28th Annual Westmont College

Student Research Symposium

WESTMONT

April 18, 2024
3:30-5:00 p.m.

Winter Hall
Westmont College

2024 Spring Research Symposium

April 18, 2024
3:30-5:00 p.m.

Winter Hall
Westmont College

One of the hallmarks of Westmont College's academic program is the opportunity for undergraduate students to work directly with faculty on research and scholarly projects. Work presented at the Student Research Symposium includes student work conducted during the past year, from the divisions of the Humanities, Social Sciences, and the Natural and Behavioral Sciences. The purpose of this symposium is to celebrate the noteworthy accomplishments of Westmont students.

With special appreciation for support from the Office of the Provost

PARTICIPANTS

Lilia Allen '24
Chemistry
Poster #5

Sofia Alvarado '24
Psychology
Poster #1

Sarah Bean '24
Psychology
Poster #4

Nolan Brandt '24
Biology
Poster #8

Anneline Breytenbach '24
Psychology
Poster #16

Kennedy Burkett '26
Psychology
Poster #21

Sophia Chan '25
Chemistry
Poster #20

Joseph Chandra '24
Psychology
Poster #23

Mason Feagin '25
Biology
Poster #18

Isabella Felix '26
Sociology
Poster #3

Natalie Fogg '24
Physics
Poster #10

Noor Guefroudj '24
Chemistry
Poster #15

Ciboney Hellenbrand '24
Kinesiology
Poster #13

Aidan Holly '24
Psychology
Poster #19

Alan Lopez '26
Chemistry
Poster #3

Karla Munoz '24
Sociology
Poster #6

Jane Nakamura '24
Kinesiology
Poster #8

Jordan Ogawa '24
Chemistry
Poster #12

Emery Oneale '24
Psychology
Poster #11

Jong Min Park '24
Kinesiology
Poster #22

Mariyan Popov '24
Chemistry
Poster #20

Riley Potter '24
Sociology
Poster #17

Daniel Rafeedie '24
Kinesiology
Poster #13

Anna Scheider '25
Kinesiology
Poster #13

Elise Short '25
Communication Studies
Poster #9

Isabella Tejeda '24
Psychology
Poster #7

Reese Toepfer '26
Physics
Poster #14

Jackson Zerwas '26
Chemistry
Poster # 3

ABSTRACTS

1. A Computational Study of C–H insertion by Cationic Transition Metal-Alkyne Complexes Using Distortion Interaction Analysis and Model Systems

Lilia Allen '24
Logan Jackson '24
Harrison Bruggeman '23
Rachel Lorson '22

Dr. Brandon E. Haines
Chemistry

The earliest known experimental precedent of gold and silver mediated C–H insertion on cyclooctyne yields two possible fused bicyclic alkenes. High reactivity for both products using IPr-Au(I) was observed, but the selectivity flipped with $AgNTf_2$. Our research used a Distortion Interaction Analysis to investigate trends in reactivity and selectivity and a series of model systems to investigate the effect of the substrate on the reaction. We found that the gold catalyst has a stronger interaction energy than the silver catalyst, and it gets stronger as the reaction progresses. An explanation for the switch in selectivity is that the silver-mediated reaction is under kinetic control while gold mediated reaction is under thermodynamic control. In addition, model studies suggest that the cyclooctyne reaction is favorable because of a decrease in the activation entropy as opposed to release of ring strain.

2. The effects of different musical genres on mood and heart rate

Sofia Alvarado '24
Sarah Remland '25

Dr. Gewnhi Park
Psychology

Music has been shown to regulate arousal and induce the enhancement or decline of someone's mood and emotional states. Literature has previously shown that the influence of music can be measured by a reflective self-report and physiological indicator of a person's current mood, such as heart rates (Vincenzi et al., 2022). In this study, we examined whether types of music--depending on if it was self-selected or pre-selected by the study design- -would influence mood and heart rates. It was hypothesized that musical influence would modulate the changes in mood and heart rate depending on if they are listening to high-arousal, low-arousal, or self-selected music, such that when people are listening to the self-selected musical piece, they will have the highest rating in positive emotions, the lowest rating in negative emotions, and have highest heart rate (HR) response. When people listen to high- arousal music, they will have a lower rating in positive emotions, a higher rating in negative emotions, and will have lower HR response than those in the self-selected condition, but higher values than in the low arousal condition. Lastly, when people listen to the low-arousal musical selection, they will have the lowest rating in positive emotion, the highest rating in negative emotions, and the lowest HR response of all three conditions. We measured participants' moods using the PANAS and heart rates while listening to different types of music. The self-selected musical pieces were chosen from the *Billboard*'s 2016 Year End Hot 100 chart top 10 and the high-arousal and low-arousal musical selections were chosen by recommendation of a musical academic. Each musical selection was played for five minutes, and the control was played in a duration of five-minute intervals in between conditions as a control.

Results would be evaluated by analyzing the differences in each participant's heart rate between every condition compared to the baseline and each other. The PANAS emotion scale would be graded and evaluated, then compared to each individual within conditions to verify that mood changes are occurring depending on the music being listened to.

3. Exploring Virtual Pet Attachment Factors: The Big Five Personality Traits and Childhood Dog Presence

Sarah Bean '24

Dr. Gewnhi Park
Psychology

This study examines whether personality type, examined using the Big Five, and having a dog growing up influences an individual's attachment to a virtual pet. Participants, 20 college-aged students on the West Coast, adopted a virtual dog using the game Nintendogs to perform tasks commonly associated with pet ownership for 45 minutes. They were also asked to complete two measures, the Comfort from Companion Animals Scale (CCAS) and the Big Five Inventory (BFI). We hypothesize that individuals who score high on agreeableness and neuroticism will have a high attachment score to their virtual dog. Additionally, we hypothesize that those who grew up with dogs in their household will have a higher attachment score than those who didn't. This study's results will provide insight into how personality type influences attachment to a virtual dog, creating potential therapeutic tools that may be used to teach responsibility and combat loneliness through companionship.

4. Modulation of stress responses by the presence of surgical masks

Anneline Breytenbach '24
Elise Kilmer '26

Dr. Ronald See
Psychology

The hypothalamic pituitary adrenal (HPA) axis mobilizes the body's resources to respond to stressful situations. The extent of the HPA response depends on a variety of both internal and external factors. The current study is interested in determining how the use of surgical face masks and an individual's personality interact to modulate the stress response. We used the well-validated Maastricht stress test to induce an acute stress response and measured physiological (cortisol release, heart rate, and blood pressure) and subjective stress responses (visual analogue scales) in women. Participants were assigned to either the masked condition where both experimenters and the subject wore masks for the duration of the study or the control condition where no masks were worn. In general, subjects showed robust stress responses to the Maastricht. Further analyses will explore the differences between the masked and unmasked conditions as well as correlations with *a priori* personality measures.

5. Superior Memory for Utilitarian Moral Judgment

Kennedy Burkett '26
Trevi Bryant
Lillian Reininga

Dr. Chloe Liebengood &
Dr. Gwehni Park
Psychology

We investigated the influence of perceived moral decisions on subsequent face recognition and the role of participants' moral judgments in the face recognition. Participants were introduced to hypothetical targets who endorsed either deontological or utilitarian judgments, followed by surprise face recognition. Six targets exhibited deontological moral judgments, while the other six demonstrated utilitarian moral judgments. Following a filler task, participants performed a surprise face recognition task, where they were asked to identify the faces from the earlier presentation. The findings revealed participants exhibited enhanced memory for targets associated with utilitarian judgments, with a more pronounced effect observed in those who favored utilitarian judgments. The results suggest that human memory is shaped by moral judgment.

6. Does HRV Moderate the Relationship between Asian Americans and Working Memory in the Presence of Microaggression Administered by Racial In-group and Out-group Researchers?

Joseph Chandra '24
Daniel Johnson '24

Dr. Gewnhi Park
Psychology

This study was intended to simulate, in a controlled setting, the impact of real-world racial discrimination on Asian/Asian American well-being. We sought to see how HRV, a biomarker for emotional regulation, might predict performance on the working memory test (n-back [2-back and 3-back]) after being placed in a mildly "stressful", micro-aggressive conversation with the researcher. Asian participants were assigned to either a White (racial out-group) or an Asian (racial in-group) researcher. Prior to taking a working memory test, participants were met with questions regarding their family origin and comments regarding how articulate they were and how "their people" typically performed well on the working memory test. These questions and comments were intended to emulate the stereotypes that Asians and Asian Americans face in the real world. We expected to see a correlation between HRV and working memory score, and we expected participants performing under the White researcher to have a lower working memory test score.

7. Unveiling the Electric Heartbeat: Computational Insights into SARS-CoV-2 Spike Protein Impact on Cardiomyocyte Signaling

Mason Feagin '25
Meredith Gibson
Grant Lockhart

Dr. Yi-Fan Lu
Biology

The spike protein of SARS-CoV-2 exhibits specific binding to ACE-2 receptors on select neuronal types, potentially facilitating infection and subsequent damage. This study aimed to explore the impact of SARS-CoV-2 spike proteins on the signaling activity of cultured mouse cardiomyocytes using micro-electrode assays. Computational analysis, facilitated by RStudio, processed electrical data recorded by the MEA throughout the experiment. Results revealed a negative correlation between cardiomyocyte signaling decrease and the dose of SARS-CoV-2 spike proteins introduced to the culture. These findings suggest a potential exacerbation of Cardiomyocyte dysfunction in the context of SARS-CoV-2 infection, underscoring the significance of computational analysis in elucidating mechanisms of viral pathogenesis on cardiomyocytes.

8. Searching for an Octupole Rotational Band in ^{71}Ga

Natalie Fogg '24

J. Döring
S. L. Tabor
B. Abromeit
R. Lubna
P.-L. Tai
Vandana Tripathi
A. Volya
J. M. VonMoss
D. C. Vengas-Vargas
C. L. Tan
M. J. Heeschen
K. Q. Le
B. L. Harbin
R. A. Haring-Kaye
Physics

Recently, a rotational band with static octupole deformation was observed in ^{71}Ge, the first odd mass isotope in the mass A ≈ 70 region to show evidence of this behavior. Systematic experimental and theoretical studies of nuclei in this region indicate that octupole deformation might be enhanced for isotopes with N = 40. The goal of this work was to search for an octupole rotational band in the N = 40 isotope of gallium (^{71}Ga) while enhancing the existing level scheme. A ^{62}Ni(^{14}C, αp) reaction at 50 MeV was performed at Florida State University to populate high-spin states in ^{71}Ga, and their decays were measured in coincidence using an array of Ge detectors. Gating was used to confirm recently observed transitions, spins were confirmed using directional correlation of oriented nuclei ratios, and cranked shell model calculations were used to compare rotational behaviors. No conclusive evidence was found for a possible octupole rotational band, however.

9. Why is Cerorubenic Acid more stable than its isomer Isocerorubenic Acid? A Computational Study of Ring Strain in a Novel Polycyclic Core Structure

Noor Guefroudj '24[1]
Sidney Wilkerson-Hill[2]

Dr. Brandon E. Haines
Chemistry[1]

[1]Department of Chemistry, Westmont College, Santa Barbara, CA;
[2]Department of Chemistry, University of North Carolina at Chapel Hill, Chapel Hill, NC

Cerorubenic acid is a sesterterpene that has sparked the interest of researchers due to its potential to be developed as a therapeutic agent. It has a unique tetracyclo[8.4.1.0.0]pentadecane polycyclic core structure with two isomers, cerorubenic acid and isocerorubenic acid, that differ based on the position of a bridgehead double bond, making them both surprisingly stable anti-Bredt compounds. In this work, density functional theory (DFT) calculations are used to investigate the stability of the unique polycyclic core structure and the relative stability of cerorubenic acid and isocerorubenic acid. It is found that cerorubenic acid is more stable than isocerorubenic acid by 2 kcal mol–1 due to differences in conformational effects.

10. Autoagglutination of *Bordetella* bacteria depends on the composition of the growth media

Nolan Brandt '24
Eden Hagen '24

Dr. Steve Julio
Biology

Bordetella bacteria cause respiratory tract infections in mammals, and one species, *B. pertussis*, is the causative agent of the human-specific disease whooping cough. In our lab, we are trying to determine how *Bordetella* infect and survive in the respiratory tract, and many years ago we discovered a genetic switch, called PlrSR, that helps the bacteria accomplish that goal. During a study into how PlrSR exerts its specific function, we observed that when grown under certain conditions, the bacteria clump together, or "autoagglutinate," in the culture tube. Since autoagglutination in *Bordetella* is known to be dependent on the FHA surface protein, we investigated if FHA levels change when the bacteria autoagglutinate vs when they do not in the growth media.

11. Effect of Subliminal Priming and Achievement Motivation on Advertising Effectiveness

Aidan Holly '24

Dr. Gewnhi Park
Psychology

Subliminal priming has long been investigated as a potential way to influence consumer behavior and choices. Priming below the conscious level of awareness is most effective particularly when coupled with a specific "need-state" such as hunger or thirst. Research on achievement motivation has shown that this type of motivation is a stable trait as opposed to a cognitive state that can change over time. Effects of subliminal priming on trait-like features such as achievement motivation have yet to be studied. In the present paper, participants underwent subliminal priming of achievement motivation-related words and then chose between two differently themed (neutral and achievement-related) products. It was hypothesized that those who undergo achievement motivation priming and are higher on the achievement motivation scale will be most likely to choose achievement-related products. Future research could aim to develop ways in which achievement motivation can be increased over time.

12. Student Experiences in Semester Study Abroad Programs

Karla Muñoz '24

Dr. Blake Kent
Sociology

Previous research highlights the disparities or barriers in college study abroad participation among ethnic minority students and lower socioeconomic status students to learn overseas. This study examines how undergraduate college students' social locations of race, gender, and class affect their study abroad experience through a predominantly white institution. Through 16 qualitative semi-structured interviews, students from the Westmont in Mexico '22 and '23 cohorts and the Westmont in Cairo '23 cohort expressed their experience from before, during, and after the program, focusing on their personal experiences with peers, faculty, and those in the host country. This research is framed by Bourdieu's concept of habitus and capital as socialization and the access to social networks or resources influences individual's behaviors and attitudes, which are mechanisms that reproduce disparities. Main thematic findings include that faculty can enhance a student's sense of belonging and how students were able to find a community abroad.

13. Believing Resistance Is Modified Via Deception In A Cycling Time Trial To Exhaustion Impacts Performance

Jane Nakamura '24
Jong Min Park '24

Dr. Timothy Van Haitsma
Kinesiology

This study was designed to evaluate whether deceiving participants about modifying resistance during a cycling TTE would alter performance, and to determine the physiological mechanisms behind the performance changes. Participants completed three official cycling time trials to exhaustion. For the second and third visits, the participants were told the resistance on the bike was increased ("difficult trial") or decreased ("easy trial") 5% when, in reality, the resistance on the bicycle was unchanged for all three visits. Results indicate significant changes in performance associated with this deception. Both metabolic and neuromuscular factors will be analyzed to explore how this deception changes performance.

14. Novel Approaches to the *Ortho*-Olefination of Aryl Carbonates

Jordan Ogawa '24
Mariyan Popov '24
Sophia Chan '25
Braden Chaffin '23

Dr. Amanda Silberstein
Chemistry

Forming carbon-carbon (C-C) bonds is critical in synthesizing pharmaceuticals and other large organic molecules. However, reactions that create C-C bonds are limited and require specific reaction parameters. Of additional concern is forming bonds with predictable and specific geometry. One way of forming these specific C-C bonds is through carbon-hydrogen (C-H) activation reactions. These reaction conditions are preferable to traditional methods of C-C bond formation due to being more efficient, sustainable, and cost-effective. An olefin (C=C) can be installed on aryl starting material with C-H activation. This research focuses on using carbonates as a directing group to facilitate C-H activation and control the geometry of installation in the *ortho* position. The primary goals of this research are to synthesize various aryl carbonates as starting material and to use these aryl carbonates to generate *ortho*-olefinated products.

15. The Effect of ADHD on the Cognitive Profile of Patients with Alzheimer's Disease

Emery Oneale '24

Dr. Steven Rogers
Psychology

Emerging research has been revealing intriguing connections between neurodevelopmental and neurodegenerative disorders. Due to an overlap in deficits between Alzheimer's disease (AD) and attention-deficit/hyperactivity disorder (ADHD), the most common neurodegenerative and neurodevelopmental disorders, respectively, this study sought to determine how ADHD alters the clinical presentation of AD. Patients completed a clinical interview and a series of neuropsychological assessments to examine significant differences in all cognitive domains (e.g., memory, attention, language functioning) between patients with AD alone and those with both AD and ADHD. The findings of this study can provide essential information for the diagnosis and treatment of individuals with AD. If psychologists are aware of the connection between the disorders, they can recognize early signs of AD that may be attributed to ADHD. Finally, this research could further the body of scientific evidence suggesting a potential neurological link between the presence of ADHD and the development of AD.

16. Camber Differentially Affects Trained Runners at Marathon Pace, Improving Running Economy in Some Individuals

Jong Min Park '24
Jane E. Nakamura '24

Dr. Adam Goodworth
Kinesiology
Dr. Timothy Van Haitsma
Kinesiology
Dr. Robert A. Haring-Kaye
Physics

Distance runners will often encounter cambers during running. Camber refers to when the road is slightly slanted sideways to promote water drainage. Camber can alter running mechanics and muscle activation patterns, which may lead to decrements in running economy and possible injuries due to asymmetries in loading. This study investigates the effects of road camber on running economy and its interactions with running mechanics and muscle activation patterns. Twelve trained runners performed treadmill runs at various cambers (0 deg, 3 deg, and 6 deg) at marathon pace. Averaged across all subjects, no significant differences were found in metabolic measures. However, a subgroup analysis revealed that about half the runners improved their running economy on cambered surfaces compared to flat surfaces. Further analyses revealed significant differences in knee and trunk movement patterns and calf muscle activation, which may help determine the effects of camber on running performance and injury risk.

17. Activation of the C-H Bond for *Ortho*-Arylation of Aryl Carbonates

Mariyan Popov '24
Sophia Chan '25
Jordan Ogawa '24
Braden Chaffin '23

Dr. Amanda Silberstein
Chemistry

Carbon-aryl (C-aryl) bonds are one of the most prevalent bond types in blockbuster drug synthesis. The common approaches for C-C bond formation rely on harsh conditions and multi-step reactions. Approaching C-C bond formation through carbon-hydrogen (C-H) activation allows for lower temperatures, safer solvents, and a one-step reaction. Also of interest is control of the regiochemistry of bond formation. This research investigates C-H activation reactions that generate *ortho*-arylation products on aryl carbonates. In this research, we use carbonates as the *ortho* directing group. Utilizing an optimized reaction from previous work, we expanded the substrate scope for the *ortho*-arylation reaction on substituted aryl carbonates.

18. "This is our country too": Experiences of belonging within the Immigrant Hope community

Riley Potter '24

Dr. Felicia Song
Sociology

This article examines the intersection of immigration and belonging through the experiences of immigrants connected to the local nonprofit, Immigrant Hope. It follows a case study framework and puts literature on immigration into conversation with theories of belonging. The analysis draws on interviews with 16 members of the Immigrant Hope community, complemented by conversations with staff and time spent volunteering there. The study shows that belonging may sometimes seem to elude immigrants as their lives are riddled with challenges, but that their resilience draws them to postures of gratitude. Furthermore, it points to the role of Immigrant Hope, as a Christ-centered organization, in facilitating relational and political belonging for immigrants in Santa Barbara.

19. Impact of Body Size on Shoulder Belt Fit in a Naturalistic Setting

Daniel Rafeedie '24
Ciboney Hellenbrand '24
Anna Scheider '25

Dr. Adam Goodworth
Kinesiology

Research has shown that body shape can negatively impact seat belt fit. Although proper seat belt fit is crucial for automotive safety, no prior research has been performed to study the effects that breast size has on belt fit. The purpose of this study was to identify the effect of breast size on belt fit in semi-naturalistic driving conditions. Anthropometric data was collected from 15 Westmont College students. They then followed a driving course making three distinct stops along the way performing an easy, moderate, or difficult reaching task at each stop. The course was driven three times, each time under a different condition: control, small breast size, or large breast size. Video software was used to evaluate belt fit throughout the tests. We will present results from 10 subjects. Together, this study provides a first step toward understanding how breast size impacts seat belt fit in realistic driving conditions.

20. "Toxic" Friendships

Elise Short '25

Dr. Lesa Stern
Communication Studies

The label "toxic" is utilized in everyday vernacular to broadly describe negative experiences within friendships. This study sought to clarify what late adolescents meant by the term "toxic friendship" and what behaviors were considered toxic. Additionally, this study examined how individuals dealt with problems present in a friendship and their reasons for staying or leaving the relationship. Twenty-six ethnographic interviews with undergraduate students suggest that the term "toxic friendship" is used most commonly to describe nonreciprocal relationships in which one of the members is engaging in selfish and immature behaviors. A majority of participants avoided the conflict before utilizing multiple strategies to deal with it and would often stay in the relationship in hopes that the person would change. Further exploration of how the term is utilized offers a better understanding of how conflict is conceptualized and how individuals respond to conflict within contemporary friendships.

21. Psychosocial and Physiological Factors that Modulate the Association Between Adverse Childhood Experiences (ACEs) and Emotion Regulation

Isabella Tejeda '24

Dr. Gewnhi Park
Psychology

Adverse Childhood Experiences (ACEs) have been known to influence an adolescent's vulnerability to depression. This study examined the psychosocial and physiological factors that would influence the association between ACEs and vulnerability to depression. We hypothesized that one's ability to regulate emotion—emotion regulation—would mediate the relationship between ACEs and depression scores. Data was collected from fifty participants from Westmont College. We measured participants' baseline heart rates using the BIOPAC System, and then participants completed the questionnaires that assessed ACEs, Emotion Regulation Questionnaire (ERQ), and Beck's Depression Inventory. We also examined the relationship between ACEs, depression, emotion regulation, and heart rate. The results showed that emotion regulation mediated the relationship between ACEs and depression. Also, participants with a high level of ACEs had a higher heart rate, poor emotion regulation skills, and higher depression rates compared to those who did not experience ACEs. This study helped us understand that emotional regulation played an important role in mediating the relationship between ACEs and depression and provided a physiological correlation of high ACEs.

22. Quenching the Octupole Rotational Band in ^{71}Ge

Reese Toepfer '26

Dr. Robert Haring-Kaye
Physics

This study's goal was to deepen understanding of the ^{71}Ge band's properties and to explore its persistence at higher spin using Florida State University's experiment: a ^{62}Ni (^{14}C, α n) consisting of 3 Clover detectors and 7 single-crystal detectors, was used to measure the gamma decays in coincidence. An analysis of the resulting reaction at 50 MeV, producing ^{71}Ge at high spin. An array of 10 Compton-suppressed Ge detectors, coincidence spectra resulted in the addition of six transitions in ^{71}Ge's level scheme, one of which (1092 keV) extends the octupole band to a (35/2-) state at 8208 keV. Spins were confirmed for each octupole band using directional correlation of oriented nuclei ratios. Calculations of the kinematic moment of inertia and aligned angular momentum for the octupole band display the 1092-keV transition disrupting the smooth rotational pattern and may point to a band crossing, potentially quenching the octupole deformation.

23. Redshifted Organizations of Biphenyl are Caused by the Dishrack Effect

Isabella Felix '26
Alan Lopez '26
Jackson Zerwas '26

Dr. Allan Nishimura
Chemistry

An underlayer of 1-chlorohexane and overlayer of biphenyl were deposited on Al_2O_3. It was discovered that altering the coverage of the bilayer affected the intensity of Dishrack-associated, planar peaks relative to peaks associated with more twisted orderings of the biphenyl overlayer. A low coverage bilayer produced Dishrack-associated peaks in a 1:1 ratio with both of the more twisted peaks, whereas a high coverage bilayer resulted in far lower intensity Dishrack-associated peaks. The intensities of Dishrack-associated peaks were greatest at low temperatures.

OFFICE OF THE PROVOST
955 La Paz Road
Santa Barbara, CA 93108
westmont.edu
(805) 565-6000