Senior Honors Thesis Presentations – Spring 2026
Location: Timken Natural Science Center (TNSC) 108

Date/Time	Thesis Topic Honors Student Presenter (Thesis Advisor, Reader)
Monday, March 16th 3:00pm – 5:00pm	"Correlation Between Conscientiousness and Accuracy of Estimated Smartphone and Social Media Screen Time" **Ian Lehman (Joseph Wayand, Davis Shelfer)**
	"Teacher's Social and Emotional Observations of Current Fifth Grade Students Through the Lens of COVID-19" **Caleigh Cheatham (Catelyn Bewley, Kali Scott)**
	"The Impact of Parent Involvement on Student Success" **Katherine Harlan (Lindsey Roush, Beth Shoemaker)**
	"Where Does Medical Malpractice Meet Telemedicine? Constructing a National Framework to Unite Telehealth Services" **Abby Bologa (Chase Senk, Rachel Constance)**
Thursday, March 19th 2:00pm – 3:30pm	"The Relationships Between Emerging Adults' Experienced Family Stressors and Financial Management Behaviors" **Amelia Freeman (Julie Szendrey, Amanda Dalpiaz)**
	"Mental Health in Collegiate Student-Athletes: An Exploratory Study of Stress, Coping Mechanisms, and Social Support" **Katie Corrigan (Yanmei Xu, Sarah Bokovitz)**
	"Introducing Children Ages 0-5 to Literacy" **Ava Dietz (Michelle Lenarz, Kacie Menendez)**
Thursday, March 19th 4:00pm – 5:00pm	**"**Cybersecurity Awareness Website for Young Adults" **Meklit Tofu (Jennifer Loudiana, David Good)**
	"Developing a Chatbot to Reduce Tech Anxiety and Improve IT Issue Resolution" **Ryan Moorhead (Jennifer Loudiana, David Good)**
Saturday, March 21st 12:30pm – 1:30pm	"Correlations between Caffeine Consumption, Social Media Use, and Impulsivity among U.S. College Students" **Troy Mazzei (Lindsey Roush, Cary Dabney)**
	"Caring Beyond the Body: Developing a Digital Educational Program to Enhance Spiritual Literacy in Nursing Education for Palliative Care" **Olivia Huzyak (Cary Dabney, Sarah Bokovitz)**
Saturday, March 21st 1:45pm – 2:45pm	"The Relationship Between Different Child-Rearing Methods and Adult Children's Perception of God" **Amelia Molitor (Nina Rytwinski, Cary Dabney)**
	"Designing Social Media to Connect Students to Church-led College Student Ministry Programs: A Case Study" **Aliya Shine (Jennifer Vokoun, Cary Dabney)**
Monday, March 23 3:00pm – 4:00pm	"Patients' Perceptions of Artificial Intelligence Within Healthcare" **Meleah Sawastuk (Jaime Paz, Neil Walsh)**
	"Evaluating the Impact of Simplified Educational Material on UTI Knowledge and Prevention in Low-income Post-partum Women" **Gloria Tindana (Stephanie Fox, Heidi Wright)**

Monday, March 23 4:15pm – 5:45pm	"Evaluating the Chemical Suitability of Digitally Printed Textiles with Objects of Cultural Heritage" **Brianna Birkle (Peter Tandler, Megan Pellegrino)**
	"Effects of Natural Extracts on Dental Pellicle" **Laura Bliese (Peter Tandler, Darlene Walro)**
	"Using Clustering and Decision-Tree Based Models to Find the Greatest Formula One Driver of All Time" **Haruki Imanishi (Jackie Novak, David Good)**
Tuesday, March 24th 3:30pm – 5:00pm	"Examining the Challenges in Forensic Investigation Processes and Procedures" **Maddox Kelly (Amy Heston, Davis Shelfer)**
	"Molecular Analysis of SOX3 Modification by Small Ubiquitin-Like Modifiers (SUMOylation)" **Madison Wagner (Adam Underwood, Amy Heston)**
	"The Functional Effectiveness of SOX7 A379V in Transcription" **Hannah Blawas (Adam Underwood, Darlene Walro)**
Wednesday, March 25th 3:00pm – 4:30pm	"The Impact of Awareness of Gender-Specific Differences in Women's Cardiovascular Health" **Shareen Awadallah (Tammie Davis, Mary Cook)**
	"Analysis of Caffeine Consumption and Caffeine Intoxication Among Walsh University Students and Student-Athletes" **Camryn Barker (Karen Wajda, Sarah Bokovitz)**
	"Nursing Education with Pediatric Heart Failure Patients and their Families" **Sarah Festi (Jessica Seich, Monica Andreski)**
Wednesday, March 25th 4:45pm – 5:45pm	"Exploring the Consequences of Sport Specialization on Injury Prevalence and Current Physical Activity and Sedentary Status in Retired Athletes" **Rachel Thompson (Meredith Joplin, Jonathan Naylor)**
	"The Effect of the Removal of Four Diet Additives in Virginia opossum (*Didelphis virginiana*) diets at the Stark Parks Wildlife Conservation Center as it Relates to Chart Tracking and Treating of Metabolic Bone Disease" **Sophia Rosa (Jennifer Clevinger, Adam Underwood)**
Thursday, March 26th 2:00pm – 3:30pm	"Ethical AI Governance: A Framework for the Future" **Antonio Paganelli (Chase Senk, Branko Bucar)**
	"Social Security: Proposal for Privatization Plan" **Colton Ferrucci (Chase Senk, Branko Bucar)**
	"Is Working from Home in the Accounting Industry Best for Business?" **Lukas Graham (Amanda Dalpiaz, Ashley Monaco)**
Tuesday, March 31st 3:30pm – 4:30pm	"Dissecting the Functional Attributes of SOX12" **Elizabeth Radis (Adam Underwood, Darlene Walro)**
	"The Biological Activity of a Non-Natural Epimer of Betulin" **Daniel Palanceanu (Timothy Smith, Adam Underwood)**

Please scroll down for more detailed information about the presentations.

Monday, March 16th
3:00pm – 5:00pm

Ian Lehman
"Correlation Between Conscientiousness and Accuracy of Estimated Smartphone and Social Media Screen Time"
Advisor: Joseph Wayand, PhD, Associate Professor of Psychology
Reader: Davis Shelfer, PhD, Assistant Professor of Sociology

Smartphone use has increased in use in daily life as well as in academic settings. Research has consistently shown that individuals have generally poor perception of how much they use their mobile phones. The current study examined whether conscientiousness was associated with accuracy of estimates of overall screen time as well as accuracy of estimates of social media screen time. A total of 69 students at Walsh University completed an online survey that assessed their estimated overall daily screen time, estimated daily screen time, confidence rating for each estimate, and a 12 question conscientiousness questionnaire adapted from Costa and McCrae. Participants reported their actual overall screen time and social media screen time based upon their phone's screen time report. Discrepancy scores were calculated by subtracting the objective screen time from estimates for both overall screen time and social media screen time. Positive values demonstrated underestimation while negative values demonstrated overestimation. Of the 69 participants, a total of 40 participants were used for overall screen time and 39 participants for social media screen time. This occurred because of incomplete responses. Pearson correlation analysis was conducted on the data obtained from this survey to assess for correlation between discrepancy scores and conscientiousness. The results for correlation between conscientiousness and overall screen time estimation accuracy approached statistical significance in the anticipated direction ($p = 0.062$), however, was not considered statistically significant. The general trend was that higher degrees of conscientiousness led to higher accuracy in estimates. The results for correlation between conscientiousness and social media screen time estimates was not statistically significant ($p = 0.119$). Overall, the findings did not reach statistical significance, but were close enough to suggest that further research may be warranted.

Caleigh Cheatham
"Teacher's Social and Emotional Observations of Current Fifth Grade Students Through the Lens of COVID-19"
Advisor: Catelyn Bewley OTD, OTR/L, Clinical Assistant Professor of Occupational Therapy
Reader: Kali Scott, OTD, OTR/L, Clinical Assistant Professor of Occupational Therapy

Kindergarten age is a fundamental age in the social emotional development of children. Around this time, children learn how to socially relate to peers and adults, behave in an academic setting, and emotionally regulate. Fifth grade students during the 2025-26 school year did not have the ideal kindergarten experience, due to the circumstances of the COVID-19 Pandemic. Therefore, research was done to collect and analyze teacher's perceptions of current fifth grade students, their social emotional development, and inferences of related effects of the COVID-19 pandemic. This research adds to existing research, especially regarding what is happening currently in the present day, as of Fall of 2025. Twenty-seven participants who hold a teaching license, completed a survey which asked them various questions related to fifth grader's Social Behavior in an Academic Setting, Social Behavior Related to Peers, Emotional Regulation Related to Authority, and Emotional Regulation Related to Peers, as well as COVID-19 specific questions. The survey was completed by teachers from different demographics; subjects taught, years of teaching, setting of school (rural, suburban, urban), etc. Besides some evidence regarding Social Behavior in an Academic Setting, no section of the Social Emotional survey questions seemed to be the primary evidence for changes in fifth

grader's social emotional development regarding the COVID-19 Pandemic. However, the majority of teachers agreed in observing a difference in the social emotional development of their students compared to students before the COVID-19 pandemic. Some gaps in the research include the researching children as a vulnerable population, the collective trauma surrounding discussions of the COVID-19 pandemic, and the small sample size, due to difficulty of getting approval from school district superintendents. Finally, further research is needed to see how social emotional development can be prioritized and assessed, especially in light of the effects of the COVID-19 pandemic

Katherine Harlan
"The Impact of Parent Involvement on Student Success"
Advisor: Lindsey Roush, EdD, Research Associate
Reader: Beth Shoemaker, MA, Director of Licensure and Field and Clinical Placements

This creative thesis is a collection of at-home Math and English Language Arts lesson plans along with vital information for parents who wish to further their involvement in their child's educational journey. Education is essential for success in early childhood students, and parent involvement plays a vital role in this success. The website created for this thesis will describe parent involvement, detail various types of parent involvement at home and at school, common ways to get involved, additional resources for parents, and at-home lessons that parents can do with their child to bridge the gap between home and school education. The website includes additional information on dyslexia, which is another important topic in education. Parents can reference the website to learn about early signs of dyslexia, family resources, and how parents can support their child if they are at risk of dyslexia. The lesson plans provide parents with simple activities to do at home with their child to continue their learning outside of school. The lessons are completed together to allow parents to see how their child learns and what their areas of strength and deficit are, so that parents can then move forward and focus on specific skills alongside their teacher. They are aligned with the Ohio Learning Standards, ensuring that they are developmentally appropriate and that they will align with what students are learning at school. The lesson plans were created to be repeatable to allow opportunities for repeated practice, and each lesson is backed by an educational theory or researcher. The gaps in the literature showed a disconnect between parents and school, and this project will help bridge that gap. The literature shows that many parents understand the importance of parent involvement, but they struggle to begin the process of involvement. Many parents do not know what opportunities are available, or how to start the line of communication with school professionals. This website will offer information about common ways to get involved, educate parents on the importance, and provide resources for open communication. Parent involvement plays a vital role in educational success for early childhood students, and it is a topic that should be widely discussed and addressed. Overall, this creative thesis website is an excellent resource for parents who wish to be involved in their child's education.

Abby Bologa
"Where Does Medical Malpractice Meet Telemedicine? Constructing a National Framework to Unite Telehealth Services"
Advisor: C. Chase Senk, JD, Associate Professor of Business
Reader: Rachel Constance, PhD, Associate Professor of History

Throughout the 21st century, telehealth services have grown significantly in the United States, cementing its role in the application of medicine for the years ahead. A large factor in this increasing utilization, especially within the last decade, was the outbreak of Coronavirus disease 2019 (COVID-19). As a result, more Americans became accustomed to visiting a doctor through a laptop screen or addressing any medical concerns over a telephone with a physician during the

pandemic and even subsequent years. It is evident telemedicine is a timely topic; however, its increasingly developed services are still quite new and not fully understood by Americans.

As smart technology and communication developments continue to transform American society, people are changing the way in which they make choices regarding their health. With no federal protocol governing this distinct form of medical malpractice, it is necessary to implement a clear and universal telehealth framework for all states to comply with before more complications and confusion ensue. Thus, this study reviewed the current research on medical malpractice that stems from telecare, and used it to create an original policy proposal, establishing national standards.

Thursday, March 19th
2:00pm – 3:30pm

Amelia Freeman
"The Relationships Between Emerging Adults' Experienced Family Stressors and Financial Management Behaviors"
Advisor: Julie Szendrey, DBA, CDMP, PCM, Professor of Business
Reader: Amanda Dalpiaz, CPA, MSA, Professional Assistant Professor of Accounting

Emerging adulthood is marked by increased financial responsibility, yet many young adults lack the financial knowledge and behaviors needed to manage their finances effectively. Prior research suggests that family financial socialization plays a critical role in shaping financial attitudes and behaviors, but limited research has examined how family stressors and socioeconomic status interact with this process. The purpose of this study was to investigate the relationships among family stress, perceived family socioeconomic status, implicit family financial socialization, and financial management behaviors in emerging adults. Data was collected through an online survey administered to 133 undergraduate students aged 18–24 at Walsh University, a private, Catholic University in Northeast Ohio. Validated scales were used to measure financial management behaviors, family stressors, and implicit parental financial modeling. Regression, correlation, and t-test analyses were conducted to test six hypotheses. Results indicated that perceived family socioeconomic status was significantly related to financial management behaviors and implicit family financial socialization. Additionally, implicit parental financial modeling was positively associated with better financial management behaviors in emerging adulthood. However, no significant relationship was found between family stress and financial management behaviors, nor between parental divorce and financial behaviors. These findings suggest that socioeconomic context and parental financial modeling may play a more influential role in emerging adults' financial behaviors than family stress alone. This study contributes to the literature by highlighting the importance of implicit family financial socialization and identifying areas for future research and intervention aimed at improving financial outcomes for emerging adults.

Katherine Corrigan
"Mental Health in Collegiate Student-Athletes: An Exploratory Study of Stress, Coping Mechanisms, and Social Support"
Advisor: Yanmei Xu, PhD, Assistant Professor of Sociology
Reader: Sarah Bokovitz, MSN, APRN, CNP, PMHNP-BC, Clinical Assistant Professor of Nursing

This study reviews the relationships among stressors, coping mechanisms, social support, and mental health outcomes among Division II student athletes. The participants in the study were 104 Division II student-athletes from a small college in Ohio, who completed an anonymous online survey. Results showed that higher overall stress levels and several stressors, including academics, financial concerns, worries about the future, and balancing academic and athletic commitments,

were associated with poorer mental health outcomes and increased levels of feeling overwhelmed. Behavioral and psychological coping were positively associated with self-perceived mental health, while cognitive coping was negatively associated with mental health. Perceived support from family, teammates, and campus was positively related to mental health, with teammate support uniquely associated with lower feelings of being overwhelmed. These findings highlight the importance of addressing specific stressors, promoting adaptive coping strategies, and strengthening social support systems to improve mental health outcomes among Division II student-athletes.

Ava Dietz
"Introducing Children Ages 0-5 to Literacy"
Advisor: Michelle Lenarz, PhD, Professor of Graduate Literacy and TESOL Education
Reader: Kacie Menendez, MFA, English Composition Coordinator

This research and creative project aimed to bridge the gap that is currently seen in how parents introduce their children to literacy, if they do so at all. Recent research has shown that early literacy introduction in a child's life has significant positive effects on their reading capabilities and academic performance in school. For example, Pilonieta and Hathaway (2024) found that kindergarten-aged students can have academically intelligent conversations regarding books. This is important because many people believe that kindergarteners are too young to sustain meaningful literacy-based conversations; however, this is not the case. The authors found that by allowing and encouraging students to form opinions, evaluate, compare, and choose a conversational topic, clarify an idea, and listen closely, it is possible for students to have meaningful conversations (Pilonieta & Hathaway, 2024). It is because of this significance that there is a need for tools that can be used to help parents learn about literacy. With this, the author and researcher of this study, aimed to create a set of flip cards and an accompanying children's book to assist parents in learning more about family literacy, and actively applying it within the home for their young children.

Thursday, March 19th
4:00pm – 5:00pm

Meklit Tofu
"Cybersecurity Awareness Website for Young Adults"
Advisor: Jennifer Loudiana, MEd, Interim Chief Information Officer; Director of User Support and Classroom Technology
Reader: David Good, MSc, Assistant Professor of Computer Science

As digital technologies continue to expand and change, young adults from 18 to 30 years of age are becoming susceptible to various forms of cyberattacks. Despite the vulnerability, there is a lack of tools designed to address this issue. The goal of the research is to build a training website specifically designed for this demographic; CyberAware was developed using Python/Flask programming language, SQLite program, and HTML/CSS/JavaScript. CyberAware provides an interactive assessment tool of 25 pre-content questions covering four areas related to cybersecurity: Password Security, Privacy and AI, Social Engineering, and Cybervictimization.Upon finishing an assessment, CyberAware generates a personal risk profile through an algorithm based on a user's response, then creates a customized training program with appropriate educational resources from organizations such as the Cybersecurity & Infrastructure Security Agency (CISA), National Institute of Standards and Technology (NIST), and Khan Academy, relating to their risk profile and assessed risk based on the algorithm. Finally, following the educational program, a post-assessment will be given to determine if the person improved their cybersecurity knowledge or will

need to continue practicing. CyberAware represents major progress in the development of cybersecurity education through its creation of a modern technological interface and interactivity across most types of digital devices.

Ryan Moorhead
"Developing a Chatbot to Reduce Tech Anxiety and Improve IT Issue Resolution"
Advisor: Jennifer Loudiana, MEd, Interim Chief Information Officer; Director of User Support and Classroom Technology
Reader: David Good, MSc, Assistant Professor of Computer Science

As technology is increasingly integrated in academic and professional settings, many people feel a sort of tension with it. Whether this tension comes from the overwhelming nature of technological functionality or some other aspect of it, many experience some degree of technology anxiety when attempting to navigate it. Because the struggle with technology is so pressing and majorly affects day-to-day tasks, it often leads to feelings of frustration, discouragement, or even task-abandonment. At the same time, IT support teams face increasing demand for low-level task resolution due to repetitive issues like password resets and locked accounts. The volume of these requests delay teams from addressing more complex issues. Challenges for both users and IT teams like this indicate that some kind of solution needs to be put in place to help resolve low-level issues at a faster and more effective rate.

This thesis aims to design, create, and improve a chatbot for IT resolution through rounds of testing and feedback. Emphasis is placed on a conversational approach and step-by-step resolution to help users limit technology anxiety when interacting with this chatbot. This approach should encourage users to seek help faster, improve confidence, and resolve common issues without human interaction. The objective of this thesis is to address psychological issues related to technology use at a small-scale but allow for future developments to be made to up-scale, add to, or publish this for public use at Walsh University.

Saturday, March 21st
12:30pm – 1:30pm

Troy Mazzei
"Correlations between Caffeine Consumption, Social Media Use, and Impulsivity among U.S. College Students"
Advisor: Lindsey Roush, EdD, Research Associate
Reader: Cary Dabney, MDiv, PhD, Assistant Professor of Theology

Caffeine consumption and social media use are increasingly popular among young people. However, they have also been found to form addictions and correlate with elevated impulsivity, an attribute that has been associated with a variety of mental health disorders. The current study aimed to compare correlations among caffeine consumption, social media use, and impulsivity, and to analyze whether impulsivity mediates the relationship between caffeine consumption and social media use. A sample of 246 students (57.7% female and 41.5% male) from various colleges at Walsh University in North Canton, Ohio, participated in this study. Participants were assigned caffeine, social media, and impulsivity scores based on their responses to three research-backed scales assessing each category. The current study found a correlation between caffeine score and impulsivity score ($r = 0.188$; $p = 0.003$). However, no correlation was observed between participants' social media scores and impulsivity scores, or between their caffeine scores and social media scores. Neither were impulsivity scores found to mediate the relationship between caffeine

scores and social media scores. The correlation between caffeine scores and impulsivity scores supports previous findings of correlations between addictive behaviors and impulsivity. Future research should investigate whether impulsivity predicts caffeine consumption's association with negative mental health outcomes, compare the pathology of caffeine addiction and problematic social media use, and develop a more widely accepted definition and measure for assessing addictive social media use.

Olivia Huzyak
"Caring Beyond the Body: Developing a Digital Educational Program to Enhance Spiritual Literacy in Nursing Education for Palliative Care"
Advisor: Cary Dabney MDiv., PhD., Assistant Professor of Theology
Reader: Sarah Bokovitz, MSN, APRN, CNP, PMHNP-BC, Clinical Assistant Professor of Nursing

Spiritual literacy and cultural humility are important aspects of nursing care, especially in palliative care, where patients and families often face serious illness, emotional stress, and end-of-life decisions. In these situations, nurses are expected to care for the whole person, not only physical symptoms but also emotional, cultural, and spiritual needs that can strongly affect how patients cope and make meaning during illness. However, many nurses in current practice report feeling unsure about how to assess spiritual concerns or respond appropriately when patients express spiritual distress, questions about meaning, or faith-related needs. This uncertainty often comes from limited training during nursing education and a lack of clear guidance on how to integrate spiritual care into everyday clinical practice. At the same time, nursing programs face challenges in teaching these skills because curricula are already full, and time is limited. This creative project presents a structured educational program that instructors can easily add to an existing palliative care course within a nursing program to help address these gaps. The program is designed to support nursing students in building confidence and practical skills for recognizing and responding to spiritual and cultural concerns as part of holistic patient care. It includes eight stand-alone modules that can be used in order or individually based on course needs. Each module contains a short educational video filmed to simulate the caregiver environment, clear learning content, an applied exercise that encourages conversation and reflection, and a brief knowledge check to reinforce learning. To support instructors, this project also includes a detailed Instructor Guide with step-by-step instructions for integrating the modules into a course with minimal disruption. The guide offers suggested pacing, learning goals, assessment ideas, and practical tips for in-person, hybrid, and online formats. An example course syllabus and a sample electronic course network page are also included to show how the program can fit into a preexisting palliative care course. Overall, this thesis demonstrates how a clear, flexible educational resource can help better prepare future nurses to assess and address patients' spiritual concerns with confidence, respect, and compassion.

Saturday, March 21st
1:45pm – 2:45pm

Amelia Molitor
"The Relationship Between Different Child-Rearing Methods and Adult Children's Perception of God"
Advisor: Nina Rytwinski, PhD, Assistant Professor of Psychology; Co-Director of The Honors Program
Reader: Cary Dabney, MDiv, PhD, Assistant Professor of Theology

This study examines the relationship between parenting style and God image. Based on previous research (e.g., Ebrahimi and Firoozi, 2016, Najam and Batool, 2012), I hypothesized that

Authoritative and Permissive styles of parenting would be associated with significantly higher scores on the Presence and Acceptance subscales of the God Image Inventory compared to those raised by Authoritarian parents. Additionally, those raised by Permissive parents were predicted to score significantly lower on the Challenge subscale compared to the other two parenting groups. The participants (*N* = 144) completed three self-report questionnaires: Demographics, The Parental Authority Questionnaire (Buri, 1989), and God Image Inventory (Lawrence, 1997). The Authoritative parenting subscale had a strong positive correlation with perceiving God as Challenging, Accepting, and Present. Furthermore, in a set of one-way ANOVAs, it was found that the Authoritative parenting style and mixed Authoritative and Authoritarian parenting style scored similarly, and significantly higher than those classified as being raised by Authoritarian parents. Although correlational, this research paves the way for more research regarding parenting styles and how it impacts perceptions of God.

Aliya Shine
"Designing Social Media to Connect Students to Church-led College Student Ministry Programs: A Case Study"
Advisor: Jennifer Vokoun BFA, MA, MFA, Associate Professor of Graphic Design
Reader: Cary Dabney MDiv., PhD., Assistant Professor of Theology

Today's college students are part of a generation that is perpetually on social media and use it to communicate with one another. This study investigates whether young adult church ministries are utilizing social media as a tool to positively reach this audience and the impact of design on engagement with social media content. The study collects data from Instagram using five social media profiles across three different 35-day time frames, measuring the engagement methods and categories of the posts. Following data collection, numerous tests were conducted to determine the meaning of the findings and what significance it had. The findings revealed that follower count has less influence on success of a post. A qualitative analysis was conducted to study the "why", and found the type of content matters greatly when posting on social media. These findings highlight a strong point in understanding how to reach college students and necessitates further research regarding what college student ministries at churches are doing to spread the news of Jesus' gift of salvation to this generation.

Monday, March 23
3:00pm – 4:00pm

Meleah Sawastuk
"Patients' Perceptions of Artificial Intelligence Within Healthcare"
Advisor: Jaime Paz, PT, DPT, MS, Professor of Physical Therapy
Reader: Neil Walsh, BS, PhD, Chair, Mathematics and Sciences; Associate Professor of Chemistry

Various studies have shown that Artificial Intelligence (AI) has produced benefits within the healthcare field, but there are limited sources regarding the perceptions of those affected by these new AI implementations. In this undergraduate project, a non-experimental, descriptive study was conducted with an anonymous, voluntary survey. A convenience sample from a local population was chosen due to the implementation of AI applications within nearby hospitals to these potential patients. The primary research question was 'What perceptions do people have towards AI within healthcare settings when it comes to trust, ethicality, and compliance?' Three hypotheses were proposed to explore the relation between trust in AI with age, willingness to use AI in treatment with familiarity of AI, and trust in AI with internet usage. Overall results showed that there were more negative perceptions towards AI. Furthermore, as someone aged, they had a higher chance of

distrust. Similarly, the less someone used the internet, the more they found distrust in the AI applications. These patterns can be compared to historical perceptions of technology suggesting that fear and distrust may be natural reactions to new technological advancements. While this study identified some correlation with factors that may influence perceptions of AI in healthcare, future research should be conducted in order to determine the perceptions of patients from different geographical regions.

Gloria Tindana
"Evaluating the Impact of Simplified Educational Material on UTI Knowledge and Prevention in Low-income Post-partum Women"
Advisor: Stephanie Fox, MSN, RN, Interim Chair of Undergraduate Nursing, Clinical Assistant Professor
Thesis Reader: Heidi Wright, MSN, RN, CEN, Clinical Assistant Professor

Urinary tract infections (UTIs) are prevalent during pregnancy and can result in serious problems if not prevented or treated promptly. Many pregnant and postpartum women, particularly those from low-income families, may have insufficient knowledge of UTI prevention and related concerns. The goal of this study was to evaluate the impact of simplified educational materials in improving knowledge and awareness about UTI prevention among low-income postpartum women. This study utilized a descriptive pre- and post-education design. Twenty participants completed a survey before and after reading an informational pamphlet about urinary tract infections (UTIs) during pregnancy. The pamphlet provided general information on UTIs (causes, symptoms, potential complications, and prevention techniques). The survey contained open-ended, Likert-scale, and yes/no questions. Quantitative data were analyzed using descriptive statistics in SPSS (frequencies and percentages), while qualitative responses were examined through thematic analysis to identify recurring themes. Results indicated that after reading the pamphlet, participants had a better understanding of UTIs. Most reported that the information was easy to read, enhanced their knowledge about UTIs, and increased awareness of lifestyle choices, hygiene practices, and potential UTI complications for both the mother and the child. These findings suggest that simplifying educational materials may be a strategy to increase awareness of UTI prevention in this population.

Monday, March 23
4:15pm – 5:45pm

Brianna Birkle
"Evaluating the Chemical Suitability of Digitally Printed Textiles with Objects of Cultural Heritage"
Advisor: Peter Tandler, PhD, Associate Professor of Chemistry
Reader: Megan Pellegrino, MAT, Director of Museum Studies and Director of the Hoover Historical Center

The increasing popularity and availability of commercially-produced digitally printed textiles (DPTs) have incited textile conservators' curiosity as to their potential use in repairing and supporting historic fabrics. While previous studies have investigated physical properties, little is known about their off-gassing behavior. "Off-gassed" compounds may interact with sensitive surrounding materials to cause or accelerate degradation. As a result, this study examines the off-gassing of washed and unwashed DPTs to assess their chemical suitability for conservation-based treatments. Custom pigment-printed DPTs ordered from Spoonflower and Contrado were subjected to accelerated aging through the Oddy test. Subsequently, they underwent iodide-iodate, Purpald, and sodium azide microchemical tests, followed by Attenuated-Total-Reflectance Fourier-

Transform-Infrared-Spectroscopy (FTIR-ATR), Pyrolysis-Gas Chromatography-Mass Spectrometry (Py-GC/MS), and Headspace Gas Chromatography-Mass Spectrometry (HS-GC/MS). Corrosion on the Oddy test's metal coupons were analyzed using an FTIR-microscope. Based on these results, the unwashed DPTs were classified as unsuitable for use with sensitive cultural heritage, due to severe corrosioon the Oddy test's metal coupons. After washing, Oddy test coupons lacked significant corrosion and no volatile compounds were identified in microchemical or analytical analyses, resulting in the categorization of washed DPTs as temporarily suitable for up to six months. This study emphasizes the need for thorough evaluation of DPTs.

Laura Bliese
"Effects of Natural Extracts on Dental Pellicle"
Advisor: Peter Tandler, PhD, Professor of Chemistry
Reader: Darlene Walro, PhD, Professor of Biology

Dental pellicle is a thin biofilm that covers all surfaces in the mouth. It is formed out of saliva and enhanced by any food or drink consumed. The pellicle acts as a barrier for any erosion or other damage. Polyphenols are natural materials that are found in most fruits, bark, and other parts of plants. They can be extracted to their purest form to be used in tests. Polyphenols have proven to be able to strengthen the pellicles' protective properties to defend against erosive bacteria and other materials. Although, the exact way that polyphenols act to strengthen the pellicle is not entirely known. It is possible that polyphenols can act as a means for bacteria to adhere to the pellicle. It is also possible that it can act to prevent bacteria from adhering to the pellicle. Four polyphenols were chosen to test the way that polyphenols act on the pellicle. The polyphenols chosen were tannic acid, gallic acid, epicatechin gallate, and hesperidin. In the beginning stages of the project, the bacteria that were tested against were grown in vitro. The bacteria were lactobacilli and streptococcus mutans. Saliva was collected from volunteers and pooled to be tested. Polyphenols' antimicrobial properties were then tested against the selected bacteria. The UV-vis of all polyphenols in RO water and saliva was taken to determine if they would affect staining the teeth after application.

Haruki Imanishi
"Using Clustering and Decision-Tree Based Models to Find the Greatest Formula One Driver of All Time"
Advisor: Jacqueline Novak, PhD, Dean of the School of Arts, Sciences and Education, Professor of Biology
Reader: David Good, MSc, Assistant Professor of Computer Science

The motorsports discipline of Formula One (F1) has long had a debate regarding who is the greatest driver of all time. The question has been analyzed using numerous methods, which include regression, econometric, and cluster models, but with varying results. Discrepancies include different drivers being ranked as the greatest and drivers who have not had substantial results being among the top-ranked drivers. One model which has never been used is the Decision-Tree model. This project proposes the use of Decision-Tree models in conjunction with cluster models to rank the greatest F1 drivers of all time. The F1DB GitHub page was used to source the comma separated value (csv) files that include comprehensive data regarding all F1 races. K-Means Clustering, Decision-Tree, and Random-Forest models were used in conjunction with each other using calculated metrics such as average points and gaps to winner for each driver to provide a definitive ranking of the greatest drivers. The findings demonstrate that the Decision-Tree models provide a strong basis for ranking drivers, with clustering enabling only the best drivers to be ranked, addressing the existing issue of drivers with unsubstantial results being among the top-ranked.

Tuesday, March 24th
3:30pm – 5:00pm

Maddox Kelly
"Examining the Challenges in Forensic Investigation Processes and Procedures"
Advisor: Amy Heston, PhD, Professor of Chemistry
Reader: Davis Shelfer, PhD, Assistant Professor of Sociology

With the ever-changing nature of forensic science and forensic investigation, review and evaluation of the processes and procedures must be conducted. However, this review is inconsistent, and issues in the field are often left improperly addressed or ignored altogether. This is especially true, as different organizations, agencies, and groups have a variety of differences in methods used, funding available, standards, and issues impacting their work. Most research in this area tends to focus on larger organizations and labs, and thus, misses the nuances that exist when looking at this area from a more focused lens. This study attempts to identify the issues within the processes and procedures in forensic investigation as experienced by individual professionals. This study specifically focuses on this population, as most research is conducted on a larger, organizational scale, and thus, this study aims to fill this gap in the literature. This research is split into two distinct parts. The first is a survey comprised of non-identifying demographic, quantitative, and qualitative questions to identify areas where forensic professionals are experiencing or observing issues with forensic processes and procedures. The second is a small-scale comparative analysis that was conducted to examine how this study's findings align with the greater literature. The survey yielded twenty-two participants and revealed a variety of issues experienced by forensic professionals that both aligned and did not align with the literature. Findings also showed that there is a divide among participants on how to address the issues as well as what issues were most problematic. Because this pilot study aimed to collect explorative data, future research will be needed to explore this area in more depth as well as to verify and expand on these findings.

Madison Wagner
"Molecular Analysis of SOX3 Modification by Small Ubiquitin-Like Modifiers (SUMOylation)"
Advisor: Adam Underwood, PhD, Professor of Biology
Reader: Amy Heston, PhD, Professor of Chemistry

SUMOylation is a post-translational modification (PTM) known to regulate several nuclear proteins, including members of the SOX (SRY HMG-Box) family of pioneer transcription factors (TF's). The SOX1B subgroup is composed of SOX1, 2, and 3. Of these members, SOX2 SUMOylation is well described with this PTM altering transcriptional activity and subcellular localization, nuclear import and/or retention. Unlike SUMOylation of SOX2, SOX3 is less studied with only a single citation suggesting possible SUMO interaction. While SOX3 is typically nuclear, cytoplasmic localization has been observed in certain cancer contexts, including human ovarian cancer cell lines and the MCF-7 invasive ductal breast cancer cell line. In other tumor cells, SOX3 has been reported to localize in the nucleus as expected. These observations suggest that context-dependent regulation, potentially through PTM's may contribute to difference in SOX3 localization and downstream activity. The goal of this project is to characterize three candidate lysine residues that could serve as SUMOylation sites in SOX3. To assess these candidate binding sites, native and SUMO-site-mutated HaloTag-SOX3 proteins were affinity-purified and SUMOylated *in vitro*. Following SUMOylation, SOX3 proteins were electrophoresed and Western blotted using anti-SUMO antibodies to determine if these PTMs occur at one or more locations in SOX3. By evaluating SUMOylation at these residues, this work aims to establish whether SUMOylation is a regulatory mechanism for SOX3 and whether it could help explain altered localization patterns seen in cancer cell lines. Defining SOX3 SUMOylation status and site(s) provides a mechanistic foundation for future studies on how SOX3 regulation may

influence cancer-relevant behaviors such as proliferation, migration, metastasis, and apoptotic control.

Hannah Blawas
"The Functional Effectiveness of SOX7 A379V in Transcription"
Advisor: Adam Underwood, PhD, Professor of Biology
Reader: Darlene Walro, PhD, Professor of Biology

To understand how genetic code relates to pathological conditions, physiology of gene expression and regulation must be examined. As necessary components of gene regulation, transcription factors are essential in genetic and proteomic research. A particular family of transcription factors, called SRY-box (SOX) related proteins, are crucial in organogenesis and cellular differentiation. These proteins have a conserved High Mobility Group-box (HMG-box) DNA binding domain and regulate gene expression. While most research focuses on the HMG-box of these proteins, protein variants with mutations in conserved regions outside the HMG-box have been identified using computational approaches. One variant with potential correlation with glaucoma and retinal degeneration has been identified in SOX7, where a valine replaces an alanine at residue 379 near the C-terminus of the protein. This thesis tested the hypothesis that this variant (SOX7 A379V) alters transcriptional activity relative to its wild-type form. To do this, HeLa cells were transiently co-transfected with wild-type, variant, and empty constructs along with a control vector and luciferase reporter pGL3 vector containing AR600, which is a SOX inducible synthetic promoter. Following transfection, transcriptional activity facilitated by each effector was measured for luciferase activity. Results indicate that the variant SOX7 A379V significantly increases transcriptional output compared with the native form.

Wednesday, March 25th
3:00pm – 4:30pm

Shareen Awadallah
"The Impact of Awareness of Gender-Specific Differences in Women's Cardiovascular Health"
Advisor: Tammie Davis, MSN, RN, CCRN, CPNP, Clinical Associate Professor of Nursing
Reader: Mary Cook, DNP, MSN, RN, CNE, Executive Director Ohio League for Nursing; Adjunct Faculty Byers School of Nursing

Cardiovascular disease is the leading cause of death among women in the United States, yet it is often underrecognized and misunderstood by women themselves. Many women do not identify cardiovascular disease as a major health threat and may be unaware that symptoms can present differently than in men. This lack of awareness contributes to delayed care seeking, misinterpretation of symptoms, and poor health outcomes. The purpose of this thesis is to examine the impact of cardiovascular disease awareness on women's knowledge, attitudes, and health behaviors related to prevention and early intervention. Factors such as age, race, education level, and access to healthcare are explored to understand how awareness influences risk perception and decision making. Existing literature highlights persistent gaps in public education, particularly among younger women and women from underserved communities. Improving awareness has the potential to promote earlier recognition of symptoms, increased engagement in preventive behaviors, and timely use of healthcare services. Enhancing education and awareness is a critical component of reducing morbidity and mortality related to cardiovascular disease in women. This thesis assesses the female population for their cardiovascular health knowledge and deficits that may be present. This thesis aims to highlight the importance of targeted awareness efforts and

support the role of healthcare professionals, especially nurses, in educating women and advocating for improved cardiovascular health outcomes.

Camryn Barker
"Analysis of Caffeine Consumption and Caffeine Intoxication Among Walsh University Students and Student-Athletes"
Thesis Advisor: Karen Wajda, MSN, APRN, CNP, PMHNP-BC, Clinical Associate Professor of Nursing
Reader: Sarah Bokovitz, MSN, APRN, CNP, PMHNP-BC, Clinical Assistant Professor of Nursing

Caffeinated beverages such as coffee, energy drinks, caffeinated tea, soft drinks, and espresso are popular among college students. This study used a survey to examine the approximate weekly intake of these beverages among Walsh University students, their reasons for consumption, and any symptoms experienced during or shortly after use. Consumption patterns were compared between student-athletes and non-athletes. The prevalence of symptoms associated with caffeine intoxication was assessed to identify potential risks among participants. This study sought to understand the experiences and effects that college students associate with caffeinated beverages and whether these factors contribute to the prevalence of use within college student culture. By evaluating the potential risk of caffeine intoxication among students at Walsh University, this research aimed to determine whether education regarding safe caffeinated beverage consumption is needed. Overall, this study seeks to encourage college students to reflect on their caffeinated beverage intake and become more aware of their consumption patterns.

Sarah Festi
"Nursing Education with Pediatric Heart Failure Patients and their Families"
Advisor: Jessica Seich MSN, RN, CPN, WCC, CHSE Clinical Assistant Professor of Nursing and Coordinator of Clinical and Laboratory Experiences
Reader: Monica Andreski MSN, RN, CPN, Clinical Associate Professor of Nursing

This study sought to provide pediatric patients with heart failure (HF) and their families with nursing education that is currently lacking in the clinical setting. The research conducted within the study culminated in an educational pamphlet that could be given to pediatric HF patients and their families. Four nursing experts, who have experience in caring for pediatric heart failure patients, were chosen through a snowball sample to participate in the study. They each participated in a 30-minute zoom interview, through which they were asked questions about the current nursing education provided to these patients and what improvements they recommended. The information provided in the interviews was analyzed for themes and guided the decision of what content to include in the pamphlet. A draft of the pamphlet was created, which included three separate sub-pamphlets for parents of infants with HF, parents of school-aged children with HF, and school-aged children with HF. All pamphlets educated the intended audience about the pathophysiology of heart failure, the important signs and symptoms, and the mental health of the caregiver and the child. Mental health was identified through the interviews as a topic that is currently educated on the least. Then, three of the four experts attended a second 30-minute zoom interview in which they critiqued the pamphlet and gave their honest feedback. The experts were impressed with the pamphlet but suggested the addition of labels for easier legibility, and a liability statement. The pamphlet was edited accordingly, and the final draft was sent as a thank you to the participants of the interviews. The pamphlet, when disseminated, could improve nursing education and patient care with pediatric heart failure patients and their families.

Wednesday, March 25th
4:45pm – 5:45pm

Rachel Thompson
"Exploring the Consequences of Sport Specialization on Injury Prevalence and Current Physical Activity and Sedentary Status in Retired Athletes"
Advisor: Dr. Meredith Joplin, PhD, ACSM-EP, Assistant Professor of Exercise Science
Reader: Dr. Jonathon Naylor, PhD, ACSM-CEP, Associate Professor of Exercise Science

Objective: Determine if any correlation exists between sport specialization status and (1) injury rates (acute and overuse), (2) injury severity (acute and overuse), (3) current physical activity levels, and (4) current sedentary behaviors. Pearson correlations were also conducted to determine a relationship between the specialization age (1) injury rates (acute and overuse) and (2) injury severity (acute and overuse). *Methods:* A total number of 151 participants completed the study. Participants were asked questions that determined their specialization status (Jayanthi et al., 2011) and injury rate and severity (Post et al., 2017). Participants then completed the Godin Leisure Time Physical Activity Questionnaire (Godin, 2011) and IPAQ (Craig et al., 2003). *Results:* Correlational data showed weak positive relationship between overuse injury and specialization score ($r = 0.243$, $p = 0.009$), acute contact injury and specialization age ($r = 0.193$, $p = 0.05$), and acute contact injury and specialization score ($r = -0.194$, $p = 0.047$). *Conclusion:* No moderate or strong significant relationships were discovered between specialization status, specialization age, injury rate/severity, physical activity levels, or sedentary behavior in retired athletes. The weak relationships between sport specialization and aspects of injury status warrant further investigation, potentially in a population of athletes from college level and above.

Sophia Rosa
"The Effect of the Removal of Four Diet Additives in Virginia opossum (*Didelphis virginiana*) diets at the Stark Parks Wildlife Conservation Center as it Relates to Chart Tracking and Treating of Metabolic Bone Disease"
Advisor: Jennifer Clevinger, PhD, Professor of Biology; Co-Director of the Honors Program
Reader: Adam Underwood, PhD, Professor of Biology

Metabolic bone disease (MBD) is a chronic disease that plagues many mammals that rely on opportunistic food sources for much of their diet. These animals are brought to local wildlife centers, like the Stark Parks Wildlife Conservation Center (Massillon, OH), for treatment. Because local wildlife centers rely heavily on community support and limited funding, saving time and resources is imperative to provide cost-effective care to as many animals as possible. This project focused on the cost-saving removal of four of five diet additives in the Virginia opossum (*Didelphis virginiana*) diet at the Stark Parks Wildlife Conservation Center to test the effect on animals plagued with MBD. The four diet additives removed are dried egg yolk, brewer's yeast, apple juice, and Nutri-Cal. The other focus of this project was to implement different types of charting and documentation for admitted Virginia opossums to assess if these charting changes were more effective in tracking specific MBD symptoms and more efficient for the staff. New charting sheets and the omission of four diet additives were implemented starting in Spring 2025, making 2025 the experimental group. Data from 2024 was analyzed retroactively and used as the control group for this project. There was no significant difference in starting weight, ending weight, net change in weight, and length of stay from the 2024 control group to the 2025 experimental group, suggesting that the diet additives that were previously thought to enhance health are not necessary for treating Virginia opossums at risk for developing or showing symptoms of MBD. This represents a cost-saving measure for animal rehabilitation facilities that often have very limited budgets.

Thursday, March 26th
2:00pm – 3:30pm

Antonio Paganelli
"Ethical AI Governance: A Framework for the Future"
Advisor: C. Chase Senk, JD, Associate Professor of Business
Reader: Branko Bucar, PhD, Associate Professor of Business

The rapid implementation of artificial intelligence (AI) systems across economic and social domains has brought forth national debates on how these technologies should be governed and constrained. While AI is poised to make further gains in efficiency, innovation, and decision-making abilities, significant risks arise related to accountability, transparency, and privacy, among many others. This thesis attempts to balance necessary AI governance with the future of the industry's innovation.

This thesis analyzes the evolution of AI technologies across multiple industries, including healthcare and military applications to date. It reviews the current state of AI policy governance, both domestic and global, and examines the guiding ethical principles upon which the AI governance should be based. The challenges posed by rapidly evolving AI capabilities are highlighted, specifically generative AI, which strain current regulatory systems. Through selected case studies, the thesis illustrates the research displaying how governance failures or gaps can lead to social harm, and how effective oversight can mitigate risks without unduly constraining innovation.

The thesis culminates with a policy recommendation, describing a three-pronged regulatory system proposed to ensure that AI governance achieves maximum effectiveness, balanced with fair freedom for innovation. The thesis concludes by arguing that AI governance requires adaptive and multi-level regulatory strategies. Rather than relying solely on static rules, governance frameworks should combine legal enforceability with institutional guidance, stakeholder participation, and ever-evolving research. The research and analysis presented in this thesis serves as an essential tool for AI systems to develop and innovate in ways that are socially beneficial, trustworthy, and aligned with fundamental legal principles.

Colton Ferrucci
"Social Security: Proposal for Privatization Plan"
Advisor: C. Chase Senk, JD, Associate Professor of Business
Reader: Branko Bucar, PhD, Associate Professor of the DeVille School of Business

Social security in the United States provides benefits to many retirees within the country. Millions of people depend on the social security checks to live off after retiring. Recently, experts fear the social security system is running out of funding in the year 2036 which is only 10 years away. This is due to several reasons including a longer life span, the number of retirees compared to contributors, and less people in the workforce. The short-term fix to slow the dilution of funds is to increase the retirement age which we have seen recently as many working Americans now cannot claim benefits until age 67. Though this will slow down the depletion of funds, it will not end it, so I have thought of a potential long-term solution to the program's problem. The current social security system in the US is not traditionally invested into the market, meaning the only source of incoming funds comes from the working class. Programs around the world utilize market investments for their own programs, so if the US system invested into the market would it increase the fund balance therefore saving the program from bankruptcy. To see if this would work for the US system, I constructed data models that mirror ten sample countries' models with the numbers from the US fund to see if investing the fund into the market saves the US social security balance from running out in 2036.

Lukas Graham
"Is Working from Home in the Accounting Industry Best for Business?"
Advisor: Amanda Dalpiaz, CPA, MSA, Professional Assistant Professor of Accounting
Reader: Ashley Monaco, CPA, CFE, MSA, Professional Assistant Professor of Accounting

Recently, the world has seen a drastic increase in the practice of working from home. This structure is still a new concept, making it a prime candidate for research to see the impact of working from home on individuals. There has been various research completed thus far; however, most studies have looked at a wide range of industries, with none being centered around the accounting industry. Therefore, this study aims to look at the effects of working from home on the accounting industry. This study examines this industry to assess whether factors such as mental health, relationship building, and productivity have seen any changes given the new setup. A survey was produced and given to accountants within the state of Ohio to take a dive into these topics to see if working from home is best for this industry. The goal of this study was to examine the accounting profession to see if there are specific challenges and benefits given the nature of this industry.

Tuesday, March 31st
3:30pm – 4:30pm

Elizabeth Radis
"Dissecting the Functional Attributes of SOX12"
Advisor: Adam Underwood, PhD, Professor of Biology
Reader: Darlene Walro, PhD, Professor of Biology

SRY-related high-motility box (SOX) genes are a family of 20 transcription factors that share a conserved High Mobility Group (HMG) box DNA binding domain. Group C of the SOX family (SOXC) is composed of SOX4, SOX11, and SOX12. Despite sharing a conserved HMG box binding domain and C-terminal region, the transcriptional strength of each SOXC member varies. SOX12 is believed to be the weakest transactivator, despite being ubiquitously expressed in tissues throughout the body. While SOX12 shares some functional redundancy with SOX4 and SOX11, particularly during cellular differentiation, the exact roles of SOX12 remain unknown. The purpose of this project is to evaluate the C-terminal region, that contains a transactivation motif, to determine if structural differences in this region alter the transcriptional output of the SOX12 protein. The transcriptional capability of SOX11 and SOX12 was assessed using dual luciferase assays. The hypothesis tested is that when the C-terminal regions of SOX11, possibly the most robust transactivator, and SOX12, are exchanged, the resulting chimeric SOX12/11 and SOX11/12 proteins will exhibit predicable differences in transcriptional potency. Structural modifications within the C-terminal transactivation domain of native and chimeric proteins will be illustrated by the expression of luciferase proteins. These expression levels directly correspond to the transcriptional strength of native and chimeric SOX12 proteins conferred by differences in the C-terminal transactivation region.

Daniel Palanceanu
"The Biological Activity of a Non-Natural Epimer of Betulin"
Advisor: Timothy Smith, PhD, Assistant Professor of Chemistry
Reader: Adam Underwood, PhD, Professor of Biology

Betulin is a triterpenoid found in various *Betula* species and is a member of the Lupane family. Due to its reported biological activities, including anticancer potential, betulin is of significant interest in pharmacological research. In this study, betulin was extracted from *Betula papyrifera* bark using an ethyl acetate/ethanol/water solvent solution and then purified by sublimation. To investigate the structural role in biological activity, chemical modifications targeting specifically the C-3 hydroxyl

group were performed. Natural betulin was converted into a benzoate diester via the Mitsunobu reaction, followed by ditosylation and following SN2 substitution with sodium acetate to yield the desired epimer. Structural confirmation and purity were confirmed using ^{1}H and ^{13}C NMR, 2D NMR, GC-MS, and FTIR spectroscopy. Biological evaluation was conducted using MCF-7 and MDA breast cancer cell lines. The cells were treated with natural and non-natural epimer derivatives at various concentrations, with DMSO serving as the control. Cell growth was assessed using MTT assays. RNA broad-range assay and yield were evaluated after treatment, and transcriptomic analysis was performed using nanopore sequencing to investigate the effects of treatment and gene expression changes, and to further interpret the molecular mechanisms underlying betulin's anticancer capabilities.