



# Using Advanced Subjects with Faculty

Undergraduate students at the University of San Francisco are increasingly teaming up with faculty on advanced research, amplifying and instilling lessons of the classroom with first-hand laboratory experience.

In physics, mathematics, business, and other departments, students, with the support of faculty, have raised the bar on academic excellence by taking on responsibilities normally reserved for graduate students at other universities. Many are using their experiences to coauthor peer-reviewed journal articles with instructors and to present their findings at regional and national conferences.

What's more, recent alums who conducted student-faculty research during their time at USF have gone on to academic and professional careers at some of the country's most prominent universities.

By Edward Carpenter



Daniel Merthe, senior

Physics

Research: Employs lasers to analyze the energy transitions and composition of rubidium at the atomic level

Professor: Assistant Professor of physics Thomas Böttger

A new movement is sweeping across the University of San Francisco campus. Quietly, without fanfare, whole branches of study once off limits or with only limited access to undergraduate students are seeing their laboratories and databases thrown open to a younger generation. More than ever, USF undergraduates are tackling advanced subjects of research and leaving their marks in fields such as atomic laser spectroscopy, evolutionary game theory, and media studies—where the media industry’s contraction has shut doors to social change groups’ outreach attempts.

Haven’t heard of laser spectroscopy? A bit cloudy on game theory? You’re probably not alone. But, these and other research projects have been underway at USF for more than a year, some for many years. What’s more, students who have been involved in research collaborations are now pursuing advanced degrees at some of the nation’s top universities, including Yale University, the University of California, Berkeley, and New York University.

In the last five years, faculty have made inroads promoting undergraduate student research across a range of departments, often leading to regional and national conference presentations and articles coauthored by students and published in peer-reviewed journals, according to Brandon Brown, director of external affairs for the College of Arts and Sciences and a physics professor.

Combined with small class sizes and a high student to faculty ratio, expanded undergraduate research allows USF to offer a level of personalized education that can’t be duplicated at larger universities, where lecture hall-style classes with hundreds of

students are the norm.

USF’s collaborative environment is a fundamental part of what sets the university apart, said Assistant Professor of physics Thomas Böttger, a perennial research mentor to undergraduate students. “Here, some undergraduates do research and work closely with professors, whereas at a bigger university it’s very cutthroat so professors usually don’t have much time for undergraduates,” Böttger said.

Gerardo Marín, USF vice provost of academic affairs, said undergraduate research on campus provides important mentoring and apprenticeship relationships between faculty and students, which has been shown to improve student engagement and learning. “The research experience for students and faculty is central as a way of fulfilling the search for the truth and for academic excellence,” Marín said.

While student-faculty research has occurred throughout USF’s history, no concerted effort was made across departments to encourage more, until recently. This time something is different, say students, faculty, and administrators who have witnessed a groundswell of new research grant requests in physics, mathematics, psychology, politics, media studies, and marketing, among others.

“On one hand, research expectations of faculty have been gradually increasing, meaning they need extra hands and minds in their projects,” Brown said. “And on the other hand, students see that the experience greatly enhances their résumés and their chances in graduate and professional programs.”

A Jesuit Tradition

If the expanding role of research at USF, with its pedigree in liberal arts education, is surprising, perhaps it shouldn’t be. After all, the pages of history are full of the names of renowned Jesuit scientists and researchers going back to the 16th century, from José de Acosta in anthropology, to Christian Mayer in astronomy, and Matteo Ricci in mathematics.

“Jesuits and Jesuit educational institutions, historically, have played a very important role in scientific and mathematical research, as well as in social science research,” said Marín. “At USF we





Allison Foertsch, junior

Psychology

**Research:** Focuses on the “positivity effect,” and attempts to understand how memory is helped or hindered by emotions in the young and old

**Professor:** Assistant Professor of psychology Marisa Knight

continue to support those fields as a way to fulfill our mission and promote learning with high quality scholarship and academic rigor.”

Jennifer Turpin, dean of the College of Arts and Sciences and a principal proponent of undergraduate research at USF, believes it’s all about giving USF students a competitive edge.

“USF is distinct among Bay Area universities in its ability to give undergraduate students the opportunity to engage in research with world-class scholars in a variety of fields,” Turpin said. “At most universities, such opportunities are reserved for graduate students, but we’ve shown that undergraduates can learn to do top-notch research under the mentorship of our faculty.”

Physics major Daniel Merthe is a case study in what Turpin sees on the horizon for more USF undergraduates. His work on atomic rubidium using laser spectroscopy landed him at the Western Spectroscopy Association Conference in Monterey in January. He was the only undergraduate student among about 100 graduate, post-doctoral, and professional scientists from the West and Mid-west.

Most of his research time at USF is spent tuning lasers to analyze the energy transitions of elements at the atomic level, said Merthe, a senior who works for Böttger. One practical application for the research may be a more precise calculation of the very fabric of time.

“If the second could be redefined in terms of these much faster (rubidium) oscillations, then we would have a much more precise definition of our

standard unit of time, the second,” Merthe said. It’s hardly surprising that Merthe won an internship at Sandia National Labs in Livermore last summer and has already been offered a job there when he graduates.

Merthe’s research, often accessible to students only at such prominent research universities as the Massachusetts Institute of Technology, is already being incorporated into an advanced lab for other USF students taught by Böttger.

On top of the obvious benefits of garnering prestige for USF and advanced experience for USF undergraduates, research provides students with a deeper set of analytical skills, appreciation for data collection, and an ability to solve problems, Böttger said.

### Applied Psychology

Those benefits and others are the findings of a number of studies conducted across the country, including one published in the *Journal of Higher Education* in 2003.

That study found that undergraduates who took part in research were far more likely to go on to graduate school. In addition, respondents who took part in research reported greater satisfaction with their undergraduate experience, and increased intellectual curiosity, research skills, and communications skills.

Other studies have found that taking part in student-faculty research resulted in higher college retention rates, particularly for minorities and those

LASER | SPECTROSCOPY



**Sofia Martinez, sophomore**

**Business, marketing/  
management**

**Research: Seeks to define  
marketing behavior among  
Hispanic-Americans and  
Asian-Americans termed  
“retro-acculturation,”  
including understanding  
the motivations behind it**

**Professor: Assistant  
Professor of marketing  
Mandy Ortiz**

from low-income families.

But, one skill not mentioned widely in the literature is leadership ability, something psychology major Allison Foertsch, a junior, has in spades. Foertsch has spent more than a year researching how memory is helped or hindered by emotions in the young and old, and has taken on a leadership role with a team of seven other undergraduate researchers, all of whom work for Assistant Professor of psychology Marisa Knight.

“I work closely with them to make sure that protocols are being followed properly and data is being collected efficiently,” Foertsch said.

Before jumping into research, Foertsch said her education was more about absorbing information without a sense of how it applied or what was important. But, having to translate that knowledge into action through first-hand research caused her to sharpen her attention from general psychology to a specialty.

The research into emotions and memory relates to the “positivity effect,” the phenomenon of people tending to recall or focus on more positive memories as they grow older.

“We want to determine the particular strategies younger and older adults rely upon to regulate emotion and how they impact emotional experience and memory. If we can learn about the strategies that are most successful, it is possible to help other people (particularly younger people) to regulate their emotions, which is better for overall emotional well-being,” Knight said.

Intent on pursuing a

doctoral degree in cognitive psychology, Foertsch has coauthored a research poster board-sized overview of her work, which she’ll present at the Association for Psychological Science conference in San Francisco in May.

### **Attention Shoppers**

Picking brains is also the focus of sophomore Sofia Martinez’s research. One of the youngest researchers on campus—most are juniors and seniors—Martinez is working with seniors Riana Hermawati and Margareth Gunawan, both of Chinese descent, on marketing research for Mandy Ortiz, assistant professor of marketing.

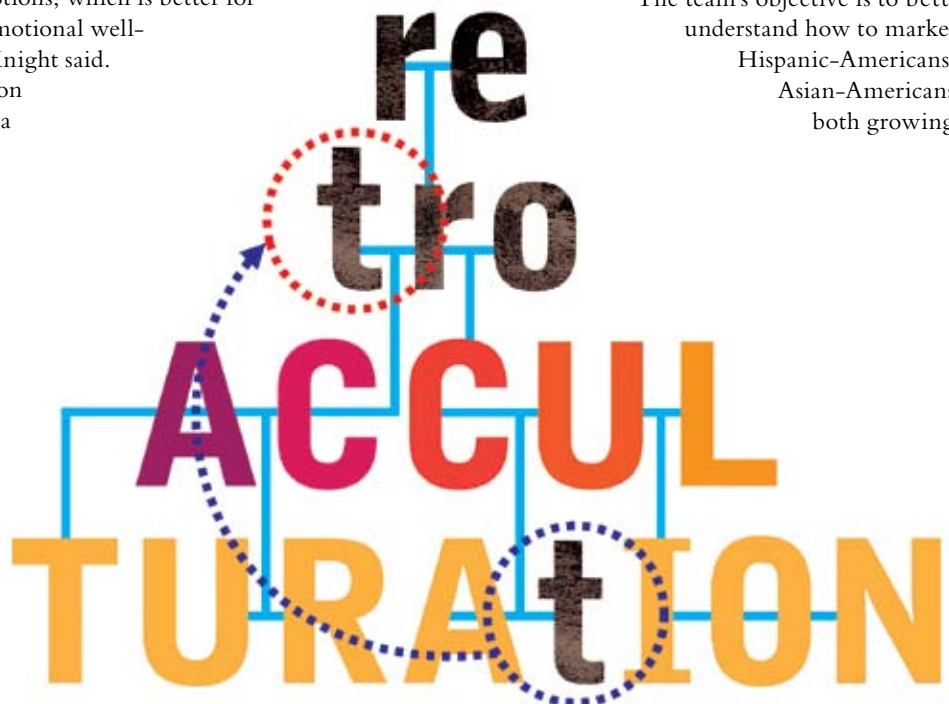
“We are looking to define a new marketing construct called retro-acculturation,” Ortiz said.

Translation: the team is researching life events that spur Hispanic-Americans and Asian-Americans, born in the United States and brought up speaking English, to be drawn back to their native culture.

“At some point, certain individuals actively seek out cultural practices from their parents’ or grandparents’ country of origin,” Ortiz said. “They learn the language, how to cook, how to dance, what music is important, etcetera.”

Ortiz has learned a great deal from her student researchers, who can relate to the pressures of acculturation personally, having grown up in multi-lingual and multi-cultural families.

The team’s objective is to better understand how to market to Hispanic-Americans and Asian-Americans, both growing



# MEDIA INDUSTRY CONTRACTION

populations inside the United States. “The idea of researching something that hasn’t even been defined yet seemed very fascinating,” Martinez said.

Ortiz believes the work will pay off with a journal article coauthored with her students that defines retro-acculturation and discloses the team’s findings by year’s end.

Projects like Ortiz’s, in which she depends heavily on students’ translation and interview capabilities, illustrate to what extent students have become intertwined in research across various subjects at USF. Still, there is more to be done. What is needed is a sustained, long-term commitment over years, said Brown, who mentored undergraduate physics researchers for six years.

“I think it’s close, but we have not quite turned the corner to the extent we’d like to see,” Brown said. “But, there certainly appears to be a greater systematic and administrative awareness and fondness for undergraduate research now.”

One indication of that fondness is an uptick in funds spent on student-faculty research by some USF colleges, usually in the form of grants and student researcher salaries. In 2008, the College of Arts and Sciences, which comprises almost 60 percent of USF’s undergraduate population, spent about \$117,000 on research assistant salaries, up from \$56,000 five years earlier.

In addition to the money spent on research assistant salaries, about \$458,000 was spent on faculty research and development in Arts and Sciences, a major portion of which went toward projects involving undergraduate research. That’s a jump of 58 percent from 2003. Another \$18,000 went directly to Arts and Sciences faculty who hired undergraduate researchers last year, under an ongoing program established by Turpin to provide grants for faculty who wish to involve students in their research.

In the School of Business and Management, comprising USF’s second largest undergraduate

population (25 percent), the 2008 faculty research and development budget jumped almost threefold over five years to \$300,000 after Mike Duffy, dean of the business school, carved out additional resources.

### The Tao of Research

Funding isn’t the only obstacle to promoting undergraduate research. Assistant Professor of mathematics Stephen Devlin, who has mentored undergraduate student researchers for five years, frequently advises students who are pulled in multiple directions by competing activities and volunteer responsibilities.

“Some can be too busy and spread too thin, whereas graduate students are solely devoted to one subject,” said Devlin, whose research tests evolutionary game theory and suggests that social networks, at least in some species, such as humans, play a role in altruistic behavior. He believes the research teaches undergraduates about life as much as math.

“In some sense, I think it’s good experience for students to work on an open-ended project like this,” said Devlin, who intends to coauthor a journal article with one or more students when the research is complete. One of his students, senior Brendan Foley, has already presented portions of the research at two conferences. “When you’re in school and in a class there are always neat questions with neat answers. But, actually in research, as in life, there are lots of questions and very few answers,” Devlin said.

On top of the challenge of balancing students’ time constraints, faculty point out that working with undergraduates requires more supervision in general, at least in the beginning. Many undergraduates haven’t developed a sense of confidence that allows them to question an unfamiliar term for fear they’ll be perceived as dumb, or to ask someone they are interviewing to clarify a confusing point.

Organization and priority setting can also be issues, Ortiz said. Helping undergrads envision the



Stephanie Luu, senior

### Media Studies

**Research:** Aims to analyze the impacts of the media industry’s restructuring on outreach efforts by social change groups

**Professor:** Associate Professor of media studies Bernadette Barker-Plummer and Associate Professor of media studies Dorothy Kidd



**Brendan Foley, senior**

**Mathematics**

**Research:** Employs evolutionary game theory to explain altruistic behavior of some species, including humans, as a result of their network connections

**Professor:** Assistant Professor of mathematics Stephen Devlin

research process through a timeline and by emphasizing the ultimate goals of creating knowledge and publishing provides structure to an often-fragmented undertaking, she said.

At the same time, it's important not to stifle students' initiative and creative thinking, Böttger said. "It is sometimes tempting to tell students the answer, but it is much more satisfying to let them discover it themselves."

The benefits of research aren't limited to USF's undergraduates. Students help professors accomplish more and often require them to step back from their work for a fresh perspective, said Associate Professor Dorothy Kidd, who, along with Associate Professor Bernadette Barker-Plummer, oversees a team of media studies researchers. For example, through interviews, one of Kidd's students identified a problematic media strategy used by a number of Bay Area nonprofits of focusing narrowly on company shareholders and politicians to promote change, rather than recruiting the public to their side through outreach and education.

In addition, working with undergrads requires professors to communicate findings and experiments

and Ortiz's on understanding minority consumers are intended to improve the lives of others, which is at the heart of *magis*.

*Magis* can also be found in the research of media studies students working for Kidd and Barker-Plummer to develop effective communications strategies for Bay Area social change organizations.

Especially timely in the context of the *San Francisco Chronicle's* and other media outlets' financial troubles, the project looks into the collapse and consolidation of Bay Area newspapers and radio and television stations in an attempt to measure the negative impact on communications published or broadcast in the public interest. A half dozen media studies students have been busy interviewing more than two dozen Bay Area nonprofits—among them the Asian Pacific Islanders Wellness Center, the Coalition on Homelessness, and the Rainforest Action Network—in an attempt to analyze their media coverage and implement strategies to reach more people.

"I would like students to realize that research into social processes takes time," Kidd said. "What's most important is to go into the community and to



clearly, rather than relying on the jargon and academic concepts so intrinsic among specialists in any field, Knight said.

### The "More"

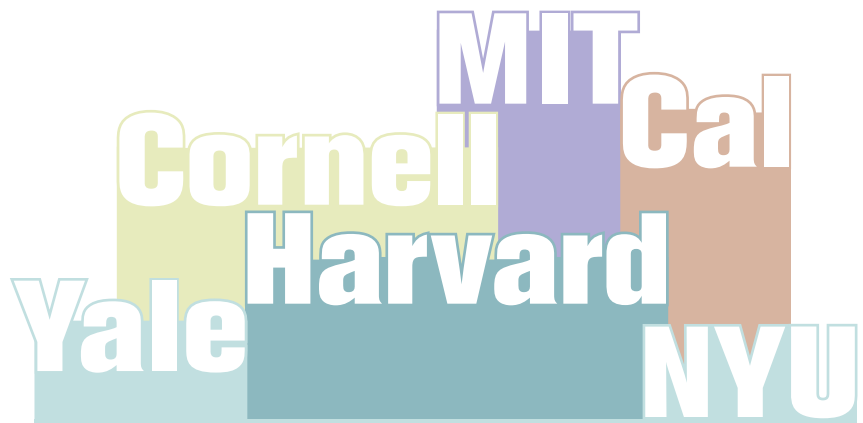
If research teaches students something about life outside the laboratory, and Marín assumes it does, then grounding that knowledge in USF's Jesuit humanistic tradition is as important as ever, he said.

"Research for knowledge sake is important; and, it is at its best when it includes a search for the *magis*," said Marín, referring to the Jesuit axiom of doing more for Jesus Christ, and, as a result, for others. Research like Knight's on emotional well-being

be a witness to what these organizations are doing for social change."

Helping these often underrepresented groups gain a greater democratic voice, whether it be through mainstream media, alternative newspapers, blogs, or their own Web site, aligns perfectly with USF's values of promoting justice, working toward the common good, and being women and men for others, Kidd said.

As she looks forward to graduating, Stephanie Luu, a senior media studies major who works for Kidd and Barker-Plummer, is enjoying her last few months conducting interviews with nonprofit leaders, and cataloguing and analyzing the trends



associated with their media hits. “It’s been a way for me to really use what I’ve learned in my major,” Luu said.

She only hopes that future USF students have even better research opportunities, especially since so much of what she learned can be applied in graduate school or across any number of careers.

“To be an undergraduate and work with your professors on their research is a really great opportunity,” Luu said. “I don’t know how many universities offer that chance.”

Merthe and other student researchers share Luu’s sentiment that undergraduate research has opened doors that might otherwise have been closed to them. In Merthe’s estimation, promoting research early in students’ education is one of the best opportunities we have for solving many of the world’s pressing problems, including global warming, a global energy crisis, and pollution. “Albert Einstein once said, ‘The problems that exist in the world today cannot be solved by the level of thinking that created them,’” Merthe said.

Working closely with faculty has also emboldened students with a sense of self-assuredness and purpose

they can carry into future studies and careers after

USF. “This research has been a gift,” said Foertsch.


“Under Dr. Knight’s guidance, my education in psychology has been given direc-

tion and I feel prepared to one

day attend graduate school and carry out my

own line of research.”

In the end, undergraduate research pushes students to confront problems outside the comfort zones of the classroom and textbook. And while student-faculty research is undoubtedly a symbiotic relationship, philosophically, it is very much about the students themselves, said Marcelo Camperi, associate dean of sciences.

“Limits being pushed and a mixture of coursework and research is what characterizes graduate school, and at USF our students get a taste of that early in life,” Camperi said. “Their curiosity is piqued to a greater degree and they want to know and do more.” 

## Graduates On a National Stage

The University of San Francisco’s expanding support for undergraduate research is about creating knowledge. But, it is also about furthering USF graduates’ education and career opportunities, something it does better than many of its peers.

USF’s hands-on teaching approach is a great strength when it comes to equipping graduates with the tools they need to attend prestigious graduate programs nationwide. Many USF alums who served as undergraduate researchers are now attending or recent graduates of such marquee programs as Yale University, Harvard Law School, and the Massachusetts Institute of Technology.

In the natural sciences alone, an estimated 8.5 percent of bachelor of science graduates from USF went on to earn doctorates, more than twice the national average, according to National Science Foundation records for 1999 through 2008.

Stephen Burkhardt ’04, a chemistry major, is now at Cornell University researching fuel cell technology and lithium-ion batteries that might one day be used to power the next generation of electric cars.

“I gained much more at USF than I would have at a larger university,” Burkhardt said. “I’m what is referred to as a ‘late bloomer,’ and the personal attention was invaluable to me.”

Burkhardt researched computational models of unstable chemical reactions at USF under chemistry Professor Claire Castro and chemistry and environmental science Professor William Karney.

Alice Albrecht ’06, a psychology major, said it was her laboratory experience with Associate Professor of psychology Shirley McGuire at USF—where she researched sibling trust issues—that allowed her to land a lab manager’s job at the University of California, Berkeley after graduating, then go on to pursue a doctoral degree at Yale.

Albrecht, who presented at the Stanford Undergraduate Research Conference while at USF, recently published a research article on her work at Yale on visual cognitive neuroscience in the *Journal of Vision*.

“My research at USF taught me the basics of experimental design and gave me an idea of the work that would be involved in this career choice,” Albrecht said.

Thomas Becker ’00, a sociology major who researched the history of the gay and lesbian struggle with Associate Professor of sociology Nicole Raeburn as well as the exploitation of prostituted women and children, graduated from Harvard Law School last June.

He’s now a human rights lawyer living in La Paz, Bolivia where he is continuing work on the “Black October” massacres case against former Bolivia President Gonzalo Sánchez de Lozada and researching social movements organizing around rights to natural resources.

“USF instills in its students that the research and academic work we are doing in the classroom can be used to better the world,” Becker said. “The work I saw my professors taking part in inspired me to participate in similar work.”

