2023 CANADA GAIRDNER AWARDS RECOGNIZE WORLD-RENOWNED SCIENTISTS FOR TRANSFORMATIVE CONTRIBUTIONS TO RESEARCH IMPACTING HUMAN HEALTH

TORONTO, ON (March 30, 2023) – The Gairdner Foundation is pleased to announce the 2023 Canada Gairdner Award laureates, recognizing some of the world's most significant biomedical and global health research and discoveries.

"Congratulations to all the 2023 Canada Gairdner Award recipients! The ground-breaking work of this year's laureates has resulted in innovative, globally accessible tools to fight diseases and improve our well-being. The work of two Canadian researchers – Dr. Christopher Mushquash and Dr. Gelareh Zadeh especially stands out. Dr. Zadeh's research to better understand brain tumours and Dr. Mushquash's research on Indigenous-led mental health and substance use will be transformative in improving the quality of life of so many here in Canada and around the world."

- The Honourable Jean-Yves Duclos, Minister of Health

"Our government knows that in order to create a better future for all, we need to foster the research that will improve human health around the globe. It is why I want to congratulate the 2023 Canada Gairdner Awards recipients showcasing international excellence in science and research. I'm proud to highlight the two Canadians awarded for their world-class achievements including improving our understanding of brain tumour treatments and providing culturally appropriate mental health services for First Nations."

- The Honourable François-Philippe Champagne, Minister of Innovation, Science and Industry

"I wish to congratulate this year's award recipients for their groundbreaking research and the profound contributions that their discoveries will have. It is specifically noteworthy to see Dr Christopher Mushquash as a recipient of the 2023 Canada Gairdner Momentum Award. Chris's contributions to our understanding of mental health amongst Indigenous communities are already profoundly affecting the needs of Indigenous peoples. As a member of CIHR's Institute for Indigenous Peoples Health Advisory Board, Chris has provided the same critical thinking to advancing Indigenous research in Canada."

- Dr. Michael J. Strong, President of the Canadian Institutes of Health Research

2023 Canada Gairdner International Award
The five 2023 Canada Gairdner International Award laureates are recognized for seminal discoveries or contributions to biomedical science:

Demis Hassabis, PhD CBE FRS FREng

Founder & CEO, DeepMind; AlphaFold Project Lead

John Jumper, PhD, MPhil

AlphaFold Lead and Senior Staff Research Scientist, DeepMind

Awarded "For developing AlphaFold, which has been heralded as an AI-based solution to the 50-year grand challenge of protein structure prediction and has culminated in the release of the most accurate and complete picture of the structure of the proteome, with enormous potential to accelerate biological and medical research."

The Work:

Proteins are essential to life, supporting practically all its functions. They are large complex molecules, made up of chains of amino acids, and what a protein does largely depends on its unique 3D structure. Figuring out what shapes proteins fold into from their amino acid sequence is known as the 'protein structure prediction problem' and has stood as a grand challenge in biology for the past 50 years. With their team at DeepMind, Demis Hassabis and John Jumper have developed the artificial intelligence (AI) system AlphaFold, which today can predict the structure of a protein, at scale and in minutes, down to atomic accuracy.

Hassabis had long suspected that protein structure prediction might be the perfect problem for AI to tackle. He was the project leader on the AlphaFold project from its inception in 2016 to its conclusion, and recruited Jumper to the project in late 2017. In 2018 the team was expanded, with Jumper becoming the new research lead, with the goal to re-design the system with a completely new architecture into what would become AlphaFold2. Together they co-supervised the subsequent projects to create the most accurate and complete picture of the human proteome and predict the structures of nearly all known proteins, and released an open-access database to make all of AlphaFold's predictions freely available to the scientific community.

In a major scientific advance, in 2020 AlphaFold2 was recognized as a solution to the 50-year grand challenge of protein structure prediction by the organizers of the biennial Critical Assessment of Protein Structure Prediction (CASP).

The Impact:

AlphaFold has culminated in the creation of structure predictions for over 200 million proteins - nearly every protein known to science - which DeepMind have made freely available through the AlphaFold Protein Structure Database (AlphaFold DB).

Designed in partnership with European Molecular Biology Laboratory - European Bioinformatics Institute (EMBL-EBI), the AlphaFold DB serves as a 'google search' for protein structures,

providing researchers with instant access to predicted models of the proteins they're studying, which has the potential to accelerate every field of study in biology.

Since launch, the AlphaFold DB has already been accessed by 1 million researchers and users in 190 countries. The program dramatically reduces the time scientists typically spend determining protein structure and demonstrates the impact AI can have on scientific discovery and its potential to accelerate progress in some of the most fundamental fields that explain and shape our world. Further, this research will help to better our understanding of disease, and accelerate the development of new targeted drugs.

Bonnie L. Bassler, PhD
Squibb Professor and Chair, Department of Molecular Biology, Princeton University; Howard Hughes Medical Institute Investigator

E Peter Greenberg, PhD
Eugene and Martha Nester Endowed Professor of Microbiology, Department of Microbiology and Molecular & Cellular Biology Program, University of Washington School of Medicine

Michael R. Silverman, PhD
Emeritus Investigator, The Agouron Institute; Emeritus Adjunct Professor, Scripps Institution of Oceanography

Awarded "For their discoveries of how bacteria communicate with each other and surrounding non-bacterial cells, providing a new paradigm for how microbes behave and yielding novel avenues for therapeutics against infectious diseases."

The Work:

Bacteria are found everywhere from soil to water to the human body. Despite their simple single-cell forms, bacteria are sophisticated organisms that are remarkably adaptable to changing conditions. Bacteria play crucial roles in medicine, both as members of the microbiome, increasingly understood to contribute to human health, and as major causes of disease. The discovery of how bacteria communicate with one another, coined "quorum sensing" by Dr. Greenberg and his colleagues, is foundational. Drs. Bassler, Greenberg and Silverman are awarded for a combined body of work that spawned an unexpected field in microbiology and are also recognized for their individual discoveries that underpin its implications for all of biology, human health and disease.

Quorum-sensing studies began with an obscure bioluminescent marine bacterium called *Vibrio fischeri*. In the 1970s, Dr. J. Woodland Hastings and colleagues described a signaling chemical of then unknown structure that stimulated collective glowing after the *Vibrio fischeri* bacteria had

reached a particular population density. This finding was one of the first clues that bacteria could communicate using chemical "words", but it lay dormant for a decade until Silverman, exploiting the power of genetics, identified the genes involved in this signaling pathway and characterized their functions. Silverman's elegant analyses of the role each component played provided the world's first quorum-sensing circuit and the foundation for thousands of similar circuits identified later.

Widely thought to be a function specific to *Vibrio fischeri*, this phenomenon did not initially gain much traction. Indeed, the idea that bacteria could communicate was deemed highly improbable. But Greenberg was intrigued and trained with Hastings before he later independently further characterized the genes Silverman had identified, and discovered a similar quorum sensing signal that controlled virulence in the pathogenic bacterium *Pseudomonas aeruginosa*. The term "quorum sensing" was born as he demonstrated that this phenomenon was indeed bacterial communication, and not isolated to *Vibrio fischeri*. He not only showed that other bacteria exhibited quorum sensing, but he also discovered nearly all major steps in its mechanism.

It was Bassler who then brought Hastings' and Silverman's findings to an unprecedented level by showing that quorum sensing is not an exception but the rule in the bacterial world. What's more, the principal reason bacteria are so successful is that they rarely act alone. Quorum sensing turns out to be essential to many aspects of bacterial virulence and antimicrobial resistance. Initially with Silverman then later independently, Bassler discovered entirely new types of quorum-sensing signal molecules, mechanisms of detection and response to those molecules, and the profound influence quorum sensing exerts over the behaviour of many bacterial species. Moving to the human health front, Bassler demonstrated that it was possible to hijack quorum-sensing mechanisms to control virulence in globally important pathogens. She also made the stunning discovery that quorum-sensing communication is not restricted to bacteria. She found that bacteria can communicate across species and, moreover, quorum sensing underlies bacterial interactions with viruses and other types of cells. For example, she showed that human gut cells use quorum sensing to communicate with resident microbiome bacteria to defend the body against invading pathogens.

The Impact:

A new field of microbiology has emerged and the discoveries of Bassler, Greenberg and Silverman are at the heart of it, shaping and defining the field we now know as quorum sensing. They have independently and collaboratively revolutionized the way we think about bacteria, completely overturning the paradigm that bacteria act independently of each other.

The originality and elegance of their work led to novel and unexpected discoveries in the field time again, laying the groundwork for a deeper understanding of the microbial world with clinical ramifications that are being realized today. For example, Greenberg's work showed promise in targeting difficult infections such as those associated with cystic fibrosis and Bassler's

small-molecule therapies are much less vulnerable to development of antimicrobial resistance than are traditional antibiotics because her strategies target the quorum-sensing mechanism rather than bacterial growth. With the recent recognition that microbes are foundational to the vitality of all corners of the biosphere, understanding their biology is crucial. Bassler's work in particular has provided vital mechanistic underpinnings that foster a growing understanding of the human microbiome, the niches in which different organisms thrive, and how behavior and competition within these niches is affected during disease.

All of this serves as pivotal in understanding how the microbiome influences our health and wellbeing and provides insight into novel ways to harness microbial communities to promote health and prevent disease. Bassler, Greenberg and Silverman have undoubtedly paved the way for unprecedented new possibilities for biological solutions to the world's most pressing problems in health, food, energy, and the environment.

2023 John Dirks Canada Gairdner Global Health Award

The 2023 John Dirks Canada Gairdner Global Health Award laureate is recognized for outstanding achievements in global health research:

José Belizán, MD, PhD

Senior Scientist, Department of Research in Maternal and Child Health, Institute for Clinical Effectiveness and Health Policy (IECS) Argentina; Superior Researcher at the National Scientific and Technical Research Council of Argentina (CONICET); Researcher, Bone Biology Laboratory, School of Medicine, University of Rosario, Argentina.

Awarded "For the development of innovative, evidence-based and low-cost global interventions in maternal and child health during the perinatal period that improve wellbeing and care during pregnancy, reduce morbidity and mortality, and promote equity in vulnerable populations."

The Work:

Dr. José Belizán is a trailblazer in the field of maternal and child health research in Latin America and internationally, focused on the perinatal period and its relevance to community health and the life cycle. His work spans basic research to international clinical studies, demonstrating the full cycle of scientific effort and leading to innovative, evidence-based and low-cost interventions. These interventions promote equity by improving maternal and child health in vulnerable populations. Through his work within these communities, he educates and empowers pregnant people, and witnesses real life health problems, which informs his outstanding scientific contributions.

Dr. Belizán discovered the connection between calcium intake and a decrease in the risk of hypertensive disorders of pregnancy (HDP) by observing Guatemalan Mayan women, where the prevalence of HDP was low, and their traditional cooking methods. Taking his observations further, he led numerous animal and human studies to confirm the association and basic studies to explain the mechanisms. He then planned and implemented international clinical trials in underdeveloped and developed country settings, which led to policy formulations at the highest international level and grassroots efforts to improve adherence to these guidelines.

This is just one of many examples of his extensive and comprehensive work to improve the wellbeing and care of people during pregnancy and interventions to reduce severe maternal morbidity and mortality. Dr. Belizán was the first to document, as well as design, test and implement landmark interventions addressing the issue of unnecessary increased use of Caesarean section. This is a complex and multifactorial challenge affecting not only high-income but also low- and middle-income countries, where associated risks can extend many years beyond delivery and are higher in those with limited access to comprehensive obstetric care. His research has also led to the decrease in unnecessary routine episiotomy worldwide, including in Canada and the US.

The Impact:

Dr. Belizán has undoubtedly improved maternal and childbirth outcomes and made a difference in the lives of pregnant people and their children. His discovery of the importance of calcium intake alone has significant potential as three billion people lack access to adequate calcium intake worldwide. Reaching the scientific community, health systems decision-makers, international organizations, practitioners, health-care providers and local communities, he has overturned practices, introduced more effective and equitable practices, and spearheaded global policies that will contribute to more equitable societies. His work has informed various World Health Organization recommendations, which have been adopted by many countries around the world. Dr. Belizán goes above and beyond, ensuring that these best practices are known and used at the community level.

As an international expert, Belizán's innovation and rigorous research from basic science to implementation has had a profound impact on global health and motivated researchers' careers and actions worldwide over the last five decades. His work has sparked and will continue to lead to important developments in this sector as he demonstrates the importance of representation from low- and middle-income countries in global health research.

2023 Canada Gairdner Momentum Award

The 2023 Canada Gairdner Momentum Award laureates are mid-career investigators recognized for exceptional scientific research contributions with continued potential for impact on human health.

Christopher Mushquash, Ph.D., C.Psych

Professor, Department of Psychology, Lakehead University; Psychologist, Dilico Anishinabek Family Care; Vice President Research, Thunder Bay Regional Health Sciences Centre; Chief Scientist, Thunder Bay Regional Health Research Institute

Awarded "For Indigenous-led mental health and substance use research that leads to culturally and contextually appropriate services for Indigenous children, adolescents, and adults."

The Work:

Dr. Christopher Mushquash brings together his clinical experience as a psychologist and his community-based participatory approach to research to meet community needs and improve systems and services that make a difference in people's lives. His innovative work focuses on Indigenous mental health and substance use through evidence-based practices that align with First Nations values. This approach ensures his research and its outcomes are culturally and contextually appropriate for people in First Nations, as well as those in rural and northern communities. Through large team collaborations and partnerships with communities, government and academia, Dr. Mushquash addresses various aspects of mental health for Indigenous communities, such as mental health, substance use, trauma, and general mental wellness. The overarching goals of his research are rooted in the four interconnected directions and include identifying culturally and contextually appropriate targets of intervention, developing methods of measuring community outcomes; developing and testing of interventions that incorporate culture-based knowledge with scientific methods; and the sharing of knowledge among Indigenous and academic communities, clinicians, and policymakers. These themes come together to form a holistic framework to improve not only systems and services but also research involving Indigenous communities. By putting the communities at the forefront of his work, Dr. Mushquash demonstrates the importance of understanding unique contexts and issues experienced by individuals in Indigenous communities. He has effectively shifted the relationship between communities and researchers, enabling more meaningful and relevant research and advancing the understanding of mental health in Indigenous communities. Systems and services are thus better equipped to address the needs of Indigenous, rural and northern communities in a culturally- and contextually-appropriate manner.

The Impact:

Dr. Mushquash champions culturally and contextually appropriate mental health and substance use services for Indigenous communities. His high-calibre work has improved the lives of many Indigenous communities and influenced national mental health and addiction understandings as he brings together western and Indigenous methodologies. His team conducted the first Canadian study of adverse childhood experiences in First Nations adults seeking residential treatment for substance use difficulties. The outcomes enhanced the understanding of the nature of developmental and intergenerational trauma in First Nations people and improved clinical care

for those with substance use difficulties. His research has also upended conventional understandings of mental health in Indigenous families and established best practices for engaging Indigenous people in research. Furthermore, his research has directly influenced federal funding policy in remote First Nations communities. As a leader in his field, Dr. Mushquash has advanced mental health across Canada, garnering various awards, honours and appointments in recognition of his research and clinical expertise. His devotion to the profession and Indigenous mental health can be seen in the impact of his work in changing Canadian policy, educating professionals working with First Nations people, and, more importantly, bettering the quality of life and care of many Indigenous youth and communities.

Gelareh Zadeh, MD, PhD, FRCS(C), FAANS

Professor and Neurosurgery Division Chair, Dan Family Chair in Neurosurgery, Wilkins Family Chair in Brain Tumor Research, Department of Surgery, Temerty Faculty of Medicine, University of Toronto; Head, Division of Neurosurgery, Toronto Western Hospital, Sprott Department of Surgery, University Health Network; Co-Director, Krembil Brain Institute, University Health Network; Senior Scientist, Princess Margaret Cancer Centre, University Health Network

Awarded "For advancing the molecular and genomic understanding of brain tumours, leading to better ways of discriminating, classifying and managing brain tumour subtypes with potential to transform the clinical care of the disease."

The Work:

Dr. Gelareh Zadeh is a neurosurgeon and senior scientist who combines her in-depth clinical knowledge of brain cancer with clinical and translational research to improve the diagnosis and management of adult brain tumours. Dr. Zadeh's research program applies advanced genomic and epigenomic profiling to further our understanding of the molecular regulators of brain tumours and to develop tools that can refine biomarkers of diagnosis to predict treatment responses and ultimately, improve patient outcomes.

Dr. Zadeh's research focuses on advancing knowledge of brain tumours through integration of multiple platforms of genomic analysis. This includes her research incorporating the largest-ever data analysis of meningiomas—the most common type of brain tumour, which has limited treatment options. She co-founded and leads the International Consortium on Meningiomas (ICOM), which provides researchers around the world with access to meningioma samples and data sets, as well as research expertise and collaborations. ICOM also helps to raise awareness of the importance of research funding into this disease. Dr. Zadeh's discoveries in this field have led to new classification criteria that are biologically and clinically relevant, with the potential to outperform the current standard classification system developed by the World Health Organization. Specifically, her research has shown that meningiomas can be classified into four molecular groups, which reveals biological insights into how the cancer behaves. Using molecular features that reflect tumour behavior, the new classification criteria more accurately

predicts cancer recurrence. Dr. Zadeh's lab has also produced a comprehensive body of work on neuronal tumours, including schwannomas and peripheral nerve tumours. By performing the first integrated molecular analysis of schwannomas, her group established the genomic and epigenomic road map for sporadic and neurofibromatosis type 2 (NF2)-related schwannomas and identified a novel fusion protein that can be used for diagnostic, prognostic and therapeutic benefit. Similarly, Dr. Zadeh's research has shown that the transformation of benign neuronal tumours to malignant cancers occurs via two independent molecular pathways, both of which can be therapeutically targeted. Another key contribution of her work has demonstrated the utility of plasma-based biomarkers for diagnosis, discrimination and determination of response to treatment, for a wide variety of brain tumours.

The Impact:

Dr. Zadeh exemplifies an extraordinary commitment to advancing our understanding of brain tumour biology to improve patient outcomes. Her team has made significant strides in understanding how molecular features influence tumour management and has identified novel approaches to reduce the negative side effects of brain tumour treatments. Additionally, her team has identified plasma biomarkers that can help to diagnose intracranial tumours, predict treatment response and detect early recurrence, as well as potential drugs to treat malignant brain tumours. Her work is having a considerable impact in the diagnosis and clinical management of brain tumours and is giving hope to individuals affected by brain cancer.

About the Gairdner Foundation:

The Gairdner Foundation, established in 1957, is dedicated to fulfilling James A. Gairdner's vision to recognize major research contributions to the treatment of disease and alleviation of human suffering. Through annual prestigious Canada Gairdner Awards, the Gairdner Foundation celebrates the world's most creative and accomplished researchers whose work is improving the health and wellbeing of people around the world. Since its inception, 410 awards have been bestowed on laureates from over 40 countries, and of those awardees, 96 have gone on to receive Nobel Prizes.

The Gairdner Foundation believes in coming together to openly discuss science to better engage the public, understand the problems we face, and work together to find solutions. Since its founding, a number of outreach events and programs have been developed with the goal of inspiring the next generation of scientific innovators and fostering an informed society.

https://gairdner.org/

For further information please contact:

Sommer Wedlock

Executive Vice President

Gairdner Foundation

Mobile: (647) 293-6785

sommer@gairdner.org

Jordana Rosen

Communications Advisor

Gairdner Foundation

Mobile: (647) 554-9157

jordana@gairdner.org