The purpose of this paper is to study quasinormal modes (QNM) of the Bardeen black hole due to scalar perturbations. We have done a thorough analysis of the QNM frequencies by varying the charge Q , mass M , and the spherical harmonic index l . The unstable null geodesics are used to compute the QNM's in the eikonal limit. Furthermore, massive scalar field modes are also studied by varying the mass of the field. Comparisons are done with the QNM frequencies of the Reissner-Nordstrom black hole. Sharmanthie Fernando is an associate professor at Northern Kentucky University. Juan Correa is a physics major who participated in the research for credit in the year 2012. Juan is a senior at Northern Kentucky University and will graduate in May 2013.

Cummins A, Briones L. Contemporary Mexican American young adult books of the Texas borderlands. *English in Texas*. 2012; 42:1: 56-61. (University of Texas Pan American)

This synthesis of contemporary Mexican-American young adult literature underscores the importance of offering secondary students texts that portray real-life issues in settings that reveal the full diversity of United States society. The research highlights themes and styles in books written by Texas borderlands authors for middle-grade and high-school English language arts readers. The article shows methods for incorporating and discussing culturally relevant literature. Amy Cummins is assistant professor of English at the University of Texas Pan American in the Rio Grande Valley. Leslie Briones is a senior English major completing education work in preparation for certification as a secondary-level English teacher. The research was supported by an Undergraduate Research Initiative Grant from the Office of Undergraduate Research and Service Learning at the University of Texas Pan American.

Bueno MTD, Reyes D, Valdes L, Saheba A, Urias E, Mendoza C, Fregoso OI, Llano M. Poly (ADP-ribose) Polymerase-1 promotes transcriptional repression of integrated retroviruses. *Journal of Virology*. 2013; 87:5. (University of Texas at El Paso)

We have identified a novel mechanism of the cellular protein Poly (ADP-ribose) Polymerase-1 (PARP-1) in the preservation of the cellular genome. Retroviruses are viruses that replicate by inserting a copy of their genome into the host genome. This replication strategy alters the integrity of the cellular genome, leading to disease. We have discovered that PARP-1 counteracts the transcription of retroviral genomes that invade the cellular genome, thus limiting the phenotypic changes induced by retroviral infection. Dr. Manuel Llano is an assistant professor in the Biological Sciences Department. Crystal Mendoza and Adarsh Saheba are senior undergraduates. They have worked in Llano's lab for two years. Crystal is applying to graduate school and Adarsh to medical school. Eduardo Urias is a sophomore and has worked in Llano's lab since his freshman year. Eduardo presented a poster at the 2011 UTEP End-of-Summer Research Symposium. Crystal Mendoza was supported by the RISE program (NIGMS-5R25GM069621-09). Eduardo Urias was supported by a Research-Teaching Integration program grant (NSF-DUE-1140469). The research was funded by NIH grant 5SC1AI098238 to Dr. Llano.

Handler P, Brabander D. Increased incidence and altered risk demographics of childhood lead poisoning: Predicting the Impacts of the CDC's 5 $\mu\text{g}/\text{dL}$ Reference Value in Massachusetts (USA). *International Journal of Environmental Research and Public Health*. 2012; 9:11: 3934-3942. (Wellesley College)

The impacts of the CDC's new sliding scale lead poisoning reference value on the prevalence and demographic risk of childhood lead poisoning were examined for the Commonwealth of Massachusetts. We found that the new 5 $\mu\text{g}/\text{dL}$ benchmark will lead to a 1,470 percent increase in childhood lead poisoning cases among 9-to-47 month-olds in MA, with nearly 50 percent of the examined communities

experiencing an increased prevalence of lead poisoning. Further, the new highest-risk communities have significantly fewer foreign-born residents and significantly larger white populations than the former highest-risk communities. The new lead poisoning benchmark will drastically increase the number of children with elevated blood lead levels and alter the distribution and demographics of high-risk communities in the state. Daniel Brabander is an associate professor of geosciences and environmental studies at Wellesley College. This research was completed by Phoebe Handler, an environmental studies major in Wellesley College's class of 2012 as part of an honors senior thesis. Phoebe is currently studying nursing and is pursuing publication of other portions of her thesis work. The work was funded in part by a research stipend from the Frost Endowed Environmental Sciences/Studies Fund.

Harper-Leatherman AS, Iftikhar M, Ndoi A, Scappaticci SJ, Lisi GP, Buzard KL, Garvey EM. Simplified procedure for encapsulating cytochrome c in silica aerogel nanoarchitectures while retaining gas-phase bioactivity. *Langmuir*. 2012; 28: 14756-14765. (Fairfield University)

This paper describes a convenient synthesis of nanostructured aerogels that encapsulate the functional protein, cytochrome c, without the previously required need for gold nanoparticles. The method greatly simplifies the bioaerogel synthesis and takes out the need for time-consuming and expensive synthesis or purchase of metal nanoparticles. There have been few reports on encapsulating proteins in aerogels, so this work is a significant step towards finding a more general procedure for encapsulating other proteins in aerogels for potential future bioanalytical devices. Amanda S. Harper-Leatherman is an assistant professor of chemistry. Mariam Iftikhar, Adela Ndoi, Steven Scappaticci, and Elizabeth Garvey each contributed to this research during the summer of each of their sophomore years. Kaitlyn Buzard contributed during the summer of her junior year. George Lisi contributed during his senior year for academic credit. Mariam is a PhD. student at UC San Diego, Adela is employed at New Brunswick Scientific, Steven completed his master's degree at Georgia Tech, George is a PhD. student at Dartmouth, Kaitlyn is applying to medical school, and Elizabeth is completing her senior year at Fairfield University. Support

was provided by a Cottrell College Science Award from the Research Corporation for Science Advancement and Fairfield University's College of Arts & Sciences and Chemistry & Biochemistry Department.

Klempel N, Wilson M, Kim S-K, Annunziato R. A measure of family eating habits: Initial psychometric properties using the Profile Pattern Approach (PPA). *Eating Behaviors*. 2013; 14:1: 41467. (Fordham University)

Although it seems likely that family characteristics and eating habits are a major factor in the development of eating behaviors, there are no self-report measures that examine how individuals view their family's eating habits. Therefore, drawing from social learning theory, the purpose of the present study is to develop a measure, the Family Eating Habits Questionnaire (FEHQ), of familial eating patterns from the offspring's perspective. Internal consistency and test-retest reliability of the FEHQ was established. Significant associations were found between the FEHQ and the Eating Inventory, indicating convergent validity for the FEHQ. Further validation was conducted using a novel statistical technique, the profile pattern approach (PPA). Rachel Annunziato is an assistant professor of psychology. Se-Kang Kim is an associate professor of psychology. Natalie Klempel initiated this research for her senior honors thesis in psychology. She is currently in a doctoral program at Hofstra University.

Kim CS, Stack DH, Rytuba JJ. Fluvial transport and surface enrichment of arsenic in semi-arid mining regions: examples from the Mojave Desert, California. *Journal of Environmental Monitoring*. 2012; 14: 1798-1813. (Chapman University)

Arsenic enrichment in mine tailings, and the dispersion of tailings through natural weathering mechanisms, is a persistent environmental concern in abandoned mine lands throughout the western United States. This study characterizes the fluvial transport of arsenic through field sampling, chemical analysis, and geospatial mapping of dry streambed sediments, tailings piles, and alluvial fans at multiple mine sites. The result is a conceptual model in which episodic precipitation events mobilize mine wastes

downstream and downslope as a series of discrete overlapping sediment pulses, with arsenic concentrations declining exponentially as distance from the source increases. Such a model is transferable to other abandoned mine lands in similar settings as a predictive tool for the fate and transport of arsenic and similar contaminants. Christopher Kim is an associate professor of earth and environmental sciences. David Stack completed an MS degree in hazards and global environmental change and is currently applying to PhD. programs. His work was conducted in 2011-2012 for credit as an undergraduate student researcher in Kim's Environmental geochemistry lab. This work was supported by USGS-MRERP (USGS award number 06HQGR0181) and NSF-CAREER (Award ID 0847811) grants.

Michalak Z, Fartash D, Haque N, Lee, S. Tunable crystallization via osmosis-driven transport across a droplet interface bilayer. *CrystEngComm*. 2012; 14: 7865-7868. (Iona College)

This work is significant for future applications of droplet technology in crystallizing targets such as proteins, where the availability of ever-newer methods for inducing crystal formation are consistently in demand. In addition, it is expected that the interaction of ions and lipids in a monolayer and bilayer should be manifested in the permeability of species across the bilayer, providing an intriguing tool to study controlled crystallization, in areas of sustained interest such as biomineralization and protein crystallization. Sunghee Lee is an associate professor and chair of chemistry. All three coauthors, Zuzanna, Darius, and Nousin, are currently seniors enrolled in the chemistry/biochemistry program at Iona College, New Rochelle, NY. The authors would like to acknowledge the financial support from the National Science Foundation. NH thanks the Patrick J. Martin Foundation for Scholarship.

Bleske-Rechek A, Somers E, Micke C, Erickson L, Matteson L, Stocco C, Schumacher B, Ritchie L. Benefit or burden? Attraction in cross-sex friendship. *Journal of Social and Personal Relationships*. 2012; 29:5: 569-596. (University of Wisconsin-Eau Claire)

We propose that, because cross-sex friendships are a historically recent phenomenon, men's and women's evolved mating strategies impinge on their friendship experiences. In our first study involving pairs of friends, emerging adult males reported more attraction to their friend than emerging adult females did, regardless of their own or their friend's current relationship status. In our second study, both emerging and middle-aged adult males and females nominated attraction to their cross-sex friend as a cost more often than as a benefit. Our findings implicate attraction in cross-sex friendship as both common and of potential negative consequence for individuals' long-term mateships. April Bleske-Rechek is an associate professor of psychology. Somers, Micke, Erickson, and Ritchie participated in the research as an ongoing faculty/student collaborative project. Matteson, Stocco, and Schumacher participated as part of the UWEC McNair Scholars program, which helps eligible students prepare for and enter graduate programs leading to the PhD. All the students are either pursuing graduate degrees or are in the workforce. Partial support was provided by UWEC's Office of Research and Sponsored Programs.

Stevens SK, Strehle AP, Miller RL, Gammons SH, Hoffman KJ, McCarty JT, Miller ME, Stultz LK, Hanson PK. The anticancer ruthenium complex KP1019 induces DNA damage, leading to cell cycle delay and cell death in *Saccharomyces cerevisiae*. *Mol Pharmacol.* 2013; 83:1: 225-34. (Birmingham-Southern College and Rhodes College)

This study established that the budding yeast *Saccharomyces cerevisiae* is an appropriate model system for examining the effect of the anticancer ruthenium complex, KP1019, on cell physiology. Similar to what has been seen in cancer cells, KP1019 inhibits yeast growth, damages DNA, and remains effective against cell types that are resistant to other chemotherapy drugs. Novel findings include the identification of translesion synthesis as the major contributor to KP1019-induced mutations. Pamela Hanson is an associate professor of biology at BSC. Laura Stultz is a professor of chemistry at BSC. Mary Miller is an associate professor of biology at Rhodes College. Shannon Stevens worked on this project as part of her 2007 senior thesis; she is now an intellectual property lawyer. Amy Strehle worked on this project as part of her 2010 senior thesis. Rebecca Miller's contribution was made through a 2011 independent study project; she is now a graduate student at the Scripps Research Institute. Sarah Gammons worked on this project as part of her 2007 senior thesis; she is currently in medical school at University of Alabama at Birmingham. Kyle Hoffman contributed to this project during the summer of 2012 and is currently a sophomore at BSC. John McCarty worked on this project as part of his 2007 senior thesis; he is currently in medical school at Kansas City University of Medicine and Biosciences. This project has been supported by the AAAS-Merck Undergraduate Science Research Program and the Associated Colleges of the South Faculty Renewal Program, as well as by BSC and Rhodes.