MEDIC FOUNDATION

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MEDIC'S MAGAZINE

SNEAK PEEK INTO THE LAB

LOW-COST DIABETES MEDICAL TECHNOLOGY

Our Diabetes team has moved into the second phase of the project, with the goal of developing a non-invasive and continuous monitoring system to detect early diabetic ketoacidosis (DKA). The team is working on compiling a scope review to highlight the lack of existing research in biomarkers which can be used for early DKA diagnosis.

GALVANIC VESTIBULAR TECHNOLOGY

GVS is a non-invasive brain stimulation technique that affects the firing of the vestibular system by conducting an electrical current to the mastoid process behind the ears through electrodes (2-pole system). The research has since evolved into a 3-pole system and our team aims to determine if 3-pole GVS induces improvement in motor performance when compared to 2-pole GVS.

MULTIMODAL CANCER PROFILER PRECISION MEDICINE

Our Cancer Research Team (CREPE) is contributing to work that attempts to identify biological patterns within cancer patients of various types. The team is progressing a software pipeline that works with pathological image representations from different types of cancer, which supports future analysis of the images to discover underlying patterns.

IBD/CROHN'S MONITOR PREDICTION SYSTEM

Our Crohn's and IBD Team have completed the preliminary rounds of research ana have been hard at work contacting doctors and professors for stakeholder engagement. Biomarker research is currently being done to establish and identify adequate detection tools for target. Our team is currently being trained on technical skills and generating concepts for the device.

FUTURE EVENTS

The Care Companion Program has started! Training took place on March 9th, and the volunteers are prepared to take the next steps in aiding the seniors in the broad community. These duties include sharing companionship with seniors, supporting them in simple tasks, and ensure that meaningful connections between the community.

With the influx of volunteer hirings, the initial obstacles have been overcome. Now, as volunteers are being trained, and relationships with senior homes been established, the anticipated start date for the program is sometime in late March. Preliminary shifts will happen over the summer, and further hiring will be conducted in the Fall.

The Care Companions program is launching in March! After some extensive hiring, the team assembled is incredibly excited to get the project underway. We currently have partnerships with several senior living homes across the Lower Mainland, and plan to incorporate more in the future.

Future Innovators is our next event! Rear more below. Successful STEM workshops have invigorated inspiration of the team, and more events of that incredible caliber can be expected. Stay tuned and subscribed to the newsletter!

FUTURE INNOVATORS CHALLENGE

Get ready for our next event! A case competition open to youth eager to get involved in the STEM field. Learn how to identify an issue, propose and research a plan, and apply these ideas from a socio-economic perspective. This event takes on a hybrid format, Details can be found on our website. Registration closes March 15th. the case will be released on March 15th. Workshops and mentoring will be provided virtually. Cases will be presented on March 23rd in person.

WORLD BIRTH DEFECTS DAY: REDUCE THE CHANCE

By: Simone Abraham

March 3rd is recognized annually as World Birth Defects Day. Statistics show that every year about 3-6% of infants worldwide are born with serious birth defects affecting millions of babies and families worldwide. These defects may include structural or functional anomalies that develop during intrauterine life and may be identified during pregnancy or only later in some cases. Common examples include heart defects, spina bifida, cleft lip/palate, and Down syndrome, which may be caused by genetic, infectious, nutritional, or environmental factors.

Birth defects are a leading cause of death, chronic illnesses, and long-term disability in infants and young children globally. The severity and impact of these birth defects depend on the body part it is involved in and how severe the defect is. Despite surviving it at a young age, individuals living with these conditions are at an increased risk for lifelong disabilities.

While not all birth defects are preventable, proactive measures can significantly reduce their likelihood. Women can increase their chances of having a healthy baby by managing any pre-existing medical conditions and adopting healthy behaviours before and during pregnancy. Avoiding the consumption of substances such as cigarettes, alcohol, and drugs and reducing exposure to chemicals and infectious

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diseases during pregnancy can help reduce the chances of these defects. Maintaining a healthy weight can further reduce the likelihood of serious birth defects.

Consulting a doctor, before planning a pregnancy can help ensure that prenatal care is taken promptly. Regular medical checkups can help ensure that pre-existing medical conditions are kept under control, as certain conditions such as diabetes have been linked to an increased risk of birth defects. Screening and tests like an ultrasound can help with early diagnosis of birth defects before a baby is born empowering families to make informed decisions and plan accordingly. Additionally, taking folic acid can help prevent major birth defects of developing brain and spine defects like anencephaly and spina bifida.

Babies born with birth defects often require special care to prevent their conditions from worsening over time. Early intervention can help improve the survival rate of these babies. Education about the child's condition equips families to provide the best care possible and get support from the relevant healthcare specialists. Current treatment options include surgery, assistive devices, and physical and speech therapy. Looking ahead, advancements in the field of gene therapy have the potential to block or replace the genes causing these birth defects, improving the survival rates of children born with these defects.

Learn more here:
https://www.who.int/southeastasia/news/events/world-birth-defects-days

https://www.cdc.gov/ncbddd/birthdefects/documents/10thingsflyereng.pdf

https://medlineplus.gov/birthdefects.html

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WORLD HEARING DAY: THE SOUND OF SILENCE

By: Mihika Mishra

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World Hearing Day, observed annually on March 3rd, serves as a platform to address the challenges surrounding hearing health worldwide. The goal is to combat deeply entrenched societal misconceptions and stigmas associated with hearing impairment by fostering global awareness and advocating for comprehensive ear and hearing care.

A staggering 80% of ear and hearing care needs remain unmet globally, underscoring the urgency of the issue. This year's theme, "Changing Mindsets: Let's Make Ear and Hearing Care a Reality for All," highlights the importance of shifting societal attitudes and prioritizing universal access to essential hearing services.

The ramifications of untreated hearing loss can be noted across various facets of life, manifesting in communication barriers, social isolation, and educational disparities. Children deprived of adequate hearing interventions may encounter obstacles in accessing education, while adults with hearing impairment face disproportionately higher rates of unemployment.

Hearing loss, characterized by auditory thresholds below 20dB in both ears, ranges from mild to profound, with implications for auditory function in one or both ears. Common challenges include difficulty discerning conversational speech and loud noises. Profound hearing loss, or deafness, signifies severe hearing impairment, often resulting in minimal to no hearing.

Estimates show the true gravity of hearing impairment, with an estimated 2.5 billion individuals anticipated to be affected by

2050, necessitating hearing rehabilitation for at least 700 million. Alarmingly, over one billion young adults are susceptible to irreversible hearing loss due to unsafe listening practices.

A multitude of factors contribute to hearing impairment, spanning prenatal, perinatal, and adulthood stages. Infections during these critical periods, genetic predispositions, prolonged exposure to loud environments, and age-related sensorineural degeneration can all result in auditory deficits. However, preventive measures such as immunizations, prompt treatment of ear infections, and adherence to safe listening practices offer pathways to mitigating hearing loss.

Numerous interventions exist to address hearing impairment, encompassing the utilization of hearing aids, cochlear implants, speech therapy, sign language proficiency, and the provision of assistive technologies. Moreover, supportive services such as sign language interpretation and captioning facilitate inclusivity across educational, occupational, and community settings, enhancing quality of life for individuals with hearing impairment.

Learn more here:
https://www.who.int/campaigns/world-hearing-day/2024

https://www.who.int/news-room/fact-sheets/detail/deafness-and-hearing-loss


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DID YOU KNOW?

Globally, 34 million children have hearing loss or hearing defects. However, of this large number, only a small fraction are given the opportunity to receive treatment or help. Hearing aids and cochlear implants, which can be used for some forms of hearing loss, can be incredibly expensive. While more common in developed countries, many families have difficulty accessing these treatments. As a result, families are forced to make lifestyle changes to help suppport their child who is hard of hearing, a feat that is not easy to accomplish and achieve/

Learn more here:
https://www.who.int/health-topics/hearing-loss#tab=tab_1

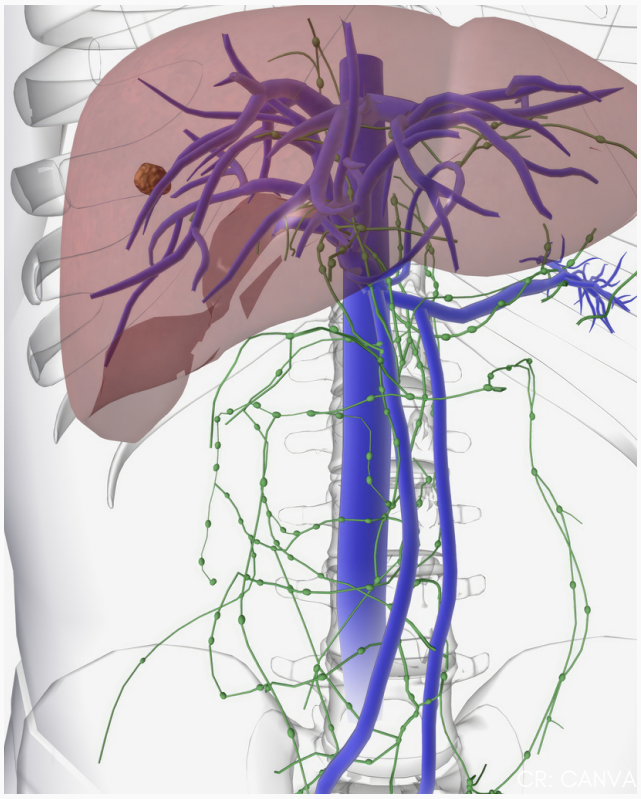
LIVER HEALTH MONTH: A VACCINE TO HELP CANCER

By: Simone Abraham

March is celebrated as Liver Health Month in Canada, a month dedicated to spreading awareness about liver diseases and their underlying causes. Recent studies have revealed that 1 in 4 Canadians may be affected by liver disease. “Liver Disease” is a term that refers to a variety of diagnoses including Hepatitis B and C, Liver Cancer, Non-Alcholic Fatty Liver Disease, Autoimmune liver diseases, Cirrhosis, liver diseases affecting children, and more. Notably, Non-Alcholic Fatty Liver Disease plagues over 7 million Canadians, while Biliary Atresia stands as the leading cause of liver failure in children. Moreover, liver cancer is swiftly emerging as one of the deadliest forms of cancer in Canada.

There are over 100 liver diseases caused by a variety of factors including viruses, toxins, genetics, alcohol, and other unknown causes. A common misconception is that all liver diseases are alcohol-related, however, this is not the case and there are many other ways kinds of liver disease and many other ways in which it can be developed. Since liver disease often shows no symptoms, people don’t realize it until it's too late, making chances of recovery more difficult.

A significant breakthrough in liver cancer treatment was found in a recent study conducted at UC Davis, shedding light on the potential of Bacillus Calmette-Guérin



p(BCG), a vaccine primarily used to combat tuberculosis (TB), as a novel immunotherapeutic approach for liver cancer. This study showed that a single dose of BCG administered subcutaneously in mice led to a reduction in liver tumor volume and an extension of survival rates, marking the first instance of the promising effects of the vaccine in treating liver cancer. BCG not only diminished tissue scarring (fibrosis), but also enhanced liver function, reduced liver lipid accumulation, and shrunk tumors.

Hepatocellular carcinoma (HCC), one of the predominant forms of liver cancer, is typically treated with surgery, radiotherapy, chemotherapy, immunotherapy, and liver transplant however the survival rate remains bleak. The study found that a single dose of BCG vaccine in mice activated the body’s

immune system and reduced tumor load. The vaccine reduced inflammation and allowed the infiltration of CD4+ and CD8+ T cells and M1 macrophages, crucial components of the immune system that fight cancer cells.

These findings reveal the transformative potential of the BCG vaccine in revolutionizing the treatment approach for HCC. Future studies are important to understand the optimal dosage requirements, frequency of administration, and timing to maximize its efficacy against liver cancer. This groundbreaking research leads to new ways to treat this growing health issue.

Learn more here:
https://www.liver.ca/we-are-liver/lhm/

https://www.liver.ca/patients-caregivers/liver-diseases/#:~:text=Non%2Dalcoholic%20fatty%20liver%20disease,affecting%20over%207%20million%20people.

https://health.ucdavis.edu/news/headlines/tb-vaccine-shrinks-liver-cancer-tumors-in-mice/2024/02

COLORECTAL CANCER: WORKING TO A CURE

By: Mihika Mishra

The groundbreaking research conducted by Dr. Yannick Benoit, Associate Professor in the Department of Cellular and Molecular Medicine at the University of Ottawa, has revealed a remarkable potential for the drug vanoxerine. Originally designed to combat cocaine addiction, vanoxerine has demonstrated promising capabilities in suppressing advanced colorectal cancer stem cells.

Colorectal cancer arises from uncontrolled cell growth and division in the colon or rectum. It often does not manifest in symptoms during the early stages. Consequently, often diagnosed in advanced stages when treatment options are limited, vanoxerine presents a beacon of hope by disrupting cancer stem cell activity, thus enhancing the effectiveness of treatment.

Vanoxerine operates by targeting the protein responsible for dopamine transport and inhibiting the enzyme G9a within colorectal tumors. This mechanism not only increases susceptibility to immune system attacks but also triggers the reactivation of ancient viral DNA fragments embedded within the genome, a process critical for enhancing the tumor's vulnerability. Moreover, vanoxerine exhibits minimal toxicity, as evidenced by testing on healthy human and mouse tissues. This aspect of safety underscores its potential as a viable treatment option for colorectal cancer, a disease known for being the world's second-leading cause of cancer-related deaths.

Vanoxerine's multifaceted action includes the inhibition of dopamine uptake in the brain, contributing to its efficacy in treating substance use disorders. Furthermore, it suppresses the repressive histone modification H3K9me2, which is known to be an epigenetic marker for cancer stem cells.

By downregulating the enzyme G9a HMTase, vanoxerine not only hampers cancer stem cell functions but also facilitates immune cell infiltration into colorectal tumors. This dual action disrupts the intricate networks that sustain cancer stemness, which is the ability of stem cells to give rise to differentiated cells, thereby hindering tumor progression.

While other compounds targeting G9a activity exist, vanoxerine stands out for its perior usage and familiarity, efficacy and safety record. Unlike its counterparts, vanoxerine holds promise for clinical application, offering a potential safe cure for patients battling advanced colorectal cancer.

Learn more here:
https://www.uottawa.ca/about-us/media/news-all/drug-used-cocaine-addiction-may-pave-way-new-treatment-advanced-colon-cancer

https://www.nature.com/articles/s43018-024-00723-2#:~:text=A%20study%20now%20shows%20that,increased%20infiltration

https://www.nature.com/articles/s43018-024-00727-y

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INTERNATIONAL WOMENS DAY: A LOOK INTO STEM

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By: Gina Zhang

Throughout history, women have played pivotal roles in shaping the landscape of scientific discovery, yet their contributions have often been overshadowed or marginalized. Despite facing systemic barriers and societal prejudices, women have defied expectations, shattered stereotypes, and revolutionized various fields of science. This essay delves into the remarkable journey of women in science, highlighting their achievements, challenges, and the ongoing pursuit of gender equality within STEM disciplines.

From ancient times to the modern era, women have made significant strides in scientific inquiry. Hypatia of Alexandria, a mathematician and philosopher in the 4th century, stands as one of the earliest known female scholars in the field of science. Her groundbreaking work in mathematics and astronomy paved the way for future generations of scientists. Despite enduring immense pressure in a male-dominated society, Hypatia's unwavering dedication to learning and discovery remains an enduring symbol of resilience and intellectual prowess.

However, it was not until the 19th and 20th centuries that women began to gain greater recognition and acceptance in scientific circles. Figures like Marie Curie, whose pioneering research in radioactivity earned her two Nobel Prizes, broke through barriers to become icons of scientific achievement. Curie's and relentless determination in the face of adversity serve as an inspiration to aspiring female scientists worldwide. Her marked and famous legacy underscores the importance of gender inclusivity and diversity in scientific endeavours.

Despite these trailblazers, women in science continue to encounter numerous obstacles, including gender bias, discrimination, and lack of representation. The "leaky pipeline" phenomenon, wherein women are disproportionately lost at various stages of their scientific careers, remains a persistent challenge. Stereotypes and societal expectations often deter young girls from pursuing STEM subjects, perpetuating the gender gap in these fields. Additionally, workplace environments that are hostile or unwelcoming to women further exacerbate these disparities, hindering their professional advancement and stifling their contributions to scientific knowledge.

Efforts to address these issues and promote gender equity in science have gained momentum in recent years. Initiatives aimed at increasing the participation and retention of women in STEM, such as mentorship programs, networking opportunities, and diversity initiatives, have begun to yield positive results. Organizations and institutions are increasingly prioritizing gender-inclusive policies and practices to create more inclusive and supportive environments for women scientists. Moreover, the visibility of female role models and advocates in science serves to inspire future generations and challenge prevailing stereotypes.

Learn more here:
https://www.aauw.org/resources/research/the-stem-gap/

CREDITS

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