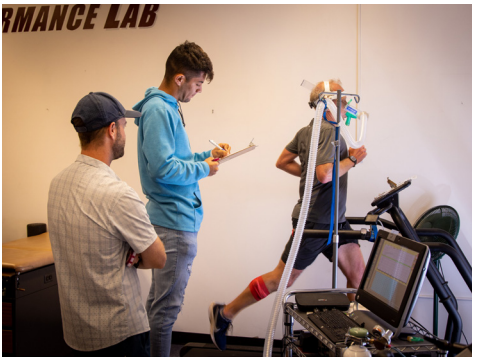
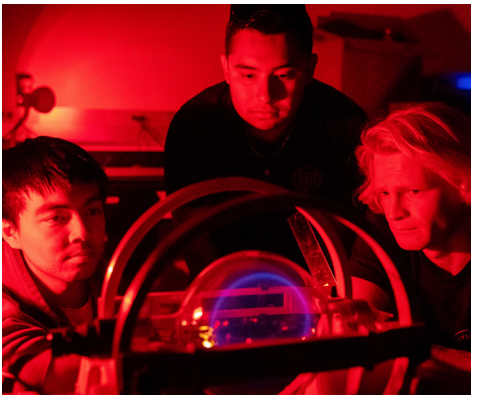


WESTMONT

2022 CELEBRATION OF SUMMER RESEARCH

October 14, 3:15-5:00pm

Winter Hall 3rd Floor Atrium



WELCOME TO THE 2022 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 a record 39 students from nine departments participating in the summer research program, including all the natural and behavioral science departments as well as the art museum, communication studies and political science.

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

Seun Afolayan '22
Biology

Chandler Baker '24
Physics

Nikki Bond '23
Chemistry

Abigail Bradshaw '23
Communication Studies

Anneline Breytenbach '24
Chemistry

Harrison Bruggeman '23
Chemistry

Braden Chaffin '22
Chemistry

Joseph Chandra '24
Psychology

Riellie Desoto '24
Chemistry

Andrea Fernandez Gaitan '23
Biology

Carly Field '23
Biology

Joshua Guinto '23
Engineering

Ellie Hagemeister '23
Psychology

Ainsley Hosley '24
Biology

Ella Jennings '23
Psychology

Riley Johnson '22
Chemistry

Michael Lew '24
Physics

Caleb Liebengood '23
Political Science

Jared Lush '23
Engineering

Mpho Mthethwa '22
Chemistry

Bailey Mueller '23
Chemistry

Kirsten Potts '24
Physics

Eric Reyes '24
Biology

Carli Roberson '23
Psychology

Daniel Rubin '23
Physics & Engineering

Alexander Rurik '23
Biology

Sean Ryan '24
Physics

Benny Saito '23
Kinesiology

Melanie Salvador '23
Biology

Madeline Stiles '24
Chemistry

Damien Ureste '23
Kinesiology

Sebastian Vethan '23
Kinesiology

Colby Young '24
Chemistry

RESEARCH PROJECT SUMMARIES

Conjunction Junction, What's your Function(alization)?: Transition Metal-Catalyzed C-H Functionalization

Braden Chaffin, Madeline Stiles, and Colby Young *(Supervisor: Dr. Amanda Silberstein, Chemistry)*

Have you ever wondered about the science behind the making of medications? These medications are composed of a network of carbon-carbon bonds that are integral to the medication's ability to function. Our research focuses on making those carbon-carbon bonds using oxygen-derived directing groups and transition metal catalysts. This specific area of chemistry is called C-H functionalization, which breaks a stable carbon-hydrogen bond and installs a carbon-carbon bond. Researching these reactions and evaluating the chemical interactions is vital in equipping chemists with the tools needed to make medications and other compounds of interest. C-H functionalization is particularly helpful because it takes an unreactive bond and causes it to react, bypassing other reactions needed to otherwise transform the bond. This summer we studied a variety of oxygen-derived directing groups, several different catalysts and numerous other reaction parameters in our attempts to develop a new C-H functionalization.

Short Legs and Island "Chunky-ism": An Investigation of Morphology and Physiology of Channel Island Lizards

Alexander Rurik and Eric Reyes *(Supervisor: Dr. Amanda Sparkman, Biology)*

Island gigantism and dwarfism are commonly observed on oceanic islands, and dwarfism has been documented for three reptile species on the California Channel Islands. However, no morphological analyses have been

conducted on two additional lizard species on Santa Cruz and Santa Rosa Island. We measured snout-vent-length, head size, weight, tail length, femur length, and blood glucose for island and mainland Sceloporus occidentalis and Uta stansburiana. Our analyses indicates that neither of the two species exhibit island dwarfism. However, differences between island and mainland populations include smaller Santa Cruz island female S. occidentalis, heavier SVL-adjusted weights of the island U. stansburiana, and shorter femur and tail length for the island populations of both species. Given the diversity present in these two non-dwarf island reptiles and the three dwarf reptile species, this promises to be an excellent system in which to pursue studies of the physiological/genetic methods underlying changes in body size.

Why Oxenium Ion? - Why Not?: A Computational Study of the Effect of Substitution on the Pyridine Leaving Group of N-aryloxypyridinium precursors to Stabilised Oxenium ion Formation

Mpho Mthethwa *and John Corbett (Supervisor: Dr. Brandon Haines, Chemistry) from Westmont College and Dr. Kevin G. M. Kou and Justin Debow from UC Riverside, Chemistry*

Reactive intermediates are transient chemical species that are targeted by chemists to make particular types of bonds. Oxenium ions are hypovalent oxygen cations that are similar to carbenes and nitrenes, but are not widely utilised because of their instability. Preliminary experiments pursuing a neighboring group strategy to stabilise oxenium ions suggest that reactivity exclusively at oxygen can be promoted, but that the current N-aryloxypyridinium precursor is too unstable. Therefore, the effect of substitution of the pyridine leaving group on the stability of the precursor was studied using modern computational methods. The change in Gibbs energies (ΔG°) for

oxenium ion formation was computed for a series of substituted pyridine derivatives, p-NMe2, p-OMe and p-COMe, where ΔG° = –4.3, –12.1, and –20.6 kcal mol–1, respectively (B2PLYPD3/def2-TZVP// B3LYP/6-31G(d), PCM = DCE). These results suggest that electron-rich pyridine derivatives will shift the oxenium ion formation equilibrium to favor the N-aryloxypyridinium precursor.

Regulatory Mechanisms in Bordetella and Expanding Virulence Phenotypes of plrSR

Carly Field and Seun Alofayan *(Supervisor: Dr. Steve Julio, Biology)*

The focus of this study is Bordetella, a bacterial respiratory pathogen that causes the human disease whooping cough. Due to a recent increase in whooping cough cases, our goal is to learn more about how Bordetella infects its host. We looked at the role that Bordetella's regulatory systems play in the secretion of certain proteins that are recognized by the immune system, and which genes are important for controlling this process.

Explorations in Platinum(II) Cyanometallate Chemistry: Towards the Synthesis of 1-Dimensional pi-stacked aggregates and 2D Networks

Bailey Mueller, *Siena Verdon, Guang Wu, Tabitha Roffelson, Taylor Cheun-Damonte, Luke Perrin, and Franchesca Montemurro (Supervisor: Dr. Stephen M. Contakes, Chemistry)*

Possible cyanometallate network-forming reactions were investigated by combining cyanometallate precursors with different counter ions, linking, and capping groups. 1-D chains of Pt(CN)2(H2dcphen) linked by Rhodium(II) acetate (Rh2(OAc)4) via μ-CN linkages only form in weakly-donating organic solvents like MeOH and acetone. The formation of similar chains

using the potassium or 1,2,4,5-tetrammoniumbenzene salts of Pt(CN)2(dcphen) was unsuccessful, as these salts are only DMSO and water soluble. Attempts to form 1D chains or rings by joining Pt centers with μ-CN linkages were similarly unsuccessful in water or dmso. However, the use of pyridine as both counterion (via pyridinium) and solvent, likely yielded pi stacked aggregates of [(dcphen)Pt(py)2] and [(dcphen)Pt(CN)2)]2. In a separate project, our attempts to form of an expanded "rectangular planar" tetracyanodimetallate, (NC)2Pt(BTA)Pt(CN)2 from a novel Cl2Pt(BTA)PtCl2 precursor (prepared and characterized as part of this study) gave a black insoluble solid, likely a 2D coordination polymer.

"Just Nailed A Sick Frontside Snap" : A Quantitative Solution To Determine If Your Surf Buddies' Claim Is A Load Of Garbage Or Not

Daniel Rubin *(Supervisors: Dr. Johan J. Estrada-Lopez and William J. Allison, Physics & Engineering)*

Surf session analysis is becoming a popular market for commercial wearable devices, however, these devices only offer analytics on ridden waves, speed, and GPS tracking, lacking detection of staple freesurf and competition maneuvers, i.e. take-off and turns. Previous studies of these maneuvers relied on the embedded sensors of a phone mounted on the back of the surfer, this study proposes detection on a wrist mounted device. A housing was designed and 3D printed to encase the sensing electronics. Several hours of acceleration, gyroscope, and magnetometer data were recorded for the take-off action in a 3D motion capture lab facility, and for snap and cutback turning maneuvers in a dry environment using a skateboard that mimicked surfing mechanics. The collected data will be subject to a rigorous analysis in order to determine a common pattern that can be distinct and detectable for the maneuvers of interest.

Life's Too Short So Live, Laugh, Love And Eat Your Veggies

Andrea Fernandez Gaitan and Ainsley Hosley
(Supervisor: Dr. Sara Johnson, Biology)

This summer we began the preliminary research to develop a comprehensive lifestyle medicine curriculum with the potential to be adapted to a variety of settings and formats. Often, the underserved populations that would most benefit from the health guidance of a lifestyle medicine curriculum are not able to access such resources due to socioeconomic and cultural barriers. Our curriculum development aimed to target this issue by creating an original curriculum that would be able to be modified by community leaders to specifically target individual populations at low cost. As the basis of the curriculum, we incorporated the six pillars of lifestyle medicine, including whole-food plant-based eating, physical activity, improved sleep, stress management, avoidance of addictive substances, and positive relationship formation, along with a unique spiritual formation component that may be modified to meet the needs of various religious and spiritual populations. The development of each pillar's lessons and guidance began with evidence-based behavior change research to determine the optimal balance of cost-savings and proven long term lifestyle change methods.

Are Political Footballs Spiked at the Water's Edge? Comparing the U.S. Government's Response to Domestic and International Sport

Caleb Liebengood *(Supervisor: Dr. Tom Knecht, Political Science)*

Are bills and resolutions dealing with international athletic competition easier to pass than those focusing exclusively on American sports? We posit that there is greater congressional unity on matters of international sports than domestic, and test this hypothesis with a

quantitative study for breadth and comparative case studies for depth. This paper offers a mixed-method approach to answering these questions, with mixed results. We began by looking at every bill and resolution on sports introduced in the U.S. Congress from 1973-2021. We find that the quantitative evidence paints a muddled picture. To add context, we then provide four mini-case studies that compare Congress's response to domestic and international sports. Although some evidence supports our claim, it is neither as clear nor convincing as we expected. Along the way, however, we end up with some broader lessons on the politics of sports.

1 Spike, 2 Spike, Red Spike, Blue Spike: Effect of SARS-CoV-2 Spike Proteins, Antivirals, and Antibody Treatments on Neuronal Activity

Melanie Salvador *(Supervisor: Dr. Yi-Fan Lu, Biology)*

Our main goal was to identify dosages of SARS-CoV-2 spike protein and its ability to alter the neuronal activity and whether antivirals or antibody treatments are able to rescue the activity. Using immature mice neurons from the corpus callosum and olfactory bulbs of P1 mice, the cells were isolated, cultured, and subjected to 0.5ng, 1ng, 10ng, 100ng, 1µg, and 10µg of Spike proteins, chloroquine and antibody treatments, and different timings of treatment. Using a multielectrode array, data was collected and analyzed in Rstudio to produce normalized density distribution graphs, heatmaps, and principal component analysis (PCA) graphs, demonstrating the Spike 1 protein's ability to decrease neuronal activity over Spike 2 in immature neurons but not in mature neurons and the inability of chloroquine to make a difference in rescuing the activity. Further directions include rescuing with Spike 1 antibodies, as well as mechanistic investigation by receptor binding domains for Spike 1 or other viral parts such as nucleocapsids.

A Computational Study on the Usefulness of Vinyl Cations' Ability to Perform C-H Insertion

Harrison E. Bruggeman, Riley Johnson, *and Rachel Lorson (Supervisor: Dr. Brandon E. Haines, Chemistry)*

C–H functionalization is an increasingly useful method of transforming bonds in chemical synthesis. Vinyl cations are known to insert into C–H bonds to form C–C bonds. Cationic gold-alkyne complexes are capable of performing C–H insertion because they can form a transient transition metal-stabilized vinyl cation. To understand the factors affecting cationic gold-alkyne complexes' C–H insertion ability, we used density function theory (DFT) calculations, computing the effects the substrate and ligand environment of the gold has on the Gibbs activation energy (ΔG‡) in a model C–H insertion reaction. We analyzed nine substrates with different properties, giving ΔG‡ values between 29.1 and 35.9 kcal mol-1. The most effective substrates were strongly electron-withdrawing. Similarly, we analyzed seven ligands with different properties, producing ΔG‡ values between 28.6 and 34.9 kcal mol-1. These calculations suggest useful substrate and ligand environments that can be tested in the laboratory for C–H insertion reactivity.

Speaking in the Tradition of Isaiah in an Age of Pollyanna: Greta Thunberg and Prophetic Children's Rhetoric

Abigail Bradshaw *(Supervisor: Dr. Elizabeth Gardner, Communication Studies)*

Greta Thunberg has been called a child prophet for her work against climate change. In her 2019 speech at the United Nations, sixteen-year old Thunberg solemnly delivered her opening line: "We will be watching you." This serious pronouncement was met with laughter and applause from a receptive audience. Few prophets have met with such a friendly response. There is an

inherent friction for young rhetors who speak in the tradition of the prophet Isaiah in the age of the priceless child Pollyanna— young speakers confront culturally-based challenges to their rhetorical agency. This project extends scholarship on children's rhetoric and prophetic rhetoric by examining Thunberg's best-selling book of speeches, No One is Too Small to Make a Difference. Under the larger umbrella of studying this rhetoric, I am looking at how her social identity both developed her ethos as well as presented obstacles to gaining credibility. Specifically, as a young girl with Asperger's syndrome, how does she create a persona that people will listen to and how does this persona help us better understand her reception? Themes that have come up so far include (in)visibility, expertise, and voice/agency.

Discovering the Torsional Angles of Sterically Hindered Biphenyl Molecules

Nikki Bond *(Supervisor: Dr. Allan Nishimura, Chemistry)*

Dihedral angles of some biphenyl molecules were plotted against fluorescence wavelengths of these molecules that had been vapor deposited on Al2O3. From a calculated trend line equation, the dihedral angle of any biphenyl molecule could be determined from the wavelength-resolved fluorescence spectra that were recorded during the temperature programmed desorption experiment (WRTPD).

Heart's Eye To See Color: Heart Rate Variability Modulates Task Performance On Identifying Negative Words Superimposed On Racially Out-Group Faces

Carli Roberson *(Supervisor: Dr. Gewnhi Park, Psychology)*

Our experiment studied the relationship between self-regulation and in-group bias using heart rate variability to measure the physiological response associated with

cognitive biases. We presented positive or negative words superimposed on either racially out-group or in-group faces. White participants were less accurate in trials where negative words were superimposed on in-group faces. However, people with higher cardiac vagal tone were more accurate in trails where negative words were superimposed on in-group faces. We also found that participants had faster reaction times when they detected negative words superimposed onto a black face and also when positive words were superimposed onto a white face. This was a demonstration of in-group biases geared towards in-group favoritism.

Beck Depressive Inventory (BDI) scores were negatively associated with identification of trustful faces at low spatial frequency (LSF).

Lydia Grenko *(Supervisor: Dr. Gewnhi Park, Psychology)*

The current study examined whether trait anxiety and/or depressive symptoms - measured by the beck Depressive Inventory (BDI) - were associated with the ability to discriminate trustworthiness of faces at different spatial frequencies. We presented the faces at broad, high, and low spatial frequencies. Spatial frequency was used to understand the neuro-cognitive mechanisms better since Low Spatial Frequency (LSF) information accesses the amygdala faster than information at High Spatial Frequency (HSF). Our hypothesis was that individuals with high trait anxiety/ depression would show less accurate detection of trustworthiness of faces at LSF due to hyperactive amygdala activity. The result showed that high BDI scores were negatively correlated with accuracy of identifying trustworthiness of faces at low spatial frequency. There was no relationship found between trait anxiety and the determination of trustworthiness.

Investigating ß-sheet Fibril Formation in Mouse Insulin 1 & 2

Riellie Desoto, *Ethan Walker, and Clare Neal (Supervisor: Dr. Kristi Lazar Cantrell, Chemistry) Westmont College and Aleksandra Antevska and Thanh Do, Department of Chemistry, University of Tennessee - Knoxville*

Insulin is a peptide involved in regulating blood glucose levels. While humans only have one type of insulin, mice have two. Previous studies have shown that insulin 2 regulates blood glucose levels similarly to human insulin, but the function of insulin 1 in mice is not well understood. Like many peptides, insulin molecules can form fibrils, or stable chains of misfolded proteins. To better understand the structure and behavior of these peptides, segments of Insulin 1 and 2 were synthesized, consisting of residues 9-23 from the B chain. The peptides were purified using HPLC and identified using ESI-MS, and the aggregation propensities of the partial-length segments were investigated. Circular dichroism (CD) and transmission electron microscopy (TEM) indicated that the partial-length peptides had formed ß-sheet aggregates after one week of incubation. Thioflavin T fluorescence studies exhibited no lag phase in fluorescence increase, indicating that fibril formation began immediately after sample preparation.

Searching For Dark Matter In Higgs Boson Decays With Simulated Muon Collisions

Michael Lew *(Supervisor: Dr. Benjamin Carlson, Physics)*

Part of my research investigated muon collisions to produce a Higgs Boson in association with a photon. The method was used to determine the sensitivity of a proposed muon collider to invisible Higgs boson decays with the center-of-mass energy only slightly above the Higgs boson mass. Through use of Madgraph simulation and the Delphes detector parameterization,

I was able to reconstruct the missing mass of the Higgs boson. Missing mass is constructed from the photon momentum and that of the missing momentum, assuming conservation of momentum. The study is an important benchmark for the proposed muon collider, as the muon collider will generate a clean sample of Higgs bosons. I demonstrate a method where even early in the muon collider program invisible decays of the Higgs boson could be searched for.

Search For ggf->hyyd Events Using Simulated Data

Sean Ryan *(Supervisor: Dr. Benjamin Carlson, Physics)*

The Higgs Boson is a recently discovered, less studied fundamental particle in physics. It decays almost as soon as it appears into other fundamental particles. One hypothetical form of decay poses that it decays into a photon and a dark photon. The dark photon is a particle which is not predicted by the Standard Model of Particle Physics, so if this is a valid process, it would lead to a new model of particle physics and explain some open questions in the Standard Model. ATLAS and CMS have been conducting searches for dark photons and recent experimental results have sparked conversation in the theory community. This analysis uses simulations of LHC data to optimize identification of signal events by applying cuts on variables and by machine learning.

A Sticky Situation: Methemoglobin Adsorption to the Surface of a Silane-Modified Silica Prism

Anneline Breytenbach *(Supervisor: Dr. Michael A. Everest, Chemistry)*

Chemical gradients were created by cleaning, coating, and characterizing a glass prism coated with a silane. Methemoglobin was adsorbed to this chemical gradient on the surface of the prism which was monitored with

a laser in an Evanescent-Wave Cavity Ring Down Setup. In the first part of the experiment we attempted to create an ideal gradient with a hydrophobic, neutral coated side and a hydrophilic, negative clean side. In the second part of the experiment we sought to elucidate whether methemoglobin adsorbed better to clean or coated glass. We found that, in fact, methemoglobin sticks equally across the gradient.

I Want To Know What Love Is! Integrating Best Practices Of Psychology With Biblical Truths

Ellie Hagemeister *(Supervisor: Dr. Andrea Gurney, Psychology)*

From the very beginning, we were created for loving, intimate relationships. Yet, despite our world's increased interconnectedness via technology, psychological research shows us that we are lonelier, more anxious, and more depressed than ever before. We have circulated and internalized myths about love that set us up for disconnection, disappointment, and despair. In other words, we're struggling to live into our relational birthright! Fortunately, we find in both psychological principles and biblical truths a guide for healthy, flourishing relationships — psychology and faith can work in harmony! Our goal this summer was integrating research-backed relationship science with biblical wisdom and distilling it into fun, engaging, and accessible online content for a general audience. We hoped to encourage and equip our audience to do the work of examining their own stories so they can combat the loneliness epidemic, maintain and pursue healthy kingdom relationships, and stand (not fall!) in love. See our work at www.andreagurney.com and @andrea_gurney on Instagram.

The Eyes are the Window to the Brain: The Role of Visuospatial Abilities in Alzheimer's Disease Authors

Ella E. Jennings *(Supervisor: Dr. Steven A. Rogers, Psychology)*

Due to the pathology of Alzheimer's disease (AD), it is not uncommon for patients to struggle with cognitive tasks involving figure copying. Since this task requires involvement from multiple domains, it is unclear whether figure copying performance is more affected by visuospatial or frontal-executive compromise. To assess this, 156 patients with AD participated in neuropsychological assessment. The findings suggest the figure copying of those with AD is significantly related to both their visuospatial and frontal-executive functioning, but the relationship with visuospatial functioning is stronger. Moreover, impairment in visuospatial, but not frontal-executive, functions seems to have a negative impact on the figure copying of those with AD and better accounts for the weaker figure copying scores among those with dementia relative to mild cognitive impairment. Consequently, the pathological effects of AD on figure copying appear to occur predominantly through visuospatial rather than executive channels, and interventions for offsetting decline may therefore be most effective when targeting visuospatial abilities.

Prototyping: A Primary Process Packed with Possibilities for Progression

Joshua Guinto and Jared Lush *(Supervisor: Dr. Daniel Jensen, Physics) from Westmont College and Dr. Gregory Reich, Principal Scientist, Aerospace Vehicles Division of AFRL*

Prototyping, in its broadest meaning, can include both digital and physical prototyping. In some sense, the question of digital vs. physical prototyping is a meta-prototyping strategy (PS) question as other PS variables could be applicable to either digital or

physical prototypes (or both). Many factors affect the decisions made in the prototyping process. We have investigated the relationships between digital and physical prototyping and created design heuristics and an accompanying process we call the Digital/ Physical Prototyping Process (DPPS) that can guide designers in their decisions regarding the use of digital and physical options. The creation of our heuristics, or rules of thumb, and DPPS was based on a significant literature review, numerous interviews with design engineers, and, to a lesser extent, on our own prototyping experiences. The heuristics and DPPS have been developed in a closed-loop fashion by iteratively seeking input from a wide variety of designers.

Pyrotechnic Pretensioners: A *Fastenating* Study on Seatbelt Safety

Benny Saito and Sebastian Vethan *(Supervisor: Dr. Adam Goodworth, Kinesiology)*

What the heck is a pretensioner? Pretensioners are a pyrotechnic (literally, explosive) device that retracts the seatbelt during a crash, securing the passenger to their seat. Believe it or not, they are standard in all vehicles! Due to the instantaneous nature of crashes, pretensioners deploy as quickly as 10 ms after first contact–that's about 1/10 of the time it takes for a human to blink! The catch? Pretensioners are designed for the 50th percentile human who is sitting in an upright, "standard" position. Research indicates that occupants (who vary in height and weight) frequently do not sit how they are supposed to. Our goal is to test the effect of body size on biomechanics when the occupant is forward-leaning. This summer we built an apparatus that simulates a front passenger seat with a live pretensioner. Using 3D motion capturing and a high speed camera, we collected data on human subjects with different biometrics.

Mental Training Magic or Physiologic Reality - The Role of Mental Training in Improving Performance

Damien Ureste *(Supervisor: Dr. Tim Van Haitsma, Kinesiology)*

Mental training improves performance; however, the role of mental training while fatigued is unknown. This study attempted to observe changes that occur post-mental training while fatigued. Twenty participants completed the study. Fatigue was induced with a 90-minute run. Participants then proceeded to the laboratory where they performed a 1.5-mile treadmill time trial (TT). This procedure was performed twice, two weeks apart, during which MS watched mental training videos to control stress, anxiety, and panic during stressful situations. Ratings of perceived exertion (RPE), pain/fatigue, heart rate, oxygen consumption, time trial duration, and distance on the track were recorded. MS decreased RPE, leg-specific fatigue/pain, and decreased heart rates during the fatiguing run compared to baseline though pace was unchanged. MS improved TT by 37 seconds while decreasing heart rate and RPE, but having increased VO2 values. Mental training increased endurance performance while decreasing subjective exertion and potentially decreasing sympathetic nervous system activity.

Exotic Higgs Decays and LHC Delays. What Undergraduate Research at CERN Looks Like

Chandler Baker *(Supervisor: Dr. Benjamin Carlson, Physics)*

Physics research at CERN is largely divided into two categories: operations and analysis. Operations are the day-to-day tasks that keep the individual detector experiments running smoothly. These tasks range from data quality monitoring to software developing and debugging. Alternatively, analysis is the research conducted by teams to discover new particles, precisely measure constants, and verify the validity of the Standard Model of Particle Physics. In this poster, we present some operations at CERN and some preliminary analysis work on an exotic Higgs Boson decay.

Triggers for Photon + MET with Machine Learning

Kirsten Potts *(Supervisor: Dr. Benjamin Carlson, Physics)*

The LHC uses a two-level trigger system to decide in real time which events to save. The level 1 (L1) trigger is a hardware trigger and the high-level trigger (HLT) is a software trigger. The response of a new HLT that uses a machine learning regression model to combine several different MET algorithms was measured. Using the law of conservation of momentum, MET (missing transverse momentum), is used to reconstruct particles invisible to the detector. The results demonstrate that the regression model outperforms the best MET algorithm. Therefore, the new regression model will be implemented in a new trigger with a photon and MET.

Subpar Ratings on Subconscious Trainings?: A Statistical Analysis on Implicit Bias Training

Joseph Chandra *(Supervisor: Dr. Carmel Saad, Psychology)*

Our research sought to answer the question: Which groups of people react most negatively to implicit bias training? Over the last few years, we conducted implicit bias training for 1,619 participants belonging to 29 different groups across various sectors, including law enforcement, healthcare, and educational institutions. In this training, we aimed to enhance participants' awareness about the negative effects of implicit bias as well as tangible steps to mitigate its effects. Following the training, participants completed a self-report questionnaire which consisted of several attitudinal and cognitive reactions to the training. We hypothesized that White, male participants would react most adversely to the training in relation to White females, POC males, and POC females. In line with our hypotheses, White males had the least favorable ratings of the training. A surprising result was White females had the most favorable ratings of the training, significantly higher than the other three groups. We believe this may be a result of white guilt compounded by the more empathetic nature of women.

WESTMONT COLLEGE
85
EST. 1937
CHRISTUS PRIMATUM TENENS

Discover

Programs at Westmont

Biology
Chemistry
Computer Science
Data Analytics
Engineering
Kinesiology
Mathematics
Physics
Psychology

WESTMONT.EDU/STEM