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Platform Presentations

Respiratory Therapy Staff Retention: A Systems Thinking Approach

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- Capstone

Abstract:
Respiratory therapists are an integral part of the healthcare workforce in the United States. The healthcare workforce shortage accelerated by the COVID global pandemic has impacted respiratory therapy departments across the nation, with organizations struggling to hire and retain staff. The prevailing approaches in combating this are linear in nature and do not consider the complexity of the system. This mode of thinking does not adequately consider the characteristics and influences of the containing system, the many elements within the problematic organizational system, or their interdependencies and interactions. This study frames retention as a complex system problem wherein organizations are social systems which include members and groups who collaborate within and between social sub-systems. The study utilizes systems-informed methodologies to frame, navigate, and solve the problem. This project utilized the Cynefin Framework that allows leaders to determine the context of the problem, and to determine which methods or approaches for decision making should be adapted. Interactive planning and idealized design, a systems-thinking methodology, where the problem's stakeholders creatively design a new system for RT retention based on what is viable, feasible, and desirable, is used to develop a prototype to solve or dissolve the problem.

[1]Faculty Presenter: Jerin G. Juby, D.Mgt., M.A., R.R.T.
[2]Faculty advisor: Larry M. Starr, School of Business, TJU

Empowering Students with 5S Organizational Skills for Research Laboratory Optimization

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- Applied Research

Abstract:
5S (Sort, Set-in-order, Shine, Standardize and Sustain) is a cost-effective organizational methodology frequently employed by biotech research labs and biomanufacturing to streamline optimization of production. Educational research labs offer experiential learning opportunities and serve as ideal environments for implementing 5S principles within undergraduate and graduate biotechnology curricula. In the Jefferson Biotechnology Program, the newly updated "Lab Design and Stewardship (BT303/503)" lecture and laboratory course, now integrates the 5S methodology into biotech student skill development. Participants in the BT303/503 course are instructed to improve workspaces within the biotechnology laboratory to bolster safety, efficiency, and inventory and equipment management. Through a surveying laboratory activity, students evaluate and implement 5S, subsequently reinforcing their understanding during lab practicum experiences in other research facilities on and off campus. Our future efforts aim to expand this initiative across Thomas Jefferson University research laboratories.

[3]Faculty Presenter: Paula C. McCourt, Ph.D.

CAPA: Quality Control Testing of Laboratory Plates

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- Applied Research

Abstract:
The purpose of a Corrective and Preventive Action (CAPA) investigation is to identify and address errors, deviations, and compliance issues to ensure the integrity, reliability, and quality of research and biomanufacturing. In the biotech industry, where identifying and rectifying root causes of errors is key to ensuring quality data and preventing future errors, CAPA plays a crucial role. The Jefferson Biotechnology (JBT) lab was asked to investigate the sterility of a biotech supplier's microbiological agar plates, when a client reported contamination in their agar plates, suspecting contamination prior to sleeve opening. By attempting to reproduce our client's results through a CAPA investigation, the JBT lab was able to confirm that the client's plates were not contaminated prior to usage. This validation persuaded the client to implement JBT's advice on aseptic techniques, thereby reducing the risk of unnecessary errors in microbiological handling and offering valuable guidance for future preventive measures.

[1]Student Presenters: Div Galdi, B.S. Student and Bryn Mallon, B.S/M.S. Student
[2]Faculty Advisors: Scott E. Gygax, Ph.D.; Paula C. McCourt, Ph.D. and Sean G. Chadwick, M.S.

Cannabis Medicine Education for Healthcare Practitioners: Addressing the Knowledge Gap

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- Capstone

Abstract:
The focus of this capstone is to develop an educational program plan that provides critical information for healthcare practitioners (HCPs) on cannabis medicine. Research indicates that a significant gap in knowledge exists between HCPs and cannabis medicine, resulting in practitioners feeling uncomfortable discussing the topic or never discussing the topic with their patients. This educational program plan will be specifically designed to target the needs, education, and clinical significance of medical cannabis. HCPs that will be considered for this program include medical professionals (physicians) and mental health professionals, however extension of the program to public health professionals and government officials are a potential goal of the project. The courses will include a "Cannabis 101" course that provides general information about cannabis medicine, a "Physical Medicine and Cannabis" course for HCPs. Topics for discussion will include the biochemical and physiological components of cannabis, how cannabinoids interact with the body, current research highlighting the effects of cannabis, and more.

[1] Student Presenter: Jess Aubin, M.A.

Free My Weed, Man: Assessing Cannabis Equity through Social Justice Initiatives

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- Capstone

Abstract:
Project Focus: The capstone project focuses on the pioneering social justice initiative "Free My Weedman", which is dedicated to addressing injustices caused by the criminalization of marijuana. The initiative is unique for its multi-faceted approached, economic development, restorative justice and community building primarily focusing on marginalized communities impacted by the War on Drugs.
Potential Implications: The findings of this research could have significant implication for public health, criminal justice reform, and social policy. It aims to provide: Insight into the effectiveness of grassroots initiative in driving policy change and social reform. Data-driven recommendations for stakeholders in public health and criminal justice to address the ramifications of marijuana criminalization.

[1]Student Presenter: Kristal Bush, M.S. Student

Endocannabinoids as Biomarkers for Renal Disease in African and African American Populations

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- Capstone

Abstract:
The current biomarkers used for detecting renal disease Creatinine has long been seen to be inadequate in identifying the extent of renal disease in African and African American populations. CB1 and CB2 receptors are ubiquitous in the human body and their expression is increased with inflammation in the body. In response to the increased expression, the hypothalamus produces endocannabinoids in response. As a result, endocannabinoids can be a biomarker in detecting renal disease where inflammation is a significant factor in renal injury.

[1]Student Presenter: William L. Doss, III, MD, M.S. Student

Poster Presentations

Adopting a Queer and Trans-Focused Lens into Curriculum Development in Couple/Marriage and Family Therapy Programs

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- Capstone

Abstract:
There are courses, lectures, and trainings on the queer and transgender community in couples/marriage and family therapy (C/MFT) programs. Despite this, C/MFT clinicians, educators, scholars, and researchers continue to highlight some of the common errors in clinical practice such as: assumptions, language/terminology, and gatekeeping. Additionally, literature showcases that C/MFT programs need to incorporate applicable curriculum while simultaneously assessing students and faculty's beliefs, attitudes, and biases towards the queer and transgender communities. For example, what is continuously limited or missed in the education of C/MFT students is inclusion of affirming and responsive curriculum connected to theory, skills, interventions, and systemic thinking and practice for C/MFT students. This increases students' inability to effectively work with these communities and simultaneously strengthens the likelihood of harm in clinical practice. Therefore, to reduce these and other mistakes during treatment, students need to receive adequate knowledge, skills, and interdisciplinary techniques to effectively work with the queer and transgender communities. Specifically, for C/MFT students, from a systemic framework to address the historical, cultural, and social constructs that sustain oppression and clinical disparities. This poster presentation will discuss literature which supports the necessity of integrating queer and transgender affirming curriculum in C/MFT programs and how this promotes standards of diversity, equity, and social justice in the field. Additionally, describing how a queer and trans-focused lens, through a theoretical framework, can be developed, implemented, and evaluated. Furthermore, highlighting limitations and future implications this approach can have across different systems.

[1]Faculty Presenter: Kelly Wallace, PhD, CPH

The Associations Between Pornography Consumption and Domestic Violence Attitudes

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- Basic Research

Abstract:
This study examines the relationship between reliance on pornography and attitudes toward domestic violence. Although other implications of problematic pornography usage have been studied, such as its correlations with rape myth acceptance and sexual aggression, there is a lack of research on its relationship with views on domestic violence. I hypothesized that there would be a positive correlation between greater investment in pornography consumption and higher domestic violence myth acceptance. To measure these variables, I used a survey with questions from the Problematic Pornography Consumption Scale (PPCS) and the Domestic Violence Myth Acceptance Scale (DVMAS), as well as additional demographic questions. There were 258 participants, with the only inclusion criteria being that participants must be at least 18 years of age. Following data collection, I conducted a Spearman's rho correlation test to analyze relationships between pornography usage and domestic violence views. The main results showed a strong, positive correlation between problematic pornography consumption and domestic violence myth acceptance, regardless of specific content. This study adds to the existing literature about the negative implications of problematic pornography usage in society concerning harm to others. This study expands the previous research beyond just sexual aggression and can apply to views of dynamics in intimate relationships.

[1]Student Presenter: Angela R. Nanayakkara, M.S. Student
[2]Faculty Advisor: Jenna K. Rieder, Ph.D.

Evaluating Bone Fracture Healing Utilizing Doppler Imaging Modes, Shear Wave Elastography, X-Ray and Dual-Energy X-Ray Absorptiometry in a Rabbit Model

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- Applied Research

Abstract:
The healing of a bone fracture is a complex, multistage process consisting of inflammation in the local tissue, angiogenesis, callus formation, and eventually, remodeling and restoration of the bone to its original morphology. It is estimated that 5-10% of fractures do not heal properly and exhibit non-union of the fractured bone segments, with long-term complications compared to properly healed fractures. There is great clinical benefit in the ability to have early detection of impending non-union fractures, and diagnostic ultrasound can be used to image formation of the callus in a healing fracture through the use of different imaging modes. Superb microvascular imaging (SMI) is a new microvascular flow imaging mode and represents this information as a color overlay image or as a grayscale map of flow, named cSMI and mSMI, respectively. Shear wave elastography (SWE) is a technique for measuring tissue stiffness noninvasively. X-ray imaging is the standard for imaging fractures, and dual-energy X-ray absorptiometry (DXA) measures bone mineral density. This study investigated methods of evaluating the bone fracture healing process using Doppler flow imaging, cSMI, mSMI, and SWE, relative to X-ray, DXA and CD-31 stains in a rabbit model. The standard of care for evaluation of fracture healing is based solely on callus formation, but ultrasound has the ability to document inflammation and angiogenesis to predict patients at risk for delayed or non-union healing.

[3]Faculty Presenter: Traci Fox, EdD, RT(R), RDMS, RVT, FSVU

Integrating Contrast Enhanced Curriculum into Sonography Education

Maria Stanczak[1], MS, RDMS, RVT, R.T. (R)(M) (ARRT); Colleen Dempsey, EdD, R.T.(R)(ARRT)

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- Applied Research

Abstract:
Contrast enhanced ultrasound (CEUS) has been performed worldwide for over 20 years. Although CEUS has been adopted into clinical practice, its integration into sonography education has been challenging for multiple reasons. The Commission on Accreditation of Allied Health Programs (CAAHEP) has included CEUS curriculum within their standards and guidelines, yet few educators have CEUS experience or access to the resources needed to meet this requirement. The objective of this project was to develop methods in which CEUS content can be incoporated into sonography education with limited tools. As an initial step towards developing CEUS curriculum a modified flow phantom was constructed using a 1.5 gallon Tupperware container, clear vinyl ID 1/4“x OD 3/8” tubing, 8 packets of gelatin, and 4 tablespoons of sugar free Metamucil. Subsequently, agitated saline was used as a contrast agent. Direct injections of agitated saline into the modified flow phantom were conducted. Grayscale and color Doppler ultrasound images were acquired using a 6 Mhz curvilinear probe affixed to an Aplio 500 ultrasound system (Toshiba) that was adjusted to replicate the parameters needed for a contrast examination. CEUS simulations were performed. Integrating CEUS curriculum can be achieved with a traditional ultrasound system, agitated saline, and a handmade modified flow phantom. This technique may have potential for successfully meeting the CAAHEP requirement of incorporating CEUS curriculum into sonography education and preparing sonography students for clinical practice.

[1]Faculty Presenter: Maria Stanczak, MS, RDMS, RVT, R.T. (R)(M) (ARRT)

Development of a Prototype Simulation Model

Gerard Keimer[1]; M.Ed., R.T.(R)(CT)(ARRT); Michael Marchetti[1], BS, R.T.(R)(CT)(ARRT); Robert Pugliese[2], PharmD; Mikael Avery[3], MArch, MS; Nicole Keimer[4], BS; Colleen Dempsey[1], EdD, R.T.(R)(ARRT)

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- Applied Research

Abstract:
To enhance a student's perspective in learning, simulation within the curriculum can provide a transition from didactic teaching in the classroom to practical application, manipulation, and critical thinking. Curricular topics in Thomas Jefferson University's Computed Tomography (CT) program have been identified to be prime for the inclusion of simulation activities. Specifically, the concepts and theory of Interventional Radiology (IR) procedures of biopsy and drainage protocols were identified to transition to the simulation environment rather than only a didactic lecture. The anticipated simulation will add an interactive segment to the teaching and learning environment to achieve psychomotor objectives. An interdisciplinary research team has worked together to move this project forward. The first stage of this project includes the fabrication of the simulated human torso prototype. This prototype will replace the traditional apple, which has been used as the simulated human torso for decades. Actual CT data will be used with a 3D printer to fabricate a simulated outer border of a human torso with a hollow core. The hollow core will allow for the use of material to be added for drainage and biopsy protocols. The prototype will provide the haptic feedback that is much desired in this simulation activity. Future related projects include the implementation of the torso prototype into the CT program's lab sessions. Additionally, this prototype could lead to the idea creation and actual fabrication of additional simulation equipment for the Medical Imaging and Radiation Sciences educational programs.

[1]Faculty Presenter: Gerard Keimer, M.Ed., R.T.(R)(CT)(ARRT)

Curriculum and Competency: A Gap Analysis of Trauma Imaging in a 1-year Radiography Program

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- Applied Research

Abstract:
The American Society of Radiologic Technologists (ASRT) provides radiography programs with the *Radiography Curriculum* document which serves as a guide in the design of a radiography program. The faculty of Thomas Jefferson University's Radiography program incorporates the national curricular outline into the program while also providing opportunities for students to develop skills beyond the entry-level position. This project seeks to identify the Radiography program's current curricular and clinical competency requirements as related specifically to trauma imaging in diagnostic radiology. A gap analysis was performed by the program faculty to determine the current trauma imaging competency content, the desired trauma imaging competency content, and the gap that exists between the two content areas. A laboratory simulation was designed to bridge the identified gap in content. The simulation will include the program's energized radiographic lab and a full body radiographic positioning manikin with which students will perform, in teams, a full trauma scenario. Prior to the lab simulation, students will participate in a lecture on trauma imaging and complete a pre-simulation quiz. Students will be evaluated on cognitive and psychomotor objectives both as a team and as individuals. Each team will be audio and video recorded during the simulation with the recordings used to debrief each team and the full student cohort. The trauma simulation will take place in the summer 2024 semester. The final results of this simulation could have a direct impact on the curriculum, schedule, and clinical rotation experiences of Jefferson's Radiography program.

[1]Faculty Presenter: Thomas Coen, BS, R.T.(R)(MR)(ARRT)

Mechanism of Lipotoxicity-Induced Fatty Liver Disease

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- Basic Research

Abstract:
Non-Alcoholic Fatty Liver Disease (NAFLD) and Non-Alcoholic Steatohepatitis (NASH) are significant and emerging health concerns. NASH is a more severe form of the NAFLD spectrum. It is characterized by excessive fat accumulation in the liver, leading to lipotoxicity, inflammation, fibrosis, and cirrhosis. As the mechanism of lipotoxicity-induced liver damage remains largely unexplored, this phase of the study aims to unveil the molecular pathway used by Palmitic Acid (PA) that leads to NAFLD and NASH, with the help of Western Blot analysis and qPCR.

[1]Student Presenter: Taylor McKenna, B.S. Student
[2]Student Presenter: Bennett Obed, M.S. Student
[3]Advisor: Pranavi Jagadeesan, M.S.
[4]Advisor: Jose Corbalan, Ph.D.
[5]Advisor: Joseph T. Nickels, Ph.D.

Investigating the role of H3K27 histone demethylase UTX/KDM6B in regulating the fibrotic response in Chicken Embryo Fibroblast Cells

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- Basic Research

Abstract:
Fibrosis, characterized by excessive extracellular matrix (ECM) deposition, poses a significant challenge in most tissues, where abnormal scarring impedes normal tissue function. Current treatments for fibrosis are ineffective, with myofibroblasts identified as key contributors to its progression. Myofibroblasts, marked by α-smooth muscle actin (αSMA), play a crucial role in tissue repair post-injury but can perpetuate fibrosis if they persist beyond this phase. There are many cellular sources of myofibroblasts, and one of the main cell types is fibroblasts. Previous research has elucidated a chromatin-based mechanism regulating the progression of the lens fibrotic phenotype, implicating UTX/KDM6B, a histone demethylase targeting histone H3 lysine 27 (H3K27) demethylation, in the regulation of fibrotic gene expression in myofibroblasts within the lens. This study employed chick embryo fibroblasts (CEFs) as a model to investigate whether UTX/KDM6B demethylase activity is a shared mechanism to progress the fibrotic response of fibroblast-derived myofibroblasts. Cultured CEFs, after their transition to an αSMA+ myofibroblast phenotype, were treated with a UTX/KDM6B demethylase inhibitor, which resulted in a decrease in proliferating αSMA+ myofibroblasts and a reduction in collagen and fibronectin production. In conclusion, the UTX/KDM6B chromatin-based mechanism regulates the fibrotic response of dermal fibroblasts, suggesting this could be a shared mechanism for the progression of fibrosis, regardless of the myofibroblast cell source.

[1]Student Presenter: Fahmida Sumaiya, B.S./M.S. Student
[2]Faculty Advisor: Janice L. Walker, Ph.D.

Testing the Effects of Auxin on Drought Recovery

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- Basic Research

Abstract:
Auxin is a key plant hormone with a major role in root initiation and development, cell elongation, and phototropism. Understanding the effect auxin has on regulatory plant-growth mechanisms is vital to crop yield optimization. To investigate how auxin can influence plant recovery mechanisms during post-drought growth conditions, we will examine the growth of *Helianthus annuus* (Sunflower) during simulating drought conditions, with or without the addition of the auxin-like molecule, indole-3-acetic acid (IAA), in the soil. The recovery phase of sunflowers will be observed. Anticipated findings based on current literature suggest plants treated with optimal concentrations should exhibit faster recovery, demonstrated by quick resumption of growth and increased leaf production compared to untreated plants. This experiment is expected to be repeated using other primary plant hormones and performed in different plant species, shedding light on critical aspects of plant resilience in a changing climate.

[1]Student Presenter: Madison Pierce, B.S. Student
[2]Faculty Advisors: Scott E. Gygax, Ph.D.; Sean G. Chadwick, M.S. and Paula C. McCourt, Ph.D.

Design and Validation of a Multiplex qPCR Assay for Diagnosis of Bacterial Vaginosis

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- Applied Research

Abstract:
Current diagnostic criteria and treatment options for bacterial vaginosis (BV) commonly result in the misdiagnosis and/or mistreatment of the active infection, as well as subsequent reinfection with BV. This project aims to design and validate a multiplex qPCR assay as a means to accurately detect and quantify populations of dysbiotic *Gardnerella vaginalis, Atopobium vaginae, Megasphaera* Type 1 & Type 2, Bacterial vaginosis-associated bacterium 2 (BVAB2), as well as the commensal *Lactobacillus crispatus, Lactobacillus jensenii*, and *Lactobacillus gasseri* in vaginal specimen for the accurate diagnosis of BV. As these bacterial species are generally unable to be independently cultured, this phase of study involves the production of positive control plasmids to confirm the identity and relative abundance of these target bacterial species in clinical samples.

[1]Student Presenter: Morgan Shriver, B.S./M.S. Student
[2]Faculty Advisor: Scott E. Gygax, Ph.D.

Putative Role of Sugars in Antifungal Resistance in *Candida albicans ENT2* knock-out mutants.

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- Basic Research

Abstract:
The pathogenic yeast, *Candida albicans*, is known to develop resistance to the antifungal drug, fluconazole, when grown in the presence of fructose. Information is limited to whether the presence of other sugars as a carbon source for *C. albicans* can induce similar antifungal resistance. This study aims to investigate the impact of various sugars on fluconazole resistance in *C. albicans,* particularly focusing on the role of the endocytosis gene, *ENT2*, in this resistance. Deletion of *ENT2* has already been shown to confer fluconazole resistance to *C. albicans* and results in an extended lag time compared to a wild type (WT) strain. *C. albicans* lacking Ent2 exhibit a suggested resistance to xylitol, a known toxic cellular carbon source molecule that causes a greater growth toxicity in a WT strain. The severity of *C. albicans* infections in hospitals, immunocompromised individuals, and diabetic individuals provides evidence on the importance of understanding how different carbon sources in diet affect risk of, not only infection, but also antifungal resistance.

[1]Student Presenter: Div Galdi, B.S. Student
[2]Faculty Advisors: Scott E. Gygax, Ph.D.; Sean G. Chadwick, M.S. and Paula C. McCourt, Ph.D.

Utilizing Plant Leaves as 3D Natural Scaffolds for Tissue Engineering

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- Basic Research

Abstract:
The ability to remove cells from an organ and adhere new cells is a method of exploration observed in human models for tissue engineering. This study focuses on the decellularization and recellularization of plant leaves to serve as 3D scaffold human model systems. To achieve this, four types of leaves (basil, poinsettias, African violet, and Primrose) were decellularized using chemical methods, followed by seeding with human fibroblast cells to visualize adherence to the leaf structure. The cultured constructs were subsequently stained with Hoescht dye to monitor fibroblast cell distribution and attachment to the leaf over time. Exploring cellular adhesion within this context allows insights into the feasibility of utilizing plant-derived matrices for regenerative medicine.

[1]Student Presenter: Bryn Mallon, B.S./M.S. Student
[2]Faculty Advisor: Paula McCourt, Ph.D.

Proper Localization of Multidrug Efflux Pump, Cdr1 in the Fluconazole-Resistant *ent2* Mutant *Candida albicans* Strain

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- Basic Research

Abstract:
Deletion of the *ENT2* gene in *Candida albicans* causes the mutant strain to exhibit fluconazole resistance despite having susceptibility prior to this mutation. It was hypothesized that the gain of resistance was sourced by the disruption in endocytic functions, specifically the inability to properly recycle the drug efflux pump, Cdr1. To fully analyze this mutation's effects on the endocytic functions of *C. albicans*, the Cdr1 protein was tagged in a wild type strain with green fluorescent protein (GFP) and its localization was examined via fluorescence microscopy. To examine Cdr1 protein localization in the *ent2* mutant strain, tagging of Cdr1 protein with GFP will be performed using homologous arm recombination via using a yeast integrating plasmid. We hypothesize that the Cdr1 protein accumulates on the cell surface of the *ent2* mutant strain during antifungal resistant growth conditions enabling fluconazole resistance.

[1]Student Presenter: Ty Moyer, B.S./M.S. Student
[2]Faculty Advisors: Scott E. Gygax, Ph.D.; Sean G. Chadwick, M.S. and Paula C. McCourt, Ph.D.

Generation of Multi-Purposed *Saccharomyces cerevisiae* Strain for Fermentation, Distillation, and Biodegradation for Biofuel Production

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- Basic Research

Abstract:
Saccharomyces cerevisiae is a yeast model system frequently used in the process of fermentation and distillation for making food and biofuel products. The model system utilizes alcoholic fermentation via anaerobic glycolysis, which metabolizes simple sugars (i.e. glucose) to an alcohol by-product. The source of simple sugars used in fermentation start from the breakdown of complex carbohydrates from grains and corn, which is enhanced with enzymes in a mixture called wort. 85% of waste from brewing and distillation consists of spent grain, primarily composed of long chain sugars. There is currently an underutilization of this waste product which serves mainly as animal feed. α-amylase can play a crucial role in breakdown of wort (specifically spent grain) as it functions through cleavage of long chain sugars. Here, we have designed a genetically engineered *S. cerevisiae* strain that will express and secrete α-amylase to aid in fermentation efficiency. The characteristics of the α-amylase enzyme from the filamentous fungi *Aspergillus niger* were found to contain the optimal activity characteristics (pH and temperature) needed in yeast fermentation conditions. The signal sequence of the *A. niger* gene was identified and primers were designed to replace it with the *S. cerevisiae* signal sequence from the secretory protein OST1. The engineered gene hybrid will be cloned and expressed within the pRS expression vector; then transformed into the *S. cerevisiae* W303-A1 strain and lastly tested for increased fermentation efficiency.

[1]Student Presenter: Trey Whiting, B.S Student
[2]Faculty Advisors: Paula C. McCourt, Ph.D., Sean G. Chadwick, M.S. and Scott E. Gygax, Ph.D.

Engineered CAR19 T-cells to Demonstrate In Vitro Antileukemia Activity

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- Basic Research

Abstract:
The Chimeric Antigen Receptor T-cells, also known as CAR T-cells is a revolutionary approach in cancer treatment. They are engineered T-lymphocytes and recombinant receptors for specific antigens and is mainly responsible for redirecting specificity, activation and function of T lymphocytes and/or other immune cells in a single molecule. It attaches on to the cancer cells thereby leading to the destruction of the tumor cells. The CAR T-cells are made up of different domains which includes, Antigen Binding Domain (CD19), Hinge and Transmembrane Region followed by Co-Stimulatory Domain (CD28) and T-cell Activation Domain (CD3). The Antigen Binding Domain recognizes the specific target on cancer cells. The Hinge and Transmembrane Region is responsible for the CAR signaling threshold and the amount of CAR signaling through the control of CAR expression level. The T-cell Activation Domain regulates the activation of T-cells, whereas the Co-stimulatory Domain plays a role for giving secondary signal for T-cell activation. The designing of CAR T-cells involves various steps which includes collection of patient's blood, followed by isolation of T-cells from it, activation/stimulation of patient's T-cells using CD3/CD28 activation beads along with addition of interleukin 2 which is used to enhance the efficiency of T-cell stimulation. Then the T-cells are genetically modified with CAR complex, thereby leading to the formation of CAR T-cells which are then expanded in laboratory and infused back into the patient's body to fight against leukemia tumor cells.

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