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The editors and faculty board of the Society of Fellows welcome comments on articles that have appeared in Transactions of the Society of Fellows of Dyson College.

DYSON COLLEGE OF ARTS AND SCIENCES

The Dyson College of Arts and Sciences offers a robust and innovative liberal arts education distinguished by its emphasis on faculty mentoring, experiential learning, and small classes. Through instruction in over fifty majors and minors across the disciplines of the arts and sciences, Dyson College prepares its students for graduate and professional schools, and the twenty-first century workforce. Students develop their potential for achievement through both academic and co-curricular programs and activities, and outstanding among these is the Society of Fellows of Dyson College.

SOCIETY OF FELLOWS OF DYSON COLLEGE

HISTORY

The Society of Fellows began in the fall of 1980 with a weekend seminar devoted to questions in applied ethics. The first class of members inducted at the formal inauguration of the society in December 1981 was named after distinguished philosopher and Pace faculty member William Barrett. Since then, a new class is inducted annually and named after a fellow who has made a significant contribution to the ideals of the Society of Fellows. To date, more than 700 students, faculty, and alumni hold the distinction of being a fellow, and the Society of Fellows has become the premier honors organization in Dyson College.

FOUNDING CHARTER

Charles H. Dyson, Edward J. Mortola, Joseph E. Houle, M. Teresa Brady, R.D.C, John H. Buchsbaum, Louis V. Quintas

Being bound by ties of friendship and dedication to the ideals of liberal education, do hereby constitute themselves and their successors, forever, as fellows of the Dyson College with the duty of promoting undergraduate scholarship among the members of said college and admitting into its society and fellowship only those students, faculty, alumni, staff and friends of the Dyson College who advance in a noteworthy and exemplary fashion the purposes of the society as expressed in its constitution.

MEMBERSHIP

Membership is open to students, faculty, and alumni of Dyson College who meet eligibility requirements and contribute to the goals of the Society of Fellows.

Enrolled students of Pace University who demonstrate excellence in scholarship or in artistic creativity will be invited to become fellows if they meet the following criteria:

1. Minimum 3.3 QPA (cumulative quality point average); exceptions will be considered on a case-by-case basis.

2. Participation in at least two Society of Fellows-sponsored events; one of these events must be presentation of research or artistic projects at the annual meeting.

3. Submission of an outstanding signature work of scholarship or creative expression; to fulfill this requirement, the candidate may use a full-length paper or artistic project submitted for the annual meeting.

4. Letter of recommendation from a faculty member attesting in detail to the quality of the academic work and achievements that are being submitted for the candidate's advancement to fellow.

5. Attendance at the initiation ceremony held annually during the spring semester.

All completed applications meeting eligibility requirements will be reviewed and voted on by the Faculty Executive Board of the Society of Fellows of Dyson College.

Faculty qualify to become fellows when they serve two or more times as mentors of research papers or artistic projects presented at the annual meeting. Faculty also are recognized for sponsoring student works accepted for publication in Transactions, and for serving as weekend seminar leaders. Faculty and alumni of Dyson College who share and further the aims of the society in other outstanding ways also may become fellows.

ACTIVITIES

The annual signature activities of the fellows are the weekend seminar, the annual meeting, and the initiation ceremony. The weekend seminar provides opportunities for students, faculty, and alumni to discuss issues of contemporary significance under the leadership of teacher-scholars. The annual meeting is a one-day student conference where undergraduate students present their research or artistic projects completed under the supervision of faculty mentors. The event also is open to graduate students, several of whom annually apply to participate. At the initiation ceremony, qualified applicants are recognized as fulfilling the eligibility criteria and are inducted as fellows. Transactions of the Society of Fellows of Dyson College is the official journal of the society. Peer-reviewed by Dyson faculty, the journal publishes the work of Pace University undergraduate students completed under the sponsorship of faculty, who often are fellows.

GOVERNANCE

A faculty executive board that reports to the Dyson College dean governs the Society of Fellows of Dyson College. The board facilitates the achievement of the society's goals by planning activities, organizing seminars, reviewing papers, and overseeing special recognitions and awards.

INFORMATION FOR TRANSACTIONS CONTRIBUTORS

Papers published in Transactions are the work of Pace University undergraduate students under the sponsorship of Dyson College faculty members or faculty fellows of the society. Student submissions originate as faculty-sponsored papers or artistic projects that have been presented at an annual meeting of the society. Recent alumni of Dyson College also may submit a paper or a revision of a paper that was presented at an annual meeting. The call for proposals for submission to Transactions is announced in the spring at the annual meeting. Papers or correspondence may be submitted at that time to the editor. Each submission will be refereed and considered for inclusion by the editor and associate editors. Papers must be submitted as a Microsoft Word document using 12-point font and double-spaced, with a maximum length of twenty pages. The citation style of a submission's discipline must be followed with respect to footnotes, endnotes, and works cited. For general guidance on the preparation of submissions, consult the Society of Fellows pages on the Pace website.

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FROM THE EDITOR

Throughout 2024, Pace students involved in the Society of Fellows dedicated considerable effort to original research and creative projects that resonate with our current times. While some worked in libraries and archives, others worked in laboratories or the field, all collaborating with devoted Dyson faculty who mentored undergraduate researchers, guiding them toward the more significant questions facing humanity.

During the spring semester, committed students shared their work with a broader audience, including faculty, students, alumni, friends, family, and Pace's neighbors at the Annual Meeting in New York City. In the fall semester, student and faculty fellows, along with others interested in becoming fellows of the society, gathered for the Weekend Seminar, "Transgression as Power: Breaking the Rules for Change." This thought (and action)-provoking seminar, led by Marcella Szablewicz, PhD (Communication and Media Studies, New York), Ying Wang, PhD (Modern Languages and Cultures, New York), and R. Emilio Fernández, PhD (Mathematics, Westchester), was hosted at a new location just an hour's drive from New York City in Stony Point, NY, on the Hudson River. Participants spent the entire weekend discussing scholarly engagements with the concept of transgression in the many different fields covered by Dyson faculty and students who contributed to the interdisciplinary seminar.

This new issue of Transactions highlights the exceptional work of just a few undergraduate students engaged in the Society of Fellows at Dyson College. It features three articles in the humanities, three in the sciences, and two in the social sciences, selected from over 60 student papers and presentations submitted for review by fellows in the society last year. In the humanities, students in this issue explore essential aspects of the human experience by reflecting on literary works and, in one case, writing their own poems. This work is invaluable for future scholars seeking insight into how the current generation perceives itself and the world. The focus on fluidity over binaries across all three contributions illustrates the ongoing movement toward breaking rules for change, as reflected in our recent seminar. In the natural sciences, students investigated biological and chemical systems to benefit human health and the planet's well-being; climate change, for instance, remains a significant concern for our student researchers. We greatly appreciate the detailed descriptions of the experimental designs in these articles. In the social sciences, students employed statistical analysis and comparative designs across different regions and periods; disparities continue to draw students' attention. Once again, we value the care taken to detail the methods of analysis. Overall, we are impressed by the scientific rigor of these contributions.

What is missing in this issue? How can we account for the lack of contributions in the qualitative tradition of the social sciences? Perhaps those students spent less time at their desks and more time in the field this past year, participating in and observing various social movements that characterize the current historical moment? So much is happening that needs to be documented in real-time and understood. However, gaining this understanding requires time, especially as the subjects and categories evolve. We should anticipate the future contributions of this particular group of student researchers as they begin to make sense of the current social transformations.

Finally, we extend our sincere gratitude to the Society of Fellows faculty board for their efforts in reviewing abstracts and papers for the Annual Meeting and, once again, for their inclusion in this issue of Transactions. Additionally, we express our appreciation to our other reviewers for Transactions. We are particularly grateful to the faculty mentors who dedicated their time year-round to guide our ambitious undergraduate students throughout their research endeavors and who played significant roles as poster judges, panel moderators, and roundtable discussants at the Annual Meeting, as well as co-leaders and guest speakers at the Weekend Seminar. Furthermore, we are pleased to acknowledge Ankita Thakkar and Priyank Sakpal, two graduate students who are recent additions to the SOF team that works behind the scenes to ensure our events run smoothly, as well as Zetta Whiting, another graduate student, for implementing the design and layout of this issue of Transactions. Our deepest thanks go to Dean Tresmaine Grimes and Associate Dean Charlotte Becket for their unwavering support of Transactions and the Society of Fellows. Thank you all!

Judith Pajo, Ph.D.

January 2025

FINE ARTS & HUMANITIES

Bedtime Stories from Brooklyn

By **Felicity Flores**
Sponsored by **Eugene Richie, Ph.D.**
English Language and Literature, New York

From excommunication to the exhilaration of Queer spirituality.

THE COLOR PINK

i think it makes god smile that i live in the color pink
i absconded from the catholic church
still wearing the color i was swaddled in for my christening
i bet it makes god smile that i didn't forget about them entirely

before i developed this slingshot mouth of mine
i was a kid with incessant questions, pen in my pocketbook
the catholic church doesn't care for kids slack-jawed staring at the sky
they could grow into Gailelo willing to live and die for something other than their god
the church tells us there is no life worth living after ex-communication

before i gave up on god entirely
in sunday school it rained like god lost their temper
"i don't understand why god's a man, shouldn't he be more, something we don't yet understand?"
"the reason god is a man—is that men are the ones who tell us what we should see.
if women held power god would be woman.
it's not about what we see, it's about who we talk to when there's trouble–" Mr. Ward tells me
sunday school teacher by day, scientist in the evening, a magician by trade,
he doesn't look at me like i've lost my mind
i think it makes god smile that i live in the color pink

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my wife isn't at all surprised to see him
they're always reminding me to smile
they slip him sugar cookies for the travel home
my wife carries me from the couch to the bed

Beyond the Binary: Lady Macbeth's Exploration of Gender in Shakespeare's *Macbeth*

By **Emilia Gillen**
Sponsored by **Sid Ray, Ph.D.**
English Language and Literature, New York

Lady Macbeth's role in William Shakespeare's *Macbeth* is unforgettable for many reasons, most notably for her exploration of gender. By challenging early modern gendered dualities through her ambition, meticulousness, and desire for power, Lady Macbeth makes a claim on what we would now call gender fluidity.[1] As an elite medieval Scottish woman, Lady Macbeth challenges traditional notions of femininity by breaking gender norms and boundaries, blurring roles deemed feminine and masculine, and embodying a three-dimensional character, even as she explores the darker side of the human condition.

Within the gender norms in medieval Scotland, Lady Macbeth holds the position of Queen, suggesting her desires for significant power, but the traditional subordinate position of women emphasizes the gender norms Lady Macbeth fights against but eventually transcends through gender fluidity. According to Laura Stoss, in her essay, "An Exploration of Conformity to Medieval Male and Female Roles in the Chronicle of Alfonso X," women in the medieval and early modern period were "confined into the roles of mother, widow, or virgin" (Stoss, 4). However, the positions for women in royalty were somewhat atypical:

> Royal women were given more opportunities than peasant women because they were responsible for the sustenance of the royal familial line. [...] Being politically active proved their capabilities to exceed the standard confines of the private sphere typically designated for medieval women. Nevertheless, royal women were still only deemed mothers, wives, and daughters and were excluded from the orders of society. Their importance was only to help males maintain power, and their influence in politics was normally temporary and sanctioned only by the fact that they were to help their son's or husband's rule (Stoss, 4).

1 The *Oxford English Dictionary* defines "gender fluid" as: "a. Not clearly or wholly male or female; androgynous; b. designating a person who does not identify with a single fixed gender; of or relating to a person having or expressing a fluid or unfixed gender identity."

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The Experience of Words: Gertrude Stein and Her Synesthetic Exploration of Language

By **Emily Whitehill**
Sponsored by **Erica Johnson, Ph.D.**
English Language and Literature, New York

How do we see words? Are they mere building blocks to convey a message, or do they transcend their literal meanings for a deeper experience? In the realm of synesthesia, a mode of cognitive perception that incorporates sensory information and how individuals interpret their senses, words take on a multifaceted nature that defies conventional perception. They become sounds and tones that create melodies and sympathies, merging the sensory experience. Words can serve as paint, bringing to life vivid images that blend language with the visual and emotional. With the written word, one pair of eyes may see text on the page, another a window to artistry and creation. Many authors and artists alike create sensory experiences for their audiences, dimensionalizing their works. One such author that did this was Gertrude Stein. Whereas many writers create visual images for their audiences, Gertrude Stein may be the first to write a form of synesthetic literature.

A renowned writer of the modernist movement, Stein's most successful book was her 1933 novel, *The Autobiography of Alice B. Toklas*, in which there was a quote that leapt from the page and resonated so deeply in me, so much so I could not ignore it. She described her experience of language as the following: "You see I feel with my eyes and it does not make any difference to me what language I hear, I don't hear a language, I hear tones of voice and rhythms, but with my eyes I see words and sentences and there is for me only one language and that is english" (Stein, 70). Gertrude Stein is infamous for her wacky and complex use of language in her poetry and writings, many people failing to make sense of it. However, this explanation provides an understanding of how she interprets the meaning of language in her brain. This experience aligns very well with the neurological function of synesthesia.

Synesthesia is not a disease, nor is it a medical condition. It is a phenomenon that occurs when people experience a blending of the senses. "Some people describe it as having 'wires crossed' in their brain because it activates two or more senses when there's only a reason for one sense to activate" (Cleveland Clinic, para. 1). For example, a person with grapheme-color synesthesia (one of the types I have) might see letters or numbers as colors, while someone with sound-color synesthesia might perceive sounds as specific colors. People with synesthesia are known for

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Nanopore-based DNA Barcoding of Herbal Medicinal Products Reveals Plant Ingredients Not Declared on the Label

By **Danny Miller**
Sponsored by **Jeanmaire Molina, Ph.D.**
Biology, *New York*

ABSTRACT

Herbal medicinal products (HMPs) are an ever-evolving market worth an estimated $199 billion dollars. However, the US Food and Drug Administration (FDA) does not regulate these herbal medicines. There have been instances of fraudulent (i.e. substituted/adulterated) herbal products in the US market exposed by DNA barcoding, which uses short genetic markers to identify an organism, typically with Sanger sequencing. However, Sanger-based DNA sequencing can only be used when herbal products contain only a single plant ingredient, not herbal products with multiple/mixed ingredients. In this project, we used Nanopore DNA sequencing to authenticate a total of 8 non-FDA regulated herbal medicinal products (HMP, 3 single and 5 mixed). Of the 3 single-ingredient HMP, 3 were sequenced using Nanopore, and we detected other ingredients not on the label (i.e. adulterated). Though some of the declared plant ingredients (not all) were detected in five of the mixed-herb HMPs, all had some level of adulteration, including plant species known to be toxic. Our research underscores the significance of Nanopore-based DNA barcoding to authenticate HMPs, especially in settings lacking stringent government oversight of herbal supplements.

INTRODUCTION

Herbal medicinal products (HMPs) are an ever-growing market worth an estimated $199 billion dollars that is predicted to reach an estimated $417 billion by 2033 (Future Market Insight, 2023). In the US, HMPs are available at local grocery stores, supplement stores and pharmacies, as well as online, providing an alternative, more affordable and accessible means of treatment when compared to conventional allopathic medicine. However, given a lack of regulatory procedures by the US Food and Drug Administration (FDA), it's no wonder we see cases of substitution and contamination of HMPs when examined through DNA barcoding, a molecular technique that uses short genetic markers to identify an organism (Newmaster et al., 2015; Molina et al., 2018). Companies often

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Experiments with the Yeast *Saccharomyces Cerevisiae* can Shed Light on Important Biological Systems

By **Allie Van Pelt, Ellen Haverstick, Alessandra Barretta, and Josue Mendoza (Project 1); Anastasiia Kirdiianova, James Hill, Andrew Chen, and Isabella Birjandi (Project 2); Rebecca Korol, Yasmin Afaneh, Arnalyaliz Esparra, and Kc Kyara Carrasco (Project 3); Mark Shelan, Nicholas Samman, and Lucas Toledano (Project 4)**

Sponsored by **Daniel Strahs, Ph.D.**

Biology, New York

INTRODUCTION

The commonality and ubiquity of shared biochemical pathways between different organisms allows scientists to investigate pathways significant to human biological processes by using model organisms. One of these model organisms is the yeast *Saccharomyces cerevisiae*, commonly known as baker's yeast or brewer's yeast.

Biology students in the sophomore and junior year are asked to originate experiments using the *S. cerevisiae* as the experimental organism. This educational structure is a significant component of the inquiry-based learning paradigm in the Biology department. The students start by using the Saccharomyces Genome Database (SGD) (1) to investigate genes and processes of interest. Once these genes are chosen the students work on investigating the gene and developing their projects. This work is supported by the resources developed to support the yeast community, including the Yeast Knockout (KO) Collection (2;3;4). From this collection, students are able to obtain yeast knockout strains (e.g., that lack chosen gene of interest) supporting their experiments.

Following is a selection of the projects which were most highly evaluated by the Biology department faculty at our 2024 annual research day.

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Carbon Capture: Investigating Carbon Dioxide Removal via Chemical Reaction

By **Trinit'y Mitchell**
Sponsored by **Rita K. Upmacis, Ph.D.**
Chemistry and Physical Sciences, New York

ABSTRACT

Anthropogenic carbon dioxide (CO_2) emissions, primarily from fossil fuel combustion, transportation, and industrial processes, are driving global climate change. Post-combustion CO_2 capture technologies, particularly those utilizing amine-based compounds, have shown promise in reducing emissions from commercial plants. However, their implementation is hindered by high installation and maintenance costs. This study aims to explore novel CO_2 capture mechanisms by investigating the interactions between metal-ammine compounds, formally known as Werner Complexes, and various forms of CO_2 in different solvents. Werner complexes, including hexaamminecobalt(III) chloride and hexaammineruthenium(III) chloride, were reacted with aqueous forms of CO_2 (bicarbonate and carbonate). The resulting compounds were crystallized and characterized using X-ray crystallography. The study led to the generation of compounds bearing bound forms of CO_2. This research enhanced our understanding of CO_2 reactions with metal-ammine complexes and identified favorable conditions for CO_2 binding. Future work in this area may potentially contribute to the development of more efficient and cost-effective carbon capture technologies.

INTRODUCTION

Anthropogenic carbon dioxide (CO_2) emissions are leading to global climate change, and it is necessary for technologies to be developed that enable carbon capture and its storage for later usage. A primary source of anthropogenic CO_2 emissions is from the combustion of fossil fuels for energy (e.g., power plants). Significant quantities of CO_2 emissions are also produced by our use of transportation and by the industrial sector as a by-product in the generation of consumer goods from raw materials. In response, Carbon Capture Utilization and Storage (CCUS) technologies, particularly post-combustion CO_2 capture techniques, have been identified as strategies that reduce CO_2 emissions (Dubey et al., 2022). Gases are produced from commercial plants and then these are scrubbed to remove the CO_2 from entering the atmosphere.

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Immigration Reform and the Labor Market: Examining *SB1070's* Wage Implications

By **Anastasia Khanukov**
Sponsored by **Mary Kaltenberg, Ph.D.**
Economics, New York

ABSTRACT

This study investigates the economic ramifications of Arizona's *SB1070* on the wages of local residents within the state. The controversial immigration policy, which was enacted in April 2010, gave law enforcement the authority to inquire about individuals' immigration status. As undocumented workers were targeted, with many forced to leave the state, a debate began on the subject regarding the wages of residents and the impacts on the labor market. Using preliminary findings from various sources, including data from the U.S. Census Bureau, allows for a multitude of quantitative analyses. Specifically, the Difference-in-Differences model framework aids this study in evaluating the effectiveness of *SB1070* on the labor market, both before and after the policy implementation. Comparing the effects on wages in Arizona, to New Mexico, provides empirical insight into immigration policy discourse and dynamics within the labor market. The results show that the policy implementation impacted wages mostly in a negative way, with non-citizens still making less than citizens.

INTRODUCTION

This paper focuses on undocumented workers and residents living in the states of Arizona and New Mexico. Similar to previous works, I analyzed data in both states and counties, to differentiate the wage implications on the residents of Arizona, who were impacted by *SB1070* in 2010. The purpose of this paper is to suggest that policies targeting undocumented workers may not cause an upward trend in wages for other residents in the state. Many factors are taken into consideration, such as employment status, educational attainment, and citizenship status. Previous papers have used data from the United States Census (e.g. Gaynor, 2017), which was also done in this study, with the help of data extraction from IPUMS. By observing over 300,000 individuals within the years 2006 to 2015, this paper compares the before and after effects of *SB1070*, using a difference-in-differences model, with OLS estimation, to observe the parallel trends and changes. Incorporating fixed effects within the panel

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The Impacts of COVID-19 on Education Inequality in America: A Statewide Study of 2017-2022

By **Lauren Perez**
Sponsored by **Mary Kaltenberg, Ph.D.**
Economics, New York

ABSTRACT

In this study, the impacts of COVID-19 on already prominent education inequality in America is studied. This research covers all 50 states as well as Washington DC from the period 2017 to 2022. SAT scores are used as the dependent variable as they are a measure of academic performance. As the United States switched to remote instruction during COVID-19, education inequality exacerbated as broadband access was not available for students at an equal level. Access to resources has already been inequitable for lower socioeconomic and minority groups, causing a large divide within education. Therefore, within this study, the main variable of interest was internet subscriptions as a percentage of total households. This variable was interacted with a series of time dummy variables to see the effects of internet access on SAT scores within specific time periods, i.e., COVID. Other variables include, logged income, unemployment rate, the Gini coefficient, percent of individuals below poverty, white population, black population, Asian population, and Hispanic population, and percent of students who took the SAT. Within the study, a baseline model, a fixed effects model, and a weighted least squares model to adjust for heteroskedasticity, were all used. The results showed that COVID-19 did widen the inequality gap between lower income and minority students. It is important that the United States works to correct this divide through policy implementation, or the country will experience significant decline in Gross Domestic Product in the future.

INTRODUCTION

The history of the United States is one of systemic inequality throughout almost every system. Education is not an exception to this idea, but rather, is one of the main catalysts for persistent inequalities throughout one's lifetime. Inequality that begins with education harms the academic pursuits of students that will follow them for years to come. One of the main contributors to education inequality is a lack of equitable access to resources in different areas throughout the country. Students from

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