

2026 CANADA GAIRDNER AWARD WINNERS

Explore the science behind today's biggest
breakthroughs



ABOUT GAIRDNER

The mission of the Gairdner Foundation is to celebrate, inform and inspire scientific excellence around the globe.

Established in 1957, the Gairdner Foundation 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 the prestigious annual Canada Gairdner Awards, the Foundation celebrates the world's most creative and accomplished researchers whose work is improving the health and wellbeing of people around the world. **The Canada Gairdner Awards are recognized internationally as being among the most prestigious in the world, based on our reputation for rigorous review and early recognition of breakthroughs in science.**

The Gairdner Foundation brings people together to openly discuss science in order to better engage the public, understand the problems we face, and work together to find solutions. Through Gairdner Connects, our national outreach program, we bring science to communities across Canada to inspire future innovators and spark public dialogue about the role of research in addressing the world's most pressing health challenges.

BY THE NUMBERS

- 5** CANADA GAIRDNER **International Awards**
For excellence in biomedical research
- 2** PETER GILGAN CANADA GAIRDNER **Momentum Awards**
For mid-career investigators with exceptional research
- 1** JOHN DIRKS CANADA GAIRDNER **Global Health Award**
For outstanding achievements in global health research

443 AWARDS to scientists from over **40** countries

103
Gairdner awardees have gone on to win the **Nobel Prize**



20 CANADIAN UNIVERSITIES | **6000+** ENGAGING students and researchers annually through outreach programs that give Canadians access to world-renowned scientists



ABOUT THE COLLECTION

This article is part of a larger collection introducing the discoveries of the 2026 Canada Gairdner Award winners, among the world's leading biomedical and global health researchers. From the inner workings of our cells to new approaches to preventing disease and improving treatment, these stories explore research shaping the future of human health.

To explore the other stories in this series, [check out the full collection here](#). By viewing the full collection, you'll discover the science behind this year's award-winning research and explore big questions such as:

- How can viruses help us fight antibiotic-resistant bacteria?
- How can technology help regulate blood pressure after spinal cord injury?
- How can we stop misfolded proteins from causing disease?
- How can scientists identify, measure and study thousands of proteins?
- How can scientists use 3D images to see inside cells?
- How can oral vaccines help prevent cholera?

ABOUT THE CREATORS

Each article was written by Gairdner student intern **Leanne Cherry**, an undergraduate student at McGill University studying Cognitive Science and Communication Studies, and developed in collaboration with the Award winners themselves. Passionate about science communication, Leanne is interested in making research accessible and combating science and health misinformation.

The articles were also reviewed by the students from the **Canadian Association of Girls in Science (CAGIS)**, whose thoughtful feedback helped make these stories clear, accurate and engaging for young readers.

Illustrations were created by **Heather Ng-Cornish**, an illustrator and communicator based in Ontario. Heather brings her science communication experience to her illustrations, creating clear, colourful and accessible visuals that help bring scientific ideas to life. To see more of her work, visit www.heatherngcornish.com

The Gairdner Foundation is committed to sharing the excitement of discovery with people of all ages. We hope this collection sparks your curiosity, encourages you to ask big questions, and inspires you to imagine the discoveries still waiting to be made.



LEANNE
CHERRY



HEATHER
NG-CORNISH



FROM DISCOVERY TO DISTRIBUTION: BRINGING THE ORAL CHOLERA VACCINE TO THE WORLD

JOHN DIRKS CANADA GAIRDNER GLOBAL HEALTH
AWARD WINNERS

Prof. John D. Clemens

Senior Scientific Advisor to the Director General, International Vaccine Institute, Seoul, South Korea; Adjunct Professor of Epidemiology, UCLA Fielding School of Public Health, Los Angeles, United States

Dr. Jan Holmgren

Senior Professor, Sahlgrenska Academy, University of Gothenburg, Sweden

SUMMARY

Over the past 40 years, Drs. John D. Clemens and Jan Holmgren have worked together to develop the only oral cholera vaccines approved by the World Health Organization (WHO). Cholera is a bacterial disease that causes diarrhea and is often spread through contaminated water. If not treated quickly, cholera can be deadly, particularly in lower income countries where access to clean and safe water may be limited. Throughout their careers, Clemens and Holmgren have devoted themselves to developing and distributing oral cholera vaccines. They have also carried out large studies to demonstrate how well the vaccines work. Their work has saved countless lives and has fundamentally changed how global health organizations respond to cholera.

STUDENT REVIEWERS:



CELINE
Grade 9



HARGUN
Grade 9



RHYTHM
Grade 7



ROSE
Grade 8

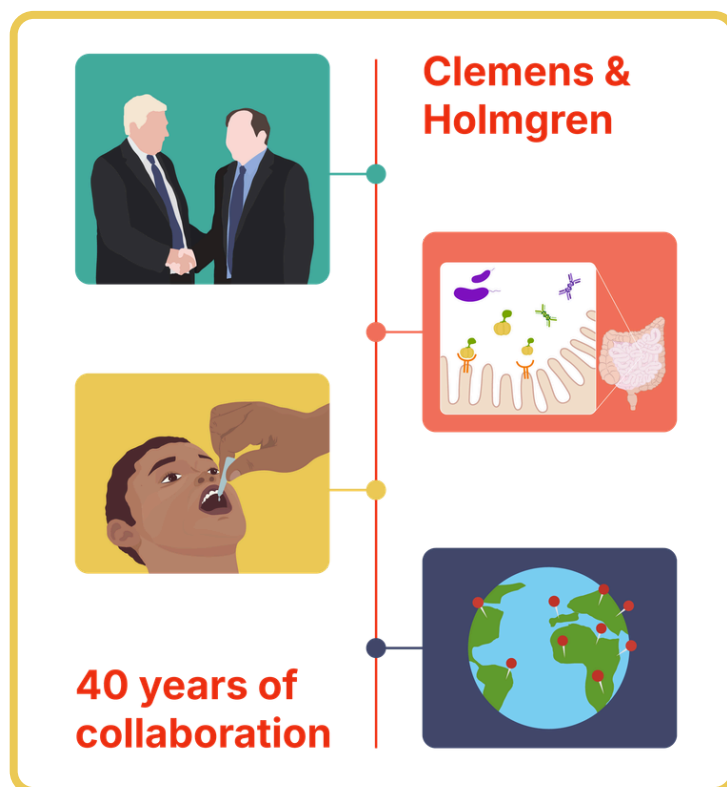
When we hear about major scientific achievements, we sometimes forget about the years of research and hard work that a team has to endure before reaching a breakthrough. Drs. John D. Clemens and Jan Holmgren remind us that continuous effort and perseverance in science can have extraordinary payoff for everyone involved. After four decades of research and collaboration, these researchers have given the world safe, inexpensive, and effective oral vaccines against cholera.

Cholera is a bacterial infection that causes severe diarrhea and vomiting after ingesting contaminated water. It can lead to life-threatening dehydration, especially in children, if it is not treated quickly. Thanks to functional **sanitation systems**, the bacteria that cause cholera, *Vibrio cholerae*, has been nearly eradicated in developed countries.

However, in developing parts of the world, where many people lack reliable access to clean water and healthcare services, cholera continues to pose a serious public health challenge. Outbreaks are especially common during periods of war and environmental crises, such as floods and cyclones, that disrupt water and sanitation systems.

Clemens and Holmgren have long understood the severity of cholera and have dedicated a significant portion of their careers to developing, distributing, and studying the impacts of **oral cholera vaccines (OCVs)**. John Clemens is an **epidemiologist** while Jan Holmgren is an **immunologist**; together, the pair was uniquely positioned to take on a disease such as cholera that affects health on a global scale.

As Clemens said in an interview, “My clinical and epidemiological skills and Jan’s basic science discovery skills formed a perfect partnership that has really sustained the work that we have done over the past four decades.”



But their work has not been easy. These researchers have run into obstacles at just about every step of the process, from the initial development of OCVs to their efforts to distribute the vaccine to communities that need it most. It was only in the past decade that OCVs were universally recognized as an essential tool for managing cholera; without Clemens and Holmgren’s perseverance, we might never have gotten the life-saving vaccines we have today (**Figure 1**).

SANITATION SYSTEM

A region's facilities for producing safe, clean drinking water and maintaining and disposing of human waste

EPIDEMIOLOGIST

Someone who studies health and disease at the population level

IMMUNOLOGIST

Someone who studies the human body's immune defenses

FIGURE 1

Over the course of 40 years, Clemens and Holmgren’s partnership has led to remarkable global health outcomes. From discovering the body’s defense mechanism against cholera, to developing an oral vaccine that harnessed that discovery, these milestones are the culmination of long-term collaboration.

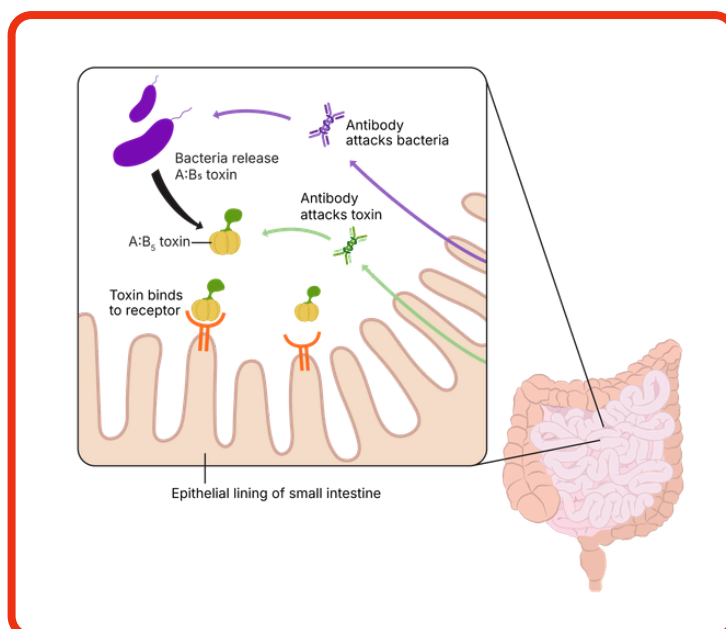
CREATING DUKORAL™, THE FIRST WHO-PREQUALIFIED OCV

In the 1960s, cholera was quickly tearing its way through Asia, despite the availability of an injectable cholera vaccine that had been in use for over 70 years. Studies conducted across thousands of people showed that this injectable vaccine only provided short-term protection lasting three to six months—and even then, they only reduced cholera cases by only about 50 percent. By the 1970s, the World Health Organization (WHO) had stopped recommending injectable cholera vaccines and new alternatives were being explored.

To develop a more effective vaccine, scientists first needed a better understanding of how cholera causes disease. Holmgren and his team in Sweden studied *Vibrio cholerae* bacteria, identifying the structure and function of the toxin it produces, which is responsible for the disease's most serious symptoms: severe diarrhea and dehydration.

Their research shed light on the toxin's structure, showing that it has five cell-binding (B) pieces connected to a toxic, active (A) piece. This led to it being named the **A:B₅ toxin**. They also identified the **receptor** in the human intestine that B pieces bind to, which has a lock-and-key kind of mechanism. When the five B pieces (the key) attach to the receptor (the lock), the toxic A piece is taken up by the body and released into the cells, allowing it to become active and make us sick with symptoms like vomiting and diarrhea.

The team also discovered that the body's primary defense mechanisms against cholera—namely, proteins called **antibodies**—are made by the local **immune system** within the intestine itself (**Figure 2**). These discoveries collectively paved the way for developing a new vaccine.



RECEPTOR

A protein that receives a signal (often a chemical message like a hormone) and produces a response, often found within biological systems. In the case of the cholera toxin, it binds to a receptor in the intestine and makes us sick

ANTIBODY

A protein made by our immune system to fight bacteria and viruses. Cholera antibodies are specifically produced in the intestine, but antibodies for diseases more broadly can be produced in many different locations around the body

IMMUNE SYSTEM

The body's network for defending against germs like viruses and bacteria

FIGURE 2

Within the small intestine, cholera bacteria release A:B₅ toxins. The toxins bind to receptors that are attached to the epithelial lining of the small intestine. Antibodies are produced below the epithelial lining. Some anti-bodies attack the toxin, while other anti-bodies attack the bacteria directly.

Earlier injectable vaccines used a **killed whole-cell approach**, containing inactivated (killed) copies of *Vibrio cholerae*. After you get vaccinated, your immune system recognizes the bacteria and begins creating antibodies against it. If you contract a live cholera infection after your vaccination, your immune system will be more prepared to defend against it, because it will have made the cholera antibodies before.

Many of the life-saving vaccines that we rely on today use inactivated versions of a disease to help us create antibodies. A problem with the injectable cholera vaccine, however, was that it only stimulated antibody production in the blood, rather than in the intestine where cholera bacteria are most prominent.

Holmgren and his team thus proposed a vaccine that could be taken by mouth. They showed both in animals and humans that the body produced significantly more intestinal antibodies when the vaccine was administered orally rather than by injection. The team also proposed that the vaccine contain killed whole-cells and an inactivated form of the toxin to help the immune system fight back against both the cholera bacteria and the toxin they produce at the same time. These developments led to the production of the first oral cholera vaccine, **Dukoral™**.

Clemens and Holmgren began collaborating in 1985 to run a large-scale trial in Bangladesh on Dukoral™'s efficacy. The trial evaluated two versions of the vaccine: one containing both the B-subunit and killed whole cells (BS-WC OCV), and another containing only killed whole cells (WC-only OCV). With over 90,000 volunteer participants in the trial, both versions of Dukoral™ proved to be effective, giving participants 50-60 percent protection over three years after receiving a dose. Dukoral™ then became the first OCV to receive WHO pre-qualification, a designation confirming global standards for quality, safety, and efficacy.



FIGURE 3

A single conversation can change the course of a career. In 1970, shortly after completing his PhD, Jan Holmgren (right) was encouraged by his department head, Örjan Uchterslony (left), to turn his research to cholera. With the seventh cholera pandemic spreading and existing vaccines proving ineffective, Holmgren was inspired to help develop a better one. That moment set him on a path that would define his career.

PRODUCING AN OCV LOCALLY IN VIETNAM

Vietnam was one of the many countries in Asia suffering from cholera outbreaks in the 1960s and '70s. When the successful results from the Bangladesh trial were released in the late 1980s, a Vietnamese professor reached out to Holmgren and Clemens about producing and testing a local version of the WC-only OCV which was less expensive than the BS-WC OCV. Holmgren helped transfer the WC-only vaccine production technology to Vietnam, and Clemens helped to conduct additional large-scale trials to assess its effectiveness. These studies found that the vaccine provided protection for approximately three to five years. Since the 1990s, more than 11 million doses of the locally produced vaccines, ORC-Vax/mOrcVax™, have been administered, contributing significantly to Vietnam's successful control of cholera.

While mORC-Vax™ was incredibly useful in its own right, it was not without its limitations. Vietnam's National Regulatory Agency (NRA) was not approved by WHO, and as a result, it was not eligible to be authorized for use outside of the country. Furthermore, Dukoral™ was regarded as too expensive for public health use at this point. For Clemens and Holmgren, this challenge marked the beginning of the next stage of their work: finding a way to make oral cholera vaccines available on a global scale.



FIGURE 4

Jan Holmgren (far left) and John Clemens (far right) pictured with colleagues in Vietnam.

OVERCOMING LIMITATIONS BY DEVELOPING SHANCHOL™ OCV

In 1999, Clemens had become the director of the International Vaccine Institute (IVI). He and Holmgren continued their work together on OCVs, modifying the composition of ORC-Vax™ and transferring production over to Shantha Biotechnics, an Indian company that was approved by WHO. They ran yet another large field trial, and found that the India-produced OCV named Shanchol™ could confer 60 percent protection for at least five years. By 2009, Shanchol™—costing only \$1.85 USD per dose—received WHO prequalification, enabling it to be used globally.

Despite these successes, some leading global health organizations remained unconvinced that OCVs were effective enough to play a major role in cholera control. They were worried that OCVs might discourage local governments from investing in better water and sanitation infrastructure; poorly built and mismanaged sewer systems are a large reason cholera can be transmitted so quickly in the first place. Before OCVs like Shanchol™ could be distributed to the rest of the world, Clemens and Holmgren needed to prove to the global health community that large-scale distribution would be worth it.

To address these concerns, Clemens and Holmgren launched a large multi-country study called DOMI—their largest project yet. While their previous trials looked at vaccine efficacy, DOMI focused more on the logistical aspects of global vaccine distribution. The project examined several key questions, including whether there was sufficient demand for OCVs, whether large-scale distribution was feasible, and whether vaccination programs could reduce the health and economic burden of cholera in a cost-effective way. Finding answers to these questions would be essential to show policymakers how necessary OCVs were.

One of the study's most important findings was that OCVs not only protected vaccinated individuals, but also indirectly protected unvaccinated members of the community. This was due to a phenomenon known as herd immunity—when enough people are vaccinated against a disease that it limits spread even to the unvaccinated. The ability of OCVs to provide herd immunity also suggested that they would be cost-effective to distribute by reducing the overall number of cholera cases, and thus the economic burden of disease. Clemens and Holmgren compiled this evidence into a comprehensive report, making the case to WHO that OCVs were essential in global cholera control efforts.

THE FINAL OUTCOME

Clemens' and Holmgren's paper was transformative for global health policy on cholera. Released during a devastating cholera epidemic in Haiti, it reinforced the growing recognition that OCVs were an important tool for controlling outbreaks. In 2011, the WHO recommended all countries currently dealing with or under immediate risk of cholera outbreak to use Shanchol™ or Dukoral™ OCVs in their cholera control programs. By 2013 Shanchol™ was being purchased and used for the global stockpile of OCVs. Clemens' and Holmgren's work was also important for the development of WHO's initiative, "Ending Cholera: A Global Roadmap to 2030," which began back in 2017. The initiative aims to largely eliminate cholera deaths and cholera transmission by 2030.

Today, more than 100 million doses of OCVs developed through Clemens and Holmgren's work have been administered worldwide. These vaccines are now a central part of global cholera control efforts and are routinely deployed in response to outbreaks and humanitarian emergencies. Thanks to four decades of laboratory research, clinical trials, and international collaboration, OCVs have been empowered to protect vulnerable communities around the world.

Article written by Leanne Cherry

Illustrated by Heather Ng-Cornish

This article has been reviewed by Drs. John Clemens and Jan Holmgren and colleagues for accuracy and accessibility.

MEET THE SCIENTISTS:



John Clemens is an infectious disease epidemiologist whose research has focused on developing and evaluating vaccines in populations affected by infectious diseases. A graduate of Stanford University and Yale University, he led the first efficacy trial of an oral cholera vaccine at icddr,b in Bangladesh. He later became the first Director-General of the International Vaccine Institute, where he led the team that developed Shanchol, an oral cholera vaccine that became an important tool for global cholera prevention. Clemens has also held leadership positions at UCLA and icddr,b and currently serves as Senior Scientific Advisor to the Director-General of the International Vaccine Institute.



Jan Holmgren is a physician-scientist and Senior Professor at the University of Gothenburg in Sweden. His research has advanced our understanding of cholera, mucosal immunity and vaccination. Holmgren and his colleagues helped uncover how cholera toxin interacts with human cells and identified important immune mechanisms that protect against the disease. This research contributed to the development of Dukoral, the first effective oral cholera vaccine, and helped enable the development and production of additional oral cholera vaccines around the world. His work has had a major impact on the prevention of cholera and the development of vaccines that stimulate protective immune responses at mucosal surfaces.



YOUTH ACCESSIBILITY REVIEW

This article was reviewed by high school students through the Canadian Association for Girls in Science (CAGIS)—Canada’s largest and longest-running STEM (science, technology, trades, engineering, and math) club for girls and gender-diverse youth aged 7-17. This award-winning club, founded in 1992, supports interest in STEM with virtual programming and local clubs that visit labs, workshops, and field sites to meet mentors and do fun, hands-on activities. Their thoughtful feedback on clarity, accessibility, and reader engagement helped shape the final version of this article and ensure it is engaging and accessible for youth readers.



Rhythm Sehgal • Grade 7

“I hope to study Health Science and Genomics to make new discoveries in healthcare.”



Rose Isakson • Grade 8

“I hope to study biology, particularly animal behaviour.”



Celine C.A. Chen • Grade 9

“I hope to study biomedical informatics and enjoy learning about how technology can improve healthcare.”



Hargun Kaur • Grade 9

“I’m interested in environmental science and how STEM can help create a more sustainable future.”

GAIRDNER CONNECTS

Gairdner Connects brings award-winning scientists to communities across Canada to engage, inspire, and spark dialogue. In doing so, it fosters meaningful connections between Gairdner Award winners and the next generation of researchers. **Through interactive events, classroom visits, community discussions, and digital resources, we inspire future innovators and spark dialogue about the role of science in addressing global health challenges.**

This article, developed in partnership with the **Canadian Association for Girls in Science (CAGIS)**, is part of the Gairdner Foundation's student outreach program to bring science to communities across Canada.

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