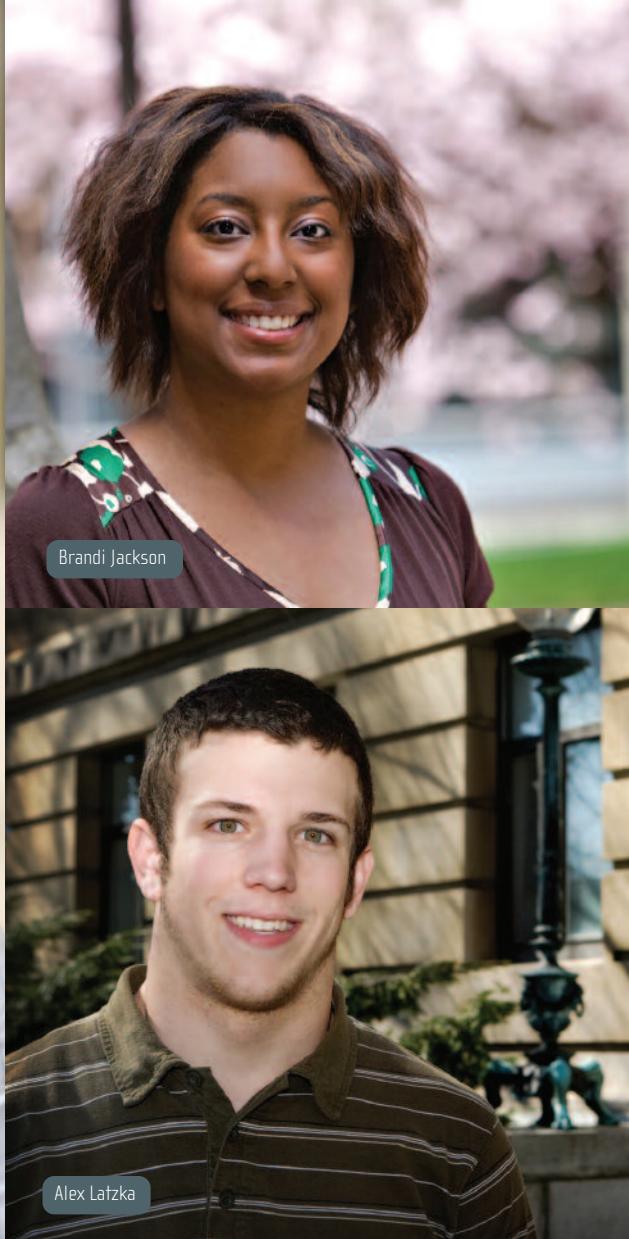


Jah Chaisangmongkon



Brandi Jackson

Alex Latzka

“Any Person ... Any Study” and the Lure of Research

Cornell provides many opportunities for undergraduate students to experience a variety of fields and perspectives, truly fulfilling Ezra Cornell's famous goal of “any person ... any study.”

During three years of writing the undergraduate research feature for *Connecting with Cornell*, I met and interacted with engaging, brilliant students who demonstrated extraordinary character and commitment to their study. The diversity of students and research gave me a chance to learn about topics such as high-energy physics, behavioral and medical entomology,

environmental policy, cancer research, nutrition, and psychology. This experience, along with my double major in biology and society and Spanish, provided a rewarding undergraduate experience.

My last undergraduate research article for *Connecting with Cornell* features undergraduates Jah Chaisangmongkon '09, Brandi

Jackson '10, and Alex Latzka '10, who take an interdisciplinary approach to undergraduate research.

From Physics and Psychology to Neuroscience

When asked about her major at Cornell, Jah Chaisangmongkon gives an answer that often surprises people. With a double major in physics and psychology, Chaisangmongkon has spent her undergraduate experience exploring two seemingly divergent courses of study. She conducted undergraduate research simultaneously in two labs, with James C. Seamus Davis, Physics, and Vivian Zayas, Psychology. She explains, “Both majors represent a means of education to discover the truth of nature. Physics helps me understand the truth of the outside world, whereas psychology helps me understand the truth of the inside world—that of the human mind. I love how, together, they help give me a complete picture.”



Chaisangmongkon came to Cornell from Thailand with a scholarship to study physics and nanoscale science. As an enrolling student, Chaisangmongkon was impressed with the diversity of people and areas of study at Cornell, compared to other American universities. She appreciates that a student's academic path at Cornell is not restricted to the core curriculum. "Cornell's curriculum is flexible. You can design your own unique path and determine your own future," she says. "It's easy to explore your true interests deeply and in an interdisciplinary way."

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In the spring of her freshman year, Chaisangmongkon became intensely interested in observing human behavior while taking an introductory psychology course. She added psychology as a second major and searched for research labs in sociocognitive psychology. She ended up working with Zayas, studying the different patterns that brainwaves elicit from unconscious cognitive processes.

Chaisangmongkon's study focused on a cognitive phenomenon called the priming effect: the idea that the brain can more successfully process a given "target" stimulus if it follows an identical or related "prime" stimulus. The effect can occur even if an individual is not aware of the priming.

The experiment monitored subjects with a device called an electroencephalogram (EEG) cap. The EEG cap connects electrodes to 64 spots on a subject's scalp, measuring the electrical potential on the scalp relative to a reference point at the back of the ears. The subject performed an exercise on a computer while brain activity was monitored. First, a prime stimulus consisting of a male or female name was shown briefly on the computer screen. Next, the prime stimulus was covered by a mask stimulus, such as a blank picture or jumbled word. The mask prevents the subject from consciously seeing the prime, making the prime subliminal. Finally, a target stimulus was shown: a male or female name.

The subject was asked to identify the gender associated with the target name. The concept behind the experiment is that a subject can process the target name faster if the prime and the target name belong to the same gender. The study found that the brain activity when the target and prime genders match is different than when prime and target genders do not match. Supported by this psychophysiological evidence, the experiment suggested that gender perception and categorization is an automatic, unconscious cognitive process.



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A demonstration

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Chaisangmongkon also appreciates how Davis "is an excellent role model for any young physicist, and he always expresses his interest in my future career." She hopes to excel scientifically in a specific area while enjoying the exploration of how different realms of science can work together to give a bigger picture. "It is not as fine a line between fields as people think," she comments.

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Chaisangmongkon will pursue a PhD in neuroscience at Yale University beginning in the fall of 2009. She will do computational neuroscience research, mathematically modeling how neurobiological components of the brain work.

Jackson's research may eventually allow nutritional scientists to individualize dietary recommendations in order to make up for shortcomings in biochemical pathways caused by genetic variation.

Cornell Presidential Research Scholars Create Their Own Paths

Brandi Jackson and Alex Latzka began their research experience at Cornell as Hunter R. Rawlings III Cornell Presidential Research Scholars (CPRS). Offering faculty mentorship and financial support for research, the CPRS program allowed Latzka and Jackson to explore their research interests in their first year at Cornell. The program gave Latzka and Jackson the flexibility and financial support to redefine their research interests and granted them the opportunity to pursue these interests at the interface of science and society.

Exploring Folate's RDA

Science and society have intertwined throughout Brandi Jackson's research. In the first year of her human development major, Jackson studied international agriculture and rural development, with a focus on nutrition. She conducted an independent study on the effects of malnutrition and disease on African family structure. While learning about the social effects of malnutrition, especially prevalent in developing nations, she grew to appreciate the importance of having a background in biology when advising on nutritional problems. With plans to become a doctor, Jackson was eager to get involved with the biological research needed to advance the social understanding of nutrition. She has been working since the beginning of her sophomore year in the lab of Marie Caudill, Nutritional Sciences.

Jackson explains that the folate recommended dietary allowance (RDA), established by the Institute of Medicine in 1998, is 400 micrograms

per day for adults. This RDA, however, may not adequately meet the folate needs of all people, particularly those with a genetic polymorphism, or change in the DNA sequence, in the region of DNA that codes for the enzyme methylenetetrahydrofolate

and eager to make progress and take on more responsibility." Her research may eventually allow nutritional scientists to individualize dietary recommendations in order to make up for shortcomings in biochemical pathways caused by genetic variation. Caudill published a paper on their findings in the *Journal of Nutrition*, with Jackson as a coauthor.

During the past semester, Jackson has worked on a feeding study of pregnant and nursing women to investigate choline and folate metabolism and requirements in third trimester pregnant women, as well as lactating women. She will continue in Caudill's lab throughout her senior year.

Jackson says, "I decided to come to Cornell because I knew it would challenge me academically and intellectually, and at the same time, give me the opportunity to meet people from all over the world." From her undergraduate research experience, Jackson has acquired an appreciation for laboratory research. She explains that working in the lab takes independence and perseverance, as "often the tests provide more failure than success. But in the end, the results are worth it!" Jackson is considering a future as an MD/PhD. She hopes to combine biology and social understanding in a practice in global health. When she studied abroad in the fall of 2008, participating in SIT's Development Studies Program in Uganda, the field experience was one more step toward her goal.

Planning for Bioelectricity Production

Alex Latzka, a natural resources major, was excited about choosing Cornell because of its great reputation and faculty in natural resources and conservation. He explains, "I knew that I would be well prepared to go on to law school, graduate school, or into the job market. Cornell provides many opportunities to learn, have fun, and get involved in interesting activities."

Latzka began his study at Cornell with a research project with Stephen Morreale, a senior research associate in natural resources, studying the impact of environmental management techniques—specifically water drawdowns—on the behavior of snapping turtles. Both Morreale and Latzka, however, became interested in climate change research.







Latzka wanted to pursue climate policy after taking a few economics classes. With the support of Morreale, Latzka contacted Antonio Miguel Bento, Applied Economics and Management, a new faculty member researching the economics of biofuels. Bento accepted Latzka as part of his research team studying the politics, economics, and environmental impact of the bioelectricity industry. Bento says, "Alex is an extremely talented undergraduate student with tremendous potential. I think this change in projects is part of his continuing growth as a future researcher."

Latzka's research will allow the team to advise power plants on the most environmentally and economically sustainable method of bioelectricity production—and policy makers on the most effective ways to mitigate greenhouse gas emissions.

Latzka began collecting background information and writing up policy briefs on the biofuel industry while developing ideas for an independent research project in the fall of 2007. The following spring he worked on a project to study the economics and environmental impact of biomass feedstock options, as well as technological innovations, such as carbon capture. The regional greenhouse gas initiative and renewable portfolio standard created incentives and requirements for power plants to reduce their greenhouse gas emissions using biomass as one alternative for energy production. Yet biomass from certain feedstock, although marketed as renewable energy, is not always economically sustainable.

Using economic modeling techniques, Latzka analyzed the different emission reduction options for local power plants. He explains, "We analyze the costs and benefits associated with each option for emission reduction. For a biomass feedstock, we consider transportation costs, processing costs, and the cost of the feedstock compared with competing uses like food. Ultimately, the power plants will choose a method that maximizes their profits in compliance with the policies

encouraging clean, renewable energy production." Ongoing research will develop and fine-tune a model using the New York power industry as a representative of the electric industry.

During the summer of 2008, Latzka visited different sites that could potentially produce biomass feedstock crops. He tested soil samples and looked at crop-growth potential, total transportation costs, and other economic and environmental impacts of crop cultivation.

CPRS program is that it allows advisers to effectively teach their undergraduate students, letting them learn about the research process while developing a range of skills.

Latzka also works with faculty in the Department of Crop and Soil Sciences, who are helping him incorporate a model to determine optimal land uses based on environmental data like latitude, precipitation, light intensity, and soil type. Once they have determined how to optimally use the land for biomass production, along with food cultivation and other land uses, they will have an idea of biofuel's theoretical potential.

The study will conclude by analyzing the effects that state, regional, and federal policies have on reducing greenhouse gases and increasing renewable energy in relation to the biomass market, and the environmental costs and benefits of the market.

Latzka's research will allow the team to advise power plants on the most environmentally and economically sustainable method of bioelectricity production—and policy makers on the most effective ways to mitigate greenhouse gas emissions. He looks forward to writing his senior honor's thesis when he completes his analysis. After Cornell, he hopes to go to graduate school or law school with an eventual career in environmental conservation and policy.

Gillian Sarah Paul '08

Gillian Paul is now in graduate school at Yale University's School of Forestry and Environmental Studies, studying tropical ecology and restoration.

Latzka continues to refine his work as he analyzes New York State's potential to produce biomass for electrical power. With GIS software, he is mapping current land use throughout New York to estimate the biomass that could be available, looking at woody biomass crops, herbaceous energy crops, and agricultural and forestry residues as sources of biomass. Using economic data, the research team will be able to determine how landowners can maximize their profits, whether by completely switching to a biomass crop or by harvesting some portion of their residues. These decisions will indicate how much biomass may be available at any given price. In addition, the researchers are mapping the location of power plants that could utilize biomass to determine the costs of transportation and processing.

Latzka says that his background in natural resources combines very well with the mathematical and economic modeling techniques that he learns with Bento's research team. "Bento does a great job integrating different ideas into research and getting students to see the different sides of a complicated environmental issue and teaching the techniques needed to advance his students' research skills," Latzka says. Both Latzka and Bento feel that the true value of the