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**FURJ** welcomes original research articles, short research communications, book reviews, and review essays to be considered for publication.

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**Selected Research Accomplishments**

**Contributing Authors**

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To the Fordham Community:

First and foremost, we would like to thank the Fordham community for making last year’s issue of FURJ—the inaugural issue—an incredible success. We are pleased to present the second issue of FURJ. This year we are bigger and better: Fordham College at Lincoln Center has joined this amazing project, we have launched an official website (www.furj.org), and we are expecting to circulate even more copies. Once again, our staff has worked tirelessly to create another issue, showcasing works on topics as diverse as the interaction of particle beams with one-dimensional potential barriers to community gardens in the Bronx. In addition to our student research, reviews, and news articles, this year we are also excited to announce the research mentor of the year award. This award is an exciting step in recognizing the talented and dedicated faculty who invigorate and guide our students’ passions for research.

Second, we are proud to continue playing an integral role in the University’s dedication to undergraduate research. We believe Fordham has planted itself firmly at the forefront of this endeavor. As students of this University, we have been taught the value of applying our knowledge for good; we have learned, as they say, the value of contemplation in action. Not only does our research capture the Jesuit essence of magis, striving for more, but it also captures our dedication to our brothers and sisters. As we work hard to unravel and understand the world around us, we do it with an eye toward each other. A quick look through this journal clearly indicates that, while our students are dedicated to their research, they are also dedicated to each other. Being men and women for others is what we believe makes Fordham’s undergraduate researchers and faculty mentors extraordinary.

Last, we would like to thank our amazing staff for working so hard to make this journal a great success. We would like to give our greatest thanks to Dr. Michelle Bata, Assistant Dean and Director of Undergraduate Research, and Dr. Michael Latham, Dean of Fordham College at Rose Hill, without whom this journal would not be possible. Unfortunately, for some of us on the editorial board, this is our last issue as we prepare to graduate in May. We would like to thank the graduating seniors on the executive board: Stephen Frayne, Helena Guzik, Stephen Sullivan, Alexandria DeCapua-Guarino, Andrew Steffan, Margaret Palazzolo, Kevin Jordan, Victoria Yang, Leena Mancheril, John Turiano, Michele Paccagnini, Stephen Moccia, Xavier Montecel, Michele Paccagnini, and Sarah Sullivan. They worked tirelessly setting the foundation for a journal that did not exist two years ago, and their hard work will be remembered and carried on for years to come.

Sincerely,

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that characterized the GSM and is now present in the Occupy movement.

More than ten years ago, the GJM carried the same energy and frustration that Occupy has today. People from around the world were connected by their opposition to the free trade rules and economic conditions set by the World Trade Organization. It started with a group of Mexican peasants called the Zapatistas, who used the relatively new Internet to their advantage, translating their local resistance into a global strike against free trade rules. They were opposing the recent passage of the North American Free Trade Agreement (NAFTA) in 1994, signed by the United States, Mexico, and Canada to eliminate tariffs and other trade barriers. NAFTA also cancelled Article 27 of Mexico’s constitution, which protected Indian communal lands from privatization, giving the state the right to privatize and sell the land on which the Zapatistas had been living. According to Gautney, “the Zapatistas to its subscribers proclaiming that “America needs its own Tahrir.” On Sept. 17, 2011, an occupation was held in the financial district of New York City, beginning the Occupy Wall Street movement. Dr. Heather Gautney, assistant professor of sociology at Fordham University, is currently writing a book on the Occupy Wall Street movement, linking it to a protest she covered in the mid to late ’90s called the Global Justice Movement (GJM). Gautney regularly visits the Occupy camps, interviewing participants and recording her observations. Her book will focus on the resurgence of activism and the prominent critique of inequality that characterized the GSM and is now present in the Occupy movement.

The Occupy movement is doing important work changing people’s perceptions of their own political involvement and encouraging policy change. “For me, the project of corporate globalization was affecting people, and this resonated not only with other peasant communities but also with people around the world, particularly students in the United States, who were organizing against sweatshop labor and environmental issues.” A multitude of causes brought together people from around the world to meet at large summits in front of trade organizations like the G8, the World Trade Organization, and the World Bank. In 1999, the movement attracted a lot of attention in the U.S. when activists successfully shut down the annual World Trade Organization meeting in Seattle. In fact, the GJM seemed to be on the verge of making significant changes to the free trade rules made by the World Trade Organization, producing larger and more popular summits everywhere the World Bank or the G8 would meet. However, in 2001 at a G8 meeting in Genoa, Italy, a protector was killed by the police. This led to “a lot of internal problems in terms of questions of violence,” Gautney said. However, numbers were still increasing until three months later, on Sept. 11. Activists got sidetracked from supporting the cause against corporate-led globalization and instead focused on trying to prevent wars in Afghanistan and Iraq. Gautney suggests that the Occupy movement is a return to the original issue, saying that “the project of corporate globalization got derailed by the war and Occupy picked it right back up again.”

The purpose of the Occupy movement is to hold a peaceful occupation of Wall Street in order to protest corporate influence on American politics and publicly to oppose the lack of legal action against those responsible for the global financial crisis. One of its major concerns is the increasing wealth disparity, explained by the movement’s slogan, “We are the 99%,” a reference to the major gap between the wealth owned by the top 1% of income earners and the rest of the country. According to Gautney, “When you have 1% owning 40% of all privately held wealth in the country, you have a real problem on your hands. Wealth is home ownership but it’s also property you make money off of. Mitt Romney made 20 million dollars this year off of his investments alone. When you control a lot of the wealth, that’s a real marker of power. Not your ability to create more wealth but your ability to control politics.” Following the recession of the late 2000’s, many have argued for higher income tax rates on the 1%, reinforcing the current belief that the majority is obligated to compensate for the mistakes of the top minority.

Occupy protesters seek to create a more democratic, participatory form of government. In the midst of budget cuts and the loss of public resources, people are growing disillusioned with politics. “The institutional channels for change are very eroded in this country. The ballot box is a very unfurling way of getting politically engaged,” Gautney said. The protests on Wall Street are a turning point in recent history because more people are becoming activists. “Protests are dramatic and they bring a lot of attention. They epitomize the outrage people express and there is a certain catharsis,” Gautney said. The media has helped amplify their voices, and the movement has spread not only to other U.S. cities, but also to countries overseas.

Despite their similarities, however, Gautney also notices some differences between the GJM and Occupy Wall Street. The latter is much more grassroots and localized, and many more people have already taken part in the Occupy movement compared to the number of attendees at the summits in front of the WTO. Although her previous work focused on international issues concerning profit-led globalization and labor standards in low-income countries, Gautney is now interested in the events in the United States. “Americans can support [international protests] and create an international solidarity, but people have different relationships with their government. We can share our support for one another, but we have to be really sensitive to the nuances of people’s context.” Many people were upset over the Adbusters call for “another Tunisia.” A decade in a recession is very different from living under a money-laundering, drug-trafficking president for three decades. Yet the Occupy movement is doing important work changing people’s perceptions of their own political involvement and encouraging policy change. “For me, I’m American, and I think it’s really interesting what is happening in America with Occupy. It hasn’t happened in my lifetime, this kind of movement, and my interest is in the national scene,” said Gautney. If Occupy Wall Street can continue to gain momentum with nonviolent and not get sidetracked by other issues, it has the potential to improve the plight of Main Street.

- Dr. Heather Gautney, assistant professor of sociology
Fordham’s First Rooftop Garden

Very few individuals on Fordham’s campus would think to go to the rooftop of the garage to observe lush greenery. Yet this past summer, Jason Aloiso, a PhD student in the Biology department at Fordham University, along with a team of undergraduate students, conducted a project to build a garden containing diverse green plants on the barren, concrete roof. Aloiso sums up his passion succinctly: “I grew up being in love with nature.” He focuses on urban ecology and sustainability in his research, and is currently performing his dissertation research on rooftop agriculture and the natural succession of green roofs over time.

Green roofs have been in existence since the time of the ancient Greeks and Romans, yet they have never gained widespread popularity. The most basic form of a green roof simply has plants growing on a rooftop. These plants are most often “sedum,” a hardy type of succulent plant and are planted in a special kind soil. Green roof garden soil can be a complicated issue since load capacity is a major issue for rooftops that were not built with the intention of growing plants atop them. Also, since potting soil and other dark soils soak up a lot of water, green roof media has to be sandier and have less organic material than one might find in ground level soil.

In the summer of 2010, Aloiso conducted a project that studied naturally colonizing plants in New York. His research was conducted for two reasons. First, there had not been much research in the New York City area about what kinds of plants would naturally colonize empty spaces. Already-established green roofs require labor to pull out unwanted plants. By allowing these “unwanted plants” to naturally colonize a bare plot of land, Aloiso could gather and study a list of plants that could potentially be eliminated from roof agriculture. Second, research has shown that plants with different morphologies (sizes and shapes) actually improve the ecosystem services of the green roof. An ecosystem service is one provided by the environment for us, such as clean air, water habitat, recreation, and carbon fixation. In a mutual relationship, these ecosystem services can keep the temperature of the building in check, help filter the air, and prevent nutrients from being run off into the ground. For example, if you have a rooftop garden, and you water it regularly, it will filter the air and keep the temperature of the building even. If you have a green roof and you don’t water it as much, the ecosystem services will be reduced.

In turn, Aloiso mentors Clonan with his own research on the amount of energy costs that could be saved if Fordham were to install a green roof on top of O’Hare Hall. The New York City Department of Environmental Protection gives a grant to anyone who reduces significant rainwater runoff. They hope to present their findings by the end of the semester.

The project was sponsored by a grant from the Green Roof Association and the City of New York. Though the project is not yet complete, Aloiso has proven that green roofs are a great way to do that, and they have lots of potential. Aloiso wanted to see what kinds of plants would naturally colonize empty spaces. Already-established green roofs require labor to pull out unwanted plants. By allowing these “unwanted plants” to naturally colonize a bare plot of land, Aloiso could gather and study a list of plants that could potentially be eliminated from roof agriculture. Second, research has shown that plants with different morphologies (sizes and shapes) actually improve the ecosystem services of the green roof.

A variety of different plants can also appeal to a variety of different species, thus creating a more diverse ecosystem. By allowing these “unwanted plants” to naturally colonize a bare plot of land, Aloiso could gather and study a list of plants that could potentially be eliminated from roof agriculture. Second, research has shown that plants with different morphologies (sizes and shapes) actually improve the ecosystem services of the green roof. An ecosystem service is one provided by the environment for us, such as clean air, water habitat, recreation, and carbon fixation. In a mutual relationship, these ecosystem services can keep the temperature of the building in check, help filter the air, and prevent nutrients from being run off into the ground. For example, if you have a rooftop garden, and you water it regularly, it will filter the air and keep the temperature of the building even. If you have a green roof and you don’t water it as much, the ecosystem services will be reduced.

In the summer of 2011, Aloiso enlisted undergraduate students studying in the sciences to start the rooftop project. Kyle Clonan, FCRH ’14, and Ame Anteyi, FCRH ’14, are two undergraduate students who met Aloiso in their freshman core classes, where he worked as a teaching assistant. Clonan, an environmental science major, had envisioned himself working someday in the wilderness, but after working with Aloiso he realized that “it’s not always realistic. Right now I’m trying to help make a bigger change in civilization to make it more environmentally sustainable. And green roofs are a great way to do that, and they have lots of potential.” Clonan has helped Aloiso with the planting and watering of purslane and amaranthus on the green roofs this past summer. He also worked in the lab gathering data and measuring run-off, soil depth, pH, and biomass growth.

In turn, Aloiso mentors Clonan with his own research on the amount of energy costs that could be saved if Fordham were to install a green roof on top of O’Hare Hall. The New York City Department of Environmental Protection gives a grant to anyone who reduces significant rainwater runoff. They hope to present their findings by the end of the semester.

Ame Anteyi is a pre-med student, and the scientific methods involved in Aloiso’s work and his love for experimenting was enough for him to get involved. This past summer, Anteyi assisted Jason with making soils and planting seeds. From Anteyi’s perspective, the world of ecology makes a huge impact on the world of medicine. “I like to open my eyes into a whole new world outside, how environment affects health and diet. I’m really interested in ecology and how it affects the human population, and if it can affect obesity,” says Anteyi. Aloiso is also mentoring Ame in another research project, which studies the effect of heavy metals on plants. Both Clonan and Anteyi’s projects are near completion.

To set up the green roof, Aloiso created a list of plants to test whether certain combinations of plants would improve ecosystem services. He decided to let nature decide what plants would grow well on the roof, letting “media grow naturally over the course of the summer, with the idea that whatever performs well, we should look at those a little more closely.” Aloiso realized that some edible plants were surviving and thriving on the rooftops. One species, the Amaranthus, more commonly known as amaranth, is a grain and vegetable producing crop and, while not commonly eaten in the United States, is eaten in various other parts of the world. Another species, Portulaca oleracea, or purslane, is a variant of a succulent plant, which boasts a high omega fatty acid content among other health benefits. When asked how the green roof plants tasted, Clonan and Anteyi were surprisingly eager to say, “Purslane looks like a weed on Eddy’s, but it’s good. It was weird, it looks like a weed, but it was actually pretty good.”

Although Aloiso has previously cultivated many rooftop gardens, including the Brooklyn Grange and the Eagle Street Rooftop Farm, this is the first garden in which the climate is so harsh. This experiment is the first project where nature takes its course. This experiment not only tested which plants were suitable for rooftop agriculture but also showed whether the soil itself played a role in yielding more growth. In order to investigate the latter, Aloiso took three types of soil: a typical sandy roof garden media, a nutrient rich potting soil, and “Gaia soil,” a lightweight growing medium with high Styrofoam content. He grew four different plants in each soil type, measured how much edible plant material they produced, and compared the different species of amaranth to see which fared best in the harsh rooftop habitat. Aloiso knew that purslane would do well because “it is adapted for hot, dry climates.” He also had buckets underneath the containers to collect the draining water and to measure both how much run-off each soil gave off and the nutrient content inside the water.

With regard to his findings, Aloiso clarifies that “there is not enough literature in peer review journals, no data that says yes or no or maybe or quantifies anything. However, the data is showing that there is a lot of nutrient run off. It also suggests that you need to water a lot to keep the plants growing because it is very dry up there. It’s a difficult environment to grow on.” The nutrient-filled run-off also runs through the sewage system and into rivers and streams. This problem, called eutrophication, can lead to algal bloom, the invasion of foreign species and a shift in the water’s pH, among other environmental changes. For this reason, Aloiso says that it is “questionable at this point in time whether rooftop agriculture should be promoted. We need to have more studies done; it’s not a complete picture yet.” Furthermore, since different soils hold different amounts of water, there must be a lot of thought put into different watering regimens. “The technology is there; people just need to use them.” However, Aloiso emphasizes that getting decent yields is plausible in green roof agriculture.

Like Aloiso, Clonan and Anteyi would like to see environmentally conscious changes enacted in the near future. Clonan says with regards to green roof projects, “There are cool experiments going on up there. With what [Aloiso] finds, if they find a way to implement it, it could be a great thing for the city and for the people.” Hopefully, Aloiso’s project will continue and provide the on-set for a green initiative across campus. No matter what their conclusion may be, their work has already proven that living in the city is no longer an excuse not to be environmentally responsible.
Did you know... that professors Allan Gilbert (anthropology) and Evon Hekkala (biological sciences) are researching 3000-year-old animal bones from Iran?

by Michael Rametta, FCRH '14

On any given week, a group of dedicated undergraduate biology and anthropology students can be found in a laboratory at Larkin Hall. Under the guidance of Dr. Evon Hekkala, a professor in the biological sciences department at Fordham, they extract, amplify, and analyze DNA from a set of 3000-year-old bones. Across campus in Dealy Hall, Dr. Allan Gilbert, anthropology professor and department chair, tries to historically contextualize these biological findings. These bones have a long and interesting history. Initially excavated between 1965 and 1973 from an archaeological site in western Iran called Godin Tepe, the bones are believed to belong to some kind of equine species, though the exact identities of these specimens are still under investigation. The bones were crucial in Gilbert's doctoral research in the late 1970s. Since the Fall of 2010, however, they have been at the center of an innovative interdisciplinary research project at Fordham University involving about a dozen biology and anthropology majors.

Even though Gilbert studied these bones as a graduate student three decades ago, his research efforts were supplemented considerably by the addition of Hekkala, an expert in ancient DNA, to Fordham's biological sciences faculty several years ago. As a result of their collaborative work, Gilbert and Hekkala have been able to determine the kind of animal from which these ancient specimens originated. Although it is possible they were zebras, horses, donkeys, or onagers (a species similar to a large wild donkey native to Asia), Gilbert hypothesizes that these bones came from animals that were deliberately hybridized thousands of years ago by humans living in Mesopotamia. If so, these findings would significantly impact the understanding biologists and anthropologists have of Bronze Age humans. "Ancient writing," Gilbert pointed out, "attests to the practice of cross breeding," though "the products of such hybridizing have not yet been identified with certainty among the skeletal remains recovered archaeologically." The decision to hybridize two animals relies on the awareness of the somewhat complex concept of "hybrid vigor," or the creation of a superior offspring as result of the mating of two different yet closely related animal species. Gilbert adds that "since Godin Tepe lies on an important trade route linking Mesopotamia with the Persian plateau and places eastward, the presence of remains from caravan animals specially bred for burden would be expected." Gilbert's data, however, is still inconclusive on account of several biological reasons too technical to include here. Nonetheless, the project has been significantly advanced by the addition of new technologies, such as the Polymerase Chain Reaction (PCR), a method for amplifying specific genes.

Back at the lab, Hekkala testifies to several difficulties involved in working with extremely old genetic material. First, much of the nuclear DNA has been broken down because of the age of the samples. The "abundant" presence of mitochondrial DNA is only marginally helpful because it is only maternally inherited. Uncovering both the maternal and paternal genetic contributions would best determine whether these bones came from a hybrid whose parents were from different species. Another issue for Hekkala and her undergraduate researchers is the high risk of contaminating these ancient specimens. She and her students must be extremely careful to keep their own DNA from coming into contact with the bones. Hekkala cautiously excised the samples at the American Museum of Natural History (where she conducted her doctoral research) under strictly regulated conditions. At Fordham, students working with the samples sterilize their equipment under a special ultraviolet hood. If such precautions are not taken, the PCR machine, which prefers to amplify intact DNA to broken genetic material, could end up copying the DNA of the human researchers.

Hekkala noted that "ninety-nine percent" of her research is performed in collaboration with her students. She tested the bone specimens herself a couple of years ago, but now her students do most of the day-to-day work, extracting and amplifying DNA specimens and comparing them to control samples, such as the DNA of a modern-day horse. Hekkala is pleased that the project includes both biology majors and students from other disciplines, creating a rich and valuable diversity in backgrounds and methods. Gilbert treasures the students' experience in learning different scientific processes and approaches. Any scientific inquiry, according to Gilbert, "is full of ups and downs and failures and successes," and it is important that students are acquainted with both. Scientific research is a slow process, and Gilbert believes that the project has shown students the importance of patience in the sciences. Given the number of unknown variables in this project, the students also learn to avoid what Gilbert calls "easy" hypotheses and instead focus on thinking of alternative and original ideas.

Hekkala, Gilbert, and their undergraduate students thus enjoy a fruitful, interdependent relationship. Just as Gilbert depends on Hekkala's laboratory findings to support or contradict his hypotheses, Hekkala's research needs Gilbert's anthropological expertise to contextualize the specimens. The student assistants also undoubtedly benefit from the exposure to scientific research afforded by these two professors. Incidentally, however, Hekkala and Gilbert also depend on their undergraduate assistants to approach their research with creativity, innovation, and perseverance.
WISDM Creates Android App to Track Couch Potatoes

by Xavier Griffiths, FCRH ’14

Your smartphone says a lot about you, including your age, preferences, and current whereabouts. Imagine an app that can monitor your physical activity, letting you know by the end of the day if you’ve been as inactive as a couch potato. An undergraduate research team in the Computer Science department at Fordham is currently building that app. Their project, called WISDM (Wireless Sensor Data Mining) will determine how information, such as whether or not you are walking or running, can be derived from the sensors included in most smartphones. The WISDM team hopes that this app will be useful for many people, especially those in the medical field.

The WISDM project focuses on the accelerometer sensor, which is often used either to change the orientation of the screen or as an input method for games in most smartphones. According to Jeff Lockhart, FCRH ’12, “the goal of the WISDM project is to take the sensor data and try to get computers to learn meaningful patterns out of that data.” The app can accurately identify a user based on his or her biometric identification, which includes the user’s name, age, weight, height and hometown. Based on the information gathered by the accelerometer, the team has developed machine models that can differentiate between when a specific person is walking, standing or performing some other activity such as jogging.

WISDM has its origins in the honors thesis of Jennifer Pappas, FCRH ’09. Since its creation, the project has been largely composed of undergraduate researchers. At first, students focused on dedicated sensor units furnished by Sun Microsystems instead of experimenting with smartphone devices. Now under the guidance of Dr. Weiss, chair of the Computer Science department, the WISDM project has expanded to include about a dozen undergraduates. However, their work goes beyond simply writing code. The team is split into four separate groups working on everything from smartphone development to managing relations with clients. Moreover, every paper produced by the project credits one or more of its undergraduate students as an author.

WISDM offers some advantages over other data collection methods that allow other smart phone users to document your activity. Data mining is not subject to the bias of what people want to report about themselves. The team has developed models sophisticated enough to recognize the unique walking pace of 222 people with perfect accuracy after less than five minutes of recording. This method has great implications for security and privacy. Based on such precise metrics, your phone will be able to identify you when you carry it in your pocket. The next phase of the project seeks to detect what the team calls “soft biometric traits,” which refers to predicting a person’s height, weight, sex and even hair color based on mined sensor data. “Anything you can think of, we’d like to try and predict. How fit you are, how long you spend studying, although most of those will be hard,” Dr. Weiss admits.

The WISDM project aims not only to mine sensor data but also to explore app development for smartphones. In fact, the WISDM team has already built an app called the ActiTracker and it is currently available for Android phones. In its current form, ActiTracker is not optimized for use by the general population. Its purpose now is to collect data from the project’s volunteer subjects. According to one of its developers, Tony Pulickal, FCRH ’13, ActiTracker was “created as a means for people to understand more about themselves. As the phone collects data which we can use to analyze them [the user], they can also use it to assess their own basic activities.” The team identifies a report from the World Health Organization, which cites that 3.2 million people die each year due to inactivity.

Even in its unfinished state, the app exhibits impressive functionality. One feature graphs the activity of a phone’s accelerometer in real time, responding quickly and accurately. ActiTracker also features a map view based on Google Maps for Android which alludes to the project’s prospective interest in GPS-based data mining. The app can also record a user’s activity, such as speed and altitude in real time.

Essentially a fitness app, ActiTracker also has a training feature. A user can complete pre-set activities, such as standing or jogging, for a set period of time and be rewarded by unlocking achievements, like playing a video game on Xbox LIVE.

The team plans to support ActiTracker with constant updates even after it is made available to the public. One plan is to give users access to records of their activity online and also the ability to share that information with friends. The WISDM project hopes to have a wide release of ActiTracker for the general population by the end of the summer. Amidst previous claims that technology discourages people from exercising and physically exerting themselves, ActiTracker may prove to be the exception.

WISDM is funded through a variety of grants and endowments. There are Summer Science Research Internships for students who wish to work on WISDM over the summer. Dr. Weiss has also received a Faculty Research Grant from the university as well as a Google Faculty Research Award worth $25,000. However, the biggest contribution so far has been the National Science Foundation Grant, which gave $420,000 to “fund undergraduate and graduate student researchers involved in the WISDM project for the next three years,” Dr. Weiss claims.

The WISDM team. Photography by Michael Rezin, FCRH ’14.
In the past, researchers largely believed that learning a second language was an interference, cognitively speaking, with academic development. However, professor Alessia Valfredini, of the Modern Languages and Literature department at Fordham University, claims that this is a misconception. According to Valfredini, "research has found that writers use the same resources and methods they use to write in English when they write in a foreign language." She is currently doing her doctoral dissertation on foreign language writing, focusing on the way students approach writing using their native and foreign language resources. The pilot study for her dissertation is based on the composition experiences of about fifteen anonymous students from the intermediate to advanced Italian classes. "The perspective of the students was missing [in previous research which] looks at the final product of the writing. But I wanted to know about their experience," Valfredini said. The students answered general questions about their writing process in a foreign language.

Valfredini subsequently followed up with the same students to learn about their writing experience with the English language. Her findings were consistent with recent research that claims students use the same tools they use to write in their native languages to support their foreign language writing. "Most of the students felt ashamed or embarrassed about it," says Valfredini, "but it's actually positive support. Writing is a very recursive process and personal process." Instead of forcing students to follow a standard writing method, such as outlining before writing, Valfredini argues, that it is more efficient for students to learn to write in a foreign language using the same tools and methods they use to write in English. She wrote about her results in a paper that has been accepted to the American Educational Research Association.

Valfredini has wanted to be a teacher since childhood. She started teaching Italian twenty years ago in Italy to second-language learners. Her focus on writing grew out of her work in academia, explaining that it became "a pillar of instruction" when she started to teach Fordham's Eloquentia Perfecta program. Her love for language is also apparent at home. By the age of three, her daughter was extremely proficient in both Italian and Spanish. Since starting school in the city, English has become her second language, followed by Spanish. "It's my aim in life to keep her proficient in Italian," Valfredini says.

A year spent studying French with Dr. Lise Schreier is not only a trip across the French-speaking world but also a voyage across time, from Napoleonic Egypt and post-Revolutionary France to modern day Haiti. Schreier is presently at work on a book entitled The Playthings of Empire: Exoticized Children and the Politics of French Femininity, 1780-1895. With the support of a Fordham Faculty Research Grant, Schreier is undertaking methodical and original archival research in Paris. Her goal is to shed new light on the ways French women contributed to the process of empire-building during the Colonial period, when those who were culturally and racially marginalized figured heavily in 18th and 19th century French society.

As a specialist of literature from 19th century France and the North African region known as the Maghreb, Schreier actively involves her undergraduate students in her research in a variety of ways. She not only offers upper-level courses on her areas of expertise, such as Franco-Caribbean literature, but she also frequently advises students completing theses in the Honors Program and the Comparative Literature major. Several of her students have also recently presented their works at the Fordham Undergraduate Research Symposium.

Schreier regards her relationships with her students as "very precious," particularly because they allow her to refine and challenge her own understanding of French literature. In order to foster a vibrant "intellectual collaboration" of dialogue in- and outside of the classroom, Schreier focuses on finding a balance between her own voice and those of her students. She is especially satisfied to be able to work in a variety of contexts with students who share her passion for scholarly inquiry and debate on French and Francophone culture and literature.

by Leena Mancheril, FCRH ’14

by Michael Rametta, FCRH ’13
From 1890 to 1920 higher education witnessed a marked increase in female matriculation among select East Coast institutions. This paper explores the personal narratives of these pioneering women to illustrate how societal forces strongly influenced these women’s college experiences. Existing discourse emphasizes the difficulties female university students faced as they tried to pursue both careers and families. Scholars claim that an unusual number of college-educated women did not marry or married at a later age. This paper examines first-hand perspectives drawn from the Barnard College Archives to supplement current secondary data. Alumnae biographical questionnaires reveal how women reconciled opportunities with societal pressures. Compromises included socio-political activism as mediatory outlets for energy. Ultimately, while a college degree allowed women at the turn of the twentieth century to pursue a life with a career as the focal point, graduates became pulled between tradition and opportunity; a woman’s college education was seemingly incompatible with the female roles of the family unit.

Ultimately, higher education conferred a new way of life that some women embraced through socio-political activism and employment after graduation. Oftentimes, employed women defined domestic roles and never married. Many who did marry attempted to enact their education through organizational activities. The graduates’ feelings toward their alma mater are complex, but their individual responses illuminate the social pressures they experienced at the time. Consequently, I assert that while a college degree allowed women at the turn of the twentieth century to pursue a life with career as the focal point as opposed to family, graduates became pulled between tradition and opportunity because a woman’s college education was not compatible with female roles in the family unit.

Jennifer Prevete, FCRH ’12

‘Maybe It Was Too Much to Expect in Those Days’
The Changing Lifestyles of Barnard’s First Female Students

From 1890 to 1920, the female graduates who matriculated from institutions along the East Coast became some of the first women to attend college in the United States. Existing discourse emphasizes the difficulties women faced while pursuing both a career and a family after graduation. These women engaged in new educational initiatives during a time when the female’s role remained within the domestic sphere. Consequently, they struggled with the costs of their unusual choice. I explore the complex social pressures surrounding women pursuing higher education during this time period. I first examine statistics about marriage and family from this time period. From the available data involving the turn of the century, scholars suggest that an unusual number of college-educated women did not marry following their graduation or at a later age. In order to provide context for these numbers and explain alterations of the woman’s place in society, I describe the creation and the nature of women’s colleges in the mid-nineteenth century. Aside from the existing interventions on this topic, I used accounts from the first students at Barnard College, founded in 1889, to supply a better understanding of a college education’s effects upon women of the time period. Biographical questionnaires allowed alumnae to comment upon their experience decades after attending Barnard. These firsthand accounts help explain the trajectories of family and employment in an individual’s life. They also help uncover why so few of these women acted as both a professional and a wife and mother.

Patterns of Family and Employment and The Evolution of Women’s Education

Generally, the first several generations of women to attend college in the United States were white, emerging from middle socio-economic status (Gordon, 2002). As increasing numbers of women began to attend college at the turn of the century, patterns involving marriage and reproduction rates emerged. Present-day scholars work to identify these patterns and isolate the socio-economic forces behind them. Various sources approximate that “60 to 70% of the first generation of graduates from women’s colleges did not marry and many pursued specifically identifiable careers” (Conway, 1974). Mary Cookingham conducted a population study in the 1980s which tracks the “V-shaped pattern” of marriage rates for women graduates from 1865 to 1910. According to Cookingham’s work, nuptials for these women were at the lowest point from 1885 to 1910. This pattern indicates some unique elements of education or society within that time period to produce the trend (Cookingham, 1984). Cookingham favors an economic explanation: the “marked decrease in the opportunity cost of remaining single for college women” (Cookingham, 1984). According to Cookingham, women balanced social and institutional restrictions with the amount of available opportunities. She supports this idea because the employment for young educated women coincided with the lower nuptial rates. Variations in the labor market determined whether or not it was in women’s ability to postpone marriage in favor of pursuing employment (Cookingham, 1984). Claudia Goldin engages in her own study and divides different generations of graduates into cohorts on the basis of their career and family outcomes throughout the twentieth century. Without the opportunity to embrace a family and a career simultaneously, graduates of the first twentieth century cohort, from 1900 to 1920, made the decision between the two. In other words, women secured either marriage or career but not both simultaneously (Goldin, 2004). Goldin analyzes the marriage and reproduction rates in each cohort and compares the differences in rates among educated and uneducated women of the time period. She observed that more than 30% of female graduates in the 1900 to 1920 cohort never married by the age of fifty. Only about 8% of
The female counterpart with no college education remained single by the age of 40, but among those who graduated in the 1900 to 1920 cohort were childless. In contrast, the work rate for those women who graduated and did get married was low, with only 20% of married graduates working at age 45 (Goldin, 1988). The generational difference from 1865 to 1920 was particularly significant because their marriage and birthing rates indicate some of the non-traditional choices they made. For example, in the 1865 cohort, only 14% of married graduates in the United States, from 1860 to 1880, was not of the highest socioeconomic class. Families of elite status believed higher education would potentially "make women unmarriageable" (Gordon, 2002). From 1890 onwards, women contended with fears that education would make women unfit or malcontent to remain within the home. From these sentiments, some promoted women's higher education as a way to intersect traditional gender roles (Gordon, 2002). Many of the coeducational institutions of the nineteenth century thus emphasized the differences between men and women, even as changes to education in the 1860s and 1870s increased career opportunities for women (Abrams, 1979).

Coeducational schools first arose in the 1830s beginning with Oberlin College in 1833, however, women in the eastern United States struggled to find institutions conferring degrees of equal merit to women until the emergence of the Seven Sisters from 1865 to 1894 (McCabe, 1983). The Seven Sisters colleges—Mount Holyoke, Vassar, Wellesley, Smith, Radcliffe, Bryn Mawr, and Barnard—were designed for the education of women from their inception. Contemporary sources explicitly praised the Seven Sisters for promoting the academic development of women and maintaining the standards of the men's colleges of the day (McCabe, 1983). In contrast, coeducational Oberlin dedicated its academic mission to the "morals and education" of students. Their curriculum included laundry duties, during which female students would wash and repair male students' clothing, as well as the daily tasks of cooking and cleaning (Conway, 1974). Many who attended these coeducational schools noted the curricular and institutional differences that would either be valuable or lacking, dependent upon their life trajectories.

The movement for women's colleges emerged from the antebellum and Civil War eras in the United States as a consequence of shifting societal values during the nineteenth century. The ideal woman of the antebellum and Civil War eras in the United States as a consequence of shifting societal values during the nineteenth century. The ideal woman of the antebellum and Civil War eras was John Burgess of Columbia's School of Political Science. To Burgess, a university was the domain of "the best of men," and the school provided these women with a number of societal transformations in the nineteenth century. Beginning in 1820, girls increasingly received schooling below literacy standards. The educational reformers who advocated this change hoped girls' continued schooling would help stabilize and reaffirm the traditional authoritative positions of the community, church, and family. In short, education would enhance a woman's abilities to act in her previously designated roles, mother and wife of a household, for the overall benefit of society. While female education at this time emphasized maintenance of traditional domestic roles, Nancy Green remarks that the young women's assimilation into secondary school acted as a precursor to the movement for women's higher education. The social implications of women's admittance to higher education correspond to the pressures they experienced.

Toward the end of the nineteenth century, the social implications of women's admittance to higher education were clearly evident. Between 1890 and 1920, America saw a number of societal transformations in the nineteenth century. Women who graduated from college between the years 1880 to 1920 comprise the second generation of collegiate female students. Development of women's higher education emerged after a number of societal transformations in the nineteenth century. Beginning in 1820, girls increasingly received schooling below literacy standards. The educational reformers who advocated this change hoped girls' continued schooling would help stabilize and reaffirm the traditional authoritative positions of the community, church, and family. In short, education would enhance a woman's abilities to act in her previously designated roles, mother and wife of a household, for the overall benefit of society. While female education at this time emphasized maintenance of traditional domestic roles, Nancy Green remarks that the young women's assimilation into secondary school acted as a precursor to the movement for women's higher education. The social implications of women's admittance to higher education correspond to the pressures they experienced.

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necessarily reconcile upon graduation. Later graduates sought to reconcile that time. Miss Hart remained single and became a teacher. In her opinion, Barnard could have trained her better for life because "there were no courses which served as preparation for marriage and home-making" (Associate Alumnae). She noticed her education’s incompatibilities with reality. Some Barnard graduates achieved both a family and employment; however, these women were not wholly satisfied with their college instruction. Elizabeth S. (Day) Fowles, class of 1905, married at age 24 and had four children. In her sparse time, she joined a women's club and the school board of her children's school. She worked part-time, but her life revolved around the home. She would have rather attended "a college offering different science courses" because "circumstances led me into a field that a classical education did not help me" (Associate Alumnae). Also from the class of 1905, married Christian worker Florence I. (Nye) Whitwell was of a similar disposition as Mrs. Fowles and desired more home economics classes (Associate Alumnae). These married graduates felt that college did not practically serve their domestic living. An alumna from the class of 1920 desired the same changes. After graduating, Lois M. (Wood) Clark married and taught English in high school for nine years. In her opinion, Barnard could have trained her better for life because she reasoned that "there were no courses which served as preparation for marriage and home-making" (Associate Alumnae). As a woman who married between the ages of 26 and 30, she may have felt disadvantaged in pursuing a career after marriage. As alumnas responded to the questionnaires, they recognized the fact that college education in the early 1900s was not necessarily compatible with their lifestyles.

At the opposite end of the spectrum, several ambitious women felt that Barnard did not allow them to achieve success in the world. Alice (Kohn) Pollitzer, graduate of the first class in 1893, commented upon what areas Barnard should focus on in consideration of several deficiencies. Mrs. Pollitzer had two daughters and completed various types of work in her life: teaching, education, and social work. She commented, "In my day Barnard ignored the important areas of sex, religion, and politics, including the issues of the time" (Associate Alumnae). She experienced Barnard in its first stages of development and perhaps lacked a tentative instruction. An account from graduate Adelaide Hart class of 1906 summarizes the opposing pressures for females pursuing higher education during the time: Miss Hart recognized that she would not enter another course and become a teacher. Miss Hart struggled to reconcile the "purely academic" subjects she studied with her need "to earn a living" (Associate Alumnae). According to her, the practical and cultural sides of life did not necessarily reconcile upon graduation. Later graduates sought to enter to new areas of employment but simultaneously encountered social and educational limitations. Graduate of the class of 1905, Marion (Franklin) Low exemplifies this situation. She married at age 21 and had two children before she received her medical degree in 1920 and found employment in the clinical and research fields. Mrs. Low worked from 1930 to 1953 under the New York City and New York State Health Departments as Assistant Director. She explained that if she could have entered college again, she would have had a different educational background (Associate Alumnae). The fact, such as those, were more difficult for women to enter. As a result, a coeducational college might have provided a better opportunity to various professions. Several alumnae, including Mrs. Low, highlight this relationship among career ambition and coeducational degrees. Graduate of the class of 1917, Therese (Hibel) Bernhard married between the ages of 26 and 30 to an electrical engineer and had one son. She worked as a full-time mathematician for Bell Telephone Laboratory and eventually found a passion in painting. Her mathematical skill and artistic talent led her to long for a different career. She wrote, "If I had to do it over again, my choice of occupation would be in architecture and training in that field could be had to better advantage in a coeducational college... maybe it was in those days" (Associate Alumnae). Mrs. Bernhard realized that she would have enjoyed working in a field that was unusual for women in her time. Decades later, women possessing this amount of ambition perused the obstacles that prevented them from reaching their goals.

Respondents often encountered a world that was unwilling to accept their increased participation in society. While several women succeeded against social pressures by both raising a family and serving their communities, the desire for a different profession often affected their educational goals. In her opinion, college education was one of the reasons why they attended Barnard. As a result, those women who did not have the opportunity. As opportunities increased, more women acknowledged the limitations they had faced at the time and commented upon their hardships in response. Some alumnae never worked a day in their lives, instead, they joined organizations as outlets for energy. This involvement is significant for particularly women who reconciled domesticity with activity outside the home. Political groups included the Republican Club, the National Association for the Advancement of Colored People (NAACP), the American Association of University Women (AAUW), the League of Women Voters, and various Women’s Societies. Social and philanthropic causes were Child’s Welfare League, Children’s Museums, Red Cross, the Young Men’s Christian Association, Service League, Overseas Division, and Parent-Teacher Association. Church organizations featured prominently as well from involvement in Methodist and Unitarian denominations to membership in the Catholic Daughters of America (Associate Alumnae). The varied and extended mediatory activities complicate the life narratives of purely- or career-only professions. Organization memberships, especially in political form, echo the efforts of women as moral guardians for society during the Civil War. Community participation demonstrated the influence college education could have beyond employment. Students emerged from Barnard changed by the years that they spent there. Women could have high expectations of their opportunities after college, however, those ambitions became tempered by realistic expectations of the time period. Adelaide Hart, class of 1906, wrote, “I am proud of being a Barnard graduate even though I have not set the world on fire with anything remarkable” (Associate Alumnae). The women who graduated from Barnard from other colleges at this time may not have set the world on fire, but they did accomplish something remarkable. During a time when women’s higher education was geared towards purposes beyond traditional feminine roles seemed unnatural, the first Barnard students enrolled in an institution that wanted to further their potential. While many alumnae assumed traditional feminine roles, others embraced lives as single women, professionals, or activists. Barnard’s new and different status helped lay the foundation for work for later generations of college women to succeed in new, non-traditional areas.

Conclusion: Accomplishing Something Remarkable

The questionnaires as a whole revealed some of the common behaviors and factors of graduates. A look at the employment experiences of women also elaborates on the difficulties of assimilation and advancement in various fields. The teaching profession recruited high numbers of Barnard graduates. The educators that entered the profession had a positive response to their single-sex education, and expressed contentment with their life and education choices. After the first decade of Barnard’s existence, areas of employment extended beyond the teaching realms. Miss Hart’s comments, the opinions of the questionnaires, and the survey answers varied as well. Because the respondents answered the surveys in 1956, the alumnae answer their questions with the knowledge that many women opened their doors to women in the time that they attended Barnard. As a result, those women who sought more ambitious employment, unusual for women at the time, often elected not to attend Barnard again should they had the opportunity. As opportunities increased, more women acknowledged the limitations they had faced at the time and commented upon their hardships in response.
Visual Forms, Visceral Themes
Understanding Bodies, Pain, and Torture in Renaissance Art

Despite its relevance to modern discussions, the scholarly treatment of torture in art is relatively infrequent. This project explores, through the visual evidence of artistic works, the implications of Renaissance philosophies surrounding the human body in the context of pain and particularly the physical suffering endured during torture. By examining varying techniques of representing the human form across an array of artistic media, this article strives to illuminate the struggle between the rise of scientific naturalism and prevailing currents of spiritual dualism when considering the question of the body in torment. In highlighting the artist as narrator of Renaissance society’s moral, spiritual, and political tropes, this research sheds additional light on Renaissance humanity’s understanding of itself in the intensified instances of physical suffering at the hands of the state. In analyzing images of torture in light of Renaissance understandings of the body, this article seeks to contribute a more contextual perspective on these types of representations to the ongoing academic dialogue.

As the members of society entrusted with the craft of interpreting and visually representing events and transcendent experiences, Renaissance artists were in a unique position to not only study and observe the workings of human form, but to demonstrate the conceptions of their societal milieu that surrounded the body and its significance for both the individual and the community at large. As the concept of genius emerged during the Renaissance and artists were increasingly seen as and portrayed themselves to be the recipients of divine inspiration, those who were trained in the creative crafts and possessed skills that made their works worthy of widespread renown became integral to the purveyance of ideas through visual means and significantly shaped the impressions of society at large about religious stories, historical events, and political practices.1 As Moshe Barasch, on Renaissance philosophy and Bocchi’s recognition of the emphasis placed on physical expressions in art, writes: “The work of art, by making us grasp its expressive character instantaneously, wields a certain power over our minds and souls.”2 Studies of the human body in the Renaissance are particularly interesting because artists of this time period were confronted with conflicting roles and expectations: on the one hand they were charged with depicting the human experience as it pertained to the laws of the Church or governing body. By putting criminals through physical ordeals and ensuring proper punishment for their wrongs, leaders of the state were able to fulfill their responsibility to the spiritual wellbeing of their populace. In a society where legality was so intrinsically linked with religious sensibilities, crimes carried more weight from a spiritual than an aesthetic perspective. For the criminal to repent his or her crime was a moral stain on the community as a whole. As officials were responsible not only to their people but also to God, ensuring the moral good standing of their city or town was their utmost responsibility. Securing a confession and reinforcing the severity of the transgression through pain made torture an effective way, in the eyes of early modern leaders, of atoning for the citizen’s sins on behalf of the rest of the community. Similarly, it was seen as serving the practical purpose of deterrence potential criminals; under the threat of the violation of their own bodies, from transgressing the law. The side effect, also, of consciously and subconsciously reinforcing the power of the state likewise had its obvious advantages for the rulers of early modern populations.

While torture took care of legal responsibilities for the rulers, it was also seen as beneficial for the criminal. Ordeals undergone in pursuit of securing a confession (the “release” of truth) assumed a cleansing quality and were a way to overcome the body’s monopoy on the soul, which, naturally drawn toward the good in

1. As an example from a paper written for Dr. David Myers 2011 seminar, “Torture and the Western Experience.” The author would like to thank Dr. Myers for his tolerant mentoring, invaluable advice, and continual support.

2. David Freedberg, Enduring Creation, 198/2. 4 In this sculpture, a male nude, bearing only subtle suggestions of armor and toned to anametrical perfection, stands contraposto with his head falling back in a gesture of submission. His embrace of death is evident in the vesvye of his face and the relaxed and heavy quality of his limbs, the overall impression of his stance being that of one ready to sink gently into a position of sleep. The physical suffering of the transgressor is overshadowed by the seemingly exultant and erotic release of his soul from its earthly bonds. Indeed, even his lifting of his tunic is suggestive of dissolving to a state of purity and innocence in preparation for death. Though pain was a useful tool for extracting the truth from uncompromising bodies and took on a purifying role in the case of the convicted criminal, the “true” person, in the form of the soul, would remain unscathed in spite of physical exertions, even throughout the process of torture and execution.

Nevertheless, the power of bodily desecration as a deterrent for potential criminals was uncontested. The concept of one’s body in torment was such a powerful one that it was not uncommon for Renaissance artists to visually undergoing his or her physical punishments to be painted in places of high traffic for all to witness, to the shame and infamy of the transgressor. In the sense that it functioned as a record of the ability to overcome, punish, and dispense with society’s miscreants, the artistic representation of torture served as a purpose for the community as a whole as an indicator of the domination of the bodies of criminals by the state and was a means of psychologically punishing the transgressor by making use of the rigid conceptions of honor that pervaded the early modern mindset.5 In some instances, images were effective punishments in and of themselves. David Freedberg expands on “images of infamy,” noting that their oral use in Italy began in the late 1200s.6 Though such a practice was generally reserved for cases where the corporal execution was not possible (as in instances when the criminal fled), images of infamy had their place definitively in law codes of the period. “Item: It is decreed and ordained that anyone who does anything against the preceding [statutes] should be painted on the Palazzo Communale, by the Commune and at the expense of the Commune, and that his name, forename and the charge (against him) should be inscribed beneath him in large letters.” 7 Freedberg suggests that “the legal aim … was the deprivation or impairing of reputation and status.” 8 Interestingly, the creation of these images reflected on the painter’s character as well as his subjects.9 Because notions of honor were intimately connected to an individual’s involvement, even conceptually, with sinful dealing, “[t]he manifestation of a crime was to be considered a defeat that no painter of sound morals could be seen to be associated with it.”10 Two high-profile victims of execution at the hands of the state that pervaded the awareness of all Renaissance Christians were the two thieves held to have been crucified alongside Christ. Act- ing as examples of the execution of the high-profile criminals in the first century, depictions of the crucifixion of the thieves evolved throughout the medieval and early modern periods. Be- cause the scene was such a common topic for representation, art-
ists felt the need to distinguish themselves in their interpretation of the image in some way. This often took the form of elaborate and inventive ways of “crucifying” the criminals, at times even going beyond what would have been physically feasible for executioners to implement. Their contortions took on increasing levels of disfigurement and inspired varying degrees of discomfort in viewers. 13 Lucas Cranach’s scene of Calvary is a prime example of the way in which the crucified thieves are made to undergo the maximum amount of pain during a method of execution already at the forefront of Roman cruelty (Figure 2). Cranach’s representation of the crucifixion follows the iconic compositional format of this scene, with Christ’s cross positioned at the forefront of the image, flanked by the crosses of the two thieves.

The key component of the painting worth noting is that while Christ’s body, serene and yielding, follows an elegant geometrical and symmetrical layout, the thieves writhe, contorted and disfigured by their suffering, on their crosses. In their torment their physicality serves as a foil to Christ’s tranquility and apparent lack of suffering. This distinction, outstanding in most variations of the Crucifixion, Christ has resigned himself to God’s will, thereby actualizing the ideals of humility and virtue by the Christian model. His divinity and status as fully human, to the extent that he gives himself over to God, contribute to a lessening of his suffering, not only was he not guilty of the crime of which he was accused, but he also used his suffering as a tool for salvation and redemption. This, however, is decidedly not the case of the thieves, who remain bound to the earth and their physical torments by their humanity compounded with the burden of their guilt and desert of their punishments. Their corporeal disfigurement serves as a foil to the tormented, yet fundamentally uncompromised, body of Christ. The early modern notion that a lack of confession or surrender in torture (in theory) demonstrated the innocence of the victim strengthens the reason for the contrast between Christ and the thieves: the nature of death, suffered in innocence as opposed to guilt, and the extent to which physical torment wreaked one’s form was seen as dependent on the goodness of the individual.

Depictions of the suffering bodies of the morally depraved allow for reactions of revulsion and a lack of sympathy for the torture/execution victim as well as a sense of justice and fulfilled duty at destroying society’s monstrosities. However, it was not only those who may have deserved it who were depicted as suffering: saints and martyrs, those who were most in touch with what was holy and in keeping with Christian values, also were portrayed as undergoing some of the most brutal torments in artwork of the Renaissance. For these, though, suffering and pain took on the function ofimitating Christ’s torments, thereby leading to a salvific religious awareness. For some religious fanatics, pain carried such desirable connotations to Christ’s life that it became self-imposed. Zealous asceticism had been a fixture among seriously committed believers almost since Christianity’s beginnings as an organized religion. It was not uncommon for the devout of antiquity and the Middle Ages to remove themselves from social contexts and undergo self-imposed discomfort in an attempt to mirror Christ’s suffering. Athanasius’s Life of Antony details the extremes to which the eponymous saint went to achieve a purer relationship with God. 14

Martyrdom, continuing in its inherited tradition from antiquity, was heavily present in the Renaissance conception of religious devotion and virtue. As Sperry points out: “Christianity thrived because it mimed for virtue in situations of distress.” 15 The martyrs, in their submissive attitudes and “clean” disfigurements, echo the form of pain often presented in depictions of Christ. Despite their intense physical suffering, the tranquility and fulfillment of the inner soul is conveyed through their physicality. While the images would still be received with pity, they served more to inspire admiration and perhaps even a desire for emulation among the pious communities of the early modern period. Operating under the same principle of Christ-emulation as asceticism did, the suffering of martyrs may have elicited envious emotions from those who would wish to demonstrate the same level of fidelity to their faith.

Still, the most prevalent suffering figure in the minds of early modern Europeans would have been the sacrificed Christ. Subjected to torture and the most cruel, and self-admittedly barbaric, form of execution employed by the Roman Empire, 16 Christ in many ways was the quintessential body-in-pain of late antiquity and the Renaissance. Representations of his suffering body as an idealized form proliferated, and given the pervasiveness of this concept/image, it is no wonder that those who found themselves in situations of agony turned to this symbol for a sense of empathy. Specifically, depictions of Christ in a very realistic portrayal of agony serve to more fully emphasize his humanity and place him on a relatable level with the viewer. The champion of this rapidly growing religion, Christ, as a human demonstration of fortitude on a relatable level with the viewer. The champion of this rapidly growing religion, Christ, as a human demonstration of fortitude and in keeping with Christian values, also were portrayed as un

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spiritual integrity was a unifying theme across the Christian faith and made depictions of Christ, even the most gruesome ones, desirable as means of connecting to the miracle of Christ’s death and resurrection.

This understanding of suffering to be a positive occurrence, when undertaken with the purity of the soul as a ballast, pervaded the early modern consciousness to such an extent that representations of suffering bodies altered to reflect it. There are often key visual distinctions in depictions of individuals that suffered innocently or for a religious purpose from those whose faces were justifiably by guilt. Bodies, even in their disfigurement, were depicted with delicacy and a suggestion of purity. Artists often emphasized the beauty of martyred forms, as if to imply that though they were subjected to such cruel fates, their status as exemplary human beings was undiminished and that they were, in fact, resplendent in their holy role. Those for whom pain serves some higher purpose often have their faces inclined toward the heavens and, though their bodies undergo mutilation and even mild contortion, their form is often drawn in a languid pose that mirrors the easy stances of antiquity (Figure 3).13 This is not the case for those being punished for their own wrongs, however. In cases of torture, the body of the criminal is almost always contorted grotesquely in a manner that reflects inward on itself rather than outward, barring the necessities of pose demanded by certain torture devices. Their gaze is frequently directed downward toward the things of the earth, if at all—or at least partially closed eyes are prevalent in images of pain more so than in depictions of unsanctioned pain (Figure 4).14

Nevertheless, the role of torture as cleansing the victim of his or her crimes persisted despite the trends of artistic delineation, and was brought into practice physically in instances of execution: “the body of the criminal is almost always contorted grotesquely in a manner that reflects inward on itself rather than outward, barring the necessities of pose demanded by certain torture devices. Their gaze is frequently directed downward toward the things of the earth” (Figure 4).14

Proffering such images to criminals in their last moments attests to a scene from the Passion of Christ; on the other hand, a martyrdom that was more or less relevant to the artist’s own viewpoint in the images he created. Charged with observing, interpreting, and documenting, the artist assumed the role of interpreter and necessarily expressed dualism, transcendence, and experience contrasted was where the artist was depicting, the acceptance of bodies that had been pieced together from various elements, which, taken in their actual context, would have been abhorrent, suggests a willingness on the artist’s part to convey humanity and a spiritual presence behind the corporeal surface suggests that not only was adherence to naturalistic depiction not necessarily the only focus of an artist, but that it may not even have been the primary one.

In the context of torture and the deliberate infliction of suffering at the hands of the state, artists would have had an intimate perspective on the incident of the body in pain. Commissioned to create images of suffering and torment, the artist would draw upon not only his training as a skilled craftsman who could trans- pose what he saw to the canvas, but also upon the philosophies of the day that dictated differing views of what humanity meant in the context of agony and death. Where these commentaries on dualism, transcendence, and experience contrasted was where the artist assumed the role of interpreter and necessarily expressed his own viewpoint in the images he created. Charged with observing and imitating life as well as communicating to their contemporaries, artists clearly did not work in a vacuum. They were subject to the traditions and prejudices of their time, perhaps more so than any other member of Renaissance society. As such, it is no wonder that preconceived notions of morality played into their interpretations of instances of suffering. In torture, especially, were their biases in place, as the subtle variances in techniques of showing a criminal in pain versus a holy individual being scourged demonstrated. Innocence and guilt, like the character traits that certain artists saw as permanently evident in the physiognomy of an individual, inevitably colored their visual accounts of the events. By grappling with their studies and masterpieces, not only with their personal beliefs but also with the philosophies informing artistic endeavors of the day, artists acted as the Renaissance’s interpreters and translators of competing concepts about the body, pain, and torture.
The Lydians were a family believed to have personally known the archaic poet Archilochos of Paros. Tradition tells of their collected suicide being motivated by criticisms launched at them in his lyric verse, and this is sometimes mistaken for historical fact. However, analysis of the evidence reveals that it is more likely the result of an ignominious murder. Inconsistencies in the characterization of the Lydians in these verses, and the aptitude of those verses for symphonic ritual, are considered to be evidence of a tragic family most likely a figment of Archilochos’s verse designed to increase his reputation.

Accounting for the nature of his work and underscoring his reputation as the prototypical artist of his genre, it is said that the iambic poet Archilochos loved the daughter of an individual named Lycambes, who denied the couple marriage, and so ridiculed him with his poetry that he and even his children hanged themselves out of shame. Some consider these characters to be figures of historical fact. However, this supposition relies on a misconceived notion of the nature and intended ends of iambic poetry as sincere in its ferociousness. Rather, iambus directs its force toward the generation of humor, often by combining it with lewd imagery or crude subject matter. Since these elements manifested themselves in vtiputation, the more abuse a poet could issue, the better the quality of his iamb. Therefore, to better his art he would need to extend his ironic range so that it might be as diverse as possible. As a result, an iambic poet should be able to chastise either the same individual for more than one thing or more than one individual for the same thing. At the same time, it should cast some individuals as good for the sake of comparison. Archilochos extends his invective range so that it might be as diverse as possible. According to Rosen this notion, which Aristotle refines into a sort of "ψογος," seems to have been more indicative of purpose and content since, in the tradition of ancient literature, it and its various grammatical uses were all associated primarily with the practice of ridicule. Indeed, West notes that, the verbs ἰαμβίζω and iąβλφκττω come to signify satirization. Such an instance can be found in Aristotle's Poetics. For instance, in his "psychology of poetry, the 'psychology of poetry, he suggests that the iambic poet should be able to control..." 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distracts her from such a severe loss as the death of her daughter, and combine to push her behavior over the bounds of the plausibly both by Iambe’s confidence in mocking the goddess and Demeter’s may or may not be Archilochos, propositions Soror for sexual the Archilochean corpus, “The Cologne Epode.”19 A figure, who in what is perhaps the most narrative-rich fragment of mayhem and demonstrates Archilochos’s tactic for the Lycambids were members ter, and that the extremes in satirical and artistic use of vulgarity performance as humorous, is as commonplace for the archaic audience would react in the matter of Demeter, with laugh-

This method of castigation, directly highlighting Neoboule’s lasciviousness, is not always explicitly stated. West places fragments 34–37 in the context of the Lycambic orgastic behavior. Ac-
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Gender and social identity rank as high priorities for undergraduate students, putting significant weight on their choice of apparel and accessories. In a university, students must also navigate the pressures of academic disciplines, which have their own norms of appearance and gender. Credibility in a discipline often hinges on one’s ability to conform to those disciplinary standards. Out of those students whose social gender role does not match the gender of their discipline, such as women in the sciences or men in gender studies, will find these two forces at odds. This study leverages statistical observations of clothing and accessories to examine how the gender performances of undergraduate students are affected by the gender of their discipline of study. The results go beyond prior work and reveal a depth and complexity to the system of gender influence that challenges simplistic narratives about pressure to conform to disciplinary gender norms.

Gender is a substantial field of study within the social sciences (frequently, gender and women’s studies have even their own departments), and the field owes much of its prowess to the theories of social construction and performativity. Central to theories of social construction is that norms of what is masculine or feminine are determined socially rather than biologically. Further, following Judith Butler (2009), performativity involves the idea that gender is a performance (a set of actions and choices people make) that either conforms with or breaks those social norms. A central feature of gender performances involves a person’s choice of apparel; for example, dressing as the masculine norm is a way to perform masculinity. The social norms of gender govern not only what appears as which gender, but also who should appear which way, and whose gender performances do not conform are said to transgress boundary lines.

Many studies of gender issues have focused on students and schools, and it has been widely recognized that some disciplines are gendered feminine (e.g. language and humanities) and others masculine (e.g. mathematics and sciences). There has been considerable work on the way a discipline affects student participation and scores (Steele, 1999), however, there has been surprisingly little work on the way the gender of a discipline affects students’ gender performance. This study leverages quantitative observations of clothing and accessories to examine how university students perform gender in the classrooms of gendered disciplines. The results reveal a depth and complexity to the system of gender influence and performance which challenges simplistic narratives about pressure to conform to disciplinary gender norms.

Dozing Gender, Constructing Social Norms

As elementary teacher Baird (1996) points out, the theory of performativity sheds a great deal of light on the ways by which gender is performed. Even young, old pupils recognize that some behaviors (e.g. playing with girls, writing poetry) connote “girl” while others (e.g. sports, rough play, dirtiness) connote “boy.” This notion that one can act out a specific gender relies upon an understanding of gender as socially constructed rather than innate or biologically determined. Butler’s words, “gender is performative[,] a certain kind of enactment,” but “the “appearance” of gender is often mistaken as a sign of its internal or inherent truth (2009, p. 1). Sociologist Michael Messner (2000) explains how structural segregation of sexes, social pressure to conform from peers and superiors, cultural messages in the media, and one’s sense of self-identity interact to provide the conditions in which people make gendered choices throughout their lives.

As numerous authors note, clothing is a major locus for gender performance. Infant garments are gender segregated into pink and blue from birth. Even fantasy and role-playing costumes such as those worn on Halloween are gendered not only by character, but also by wearer (Nelson, 2000). Moreover, clothing can be an important and conscious part of identity construction, as Mary Buczoń (1999) work on high school nerd girl culture demonstrates. Raine Dozier (2005) provides an example of the trends that these case studies examine. For her, bodies are treated and interpreted as ongoing projects of gender performance; people are constantly “doing gender” by making choices about how to appear and what to wear; whether and how much to conform or transgress against gender norms, and what such conformity or transgression could gain or cost them—in some cases gender transgression can be extremely costly to family, social, and professional goals (Mr, 2009). This concept of “doing gender” was first introduced in West and Zimmerman’s paper by that title in 1987, where they argued that we cannot do gender because all things we do risk being perceived in a gendered way.

Performing Gender on a College Campus

The university is a major social institution for U.S. students during their college years. Whether they are new students during class, students rank social goals such as friendships and romantic relationships highest among their top concerns, and to that end they may put
a great deal of thought into their appearances and gender performance (Holland, 1989; Ong, 2005). To explore these competing pressures, this work compares patterns of gendered dress across different disciplines in Fordham University classrooms. Classroom spaces are intimately linked to academic disciplines not only by the subjects discussed in class, but also by those who occupy the spaces (i.e., people participating in the discipline). Students’ choice of apparel during attendance is a visible aspect of their gender performance at a time when they are directly engaged with both the topics and community of the discipline. As such, student apparel in classrooms is a prime position from which to study the effects of gender norms on students within gendered disciplines.

Many studies have examined the case of womyn in the traditionally masculine disciplines of mathematics and sciences. National statistics from the National Science Foundation (England and Li, 2006) indicate that the sciences and engineering are overwhelmingly dominated by men. Being taken seriously as a student, expert, or researcher in departments with only a handful of same-gender peers is a difficult task. Both men and women frequently conform to disciplinary standards of speech and appearance. People whose social gender role does not correspond to the gender of their discipline, such as womyn in the sciences, will find these forces at odds. To explore these competing pressures, this work compares patterns of gendered dress across different disciplines in Fordham University classrooms. Classroom spaces are intimately linked to academic disciplines not only by the subjects discussed in class, but also by those who occupy the spaces (i.e., people participating in the discipline). Students’ choice of apparel during attendance is a visible aspect of their gender performance at a time when they are directly engaged with both the topics and community of the discipline. As such, student apparel in classrooms is a prime position from which to study the effects of gender norms on students within gendered disciplines.

Methodology
To explore the influence of disciplinary gender norms in university classrooms, I observed the apparel choices of students in three types of classes: masculine, feminine, and neutral classes are expected to represent the range of possible scenarios in which a discipline’s gender norm might impact the gender performance of students. Because the masculine and feminine spaces are chosen from upper level courses, self-selection is assumed to be at play. That is, students taking upper level women’s studies courses are assumed to take part in to that feminine discipline either by major or elective choice. The effects of the gender of the group, with students expected to be strong here because the students and those around them are actively engaged in it. For this reason, classes which focused on multiple issues (e.g. gender and race) or which were required for another program (e.g. a diversity requirement) were excluded. Additionally, only coed classes were considered so that the impact of and on gender minorities could be evaluated.

The following spaces were chosen for evaluation:

• Masculine spaces: upper-level classes in the Computer and Information Science department. Naturally, such courses are overwhelmingly populated by male students (England and Li, 2006), and only 12.7% of students observed here were female. One-third of the department’s full-time professors are female, but all classes in this group had male instructors. Additionally, the discipline’s culture is very masculine, even compared with other sciences (Mukhopadhyay, 2004).

• Feminine spaces: upper-level classes in the Department of Women’s Studies. These classes contain an overwhelming majority of female students, though the ratio of female to male students is less extreme than in the masculine spaces. All observed professors were female. These classes focus on the traditionally feminine disciplines of gender and women, and are within the generally feminine disciplines of humanities and social sciences (England and Li, 2006).

• Gender neutral spaces: lower-level core courses which are required of all Rose Hill undergraduate students. These classes have a nearly even sex distribution (54% female). No male student self-selection is assumed to be at play; because these courses are required of all students. Further, because they are considered general knowledge for all students by the university, there is no assumed institutional influence in general. For the male students, who make up the majority and define the norm, the trend toward clothing of medium tightness held. However, it should be noted that when clothing was tight, it was often not fitted (as the category “tight/fitted” did encompass), but rather simply smalle she the wider. Like in the neutral space, dark/drab colors and patterns dominated, but male students found more room to wear bright/feminine clothing and clothing with bright accents here than anywhere else in the study. There were even a few instances of male students wearing bottoms classified as bright/feminine, breaking the hegemonic social trend of only dark bottoms.

Womyn in masculine spaces tend to conform to masculine apparel appearances in general. They show no unnecessary skin and wear even more baggy tops than the men. Their bottoms are always dark. Masculine space, dark/drab colors and patterns dominated, but male students found more room to wear bright/feminine clothing and clothing with bright accents here than anywhere else in the study. There were even a few instances of male students wearing bottoms classified as bright/feminine, breaking the hegemonic social trend of only dark bottoms.

Womyn in masculine spaces tend to conform to masculine apparel appearances in general. They show no unnecessary skin and wear even more baggy tops than the men. Their bottoms are always dark. In this way, they seem to be meeting the space’s norm of masculinity better than some of the male students. A closer examination tells a different story, howev er, Womyn in masculine spaces are more likely to wear the all-black dresses, pants, shorts, etc.) were tight 80% of the time, with less popular styles are the “gender appropriate” styles (e.g. tight for womyn, dark for men).
This trend does not extend to the male students, however, who seem to represent an elevated masculinity. Indeed, they do not wear the highest portion of baggy bottoms (double the other spaces) and have no bright/feminine colors or patterns on any article of clothing. They also represent the only consistent showing of ‘silly’/organizational clothes. Instead, for female students, especially those who tend to remain normal relative to the gender-neutral spaces, no bright/feminine tops were observed and men tend to wear extremely loose and baggy clothing of varying colors or simply try to conform to, the feminine norm, men uphold more masculine dress styles.

Interestingly, womyn’s adoption of some masculine and some feminine traits could indicate that women are still in tension between conflicting femininity and masculinity. It is possible that this conflict is a product of the discipline, which forces students to consciously engage with these very norms. Womyn, then, may be conflicted by social pressures toward femininity and disciplinary pressures critical of those social pressures. If this effect of self-consciousness is happening for women, it does not seem to be happening for men, who may instead feel challenged by a discipline which rejects patriarchy. In fact, it is precisely this critical examination which makes womyn’s studies different from computer science. In the former, gendered norms are openly discussed and evaluated; pressures are direct and overt. In the latter, pressure to conform is unacknowledged by the technical subject, as if the discipline were somehow genderless. This line of thought, that masculine disciplines are without gender, has also been found in other studies and interviews (Ong, 2005).

**Implications**

With this study, we have provided corroboration of previous conclusions that masculine disciplines place conflicting pressures on their female members. Womyn in these spaces are not exclusively centers of rejection. In fact, they have the average range of styles open to them. When no one style predominates, the discipline’s femininity seems almost schizophrenic. Maria Ong’s (2005) work with physics students suggests that a discipline’s femininity and local community masculinity. This tension is evident in our study: womyn work to blend in generally meeting masculine norms such as baggy, casual, and drab clothing. While they also assert their femininity with subtle but firm signifiers like fuchsia scarves and tight jeans. Female students in masculine classroom spaces seem to partake in both gender extremes. Male students here do not have tension between social and disciplinary gender influences and can comfortably partake in masculine apparel norms. This comfort also affords them the space to break those norms and wear overtly bright/feminine articles which are not typically observed wearing. That is, while womyn’s femininity seems an asserted but subtle balance, men’s masculinity is unchallenged and free to openly Transgress boundaries.

**Female Spaces**

The feminine space, however, does not demonstrate the reverse. Female students appear to break some norms of femininity in favor of masculine garments such as loose tops and drab accesso- ries. Unlike in the masculine spaces where men seem comfortable, but not inclined to break, wearing norms, women’s gender-bending in feminine spaces is widespread. Women’s fashion as- sists its claim to these masculine traits in feminine spaces more than places second to masculinity. However, the discipline’s femininity of this defensiveness should not be overlooked simply because they come from privilege. If male students are uncomfortable and defiant about their gender status, it can impede their work just as much as female students’ work can be impeded by concerns about their gender status.

**Limitations and Future Work**

There are some significant limitations to this work. The study only contains nine classes representing a few days at a single university. Without further study, we cannot make generalizations to the universality of this system or the results. The results of broader analysis, particularly one that included a more representative sample of science and non-science courses, would be very interesting in order to assess whether there might be some variation within those spaces.

Additionally, students were grouped into two spaces for the pur- pose of observation. Not only is the two-system juxtaposition inadequate to describe the diversity of student bodies, but also how to clas- sify which students belong to which sex is also an uncertain practice. Students were assigned to a sex based upon their apparent ex- tent and gender performance, but it is entirely possible that transgender students have passed for the other sex. Anec- dotal evidence and personal experience indicates that the Ford- ham community has active transgender members, but for privacy reasons data on their prevalence have not been gathered for this study. While the experience oftrans individuals is important to understand, this study is different from the experience of cis-gendered students, and may not be adequately described by my analysis here.

This study only examines the impact of gender and gender identi- ties, and does not examine other important factors like race and social class. Social scientists are becoming increasingly aware of the different ways in which gender, race, and class intersect, and further studies on identities and attire should take such relationships into account.

Further study should also take into account students’ individual clothing, while the patterns and fits of mens tops and bottoms may be conflicted by social pressures toward femininity and disciplinary pressures critical of those social pressures. If this effect of self-consciousness is happening for women, it does not seem to be happening for men, who may instead feel challenged by a discipline which rejects patriarchy. In fact, it is precisely this critical examination which makes womyn’s studies different from computer science. In the former, gendered norms are openly discussed and evaluated; pressures are direct and overt. In the latter, pressure to conform is unacknowledged by the technical subject, as if the discipline were somehow genderless. This line of thought, that masculine disciplines are without gender, has also been found in other studies and interviews (Ong, 2005).

**References**


Communications

Communications are short reports of original research that focus on highlighting an important finding that will likely be of considerable interest to others in the discipline.

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**FURJ is pleased to announce the winners of the inaugural Undergraduate Research Mentor Award!** This award aims to recognize those faculty members who show consistent passion and dedication in working with undergraduate students and promoting research at Fordham.

We received feedback from many students about their research experiences, who nominated the following:

<table>
<thead>
<tr>
<th>Sciences</th>
<th>Social Sciences</th>
<th>Humanities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dr. Ipsita Banerjee</td>
<td>Dr. Beth Knobel</td>
<td>Dr. Larry Welborn</td>
</tr>
</tbody>
</table>

The winners are:

- Dr. Ipsita Banerjee, Chemistry
- Dr. Beth Knobel, Communication and Media Studies
- Dr. Larry Welborn, Computer and Information Sciences

Thank you to our outstanding faculty and to the students who cast their votes.

Do you know a faculty research mentor who you think should be on this list? Nominate him or her for next year’s Undergraduate Research Mentor Award!

To nominate a faculty mentor, send an email to tfurj@fordham.edu.
Interaction of Particle Beams with One-Dimensional Potential Barriers

Introduction

The objective of this project was to model particle beams in a number of 1-D potential systems and to create generalized Mathematica programs that modeled different matrices to displace the particle beam over various potential discontinuities and structures (Walker and Gathright 1994). The discontinuity, propagation, and delta matrices can be used to derive any number of complicated shapes. We wrote programs using Mathematica code that modeled different barrier systems, beyond those considered in the Walker paper, ranging from a simple double barrier to an N-barrier system.

Methods & Techniques Used

The standard procedure was to follow the method introduced by Walker and Gathright in their 1993/1994 paper “Exploring one-dimensional quantum mechanics with transfer matrices”, which uses different matrices to displace the particle beam over various potential discontinuities and structures (Walker and Gathright 1994). The discontinuity, propagation, and delta matrices can be used to derive any number of complicated shapes.

The main equation used was Schrödinger’s time-independent equation,

\[ \frac{\hbar^2}{2m} \frac{d^2\psi}{dx^2} = (E - V(x))\psi \]

The solution to the above equation (for \( E > V_0 \)) is the generalized 1-D wave equation,

\[ \psi(x) = Ae^{iKx} + Be^{-iKx} \]

The generalized potential discontinuity used corresponds to the following figure:

\[ \begin{array}{c}
\text{A} \\
\text{B} \\
\text{C} \\
\text{D} \\
\text{I, k_1} \\
\end{array} \]

with \( A, B, C, D \) corresponding to the coefficients of the approaching and reflected wave on each side of the discontinuity.

The coefficients on either side can be related to each other through the following discontinuity matrix (Walker 1992),

\[ \begin{pmatrix}
1 + \frac{1}{\sqrt{V_0}} & 1 - \frac{1}{\sqrt{V_0}} \\
\frac{2}{\sqrt{V_0}} & \frac{2}{\sqrt{V_0}}
\end{pmatrix} \]

where \( k_1 = \frac{\sqrt{2mE}}{\hbar} \sqrt{V_0} - V_0 \) and \( k_2 \) are the respective wavenumbers on each part of the potential and \( \psi = e^{iKx} \). All potential and energy terms are scaled by a reference potential \( V_1 \). Therefore \( E = EV_0 \) and \( V = V_1/V_0 \) where \( E \) and \( V_1 \) are the energy of the particle beam and the potential of the system respectively.

If the discontinuity does not occur at \( x = 0 \), the coordinate system can be translated by the use of a propagation matrix \( \rho \) (Walker, 1992). This allows the discontinuity and propagation operators to remain independent of each other and allows for a “cleaner” handling of the system.

If the unprimed coordinate system is translated into the primed coordinate system with \( x = x' + a \) with no change in potential, then

\[ \psi'(x') = \psi(x) \]

Using these, transfer matrices of a large number of complicated systems were modeled very efficiently and the transmission graphs of up to 1 000 barriers could be generated within the order of a minute. The transfer-matrix approach also has the advantage of being an exact representation of the system, with numerical calculations done only when calculating the final transmission coefficient graphs.

Conclusion

Standard tunneling effects were replicated through the codes which clearly showed Ramsauer peaks when a small number of barriers were considered. As the number of barriers were increased, bands of unit transmission formed (a precursor to the electron energy band structure found in solids) (Griffiths and Steinke 2001), with the number of peaks alternating between \( N \) and \( N - 1 \) between odd and even bands respectively.

Implications and Further Work

These Mathematica codes provide the basis for modeling a large number of complicated systems. Since the codes were used from scratch and are completely different from those used by Walker to generate the graphs in his paper, they are versatile in different ways. Also, unlike Walker’s programs, the ones created for this project are real-time interactive, allowing the user to graphically change all the parameters without resorting to modifying the code. We will continue to keep building on these codes, eventually adding the effects of external electric fields simulating those in real one-dimensional systems such as nanowires. This would let us investigate phenomena such as Fano Resonances.2

Notes

1. Ramsauer peaks are peaks of unit transmission in symmetrical barriers when an integral number of half wavelengths fit in the barrier. The effect of this is to make the barrier transparent. For non-symmetrical barriers, the peaks still occur, but do not reach unit transmission but follow the envelope formed by the transmission through the discontinuity within the barrier.

2. All potentials are scaled using an arbitrary factor of \( V_1 \), and all lengths are scaled by a factor of \( a_0 \). Barrier strengths is a dimensionless quantity. All of these values depend on the particular system being studied and the specific particle used in the beam.

References


Synthesis and Characterization of Mono- and Di-O-Alkylated Derivatives of Methyl 3,5-Dihydroxy Benzoate

Introduction

In the course of searching for monomers for larger macromolecular structures, we attempted the bis-O-alkylation of methyl 3,5-dihydroxy benzoate (1) with (bromomethyl)cyclohexane (2). To our knowledge, no literature procedures have been published on the preparation of ethers by alkylation of a phenol substrate with (bromomethyl)cyclohexane. We were surprised to find that the mono-O-alkylated product was predominantly obtained in this reaction. This finding is in contrast with those reported for alkylation, utilizing benzyl bromide where bis-O-alkylation is the predominant reaction (Yan et al. 2011). Herein we report a convenient synthesis of the bis-O-alkylated product in 3 good yield.

Results and Discussion

Initial attempts to prepare di-O-alkylated ether 3 involved reacting 1 with 2 in the presence of K₂CO₃ with 18-C-6 in aceton at 60 °C. This di-alkylation did not proceed presumably due to the decreased reactivity of (bromomethyl)cyclohexane relative to other alkyl halides such as benzyl bromide. To identify conditions under which we modified the reaction solvent and temperature. Upon exposure of the (bromomethyl)cyclohexane and 2 with K₂CO₃ in DMF at 60 °C (Scheme 1), two new products were observed by thin layer chromatography (TLC).

To our knowledge, no literature procedures have been published for commercially available methyl 3,5-dihydroxy benzoate. For this reason, all procedures were performed utilizing the pure material obtained in the first alkylation with (bromomethyl)cyclohexane. We were surprised to find that the mono-O-alkylated product was predominantly obtained in 4 (Scheme 3), with a triplet at 6.63 ppm two overlapping doublet of doublets for 1H NMR spectrum obtained in CDCl₃ are referenced to 7.26 ppm.

Experimental Procedure

All reactions are performed under an argon gas atmosphere using oven-dried glassware. Solvents and reagents are used without further purification. Reactions are monitored by TLC using silica gel 60 F₂₅₄ plates. TLC bands are visualized by UV. Eluent solvent ratios are reported in v/v. ¹H NMR spectra are recorded at 300 MHz and ¹³C NMR spectra are recorded at 75 MHz on a Bruker Avance DPX 300 MHz spectrometer. Chemical shifts are reported in parts per million (ppm) and coupling constants are reported in Hertz (Hz).

3H NMR spectra obtained in CDCl₃ are referenced to 7.26 ppm. ¹H NMR spectra obtained in CDCl₃ are referenced to 2.04 ppm for the free phenol proton. The ¹C NMR spectra of 3 and 4 also displayed distinguishing differences. Because of the inherent symmetry, four aromatic carbon peaks were observed for 3 (169.3, 131.8, 107.6, and 106.5 ppm) while six aromatic carbon peaks were observed for 4 (160.6, 156.6, 132.0, 108.8, 107.9, 107.0 ppm). In both cases, the (H and ¹C NMR spectra of 3 and 4 were different from the corresponding spectra for commercially available methyl 3,5-dihydroxy benzoate.

One potential use for di-O-alkylated 3 is as a monomer for larger molecular structures such as polymers and dendrimers (Fréchet and Tomalia 2002). Because of its unique molecular structure containing polar and nonpolar moieties, compound 3 is an interesting monomer for incorporation into macromolecules that might be able to remove hydrophobic, nonpolar organic pollutants from aqueous environments. Previous work in our group has demonstrated that the incorporation of different functional groups influences the pollutant entrapment (Triano et al. 2011). We anticipate that cyclohexane analogues will influence the encapsulation properties of dendrimers. Compounds 3 and 4 are also novel synths for organic synthesis: the ether group serves as a handle for further functionalization through the formation of new carbon-carbon bonds or hydrolysis to the carboxylic acid.

Conclusion

In summary, we have disclosed a previously unknown alkylation reaction between methyl 3,5-dihydroxybenzoate 1 and (bromomethyl)cyclohexane 2. The reaction proceeds by initial mono-O-alkylation to furnish an intermediate that was isolated and subjected to the same alkylation conditions to obtain the desired product in good yield. Purification by silica gel column chromatography followed by trituration resulted in an analytically pure product. Because of its unique physical properties, di-O-alkylated product 3 has been incorporated into dendrimers for encapsulating organic pollutants from aqueous environments. Future studies of the effectiveness of this monomer in the encapsulation of pollutants will be disclosed in due time. Furthermore, our di-O-alkylation protocol may find broader use in other synthetic targets.

References


Tending the Flowers, Cultivating Community: Gardening on New York City Public Housing Sites

Introduction
Founded in 1934, The New York City Housing Authority (NYCHA) is the nation's oldest and largest public housing agency. As of March 2014, almost half a million people live in NYCHA's 334 housing developments located throughout the five boroughs. If a NYCHA resident wants to garden, he or she may submit a garden application to his or her development's management office and begin to garden in a place approved by the developer's management. Some developments have preordained places for their residents to garden, complete with fences. In other developments, residents simply choose a place on the development's grounds, such as a part of a lawn close to their apartment, and begin to garden. NYCHA will reimburse the gardener for up to $40 of his or her gardening expenses and will also provide seeds, bulbs, starter plants, compost, and some technical assistance. NYCHA is supportive of resident gardening because it is an economically efficient means of grounds beautification, as well as being environmentally beneficial and connected to a decrease in crime and vandalism on development grounds (Bennaton, 2009, Lewis, 2008). Currently, there are over 600 public housing residents gardening on NYCHA grounds (Bennaton, 2009). The table below offers basic information on different types of gardens in New York City.

<table>
<thead>
<tr>
<th>Description</th>
<th>Community Gardens</th>
<th>Home Gardens</th>
<th>NYCHA Resident Gardens</th>
</tr>
</thead>
<tbody>
<tr>
<td>Where gardens are maintained</td>
<td>On community grounds</td>
<td>On private property</td>
<td>On community grounds</td>
</tr>
<tr>
<td>Who maintains the garden</td>
<td>Maintained by a collaborative community group</td>
<td>Maintained by an individual</td>
<td>Maintained by an individual</td>
</tr>
<tr>
<td>Why?</td>
<td>Individual benefit of community</td>
<td>Individual and household goods</td>
<td>Individual and household goods</td>
</tr>
</tbody>
</table>

Table 1. Types of Gardens in New York City

While working part-time in NYCHA's downtown office for the past two years, I received many calls from resident gardeners seeking help for the problems they were experiencing with their gardens: gardens were vandalized, plants were stolen, and requested flowers were not received. Hearing how much of a struggle it was to plant and maintain gardens on development grounds made me wonder why these individuals continued to garden.

Methods
To answer this question, I spent the summer of 2011 conducting ethnographic research at three different NYCHA sites in New York City, focusing on the role gardens play in their communities. All of the gardeners I spent time with were women (as are most NYCHA gardeners), ranging from 30 to 90 years old, none of whom had a higher than high school education. Julia (50 years old) is of Puerto Rican and Italian descent. Maria (30) is Dominican, and Gloria (79) is Puerto Rican. All three were born and raised in the New York City area and had no prior knowledge of gardening before they began gardening on NYCHA grounds. Josephine (66) and Sarah (90), on the other hand, are African-American and lived as children on farms in the rural South where they had participated in farming and gardening before moving to New York City as teenagers.

The Garden as Personal Space for Creative Self-Expression
In Taste for Gardening: Classed and Gendered Practices (2008), Lisa Taylor argues that there are intrinsic differences in the processes and goals of gardening for the middle and working classes; these, Taylor argues, are the direct result of class differences. One particularly striking point that Taylor makes equates working-class gardening with providing a feeling and expression of self-worth. Taylor writes that by keeping a "tidy" garden, members of the working class are able to "refuse pejorative associations about being working-class and to ensure that others recognize their respectability" (p. 117). Taylor’s finding is in keeping with what my gardeners experienced. When I asked why Julia thinks more people do not garden, she said, “It’s a lot easier to sit on the couch all day and watch novels.” She viewed herself as different from residents who did not garden, and wanted to distance herself from the negative stereotype of lower-class people as lazy and unproductive. However, she also reasoned that other residents might think of her as different or that she was trying to show she was better by gardening. Julia told me that one time she was protecting her daughter’s friend from her boyfriend’s abusive mother, and the mother shouted at Julia, “You just think you’re special because you have a garden.” Julia was angered, hurt, and baffled by that accusation. For her—and for other gardeners as well—the purpose of gardening is not to show other housing residents that they are superior; rather, gardening serves as a way of defying stereotypes and a form of self-expression.

Just as social class is important to the community gardening experience, so too is gender. The garden in Western culture is traditionally considered a “private, domestic, feminine space” because of its proximity to the home, as opposed to the “male sphere of waged work and politics” (Rose, 1993, p. 18). Gardening is indeed a gendered leisure activity. Raisborough and Bhatti (2007) argue that although much feminist analysis of leisure reads resistance as “a counter to power relations that aim to maintain, reproduce, or repackage explosive gender relations,” empowerment does not necessarily come from resistance; it can also “stem from an active repositioning to contextualized gender norms that escapes an easy categorization as resisting or reproducing gender relations” (p. 460-461). Furthermore, in their analysis of a woman’s written autobiography as a gardener, they argue:

*The gardener’s* story of creative positioning is also one of her empowerment. The garden becomes a site and source of her empowered agency as demonstrated through self-expression, strategies of commitment and discipline; pleasure; control of space and time and, importantly, a social recognition as she takes up her position to the socially inscribed identities of gardener, wife, mother and neighbor (Raisborough & Bhatti, 2007, p. 473).

In this way, the NYCHA women gardeners embrace the domestic act of gardening while they are also empowered by it. Julia, a mother of ten, admits to being “the domestic type.” At the same time, however, she values her time in the garden as a way to escape her family and have some peaceful time alone. Maria told me that, since she started gardening, she loves to spend time in her garden, but her family started complaining that she spends too much time there and not enough time tending to them and their needs. Thus, Julia and Maria’s gardens, while being feminine, domestic spaces, serve as an alternative option to disempowering situations.

The Garden as Location within Public Sphere
The resident gardeners have come to embrace their public position. It seems that for them, being comfortable enough to garden on their own and also giving them confidence to be community leaders, and vice versa. Bhatti and colleagues (2009) claim that “in ‘doing gardening’ gardeners are not just taking care of their plants, but also taking care of the self, and others” (p. 69-70). Although usually presents itself as “home-making” (p. 69), as Bhatti is referring to home gardens, what happens when the “care and concern” (p. 70) generated by gardening takes place in a public setting? Their “care and concern,” then, does not flow into the adjacent home, but is directed toward the surrounding community. The resident gardeners often take it upon themselves to better the community by cleaning up public spaces beyond their gardens, holding special events on development grounds for their residents, and joining community improvement organizations.

Josephine told me that she started gardening to “stay out of the way”—she was raising “too much trouble” being on community boards and tenant organizations. However, she tends to her gar-
sometimes she will move beyond its fence and spray down the playground area, clearing away the cigarette butts and bottle caps so that “the kids will have a clean place to play.” She reprimands people for smoking marijuana by the development’s playground and has confronted children for harassing passing drivers. Without the access to her garden, she would not have been able to do that. Indeed, the gardens play a central role in the gardeners’ ability to help and care for their community.

Conclusion

It could be said that the gardeners consider their work a source of beauty, relaxation, exercise, food production, and self-worth. On a deeper level, the gardens are places of the gardeners’ own personal expression as they position themselves within a society full of expectations and stereotypes regarding class and gender. In gardening, they have a place for relaxation and solitude, and as such it is an “escape” from their daily lives as mothers and nurturers—lives that allow very little time spent for themselves. While they are sources of beauty, exercise, and accomplishment, resident gardens also allow their keepers to be active and productive, and to create a beautiful place, thus allowing them to defy negative stereotypes of class and gender. How they choose to garden is linked to how they see themselves as people, and this statement of identity is made even more powerful as they make it on public grounds. Regardless of whether they garden for themselves or for the community, it is clear that there is a responsibility the gardeners feel to take care of their community, generated by and/or expressed in their gardening on community grounds. In that way, their gardens make public grounds invaluable places to them, not only as places for themselves but also as self-designed outlets for community involvement and improvement. By gardening on NYCHA grounds, they are cultivating community.

References


Service.

The spatial configuration of a molecule or a robot’s manipulator can be modeled by a polyhedral structure, a three dimensional figure with straight edges, such as a geodesic dome. The faces of a polyhedral structure are polygons, typically triangles. Where these edges join is known as a vertex. It is important to distinguish between generic and nongeneric flexibility. For example, a planar rectangle made of rigid rods but hinged at each vertex is clearly flexible: one can easily change its shape. That is generic flexibility; there are simply not enough constraints to make it rigid. In this paper we are concerned with nongeneric flexibility, which means that the configuration of hinged rods (edges) is rigid if the lengths of the sides are arbitrarily assigned may become flexible under certain precise conditions on the edge lengths (see Figure 1). Similarly, if the bond lengths of the molecule satisfy these conditions, the polyhedral structure of the molecule becomes flexible as well.

Lewis has developed an algorithm to detect conditions under which a generically rigid polyhedral or polyhedral structure becomes flexible (Lewis and Coutais 2006). It relates the sides and the angles of the figure by using basic trigonometry and the distance formula. This yields a system of multivariate polynomial equations, a classically difficult problem to solve. To solve the system efficiently, he uses the Dixon-EDF method to compute a “resultant,” a single equation that encapsulates many of the important properties of the original system (Lewis 2010, 1996). The last part of the algorithm, called Solve, searches to find the ratios of side lengths necessary for the structure to become flexible. This means as long as the distances between them remain constant. Note that A and D are not vertices, they are attachment points of the segment AD. The structure as pictured is rigid because the rod across the middle appears to brace it up.

First, by establishing a canonical form for the solution tables, a test for equivalence can be used to identify and eliminate duplicate solutions. Furthermore, we found ways to eliminate duplicates as they arise by following a similar procedure on the fly (that is, as the algorithm runs).

The remainder of this paper is structured as follows. In the second section, we walk step-by-step through the algorithm for determining molecule flexibility using a simple “toy” quadrilateral example. The third section describes the improvement for comparing different algebraic descriptions of the same geometric figure. Finally, the fourth section summarizes the results of our improvement and its applicability to new problems.

Detecting Flexibility

Consider the quadrilateral with a bar across it in Figure 1. It is attached to the x-axis at the origin (0, 0) and (s0, 0). The reader can imagine that each of the six connection joints is a hinge allowing the sides s1, s2, s3, s4, s5, and the rod to pivot within the 2D plane of the page. The only constraint on the sides is that as long as the distances between them remain constant. Note that A and D are not vertices, they are attachment points of the segment AD. The structure as pictured is rigid because the rod across the middle appears to brace it up.

On the other hand, if this quadrilateral is arranged as a parallelogram with the bar across the middle parallel to the bases as in Figure 2, the figure becomes flexible. This means that if the plane were vertical, under the force of gravity, the figure would “fall” to the x-axis, flexing at all four of its corners while the segment AD moves along smoothly.

The variables, which determine the shape and configuration of the quadrilateral are the locations of points A, B, C, and D. By placing...
notation and to emphasize that these equations are polynomials:
\[ i.e., \]

Since there are four unknowns, four equations are necessary to

The same method of writing a system of multivariate polynomial

The result of

The next step in the analysis, the Dixon-EDF method, transforms

The key example in this research is a configuration of three quad-

If we consider the resultant arising from the Bricard

Recursively call Solve on the leading coefficient with that parameter as the primary variable.

For each parameter that was not detected as a linear factor, recursively call Solve on the leading coefficient with that parameter as the primary variable.

Canonical Form for Solution Tables

Solve is a recursive algorithm which calls itself from the body of its own code. If the first part of the algorithm finds a polynomial, it calls Solve on the multivariate coefficient, which is also a polynomial. As a consequence of the recursive search tree in Solve, the algorithm finds a very large set of solution tables, many of them redundant. As partial substitution tables are discovered, the recursive nature of the algorithm causes even more potentially redundant tables to be found, undetected until the end of the algo-

the key to significantly accelerate the algorithm.

The algorithm proceeds, duplicates that arise early on in the algorithm lead to exponen-

Without the rod HI to brace it, it is clearly flexible. With HI, it is
generally rigid. Bricard showed that there are three nonde-


tical to include here.

We study the redundancies that arise in this example. Lewis’s first

The configuration of the structure, yet by inspection, they appear algebraically differ-

Variables in the solution tables are

Swapping rows (i.e., rearranging the order of equations) produces

table to move that variable from the RHS to the LHS. This is a more difficult type of redundancy to detect visually or algorithmically.

We sort tables by the variable that appears on the right hand side (RHS) of the variable moved up in the table must be substituted down the right hand side of the lower rows. Using this process of sorting tables and doing a simple rearrangement to the LHS of the table (i.e., if the value of a is 0, it is equivalent tables) still leaves many redundant solutions. We refer to the LHS of the table in Figure 2 as the reduced version of the table (e.g., Table 1 to Table 2 in Figure 5). Table 3 in Figure 5 reveals a more subtle equivalent variation.

In order to identify and detect these lingering redundant solutions, we establish a canonical form for the tables. A canonical form is a standard expression for the arrangement of the solution sets. Our process of standardizing the form of the table follows these steps:

1) Establish an order of variables from highest to lowest, a step already required by the Solve algorithm.

2) Search each table for the row with the lowest linear variable (i.e., linear in the sense that it is raised to the power of one). This variable will be either on the LHS of the LHS of the table or the RHS, but never both.

3) Re-sort the rows in terms of the lowest variable.

4) Before committing to the rearrangement, check that this new expression does not cause any denominator to become zero.

5) Permute the row to the top of the table, arranging the LHS from lowest variable to highest variable (top to bot-

6) Sort the table and repeat until the table does not change.
Once the tables have been arranged into canonical form, they can be compared using a simple and efficient algorithm for comparison. 

1) If the tables do not have the same number of entries, they are not equal.

2) Otherwise, subtract the RHS of each row from the LHS within the same table.

3) Compare corresponding rows from the two tables up to sign.

4) If all rows return positive correspondence, the tables are equal and one can be discarded.

The resultant arising from the cyclohexane molecule has 5 685 terms with 1 variable and 16 parameter variable of the coefficients. If the order of the parameter variables is assigned to be: $e_1, e_2, d_1, a_1, d_2, d_3, b_1, b_2, b_3, a_2, b_4, a_4, d_4,$ then both tables have the same canonical form given above.

### Conclusion

Although these algorithms were developed for post-processing, we are also able to compare tables on the fly to eliminate duplicates as they arise. After each level of recursion, all partial tables of substitutions that have been discovered are sorted and compared using these algorithms. By discarding the duplicates, we have greatly decreased the overall run time of the Solve algorithm.

For the cyclohexane molecule, the run time for Solve was reduced from approximately 70 h, to just 3 min and 14 s. The set of 3 139 solution tables was condensed to 62 tables. All three of the nondegenerate solutions of the cyclohexane configuration appear in the list of 62. The results of this work could lead to the ability to analyze more complex and larger molecules and geometric structures and have been used by Lewis to further explore the solution space of flexible polyhedra.

### References


### Fabrication of CdS Nanoparticle Coated Jasmonate Conjugates and their Interactions with Mammalian Cells

#### Introduction

Self-assembled nanomaterials have been gaining importance because of their wide range of applications for the development of nanodevices (Zhang et al. 2002; Reinholdt and Crego-Calama 2003; Zhang 2003). Molecular self-assembly primarily occurs by non-covalent interactions such as hydrogen bonding, electrostatic interactions, van der Waals forces and hydrophobic interactions that are the result of chemical complementarities and structural compatibility (Ratner and Bryant 2004). Depending on growth conditions, distinct structures such as micelles, vesicles, rods or tubes are formed (Hartgerink et al. 2001). There has been much focus on biological building blocks such as DNA, proteins and lipids using bottom-up approaches for the development of nanomaterials due to relatively economic, mild, and environmentally friendly methods utilized therein (Lowe 2000; Booezr et al. 2003).

By combining biological building blocks with synthetic nanoparticles such as quantum dots or magnetic nanoparticles, one can prepare composites capable of a wide range of applications. For example, quantum dots (QDs) are being utilized as biomarkers for tumor targeting in vitro and in vivo (Michael et al. 2005). QDs are slowly replacing molecular fluorophores and dyes due to their spectral stability, and high molar extinction coefficients (Leatherdale 2002). In particular, cadmium sulfide (CdS) QDs has a band gap energy of 2.52 eV (Brucker et al. 1999). Several methods have been utilized for the growth of CdS nanoparticles such as laser ablation, electrochemical fabrication, surfactants, and, in recent times, biological templates (Artemyev et al. 1997).

In this work, we have grown CdS nanoparticles on jasmonate nanocomposites biometrically and examined their interactions with mammalian cells. In general, plants naturally secrete the phytohormone jasmonic acid during development and in response to biotic and abiotic stress as a defense mechanism (Traw and Bergelson 2003; Sembdner and Parthier 1993). We have developed a new class of nanomaterials by utilizing nanocomposites of the plant phytohormone jasmonic acid (JA) as templates for the growth of quantum dots, which may have potential applications as sensors and may potentially be utilized for biomaging applications.

#### Experimental Procedure

##### Materials

- Jasmonic acid, cadmium chloride, sodium sulfide, 100μg/ml penicillin, 100 μg/ml streptomycin and 10% fetal bovine serum were purchased from Sigma Aldrich.
- Modified Eagle’s Medium was purchased from Gibco.
- Modified Eagle’s Medium was purchased from Gibco.
- Modified Eagle’s Medium was purchased from Gibco.
- Modified Eagle’s Medium was purchased from Gibco.
- Modified Eagle’s Medium was purchased from Gibco.

- For confocal microscopy, the samples are mounted on glass slides and sealed with cover slips. The coverslips are sealed with fingernail polish and the samples are imaged with a Leica TCS-SP2 laser scanning confocal microscope.

##### Results and Discussion

Self-assembly of JA at various pH values was examined over a period of four to six weeks. In general, under acidic conditions, hydrogen bonding interactions between the hydroxyl groups as well as the carboxyl group of JA is protonated leads to an increase in hydrogen bonding causing the formation of aggregates of spherical structures. On the other hand, under neutral to basic conditions, the carboxyl group is deprotonated but hydrogen bonding still exists due to O-H...O intermolecular hydrogen bonds. Although there is a decrease in hydrogen bonding, pH 2–5, we observed the formation of nanocomposites (figure 1a). In contrast, under neutral to basic conditions, the assembly of short fibrous structures was observed (figure 1b). It appears that under acidic conditions, hydrogen bonding interactions between the hydroxyl groups as well as the carboxyl group of JA is protonated leads to an increase in hydrogen bonding causing the formation of aggregates of spherical structures. On the other hand, under neutral to basic conditions, the carboxyl group is deprotonated but hydrogen bonding still exists due to O-H...O intermolecular hydrogen bonds.
Coulombic repulsions, due to the deprotonated carboxyl groups exist, causing a decrease in aggregation. Further, hydrophobic interactions between the five membered ring systems and the phenyl groups also allow for self-assembly leading to the formation of fibrous nanostructures. Since JA is a polar acid, solvent-particle interactions also exist in addition to inter-particle attractions. These solvent-particle interactions are due to van der Waals interactions based on dispersion forces and dipole-induced dipole attractions (Jonas and Krüger 2002). At higher pH levels, competition between the inter-particle and solvent-particle interactions causes the assembled structures to be larger and spread out compared to the clusters formed under acidic conditions.

The nanoassemblies formed at pH 7 were then conjugated with CdS nanocrystals. The fluorescence spectra of CdS nanocrystals before and after conjugation with JA assemblies are shown in Figure 2. Upon incorporation of JA with CdS QDs, a blue shift of 7 nm is observed compared to the peak at 540 nm for CdS nanocrystals alone indicating the incorporation of the QDs on the assemblies.

Further analysis by TEM confirmed that the JA assemblies were conjugated to CdS nanoparticles (Figures 3). The CdS nanoparticles ranged between 20–30 nm in diameter and completely coated the surfaces of the JA assemblies. It is likely that the CdS nanoparticles efficiently bound to the JA assemblies due to the complex formation between the Cd2+ ions and the hydroxyl groups of the JA assemblies, followed by the formation of CdS nanoparticles. In addition, the electron diffraction pattern Fig. 3c reveals that the CdS nanoparticles bound to JA assemblies are highly crystalline.

In order to explore the potential of these nanomaterials as bio-markers, the interactions of the nanocomposites with mammalian cells was explored. Confocal microscopy of the JA-CdS nanocomposites after incubation with normal rat kidney (NRK) cells and HeLa cells was explored. Confocal microscopy of the JA-CdS nanocomposites after incubation with normal rat kidney (NRK) cells is shown in Figure 4. The DIC image is shown in Figure 4a, while Figure 4b shows the superimposition of fluorescence and DIC microscopy indicating that the JA-CdS nanocomposites successfully adhered to the cell membranes. These results indicate that JA-CdS nanocomposites can successfully attach to mammalian cells and may potentially be used as biomarkers.

### Conclusions

In conclusion, we have reported the assembly of the plant phyto-hormone Jasmonic Acid. We found that under acidic conditions, JA assemblies into spherical nanostructures. Under neutral to basic conditions, the formation of fibrous assemblies is observed. Further, nanocomposites of JA-CdS were formed, and they were observed to be highly luminescent as indicated by confocal microscopy. The nanocomposites were found to efficiently attach to mammalian cells and may potentially be useful as biomarkers.
The effect of modernization on foreign policy has been a focus of study for almost two decades. Remarkably, given the multitude of authors tackling the subject, modernization has rarely been approached in a comprehensive manner. Few have attempted to give a complete and cohesive history of the formation of modernization as an ideology and its application in public policy. Dr. Michael Latham undertakes this task in his recently released book, tracing the thread of modernization in the United States back to its ideological origins in the Enlightenment, American imperialism, and both World Wars. The book’s organization is somewhat unusual, but accomplishes analysis of each specific conflict. It offers a different perspective, illuminating long term trends that indicate the best policy options for future foreign relations.

The book’s organization is somewhat unusual, but accomplishes as much as possible. It is neither purely chronological nor purely thematic, but rather switches between the two styles of organization. Initially, I thought this style would be confusing or require unnecessary repetition of background information, but the chapters work together despite the differences in their approach. Latham provides a chronological narrative first, tracing the origins of modernization as an ideology. He believes these origins are much older than the traditionally conceived beginning of modernization in the 1940s and 50s. He puts forth an interesting supposition that the components of modernization may have been fundamental in the founding of the United States. Almost as soon as the U.S. forged an identity, Americans believed in the universality of their values and their ability to transpose the rest of the world. Latham then traces this sentiment through manifest destiny, U.S. imperialism, and World War 1, and foreshadows later events by including by early indications that American hubris and disregard for native cultures and desires would remain problematic.

Latham then switches to thematic organization, discussing U.S. intervention case studies in different countries, as well as including sections about modernization’s progress in academia and its relation to technocratic revolutions. Overall, these sections are well written and quite interesting. Each attempt at U.S. intervention is described with reference to individual national events in a manner that clarifies the motives for actions on both sides. Describing India, Turkey, Guatemala, and other underdeveloped nations that were targeted by the U.S. for modernization, Latham uses non-generalized and country-specific details. He also includes in this section information that should have been critical to U.S. policy makers at the time but was rather ignored. Without using this information, they gave vastly different nations extreme-and-appalling strategies for improvement. These details explain why the U.S. plans for other nations did not work, but they do not discuss at length the tremendous negative consequences the plans had on the local people. To be fair, Latham does include additional on-the-ground details in later thematic sections, but the case studies of different, failed interventions would have benefited from slightly more social history on the repercussions of the U.S. plans. The policy makers and local politicians undoubtedly could not understand the complexities of “the modernization” of the nation-building that ignores the historical, cultural, and political factors of the foreign country. Latham’s discussion here largely avoids partisan concerns, examining primarily logistical problems and errors in planning. This examination not only links Bush’s nation-building to the long history of U.S. interventionism described throughout the book, but it also helps readers to understand the problems of the ideology as a whole and contemplate policy alternatives for the future.

The Right Kind of Revolution is a valuable contribution to studies on modernization. It provides insight for a wide audience, not just those within the field. While its scope is broad, its analysis is not rendered superficial. Latham’s account of U.S. attempts to modernize the third world comprehensively covers events from throughout the past century, providing a new and insightful perspective from which one may view the relationship between the U.S. and less developed nations. The book’s proof of modernization’s disastrous effects necessitates a change in the U.S. mindset regarding foreign development, and it reveals, if nothing else, repeated mistakes that policy makers must avoid in future relations with underdeveloped nations.

Margaret Dunbar, FCRH ’14

Notes

Benjamin Dunning’s Specters of Paul: Sexual Difference in Early Christian Thought skillfully explores the problem that is gendered bodies within the Pauline theological anthropology. For Paul, Adam and Christ exist in a diametrically opposed yet harmonized relationship, which Dunning describes as “two paradigmatic human beings: the creation, as represented by Adam, and the eschatological resurrection to come, as represented by Christ…” (9).

What is problematic about this dichotomy for Dunning becomes the crux of Specters of Paul: the question of where sexual bodies fit in a hermeneutic masculinity in which only male figures (Adam and Christ) represent the ends of human ontology. At stake, then, is the other and difference—and in this case, sexual difference—in Paul’s theological anthropology. Specters of Paul explores the space that female bodies occupy in a theology that does not seem to make room for them. Moreover, Dunning insightfully shows how “sexual difference becomes a problem of signification—the stubborn trace of otherness that needs to be deferred or domesticated, insofar as it calls into question the dream of a single, divinely ordained fullness to human meaning” (27).

Underpinning Dunning’s work is the understanding that the Pauline eschatological body permeated early Christian writers, particularly in regards to sex and gender. Specifically, Dunning points to Paul’s proposed collapse of gendered bodies into one, as Galatians 3:28 (“There is … no longer male and female, for all of you are in Christ Jesus”) suggests, and its incompatibility with “an anthropological framework bookended by two enigmatic figures—Adam, the first human, on the one hand, and Christ, the second Adam, on the other” (4). To better understand how ancient authors dealt with such an incompatibility, Dunning interprets early Christian texts in the vein of Jacques Derrida’s “hauntology,” presenting Paul’s theology as an ever-present specter for each author. Dunning’s study is divided into two sections corresponding to the ways in which Christians tried to resolve the problem of sexual difference. Part One, “The Platonic Woman,” addresses a strategy that either reabsorbs the female body into the male eschatological body or completely erases the female body altogether. Part Two, “Flesh and Virginity,” deals with “the feminine not as an anomaly in need of eradication, but rather as a legitimate—if always secondary—supplement to the masculine” (153). From a well-researched argument, Dunning concludes that these texts, in putting sexual difference and the Pauline theological anthropology in conversation with one another, ultimately fail to achieve their intended synthesis. Dunning shows that although the early Christian solutions to the problem of Paul’s anthropological formations resist any kind of simple reduction. While the questions surrounding gender and sexuality loom large in contemporary scholarship, Dunning knows which ones to raise in order to illuminate the ways early Christians dealt with these same problems. His work, then, is an exceptional contribution and resource for these conversations.

In the introduction, Dunning carefully situates his audience in today’s conversations on gender theory, feminist thought, contemporary French philosophy, and ancient anthropology. Particularly, he notes the differences between the terms male and female and masculine and feminine, showcasing the difference between sex and gender. More importantly though, Dunning lays out the importance of the term sexual difference to his argument: “at stake in this terminological move is the capacity for an analysis that lies somewhere between either the rigidity of the sex/gender distinction or the collapse of that distinction into a space where everything is gender” (15). In doing so, Dunning avoids imposing twentieth and twenty-first century cultural distinctions between sex and gender on texts from the second and third centuries. For such a broad yet thorough analysis that offers a comprehensible reading of current scholarship, Dunning deserves to be commended.

Chapters four and five comprise the second part of Specters of Paul, “Flesh and Virginity.” Here, Dunning investigates how the early Christian authors Irenaeus of Lyons and Tertullian of Carthage, respectively, understood the role of Mary as the “second Eve” and Christ as the “second Adam.” His analysis finds that both Irenaeus and Tertullian “mobilize the trope of virginity in relation to female and male flesh as the conceptual leitmotif to their respective theological anthropologies” (98). However, as Dunning points out, each author holds the genders to different standards of virginity. With thorough attention to Irenaeus’s rhetoric, Dunning parses the way virgin bodies are differentiated from one another: they either exist in childlike innocence, remain unperturbed, or are spiritually fertile. Thus, through careful exegesis, Dunning exposes both the rhetorical acrobatics that Irenaeus must execute and the overall failure of the Irenaean strategy of recapitulation as applied to the Eve-Mary typology. Tertullian, on the other hand, sets Eve and Mary in contrast to Christ and Adam. Moreover, he redelineates “what virginity is and how it works (i.e., how it is kept and how it is lost)” (149). Tertullian, figuring the female body as incredibly porous and thus easy to penetrate, casts Mary as actually having been penetrated during childbirth, thus allowing Christ to be the sole ideal virgin. Dunning’s task in pointing out the failures of Tertullian’s theology may have been easier compared to previous texts, but his interpretation of it imbues the text with new meaning. Recontextualizing Tertullian’s theological anthropology as haunted by the specter of Paul, Dunning reveals that Tertullian’s seemingly absurd claim is motivated by a necessity to synthesize Paul’s theological anthropology and sexual difference. Dunning’s work in Spector of Paul is clearly argued and effective scholarship. By posing sexual difference as a signifier that unsettles foundational early Christian logic, spectrally anthropological logic, Dunning opens a space for feminist and queer methodologies to enter into conversation with the Pauline eschatological body. Thus, his work is a resource that evidences the “necessary instability” of early Christian anthropologies, and in this instability Dunning proves (sexual) difference could neither be fully assimilated, nor fully ejected (154-55, emphasis added). However, given how On the Origin of the World resolves the problem of sexual difference unlike any of the other texts or authors, Dunning, perhaps unconsciously, raises questions of how strictly the “Gnostic” (loaded term as that may be) authors chose to interpret the Pauline anthropology. But this question is not one in which Dunning wishes or needs to engage. Intended more for graduate-level audiences, Specters of Paul is a nuanced analysis of how anthropological formations resist any kind of simple reduction. While the questions surrounding gender and sexuality loom large in contemporary scholarship, Dunning knows which ones to raise in Spector of Paul in order to illuminate the ways early Christians dealt with these same problems. His work, then, is an exceptional contribution to and resource for these conversations.

LYONS DM and BENJAMIN P. Locating and tracking objects by efficient comparison of real and predicted synthetic video imagery. Proceedings of the SPIE Conference on Intelligent Robots and Computer Vision; 2009 Jan; San Jose, CA.

Several robot architectures have been created in the field of cognitive robotics and autonomous agents that operate in a dynamic environment but are limited in functions. The authors of the two selected articles have proposed an approach that can help behavioral robots keep track of unexpected objects appearing on their field of view. They focus on a mechanism that effectively compares and continuously synchronizes images from predicted and real world imagery. This way a robot's sensory system can communicate with the simulation through the use of visual images enabling the robot to run thought experiments by having the robot compare and continuously synchronize images from predicted to real world imagery. In this way a robot's sensory system can compare and continuously synchronize real and synthetic images for localization synchronized to the observed environment and the robot motion. For prediction purposes, the simulation can be allowed to "fast forward" in time, so that the expected position of a target, for example, can be calculated and then compared to observations. In order to do that, they introduce the Match-Mediated Difference image comparison operation (MMD).

Lyons, Chaundry, and Benjamin implement a match-mediated difference by applying a match-mediated difference mask to a generated absolute difference image, which merges the real and synthetic images. Then, two matched points are taken, one from both the real and synthetic images. The better they correspond, the more the images are considered to be similar. In Fig. 1, the image and warped image are compared, and an absolute difference image on which the different pairs of match points overlay is generated (A). The MMD is then applied, and the match-mediated mask is generated (B). Calculating the MMD image using the MMD mask results in Fig. 1(C). The threshold difference, which is shown in the final image, displays only the edges of the common region, meaning that the two images are of the same scene (D). If they had not been the same, then the objects would have appeared in white in the final image.

This is how Lyons, Chaundry, and Benjamin illustrate their approach of using the match-mediated difference to synchronize real and synthetic imagery and demonstrate its use. They further experiment with how this approach works when a new object is introduced in the real environment or when an object is removed from it. Through calculating the match-mediated difference, they show that an unexpected object (one that is in the real image but not in the synthetic one) appears in white when the threshold difference image is displayed. Similarly, a missing object (one that is in the synthetic image but not in the real one) is outlined in white in the threshold difference. They further improve this technique of effectively locating and tracking objects by allowing a robot to continuously synchronize its simulated camera pose with the actual camera pose by using MMD processing (Lyons et al. 2010).

The improved approach that the authors propose makes an important contribution to the cognitive robotics field and to artificial intelligence in general. It makes up a small part of the research in these areas of study, but, in my opinion, it provides sufficient and accurate proof of a problem that can be solved by integrating the technique into a behavior-based robot architecture. For example, a mobile soccer robot that has to track a soccer ball in order to intercept it could potentially recognize unexpected objects on the soccer field (Shen et al. 1998). Although there are approaches that include visual tracking of a ball that can yield a robust solution, they can neither track nor predict where the ball will go if it unexpectedly bounces off a fence or wall. The object-tracking model addresses this problem.

I think that it is a long way from being resolved, however, because this approach still has to implement the given object's functionality and devise a strategy that accounts for the scene location. Such problems also arise whenever a robot is operating in a complex, dynamic environment, like an urban search and rescue robot moving on an unstable pile of rubble. Factors like this must be taken into account especially when applying the technique to rescue robots or security robots used for target tracking. In such cases, the robots need to predict when, where, and what objects or people they will come across as well as their potential movements (Lyons 2011). Applying the proposed technique in such a way is very useful, and I think that it can contribute greatly to the field of target tracking.

The approach of effectively comparing real world and predicted synthetic images has great potential in that it integrates problem solving into a robot's perceptual process, leading to slowly advancing cognitive robotics, robot simulation, and computer vision. It may seem like a very small step toward building robots that can independently implement a fully functioning robotic system capable of reasoning about the world, itself, and other agents, but it enables specific robot functions to be accomplished with greater precision and accuracy. In fact, I think that little tasks, when done properly, build the way for accomplishing the biggest and most daring projects that push the boundaries of technology.

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Peteva Nikolova L. FCLC '14.
Selected Research Accomplishments of Fordham Students

Publications

Margaux Bruzzone (FCRH '12) is a co-author on the article, "Attempted suicide and non-suicidal self-injury among adolescents: Differentiating between self-injurious behaviors," which will be published in Child and Adolescent Psychiatry and Mental Health (mentor: Margaret Andover, Psychology).

Megan Cattell (FCRH '13) published "How does the use of the Holocaust as a metaphor in 'Daddy' and 'Lady Lazarus' by Sylvia Plath compare in her development of the definition of self identity?" in Plath Profiles in 2012 (mentor: Martin Chase, S.J., English).

Jeffrey Lockhart (FCRH '13), Shaun Gallagher (FCRH '13), Andrew Grossner (FCRH '12), and Tony Pulicak (FCRH '13) are co-authors on the article, "Design Considerations for the WISDM Smart Phone-Based Sensor Mining Architecture," which was published in Proceedings of the Fifth International Workshop on Knowledge Discovery from Sensor Data in 2011 (mentor: Cornelius Collins, English).

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Nazmul Sarker (FCRH '13), Stacey Barnaby (FCRH '11), Aaron Dowdell (FCRH '12), and Nako Nakatsuka (FCRH '12) are co-authors on the article "Smart Fabrication of PN Nanoparticles on Gallic Acid Assemblies and their Catalytic Applications," which will be published in Soft Materials in 2012 (mentor: Ipsita Banerjee, Chemistry).

Kathryn Silva (FCRH '12) is a co-author on the article, "Retinal pigment epithelial cells use a MetTK-dependent mechanism to limit the phagocytic particle binding activity of αvβ5 integrin," which was published in Biological of the Cell in 2012 (mentor: Silvia Finnemann, Biological Sciences).

Rebecca Triano (FCRH '12) is a co-author on the article, "Sulfated Ligands for the Copper(I)-Catalyzed Azide-Alkyn Cycloaddition," which was published in Chemistry – An Asian Journal in 2011 (mentor: Amy Balija, Chemistry).

Presentations

Gray Crenshaw (FCRH '12), Stephen Gray (FCRH '12), and Jung-Wook Park (FCRH '13) were listed as co-authors on "3D Vesicle Membrane Simulation," which was presented at the 56th Annual Biophysical Society meeting in February 2012 (mentor: Rolf Ryham, Mathematics).

Faith Forgione (FCRH '14) and Jillian Minihan (FCRH '13) are co-authors on "Defining perceived support: Relationships to social desirability, optimism, attachment, and adjustment," which will be presented at the annual meeting of the Stress and Anxiety Research Society in July 2012 (mentor: Mary Procidano, Psychology).

Stephen Frayne (FCRH '12), Nazmul Sarker (FCRH '13), Stacey Barnaby (FCRH '11), and Nako Nakatsuka (FCRH '12) are co-authors on "Self-Assembly of Polyphenol Based Microfibers and their Applications from Drug Release to Bioimaging," which will be presented at the 66th annual Eastern Colleges Science Conference in April 2012 (mentor: Ipsita Banerjee, Chemistry).

Jeffrey Lockhart (FCRH '13), Shaun Gallagher (FCRH '13), Andrew Grossner (FCRH '12), and Tony Pulicak (FCRH '13), were listed as co-authors on "Design Considerations for the WISDM Smart Phone-Based Sensor Mining Architecture," at the Fifth International Workshop on Knowledge Discovery from Sensor Data in August 2011 (mentor: Gary Weiss, Computer and Information Science).

Nako Nakatsuka (FCRH '12) is a co-author on "Interactions of Osteosarcoma Cells with Engineered Nanocomposite Scaffolds," which was presented at the 243rd annual meeting of the American Chemical Society in March 2012 (mentor: Ipsita Banerjee, Chemistry).

Michele Paccagnini (FCRH '12) was listed as a co-author on "Cyclohexane Based Dendrimers: Synthesis and Encapsulation Studies," which was presented at the 242nd annual meeting of the American Chemical Society in August 2011 (mentor: Amy Balija, Chemistry).

Nazmul Sarker (FCRH '13) was listed as a co-author on "Design of Self-Assembled Peptide Assemblies and their Interactions with Lipid Membranes," which was presented at the 56th annual Biophysical Society meeting in February 2012 (mentor: Ipsita Banerjee, Chemistry).

Rebecca Triano (FCRH '12) and Michele Paccagnini (FCRH '12) were listed as co-authors on "Encapsulation Properties of Reverse Bifunctional Dendrimers," which was presented at the 242nd annual meeting of the American Chemical Society in August 2011 (mentor: Amy Balija, Chemistry).

Sheehan Ahmed graduated from Fordham University in 2011 with a BS in physics. As an undergraduate at Fordham College at Rose Hill, he was primarily involved in Condensed Matter research with Dr. Vasillos Fessatidis, Associate Professor of Physics, and Dr. Antonios Balasias, Visiting Assistant Professor of Physics. Currently he is enrolled at Rutgers University pursuing a PhD in Physics and leaning towards astrophysics research.

William Bruckel, FCRH ’11, graduated last May with a degree in classical civilization and ancient Greek. Originally from Geneseo, NY, William received the Richard E. Doyle, S.J., Memorial Award in recognition of his demonstrated excellence in the study of classical civilization. He is currently developing a paper on the force of Peitho in Aeschylus’s Agamemnon and designing another on authorial identity in Aristophanes’s Acharnians, all while applying for doctoral programs in the fall.

Margaret Dunbar, FCRH ’14, is a psychology major and Spanish minor from Moorestown, NJ. Currently an undergraduate lab assistant of Dr. James MacDonnell, professor of psychology, she hopes to begin working on research of her own either this summer or the following academic year, and ultimately to pursue a graduate degree after graduating from Fordham.

Stephen Fox hails from Allen, TX and earned his BS in mathematics from Fordham in 2011. During his four years as an FCRH undergraduate, he conducted research on algorithmic detection of molecule flexibility and fast fourier transforms for multiplication of univariate polynomials over finite fields alongside Dr. Robert H. Lewis, professor of mathematics, while also working with Dr. Damian Lyons, associate professor of computer science, on registration of stereo point cloud scans via image homographies and iterative closest point, applied to mobile robots. A two-time participant in the A. S. A. C. I. A. – the U. S. A. ’s intelligent ground vehicles competition, he will soon be heading to Dallas, TX to start his career.

Helena Guzik, FCRH ’12, is a double major in art history and history. Born in New York City and anchored in the environs of Washington D.C., she has been lucky enough to spend her life traveling and to have grown up in four very different countries. Helena was awarded the George McMahon, S.J., Travel Fellowship this past summer to do research in Italian libraries, museums, and archives on her thesis about the influences of anatomical study on sixteenth-century Italian art. She plans to pursue a PhD in Renaissance art and continue to explore the museums of the world.

Jeffrey Lockhart, FCRH ’13, GSAS ’14 is a computer science and women’s studies double major from Phoenix, AZ. Since his freshman year he has been working in the computer science department’s Wireless Sensor Data Mining (WISDM) Lab, where his research consists of using data mining techniques to induce computer models of human motion from the accelerometer data generated by android-based cell phones. The paper he is publishing in this edition of FURJ is the end of a 15-month comparative project to study the effects of gender pressures on student apparel norms in disciplines that are traditionally coded either masculine or feminine. His ongoing research into the direction and future of queer theory may form the basis of his thesis project. His future plans include doctoral studies following his completion of the five-year accelerated computer science BS/MS program at Fordham.

Contributing Authors

Lila Peteva Nikolova, FCLC ’14, comes to Fordham from Vidin, Bulgaria. A computer science major and visual arts minor, she has teamed up with Dr. Damian Lyons, an associate professor in the department of computer and information sciences, to work on a project that involves three-dimensional robot modeling and graphical rendering of objects within that robot’s environment. Her post-graduation hopes include graduate studies in computer science or software engineering.

Michele Paccagnini, FCRH ’12, hails from Randolph, NJ. A chemistry major and environmental policy minor, as well as a past recipient of the chemistry department's Alycia and Hane Fuchs Memorial Award, she currently works in Dr. Amy Bajkaj’s organic chemistry lab, where she has evaluated the first generation cyclohexane based dendrimer and is now completing the synthesis of the second generation dendrimer series. Her excellence and experience as a student researcher—which also includes her two consecutive summers spent working on a rheumatoid arthritis drug as a Discovery Chemistry Intern at the international pharmaceutical research firm Hoffman-La Roche—have earned her membership in Fordham’s chapter of Sigma Xi, the science research honor society. She plans to attend graduate school to obtain a PhD in organic chemistry.

Jennifer Prevete, FCRH ’12, is a native of Roslyn, NY, majoring in American studies with a minor in business administration. Her senior research project, a version of which appears in this issue of FURJ, analyzes both first-hand perspectives and secondary data to examine the challenges and opportunities facing the first students of Barnard College in Manhattan – members of only the second generation of women to attend college in the United States. After receiving her diploma in May, she will be preparing to begin law school in the fall.

Narmul Sarker, FCRH ’13, is a chemistry major from the Bronx, NY. His work as a research student in the laboratory of Dr. Ipsita Banerjee, associate professor of chemistry, focuses on utilizing plant hormones and various peptide sequences for the fabrication of nanomaterials with catalytic, antibacterial, and luminescent properties; currently, they are exploring the biomimetalization properties of ephbrassinoide and studying the interactions that take place between peptides and lipids. After completing his Bachelors degree, he intends to enroll in a PhD program in chemistry or materials science.

Lauren Sepanski, FCRH ’12, is a native of Muenster, TX and an American studies major. Her experience working in the Manhattan office of the New York City Housing Authority inspired her research on the gardens of NYCHA properties and their resident caretakers, conducted over the summer of 2011. After graduation this May, she plans to take a year off before pursuing a PhD in American studies.

Jeffrey Lockhart, FCRH ’13, GSAS ’14 is a computer science and women’s studies double major from Phoenix, AZ. Since his freshman year he has been working in the computer science department’s Wireless Sensor Data Mining (WISDM) Lab, where his research consists of using data mining techniques to induce computer models of human motion from the accelerometer data generated by android-based cell phones. The paper he is publishing in this edition of FURJ is the end of a 15-month comparative project to study the effects of gender pressures on student apparel norms in disciplines that are traditionally coded either masculine or feminine. His ongoing research into the direction and future of queer theory may form the basis of his thesis project. His future plans include doctoral studies following his completion of the five-year accelerated computer science BS/MS program at Fordham.

Andrew Stefan, a member of FCRH ’13 from Buffalo, NY, is majoring in theology with minors in medieval studies and Orthodox Christian studies. In the summer of 2011 he worked with Dr. Robert Hume, associate professor of political science, on a study comparing the effects of gubernatorial influence on state legislatures, particularly with regard to the proposal of same-sex marriage bills. That same summer he acted as research assistant to Dr. J. Patrick Hornbeck, assistant professor of theology, contributing to his online digitization project, “The Latin Works of John Wyclif.” After graduation next spring, he hopes to continue studying the New Testament and early Christianity in graduate school.
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