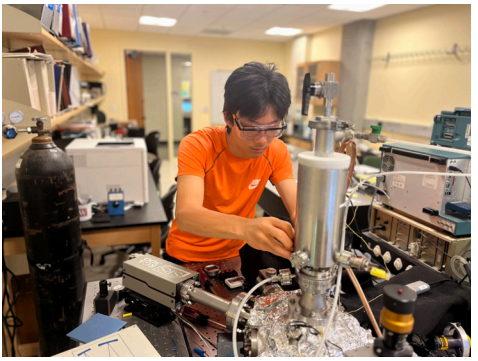
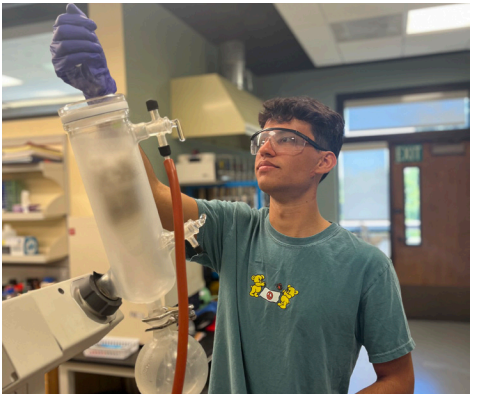


WESTMONT

2025 CELEBRATION OF SUMMER RESEARCH

October 16, 3:00-4:30 p.m.

Winter Hall 3rd Floor Atrium



WELCOME TO THE 2025 CELEBRATION OF SUMMER RESEARCH

A hallmark of Westmont's outstanding undergraduate liberal arts education is providing opportunities for students to conduct significant research with faculty.

Approximately 1,300 undergraduates enjoy a student-to-faculty ratio of 11 to 1 and an average class size of 18, which allows them to develop close relationships with outstanding faculty who are committed to teaching, scholarship, research, service and involving undergraduates in research.

Westmont's faculty place high value on research. Each summer, over 30 students from many disciplines work as full-time research assistants, collaborating closely with professors on cutting-edge projects.

This past summer, faculty and students were very busy conducting research with 36 students from six departments participating in the summer research program, all in the natural and behavioral science departments.

Many of these research projects extend into the school year. Some students even co-author scholarly papers with their faculty. These are extraordinary opportunities that advance and make significant contributions to research.

Congratulations to all the summer research students and the great work they have accomplished with their professors and academic disciplines. **We celebrate you!**

FOR MORE INFORMATION ON WESTMONT'S RESEARCH, GO TO
WESTMONT.EDU/RESEARCH

SUMMER RESEARCH PARTICIPANTS

Poster #11
Caprisabel Acquistapace
Chemistry

Poster #5
Tyler Allan
Engineering

Poster #9
Sydney Buesser
Chemistry

Poster #10
Kylie Cekalski
Chemistry

Poster #13
Isaiah Conway
Physics

Poster #16
Abby Dickinson
Psychology

Poster #7
Micaela Fernandez
Biology

Poster #17
Anthony Gose
Chemistry

Poster #8
Zach S. Haring-Kaye
Physics

Poster #10
Mary Heldwein
Chemistry

Poster #2
Caleb Jensen
Biology

Poster #4
Skylar Jones
Chemistry

Poster #15
Mia Kenyon
Biology

Poster #6
Jennifer Kilungga
Biology

Poster #4
Kara Kingsley
Chemistry

Poster #19
Sasha Kuljis
Kinesiology

Poster #12
Sofia Latta
Psychology

Poster #1
Alan Lopez
Chemistry

Poster #13
Berit Lunstad
Physics

Poster #8
Ainsley Martin
Physics

Poster #6
Sierra J. Martin
Biology

Poster #18
Sophia Morgan
Kinesiology

Poster #1
Brandon Moses
Chemistry

Poster #11
Jessica Rosenfeld
Chemistry

Poster #3
Eirenna Sequiera
Engineering

Poster #14
Phoebe Tilburt
Chemistry

Poster #1
Caleb Tobey
Chemistry

Poster #8
Joshua Treece
Physics

Poster #5
Peter Velgersdyk
Engineering

Poster #19
Annie West
Kinesiology

Poster #17
Luke Williams
Chemistry

RESEARCH PROJECT SUMMARIES

POSTER #1

Enhanced Naphthalene Fluorescence via 1,6-Dichlorohexane Induced Morphological Reordering

Alan Lopez, Brandon Moses, Caleb Tobey *(Supervisor: Dr. Allan Nishimura)*

When different homologous 1, ω-dichloroalkanes were vapor deposited below naphthalene, a remarkable increase in naphthalene fluorescence was observed, most notably when 1,6-dichlorohexane was used as an underlayer. The 1,6-dichlorohexane permeated through the naphthalene, inducing lasting conformational changes on the fluorophore and causing a shift from excimer emissions to monomer emissions, contributing to the increase in fluorescence. Most notably, spatial isolation reduced Förster-type energy transfer (FRET) and allowed the naphthalene to more efficiently self fluoresce. The end-end bond distance of 1,6-dichlorohexane was sufficient enough to suppress FRET, which encouraged defect sites for nucleation and increased trap formation, leading to a remarkable rise in monomer emissions.

POSTER #2

Higher Rainfall and Lower Temperature Are Correlated with Higher Reptile Capture Rates on Santa Cruz Island

Caleb Jensen*, David Miller, Tonia Schwartz, Lydia Stead, Desiree Tinkess (Supervisor: Dr. Amanda Sparkman)*

As the climate rapidly changes, it is important to understand how population dynamics in local ecosystems may be impacted. In this study, we compared coverboard capture rates from 2015 to 2025 for Santa Cruz Island gopher snakes, racers, and alligator lizards to mouse prey numbers and environmental data. We found a positive correlation between snake capture rates and winter rainfall. Gopher snake and alligator lizard capture rates were negatively correlated with average winter temperature. Racers showed a positive correlation with the previous year's winter rainfall. While we found

no relationship between mice counts and reptile captures, there was a positive correlation between mice and vegetation the year prior. This suggests that the environmental variables may have an impact on these reptile species' behavior and/or population numbers. On a larger scale, increased temperatures and more severe drought due to global climate change could negatively impact reptile species in the future.

POSTER #3

Development of Low-Cost Movement Analysis System

***Eirenna Sequeira**, Richard Hibbs, Zeo Pereira (Supervisor: Dr. Adam Goodworth)*

This project explored low-cost approaches for neurological assessment of human movement in low-resource contexts. Three pilot studies of key movements were conducted. We designed, built, and tested several trolleys for gait analysis with smartphones. We also designed and built a manually tilted platform to assess postural responses. Finally, we leveraged existing low-cost portable force plates (PASCO) to assess symmetrical loading, both with and without visual feedback, in a squat activity. Across studies, participants completed simple, repeatable tasks while data were collected through video and force plates and clinical stakeholders provided feedback. Data was processed in Excel and MATLAB. Results support the potential for affordable devices to aid clinical decision making and rehabilitation research, particularly in settings where conventional expensive systems are unavailable.

POSTER #4

The Development of Novel Oxygen-Based Directing Groups in ortho-Arylation

***Skylar Jones, Kara Kingsley** (Supervisor: Dr. Amanda Silberstein)*

Carbon-carbon bonds are the backbone of all organic molecules, making them essential for life. The formation of these bonds is especially critical for pharmaceuticals, agricultural fertilizers and insecticides, along with plastics.

Despite how important carbon-carbon bonds are, they are difficult to make due to a limited number of known reactions and most also require pre-activation or specific conditions. Our group aimed to utilize C-H activation to make a carbon-carbon bond between two aryl groups with a specific placement on the starting material. We focused on optimizing a reaction using an oxygen-based directing group, to form a carbon-carbon bond adjacent to the directing group. With optimized conditions in hand, we explored the scope of this reaction.

POSTER #5

Customized Use of AI to Create Bio-Inspired Mind Maps for Enhanced Ideation

Tyler Allan, Peter Velgersdyk*, Samuel Young (Supervisors: Dr. Dan Jensen and Will Allison)*

This work details a customized, AI assisted process to create bio-inspired mind maps for enhancing ideation. Using biological examples as inspiration for innovation in the design ideation process is well documented. Finding the "best", or even relevant, biological examples to inspire ideation for a specific design problem is challenging. Mind maps are a method that has been proven to enhance the organization of an ideation activity. Our work uses a custom process we developed to use AI to generate biological examples to populate the mind maps. Functional decomposition of a design problem forms the input to the AI assisted method. This makes the biological examples in the AI generated mind map tailored to the specific design challenge. The method has been tested using a standard "control and experimental group" assessment process. This assessment, while somewhat preliminary, has shown that the method is effective and well received by the designers.

POSTER #6

Ashes to Grasses: Fire Supports Native Life

Jennifer Kilungga, Sierra Martin*, Nicole A. Molinari (Supervisor: Dr. Laura Drake Schultheis)*

California's native grasslands are under threat from invasive species which are steadily displacing the natives. At Coal Oil Point Reserve, a wildfire in 2014 provided an unexpected opportunity to study how fire influences this struggle. Over 11 years, annual surveys were conducted of burned and unburned plots, recording plant cover and diversity to track how native and non-native species responded over time. In burned plots, native species like the perennial bunchgrass Stipa pulchra (purple needlegrass) maintained relative stability, while unburned plots saw natives decline consistently as exotics increased. Species diversity in burned sites dipped immediately after the fire but quickly recovered, while unburned sites shifted toward exotic dominance. Altogether, this long-term dataset shows that prescribed fire can be a highly effective strategy for promoting native species resilience even in highly invaded, unmaintained systems, providing valuable insight for restoring native California grasslands.

POSTER #7

Exploring the impact of cytokines & SARS-CoV-2 proteins on early neuronal signaling

Micaela Fernandez *(Supervisor: Dr. Yi-Fan Lu)*

We investigated how COVID-19 viral proteins affect neuronal activity using multi-electrode arrays (MEAs) and further examined alterations in gene expression and immune marker profiles induced by these proteins using ELISA and qPCR.

POSTER #8

Exploring octupole deformation and the search for a "missing" 6+ state in 76As

Zach S. Haring-Kaye, Ainsley Martin, Joshua Treece *(Supervisor: Dr. Bob Haring-Kaye) Joachim Döyring, BfS, Germany; Sam L. Tabor, Vandana Tripathi, Rebeka S. Lubna, Elizabeth Rubino, and Caleb Benetti, Florida State University; Dexter J. P. Allen and Colin A. Hawes, Ohio Wesleyan University; Grace E. Klausen, University of Missouri, Kansas City*

Recently, octupole deformation was inferred in 76As based on the observation of two electric dipole (E1) transitions linking the lowest positive- and negative-parity bands. However, this interpretation is based on tentative spin assignments in the positive-parity band and a potential "missing" 6+ state that is common to all neighboring odd-odd As isotopes. Additionally, one of the linking E1 transitions is shown as tentative in the level scheme. The goal of this study was to provide an independent test of the assumption of octupole deformation in 76As by addressing the lingering uncertainties associated with this interpretation. A 64Ni(14C, pn) reaction at 43 MeV was performed at Florida State University to create 76As products. The resulting γ decays were measured in coincidence using an array of Ge detectors consisting of 6 Clover detectors, 3 coaxial single-crystal detectors, and 1 low-energy photon spectrometer (LEPS). Although several of the high-spin transitions from the most recent work were verified, we could neither confirm the placement of the two E1 linking transitions nor observe a new decay that could identify a 6+ parent state. A comparison between the experimental excitation energies and the predicted ones from shell-model calculations using the JUN45 effective interaction will be presented.

POSTER #9

High Resolution Spectroscopy of Methane in the Visible Range near 682nm

Sydney Buesser *(Supervisor: Dr. Michael Everest)*

This study uses Cavity Ring-Down Spectroscopy (CRDS) to investigate the absorption spectrum of methane in the visible region near 682 nm, with the goal of resolving previously uncharacterized vibrational overtone features. While most vibrational spectroscopy focuses on the infrared, this project observed weak overtone transitions that can be seen using visible light. Absorption spectra were recorded in the 680–684 nm range and ongoing analysis includes determining peak center positions, widths, and integrated areas. A Fizeau wavemeter provided wavelength calibration with an estimated uncertainty

of 0.02 cm^{-1} in peak position measurements. This work contributes to a more complete understanding of methane's absorption characteristics, with implications in atmospheric modeling, planetary science, and astrophysical applications.

POSTER #10

Dendrimer-Enhanced Fluorescence Quenching by Covalent Attachment of Ruthenium-Diimine Complexes to PAMAM Dendrimers

Kylie Cekalski, Mary Heldwein *(Supervisor: Dr. Stephen Contakes)*

There is considerable interest in removing endocrine-disrupting chemicals such as nitrate and perchlorate from wastewater. At present, these ions are removed by adsorbing them on solid adsorbents while the development of biotic and abiotic strategies for degrading pollutants to harmless species is ongoing. As part of our efforts to develop abiotic photocatalysts capable of degrading perchlorate to harmless chloride ion, herein we report enhanced fluorescence quenching in PAMAM dendrimers functionalized with substoichiometric amounts of ruthenium(II) diimine complexes. The conjugates were made by covalently attaching [Ru(bpy)2(5-aminophen] 2+ to G1.5 PAMAM using HOBt-assisted EDC coupling and purifying the resulting conjugate by membrane dialysis. By following the emission of [Ru(bpy)2(5-aminophen] 2+ it was found that the Stern-Vomer constant (a measure of the bimolecular quenching rate constant) for quenching of the PAMAM amide of [Ru(bpy)2(5-aminophen] 2+ by ascorbate in conjugates containing 0.5 metal complex per dendrimer on average was 144, nearly twice as large as that for 0.5:1 physical mixtures of [Ru(bpy)2(5-aminophen]] 2+ and G1.5 PAMAM. Similarly, Stern-Volmer constants for quenching by Cu 2+ ion were 113 and 31 in the cases of covalently-attached and unbound [Ru(bpy)2(5-aminophen]] 2+ . The observation of enhanced fluorescence quenching when the ruthenium complex is covalently attached is consistent

with the dendrimer acting as a conduit for electron transfer between photoexcited ruthenium diimines and ascorbate. Additionally, the quenching behavior suggests the dendrimer:photocatalyst conjugates are effective at photooxidizing ascorbate at low micromolar (low ppm) concentrations and photoreducing Cu 2+ at low nanomolar concentrations. Specifically, the Stern-Volmer plots reveal that quenching in the conjugates is biphasic. Specifically, bimolecular quenching dominant at ascorbate concentrations above 2 mM and while below 2 mM quenching exhibits saturation behavior consistent with noncooperative ascorbate-dendrimer binding with a dissociation constant of 44 micromolar (~7 ppm). In contrast, the biphasic behavior for Cu 2+ quenching exhibits cooperative behavior consistent with two 2 and 10 nM dissociation constant sites with Hill coefficients of 1.8 and 2.7, respectively.

POSTER #11

o-Arylation of N,N-dimethyl and Pyrrolidine Carbamate Substituted Aryl Rings

Caprisabel Acquistapace, Jessica Rosenfeld*, Mia Kenyon (Supervisor: Dr. Amanda Silberstein)*

Aryl-carbon to aryl-carbon bonds are important in chemical synthesis, particularly medicinal drug synthesis. Recent research efforts have been focused on optimizing the o-arylation reaction of different carbamate-substituted aryl rings with other substituent groups. We explored the arylation to two different carbamate groups, the N,N-dimethyl carbamate and the pyrrolidine carbamate. Arylation conditions were optimized and the substrate scope/functional group tolerance was analyzed. Purification methods were developed for arylated product mixtures and product purity and identity were determined by various kinds of NMR spectroscopy.

POSTER #12

The Cognitive Impact of Diabetes in Parkinson's Disease: Beyond Vascular Risks

Sofia Latta *(Supervisor: Dr. Steve Rogers)*

The present study aimed to examine the impact of comorbid diabetes on the neuropsychological functioning of patients with Parkinson's disease (PD), while controlling for potential compounding vascular influences (i.e., hypertension, hyperlipidemia, and sleep apnea). Data collected on 147 patients (99 men, M age = 74.23, M education = 15.48) diagnosed with PD found that diabetes has a distinct and negative impact on the processing speed, frontal-executive, visuospatial, and nonverbal memory abilities of those with PD. This could be due to shared neuropathology, such as alpha-synuclein aggregation, mitochondrial dysfunction, and neuroinflammation. Better appreciation of this comorbid relationship will enable early identification of individuals at high risk for PD, improving clinical practice prevention and treatment. Future research can further develop these findings by focusing on various forms of treatment for diabetes and how variables like pharmacology and lifestyle moderate or mediate the onset and development of diabetes-associated cognitive dysfunction among those with PD.

POSTER #13

She's a Muon, She's a Track Star: Tracking Particles through Cloud Chambers

***Berit Lunstad**, Isaiah Conway (Supervisor: Dr. Ben Carlson)*

A cloud chamber was developed with a focus on cost-effectiveness and ease of use. Cloud chambers are a kind of particle detector that reveals tracks of highly energetic particles like muons. Alcohol vapor inside the chamber ionizes when it comes into contact with an energetic particle and leaves a trail of droplets. The experiment involved peltier coolers, fans, and a small radioactive source. Research was conducted on the effectiveness of various peltier coolers for different heat dissipation methods and resulted in a product that was optimized to reach audiences to whom cloud chamber experiments were previously too expensive or impractical. This design only requires it to be plugged into an outlet to function. This research resulted in both data on the efficiency of

various peltier coolers and a physical experiment which is useful for education and further research.

POSTER #14

Cryobiopsy in Lung Pathology: If it's not cancer, what is it?

Phoebe Tilburt *(Supervisors: Henry Tazelaar, M.D.; Xiaoyan Cui, M.D.; and Selina Ji, M.D.of Mayo Clinic)*

If a patient is suspected to have lung cancer, one screening they may undergo is an endobronchial ultrasound (EBUS). When an EBUS is performed and no tumor is found, pathology then examines it in hopes of finding a diagnosis, so the patient can then be treated. Cases like this were examined, and pathology's later diagnosis was collected in pursuit of a general overview of noncancerous lung diseases. If there were cases not originally inspected by pathology, I reviewed them with the pathology consultants. Occasionally cases had not been re-reviewed and some diagnoses were changed, sometimes even identifying a definitive infection or finding a rare type of pneumonia. While this project provides a broad overview of non-neoplastic lung conditions in two years' worth of EBUS cases at Mayo Clinic, it also provides some examples of significant cases where pathology consultants changed the patients' original diagnosis in very clinically significant ways.

POSTER #15

The Role of Potassium Transporters in Osmoregulation and Virulence of Bordetella bronchiseptica

Mia Kenyon *(Supervisor: Dr. Steve Julio)*

Pertussis, or whooping cough, is a highly infectious respiratory disease that is caused by the gram-negative bacterium Bordetella pertussis. Despite widespread vaccination, cases of the disease have resurged over the past decade. The closely related Bordetella bronchiseptica is a commonly used model to study the pathogenic mechanisms of the disease because of its broader

specificity for hosts. Recent research has identified the PlrSR two-component system as necessary for bacterial colonization of the lower respiratory tract. Like all two-component systems, PlrSR consists of two proteins that together help the bacteria sense their surroundings and respond appropriately by regulating other genes. Two of these genes hypothesized to be under PlrSR control are trkAH, whose coding sequences overlap with plrR and whose proteins are predicted to compose a potassium (K+) transport system. This study focuses on determining how PlrSR influences K+ transport via the TrkAH system. We found that the TrkAH system is required for osmoprotection under particular cellular conditions. Furthermore, we discovered that TrkAH activity is controlled by a nitrogen-sensitive regulatory system: specifically, the allosteric regulator IIA-ntr is essential for cell viability but is dispensable when the TrkAH system is absent.

POSTER #16

The Cognitive Impact of Psychotherapy on Patients with Parkinson's Disease

Abby Dickinson *(Supervisor: Dr. Steve Rogers)*

The present study aimed to examine the impact of psychotherapy on the cognitive functioning of individuals with Parkinson's disease (PD). Data collected on 50 patients (21 women, M age = 76.84, M education = 14.88) diagnosed with PD found that those who have participated in any type of psychotherapy performed significantly better on measures of attention, processing speed, and language than those who had not participated in therapy. This could be due to the verbal nature of psychotherapy, which requires patients to engage in sustained verbal expression, word retrieval, and emotional articulation. Incorporating language-based interventions such as psychotherapy could therefore be beneficial for PD patients with communication difficulties. Future research could explore (a) whether psychotherapy can be used as a targeted treatment for improving verbal fluency and

cognitive processing in PD, and (b) whether early language or communication impairments may be predictive of later PD development.

POSTER #17

A New Method to Calculate the Triplet Energy of Alkenes

Anthony Gose, Luke Williams *(Supervisor: Dr. Brandon Haines)*

Molecular triplet states, defined by two unpaired electrons, enable otherwise inaccessible reactivity such as double-bond rotation. Current methods for calculating triplet energy are often inaccurate or computationally demanding. We present a new method using a constrained planar model of the triplet geometry and explicit analysis of vibrational states, reducing the computational demand while maintaining accuracy. We applied the method to 64 acyclic and cyclic alkenes and aromatic substrates and achieved a mean absolute error of 2.6 kcal/mol, significantly lower than other efficient methods. More precise triplet energy calculations enable accurate prediction and mechanistic understanding of isomerization in chemical reactions.

POSTER #18

A Snapshot in Time: Faith, Fertility, and Knowledge: Evaluating Reproductive Health Awareness Among Adults

Sophia Morgan*, Lauren L. Ahmann, Ellie J. Muench, Alexandra C. Pilch, Elizabeth A. Vousboukis (Supervisor: Dr. Jada Willis)*

Despite the critical role of reproductive health in overall well-being, research on women's health remains disproportionately underfunded and understudied. An accurate and full understanding of women's reproductive health is essential for informed decision-making, as a lack of knowledge impacts contraceptive use, family planning, and the recognition of the menstrual cycle as indicator for a woman's health. Moreover, there exists a significant

gap in the absence of validated instruments to assess reproductive health knowledge, even less performed with individuals of a faith-based background. The purpose of this study is to understand the knowledge participants possess regarding reproductive health/menstrual cycle, nutrition, fertility, and faith. The pilot study utilized a descriptive, cross-sectional, mixed methods design. Participants (n=100) between the ages of 18-40 were recruited from faith-based organizations, secular institutions, and online platforms participated in the study. After informed consent, the participants completed a 15-20 min questionnaire (25 questions).

POSTER #19

Poor man's altitude: heat exposure may enhance altitude acclimatization

Sasha Kuljis, Annie West *(Supervisor: Dr. Tim Van Haitsma)*

INTRODUCTION: Heat has been referred to as the "poor man's altitude". Therefore, our study investigated whether repeated heat exposure improves acclimatization to altitude. METHODS: Fifteen participants traveled and lived at 2,740 meters above sea level after being randomly assigned into a heat-training (HT; n=8) or control group (CON; n=8). HT consisted of dry sauna sessions progressing in duration over four weeks (180°F, 3x/week; increasing from 30-60 minutes). Participants completed step tests with HR and oxygen saturation measurements at baseline, post-heat exposure, and altitude. RESULTS: Altitude exposure elevated resting and exercise HR for HT and CON, though HT had attenuated resting HR increases during altitude exposure, attenuated exercising HR post-heat and at altitude, and attenuated post-exercise recovery HR at altitude. O2 saturation decreases for HT were also attenuated as compared to CON at altitude. DISCUSSION: Despite sample size and equipment limitations, HT may enhance altitude acclimatization.

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