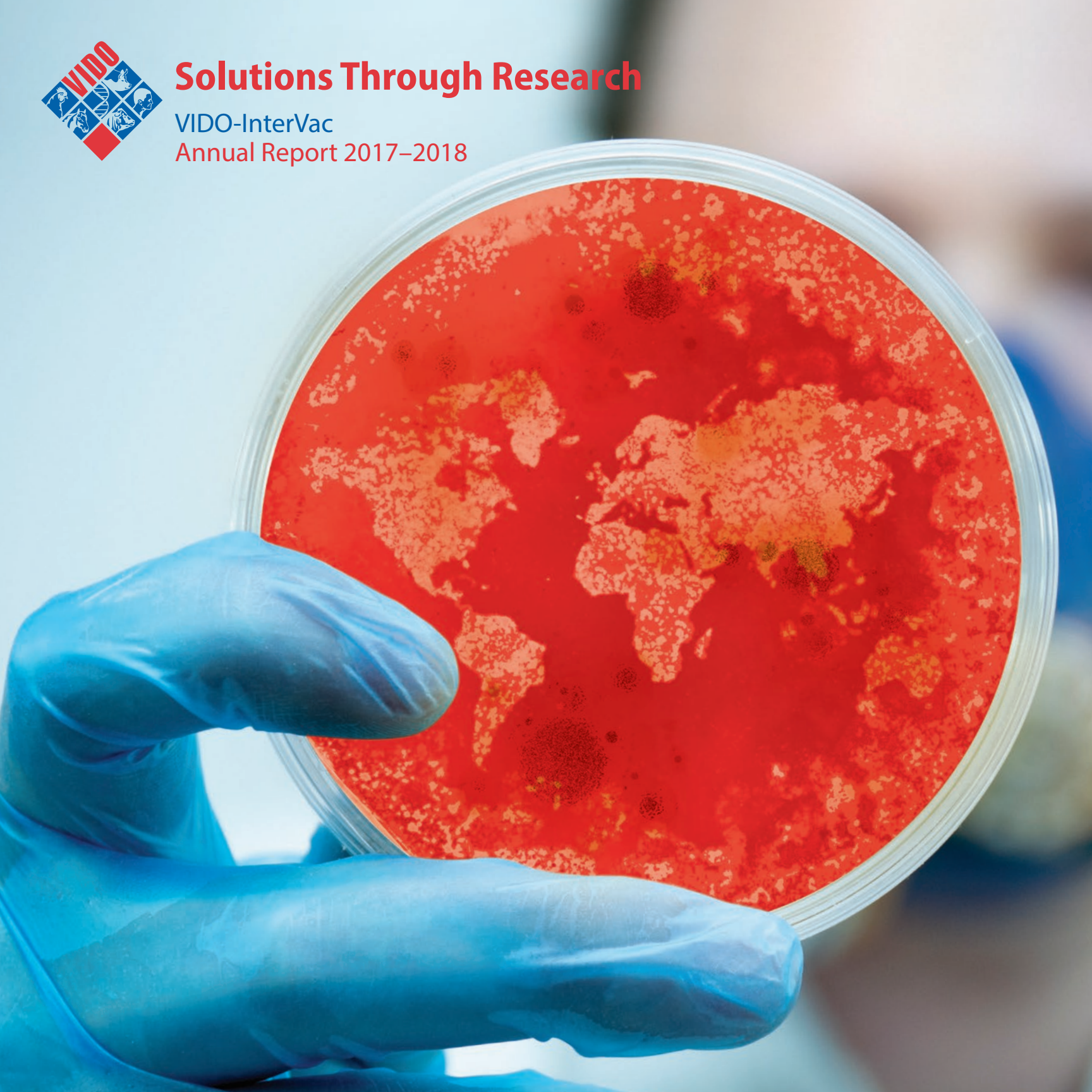
Solutions Through Research

VIDO-InterVac

Annual Report 2017–2018



2017–2018 VIDO-INTERVAC ANNUAL REPORT

Contents

Scientists from 25+ nations working together to advance infectious disease research.

Vision

Protecting Canada and the world from infectious diseases.

Mission

To conduct research and develop vaccines and related products with key national and international partners for the prevention and control of human and animal disease.

Message from the Chair

An important aspect of VIDO-InterVac's mission is to prevent diseases and protect human and animal populations in Canada and around the world. Our efforts over the past year reflect a commitment to public health and the scientific goals of the organization.

The organization continues to monitor the infectious disease environment for emerging threats, outbreaks, and their impact on humans and animals. We have seen more frequent severe outbreaks of infectious diseases and transmission between species. VIDO-InterVac's research efforts aggressively address the discovery science necessary for understanding and combatting these diseases, as well as the advanced development studies needed to translate those insights into tools for public health interventions. The development of these interventions requires investments in the physical assets and processes needed to bring these tools into use. In 2018, federal funding was received to establish small-scale vaccine manufacturing at VIDO-InterVac. This is a small but necessary step towards meeting Canadian needs for vaccine independence.

Of course, it is the world-class quality of VIDO-InterVac's staff that is at the heart of our success. The scientists, technicians, animal care staff, administration, students, and post-doctoral fellows are dedicated to advancing infectious disease research and are developing the vaccines and diagnostics to be employed in Canada and around the world. We continue to look to their energy and intellect as our critical assets.

Addressing these health challenges requires an enterprise effort, as this is a complex and difficult mission across many sectors. We view your interest in VIDO-InterVac as an opportunity to engage you in our effort to prevent disease and improve the health and well-being of the communities we serve, both animal and human. Join us if you can.

W C VANDERWAGEN MD

Craig Vanderwagen
Chair, Board of Directors

VIDO-INTERVAC

2017–2018 BOARD OF DIRECTORS

A **AMY CRONIN** – ON
B **ANDREW POTTER** – SK
C **BILL KAY** – BC
D **CORNELIA KREPLIN** – AB
E **CRAIG VANDERWAGEN (CHAIR)** – USA
F **DOUGLAS FREEMAN** – SK
G **KAREN CHAD** – SK
H **LEONARD EDWARDS** – ON
I **PETER BRENDERS** – ON
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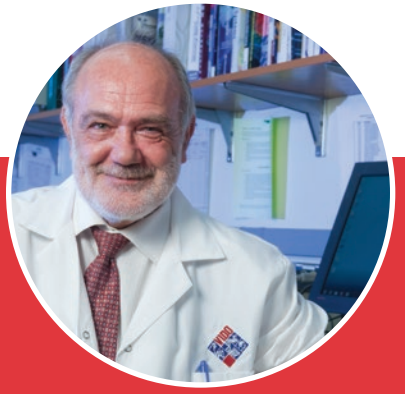
M **TERRANCE OLEKSYN** – SK
N **TIPPI MAK** – SINGAPORE
O **WES JICKLING** – SK

Truly effective **solutions**
are multi-sectoral and involve
a diverse group of stakeholders.

Andrew Potter
Director and CEO



Message from the Director and CEO

Solutions through research. These are simple words that have guided the work done at VIDO-InterVac for over 40 years. The phrase represents more than just a tag line used on our letterhead, with solutions taking many different forms—from information of value to our stakeholders to vaccines that reduce losses from disease.

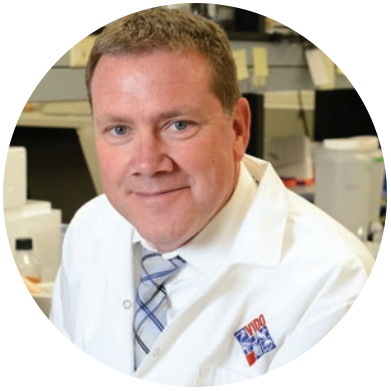
Over the past year, this was exemplified by Dr. Volker Gerdts and his team as they worked to develop the porcine epidemic diarrhea virus (PEDV) vaccine at VIDO-InterVac for emergency use in Western Canada. This work was founded on excellent science and involved not only our staff but two provincial governments, one federal agency, swine industry representatives, and the vaccine industry. The collaborative effort was a demonstration of how truly effective solutions are multi-sectoral and involve a diverse group of stakeholders.

Of course, when dealing with emerging threats to either animal or human health, the degree of complexity expands considerably. This is one reason why VIDO-InterVac has aggressively pursued formal international interactions that go well beyond traditional scientific collaborations. For example, we have established a number of public and private sector partnerships in China and Africa in order to ensure that we can identify and respond to emerging threats in a timely fashion.

One of Canada's most significant shortcomings in the vaccine field is small-scale manufacturing, which was a challenge our researchers faced most recently with the PEDV vaccine and the preparation of material for the upcoming respiratory syncytial virus (RSV) vaccine clinical trial. A number of years ago, we decided to solve this problem by establishing manufacturing capabilities at VIDO-InterVac. I am pleased to say that the Federal Government, through Western Economic Diversification Canada, as well as other public and private sector sources have agreed to support this initiative. We are looking forward to providing this significant resource to our researchers, the business community, and academic partners within the next two years.

On December 31, 2018, I will be retiring after 34 years with VIDO-InterVac—the past 11 as director and CEO. Reflecting on the progress I have witnessed over those years, I believe that we are in an excellent position to meet the needs of our numerous stakeholders in Canada and around the globe. I am confident the organization will continue to be a world leader in providing solutions through research.

Volker Gerdts
Associate Director of Research



Solutions Through Research

VIDO-InterVac lives its mandate – to provide "solutions through research."

Focused on the combination of early discovery research, advanced development, and commercialization, the organization has remained nimble and fast—crucial characteristics for working with infectious diseases. Over the last five years, we have:

- developed and commercialized two new vaccines;
- developed three new animal models for human diseases;
- provided expertise and infrastructure to more than 200 users from around the world; and
- worked with over 35 different companies on novel technologies.

TACKLING INFECTIOUS DISEASES: A GLOBAL THREAT

Infectious diseases remain a global problem by threatening the lives of humans and animals. Ebola, influenza and Zika are recent examples of the social and financial impact diseases can have. Many others, including tuberculosis, rotavirus, measles, and pertussis, continue to cause severe illness or even death in humans. Similarly, infectious diseases cause significant losses in modern livestock production, from underlying subclinical conditions that affect individual performance to large outbreaks killing thousands of animals at once. Thus, "solutions through research" are needed more than ever before.

Our research activities focus on infectious diseases affecting humans and animals, with particular focus on emerging diseases. To mitigate emerging diseases, one needs a wide range of tools, including animal models, vaccines, adjuvants, and antimicrobials.

DEVELOPING NEW VACCINES

Adding to the eight vaccines previously commercialized, three more are in clinical development. The first is a novel vaccine for contagious bovine pleuropneumonia (CBPP), which is being developed in partnership with the Kenyan Agriculture and Livestock Research Organization (KALRO) and the International Livestock Research Institute (ILRI) in Nairobi. CBPP is an infectious disease of cattle that affects the livelihoods of approximately 24 million small-scale farmers in Africa and causes over US$60 million in losses annually. The vaccine was licensed to the Kenya Veterinary Vaccine Production Institute (KEVEVAPI) and is expected to enter commercial production in the next two years.

The second is a novel vaccine for porcine epidemic diarrhea virus (PEDV), which was licensed to Huvepharma and is currently seeking regulatory approval in North America. Under a permit to release from the Canadian Food Inspection Agency (CFIA), the vaccine was used to help contain outbreaks in Manitoba. Twenty thousand doses were produced at VIDO-InterVac and shipped to infected barns in Manitoba in the summers of 2017 and 2018. We are also involved in projects to faster diagnose PEDV and to ensure that the virus is not spread further by swine transport vehicles.

Lastly, clinical trials for our novel vaccine for respiratory syncytial virus (RSV), in partnership with South China Vaccine Corporation Limited, are expected to start in 2019. RSV is one of the most common infectious diseases in young children and is second only to malaria as the leading cause of mortality due to a single pathogen in infants between one month and one year of age. Currently no vaccine is commercially available.

"This is a major milestone for farmers in Africa who have suffered major cattle losses as a result of CBPP-related deaths. We are happy to be part of the team that worked tirelessly to develop the new vaccine."

–KALRO Director General, Eliud Kireger

THE IMPORTANCE OF ANIMAL MODELS

The development of human and animal vaccines and other anti-infective agents relies on the use of animal models. Large animal models are ideal for evaluating the effectiveness of vaccines in their natural animal hosts and have been found to more accurately predict vaccine outcomes in humans. One of VIDO-InterVac's unique assets is our containment level 3 (CL3) large animal research capacity, which helps to makes us an international leader in large animal model development.

Several new animal models for human diseases were developed in large animal species, including a Zika model in pigs. Evidence increasingly links Zika infections with abnormal brain development and behavioural abnormalities in infected children. Our model offers an excellent opportunity to develop solutions for Zika prevention and therapy as we continue to understand the public health impact of the disease.

Similarly, the Middle East respiratory syndrome coronavirus (MERS-CoV), a close relative of SARS-CoV, is responsible for severe disease in humans in the Middle East and Asia. As the disease is transmitted to humans from camels and bats, our approach has been to develop a vaccine for camels to prevent transmission. A novel animal model was developed in alpacas, a close relative of camels, and is now being used to test vaccine candidates.

Finally, we developed a disease model for human tuberculosis (TB) in pigs, which allows us to evaluate novel mitigation strategies to prevent disease transmission. TB is one of the deadliest infectious diseases in the world, and a similar pathogen in cattle that causes bovine TB (which can also infect humans) is an important trade issue for Canada.

LIVESTOCK DISEASES AND PLATFORM TECHNOLOGIES

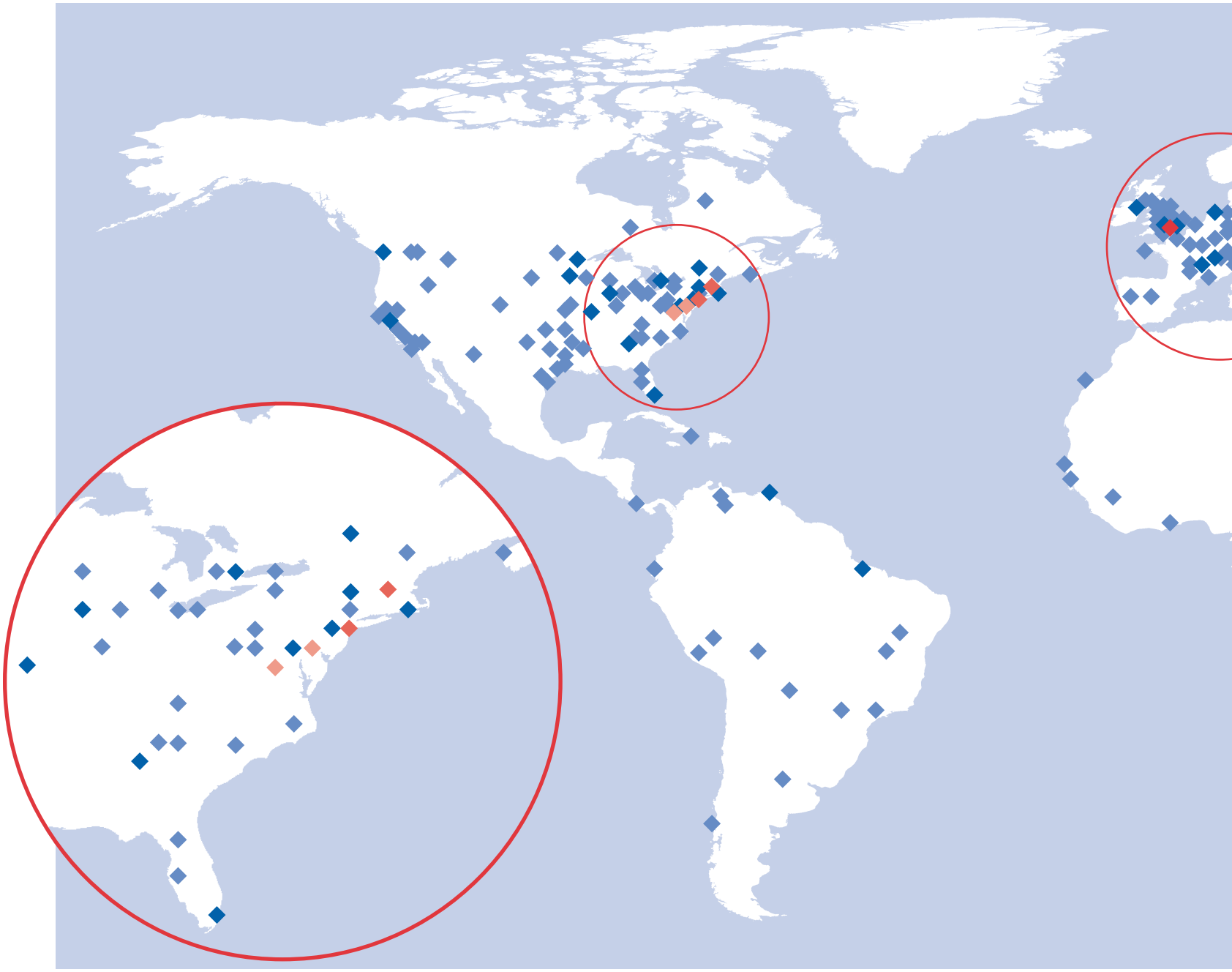
Infectious diseases remain a major issue of concern for modern livestock production. Serving our stakeholders in the Canadian livestock industries has always been a major priority for VIDO-InterVac, and we are proud to work closely with producer groups. A large percentage of our research remains focused on cattle, pigs, and poultry diseases. This includes bovine TB and Johne's disease in cattle, Mycoplasma infections in cattle and bison, infections with the porcine reproductive and respiratory syndrome virus (PRRSV) or influenza in pigs, and bacterial and viral infections in poultry. Other projects focus on platform technologies such as novel adjuvants, vaccine formulations for *in ovo* vaccine delivery in poultry, or the development of mucosal, needle-free vaccines for pigs against ileitis. As the Canadian industry evolves, so will these diseases—they will always be a high priority for our organization.

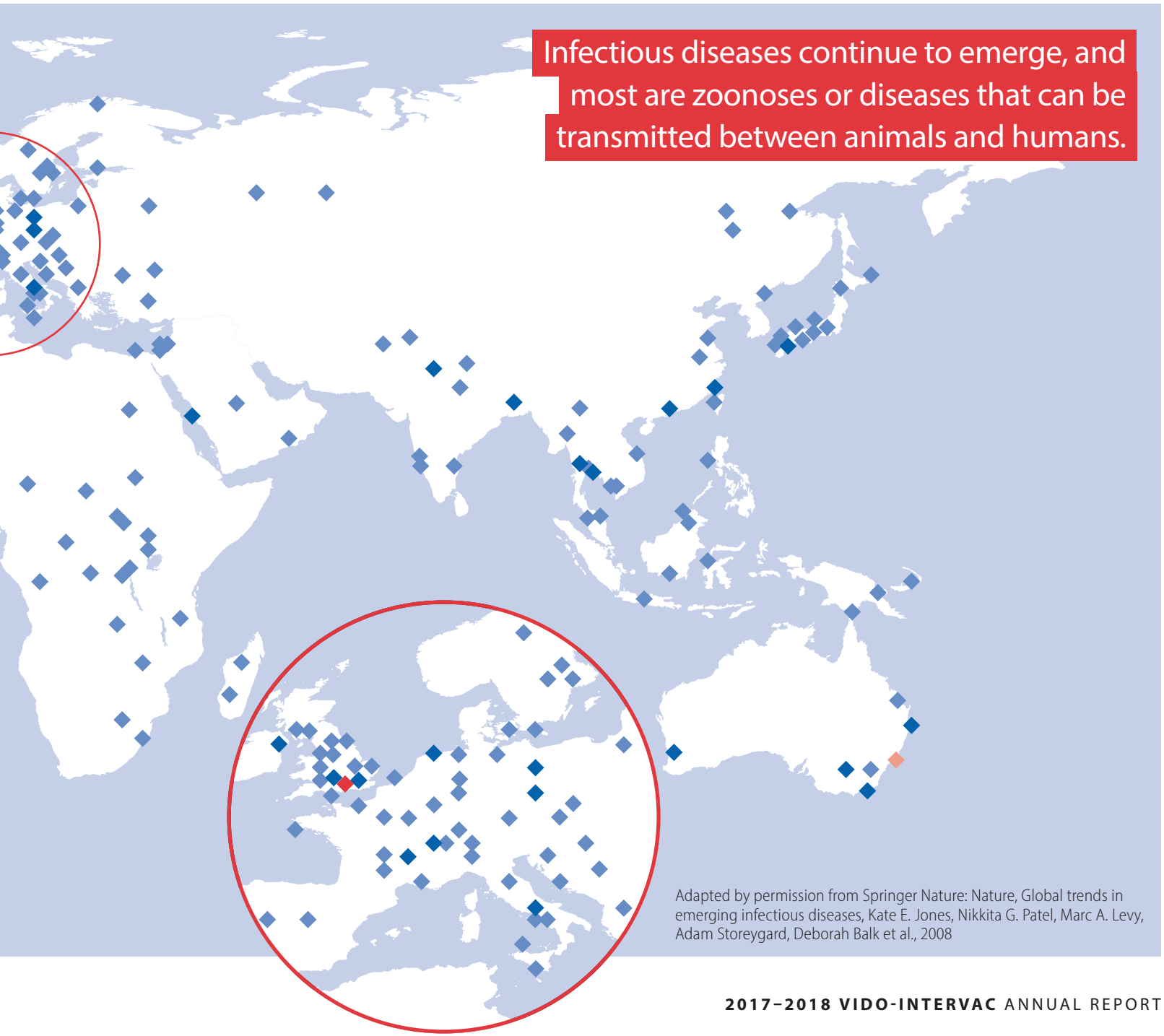
FIGHTING THE NEVER-ENDING THREAT

VIDO-InterVac's research aims to improve human and animal health. Through surveillance, collaboration, and communication, we can identify and target our efforts on the infectious diseases of greatest concern.

However, developing "solutions through research" is only possible with a dedicated group of individuals willing to put in extra effort for the greater good. Working in vaccine research can be an extremely rewarding experience, especially as novel technologies transition into the development phase. At VIDO-InterVac, we are fortunate to work with a large group of highly dedicated and passionate individuals. Without them, the organization could not do what it does best. This expertise, supported by world-class infrastructure, ensures we develop solutions for today's threats and can meet tomorrow's challenges.

Emerging Infectious Disease Events





Adapted by permission from Springer Nature: Nature, Global trends in emerging infectious diseases, Kate E. Jones, Nikkita G. Patel, Marc A. Levy, Adam Storeygard, Deborah Balk et al., 2008

Paul Hodgson
Associate Director of Business Development

Partnering to Solve Global Infectious Diseases

Today's era of international travel and trade has enabled the rapid spread of infectious diseases. Developing effective solutions to these global threats requires partnerships.

For 43 years, our international approach to research and development has helped define our organization. Our worldwide partnerships with industry, academia, and governments are facilitated by the 25 nations represented on our team. These partnerships have involved the exchange of scientists and students, enhanced grant and business opportunities, and enabled the production of a new cattle vaccine in Africa.

We are expanding our outreach to increase the use of our containment level 3 facility (the International Vaccine Centre). Initial efforts were focused on Canadian vaccine research and development, but these efforts are rapidly expanding to address international needs. The goal is to ensure the facility is operating at full capacity to maximize the return on investment.

The recently announced funding for our small-scale vaccine manufacturing facility is a significant milestone towards bridging the gap between discovery and commercialization. The added capacity will help drive innovations in the sector, ultimately advancing clinical development of technologies to the benefit of human and animal health.

Continued business development and partnerships internationally will ensure VIDO-InterVac remains at the forefront of innovative discovery as we work to prevent and control human and animal infectious diseases.

Raf Jamil
Associate Director of Human Resources

Paving the Way

Over the past year, an increased focus on automation and process changes benefited all relevant stakeholders and improved efficiencies.

We challenged our creative appetite and implemented fully automated, self-driven-leave, performance management, offboarding, and recruitment end-to-end processes. The post-implementation engagement statistics are striking. Additionally, we are within arm's reach of achieving another goal—becoming a completely digitized office. While these were intricate undertakings, they only serve as building blocks for future strategic programs geared towards coaching, training, developing, and motivating our employees and associates.

A workforce-data infrastructure was created to assist us in taking a bird's-eye view of our organization and support evidence-based decision making related to all aspects of people management. We have also implemented state-of-the-art practices to become more fluid in the internal transitional mobility of our employees, with the goal of providing more cross-training opportunities.

In addition to these new initiatives, we continue to deliver on VIDO-InterVac's human resources mandate to train students and post-doctoral fellows.

In the future, we will maintain a focus on developing and delivering people management strategies that will allow us to meet our vision and remain at the forefront of science. The chief goal will continue to be an organization that is agile and equipped to meet and exceed the emerging challenges posed by knowledge and gig economy.

Cam Ewart
Associate Director of Operations and Maintenance

Facilities Supporting Innovation

Our operations team strives to ensure VIDO-InterVac is a safe, high-performing research facility that supports scientific innovation and advances national and international research efforts.

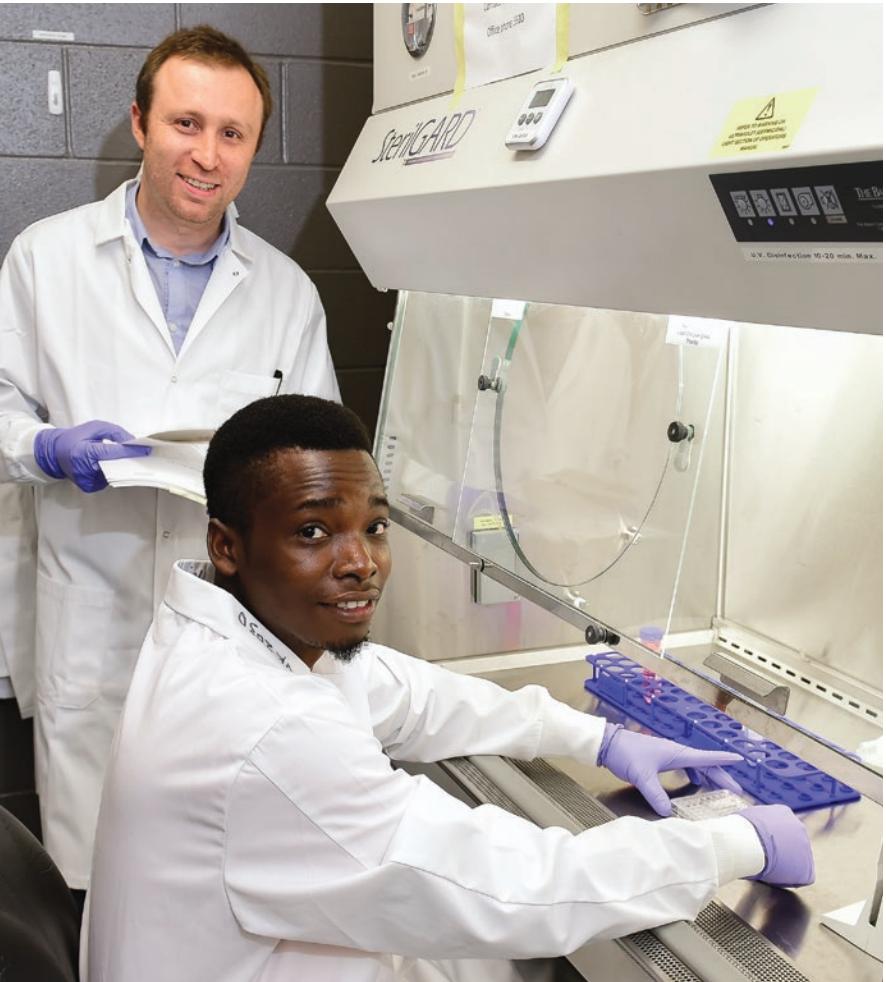
With an emphasis on continuous improvement, we have refined our maintenance procedures and the functionality of our research laboratories and animal holding suites. Since the completion of our containment level 3 facility (InterVac), the operations team has focused on achieving a higher degree of operational efficiency for the mechanical and electrical infrastructure. However, the facility is almost six years old, and the focus has now shifted to life cycle cost analysis. Our maintenance programs have expanded, and we are working with equipment manufacturers to address the needs of the facility as dictated by its physical condition, performance, or regulatory requirements.

The next phase of VIDO-InterVac's development will be the addition of a small-scale vaccine production facility.

We are also planning numerous access control and communication upgrades. As a high-containment facility, a secure access control system is an important operational requirement. The upgraded communication system will enhance safety and support for the researchers, veterinarians, and animal care team working in the containment areas.

The next phase of VIDO-InterVac's development will be the addition of a small-scale vaccine production facility—an exciting opportunity that will help address a national need for vaccine manufacturing capacity. This manufacturing facility will be housed in InterVac, which is well-suited to support this endeavour. Planning is underway and construction will begin next year.

We remain committed to maintaining and improving our infrastructure to meet the changing needs of infectious disease research.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Lorne Vanin
Associate Director of Finance

Financial Information

VIDO-InterVac's success relies on contributions from our collaborators and stakeholders.

This includes the Government of Canada, the Government of Saskatchewan, livestock industry councils and agencies, foundations, and human and animal health companies (for more information, please refer to the revenue graph and list on the back cover). With their financial support, we can conduct research on infectious diseases and develop innovative solutions.

Leadership in the vaccine field requires world-class technology and infrastructure—like our containment level 3 facility—that supports researchers and others from across Canada and internationally. Beginning in 2017, VIDO-InterVac will receive $19.3 million over five years from the Canadian Foundation for Innovation's Major Science Initiatives Fund to offset operating costs and promote ease of containment level 3 access for Canadian researchers. The vaccine development and infectious disease research sectors will also be able to develop a small-scale vaccine manufacturing facility at VIDO-InterVac thanks to funding from Western Economic Diversification Canada and additional public and private sector support.

Over the past year, revenue increased 7%, reflecting continued stakeholder trust and confidence. Despite provincial budgetary challenges, we maintained 95% of our operational funding from the Government of Saskatchewan through Innovation Saskatchewan. Additionally, revenue from research grants increased by $1,655,002.

Expenses increased slightly over the previous year. To ensure we can continue to cover expenses, we work to engage with external organizations to build alliances and secure alternative revenue sources.

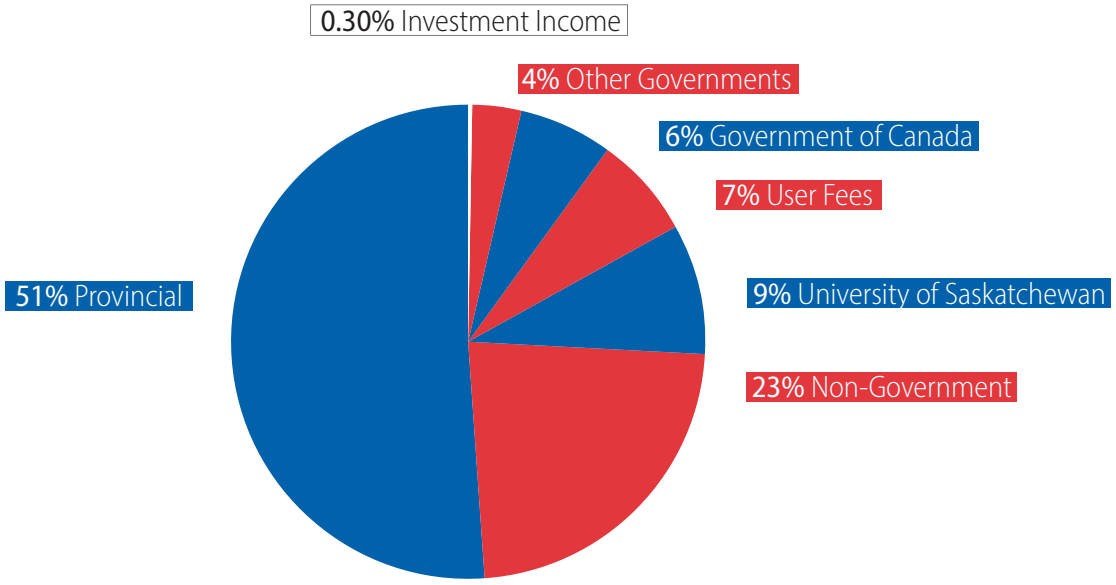
The financial support committed by our diverse stakeholders is vital. Their support enables us to develop the infrastructure and solutions needed to combat infectious disease threats and meet new global challenges.

The University of Saskatchewan's Financial Reporting Department has examined the Financial Statements as prepared by VIDO and have found that the figures presented therein reconcile to the University's financial records. In addition, Financial Reporting has reviewed the adjusting transactions and have concluded that the adjustments are reasonable and accurate. Therefore, the University of Saskatchewan can confirm that the statements as presented by VIDO are accurate and in accordance with the University's financial policies.

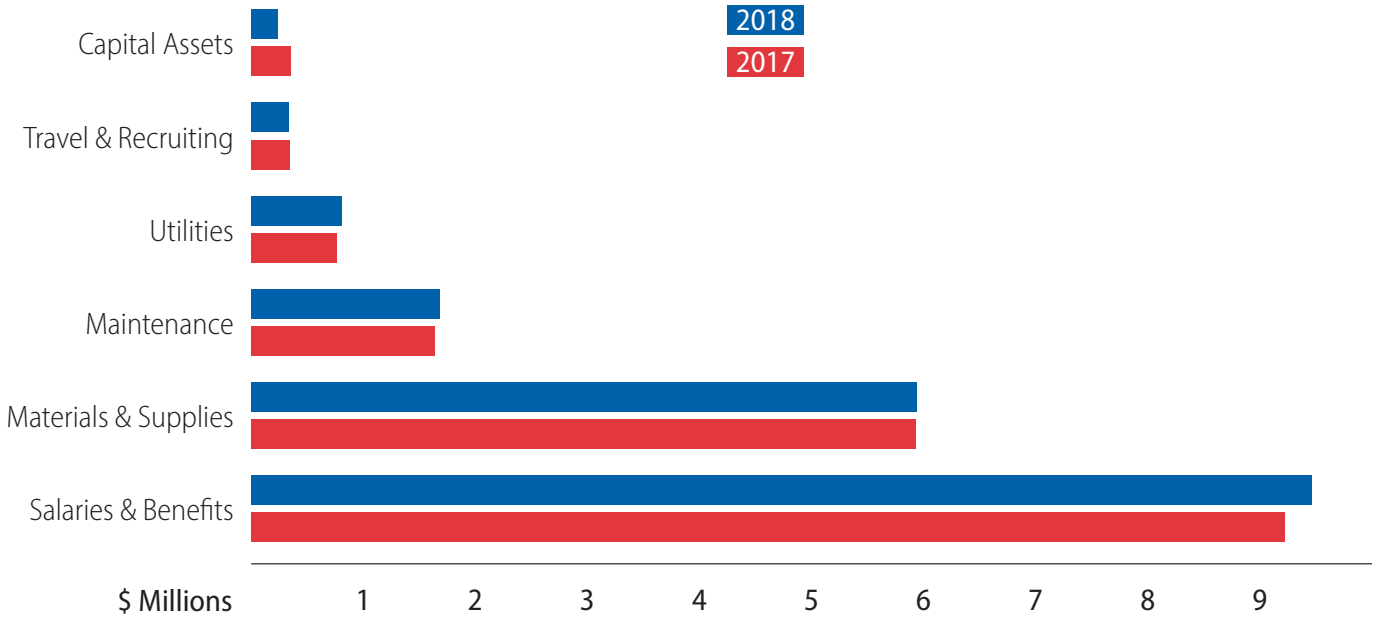
Financial statement users are cautioned that these statements have not been audited or reviewed for purposes other than those described above.

August 28, 2018

SOURCES OF REVENUE



ANNUAL EXPENSE COMPARISON



UNIVERSITY OF SASKATCHEWAN
VACCINE AND INFECTIOUS DISEASE ORGANIZATION – INTERNATIONAL VACCINE CENTRE

STATEMENT OF FINANCIAL POSITION

AS AT APRIL 30, 2018

	2018	2017
ASSETS		
CURRENT ASSETS		
Funds Held – University of Saskatchewan	$ 10,490,691	$ 9,878,321
Accounts Receivable	3,559,199	4,822,169
Inventories	220,549	228,485
	14,270,438	14,928,976
LONG-TERM ASSETS		
Long-term Accounts Receivable	640,303	365,212
Investments	11,062,369	11,787,004
	$ 25,973,110	$ 27,081,192
LIABILITIES		
CURRENT LIABILITIES		
Accounts Payable & Accrued Liabilities	$ 141,713	$ 138,802
	–	–
	141,713	138,802
Long-term Liabilities	–	–
	141,713	138,802
EQUITY		
EXTERNALLY RESTRICTED FUNDS	$ 5,825,073	$ 8,691,857
INTERNALLY RESTRICTED FUNDS	20,006,324	18,250,533
	25,831,397	26,942,390
	$ 25,973,110	$ 27,081,192

Unaudited

STATEMENT OF OPERATIONS & CHANGES TO FUND BALANCE

FOR THE YEAR ENDED APRIL 30, 2018

	2018	2017
INCOME		
Government of Canada	$ 935,636	$ 839,378
Province of Saskatchewan	7,670,157	6,941,994
Other Governments	528,378	154,734
Non-Government	3,453,236	4,206,738
User Fees	1,071,447	495,006
Investment Income	47,488	301,263
University of Saskatchewan	1,345,000	1,621,941
Miscellaneous Income	813,536	327,458
	15,864,878	14,888,512
EXPENDITURE		
Salaries and Benefits	9,458,557	9,217,630
Materials and Supplies	5,938,758	5,927,622
Maintenance	1,677,597	1,641,444
Utilities	804,104	758,799
Travel and Recruiting	333,010	340,408
Capital Assets	235,654	348,511
Internal Cost Recoveries and Transfers	(1,471,769)	(1,751,532)
	16,975,911	16,482,883
EXCESS OF INCOME OVER EXPENDITURE	(1,111,033)	(1,594,371)
FUND BALANCES, BEGINNING OF YEAR	26,942,430	28,536,801
FUND BALANCES, END OF YEAR	$ 25,831,397	$ 26,942,430
INTERNALLY RESTRICTED FUNDS	$ 20,006,324	$ 18,250,573
EXTERNALLY RESTRICTED FUNDS	5,825,073	8,691,857
	$ 25,831,397	$ 26,942,430

Unaudited

Susan Lamb
Chair, Community Liaison Committee

Community Liaison Committee Report

The VIDO-InterVac Community Liaison Committee, comprised of community leaders, is an example of best practices for containment facilities worldwide. While the committee has no authority over InterVac's operations, the University of Saskatchewan has given us a mandate to stay informed on ongoing activities at InterVac and provide safety and security information to the public as appropriate.

This past year, we received reports on seven issues—four which were minor and three concerning more significant issues related to infrastructure operation. These issues were all dealt with to the satisfaction of the committee. There was no risk to the public.

In addition, the Saskatoon Fire Department's Hazardous Materials team was able to access InterVac on four occasions to analyze the contents of suspicious packages that had been delivered elsewhere in the city.

The committee also makes efforts to remain informed on infectious diseases, particularly as they apply to VIDO-InterVac. We sought out experts who made presentations on topics such as ongoing research projects at the facility, Saskatoon Emergency Measures, the new vaccine manufacturing facility, and international projects.

To help create and maintain an atmosphere of public trust and confidence, the Community Liaison Committee holds a public meeting every other year to demonstrate transparency. The last meeting was held in September 2018.

Members of the public can contact the committee by emailing intervacclc@usask.ca.

2017/2018 CLC members from left to right: Andrew Potter, Patricia Roe, Morgan Hackl, Susan Lamb, Noreen Jeffrey, and Dick Batten. Missing: Brian Gibbs, Janice Hobbs, and Simon Kapaj.


The Baker Company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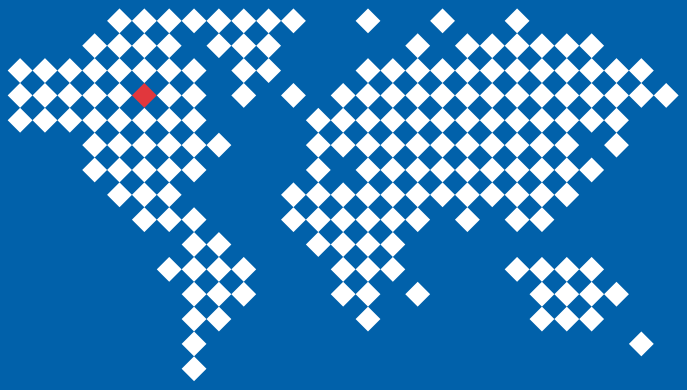
Research efforts aggressively address the discovery science necessary for understanding and combating disease, as well as the advanced development studies needed to translate those insights into tools.

In the past 5 years we have:

Developed & licensed **2 new vaccines**

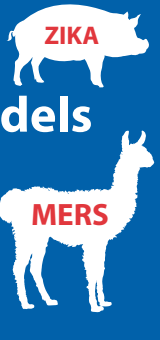


Provided expertise and infrastructure to over **200 global users**

Worked with **30+ companies**

Made over **600 publications and presentations**

Developed **3 animal models for human diseases**



VIDO-INTERVAC CONTRIBUTORS

AbCelex Technologies
Alberta Agriculture and Forestry
Alberta Research Chemicals
AnGes MG
Basic Science Co.
BioNote
Boehringer Ingelheim
Canadian Swine Health Board
Chicken Farmers of Saskatchewan
Egg Farmers of Alberta
Egg Farmers of Canada
Elanco
Genome Alberta
Genome Prairie
Government of Canada
- Canada Foundation for Innovation
- Canadian Institutes of Health Research
- Department of Foreign Affairs, Trade and Development
- International Development Research Centre
- Natural Sciences and Engineering Research Council
- Public Health Agency of Canada
- Western Economic Diversification Canada

Government of Saskatchewan
- Agriculture Development Fund
- Innovation Saskatchewan
- Saskatchewan Health Research Foundation

Guangzhou Institute of Respiratory Disease
Guangzhou Yuanbo Medical Technology Co.
Huvepharma
Intervet Canada
Jarislowsky Chair in Biotechnology Management
Kamada
Konkuk University
Krembil Foundation
Lumen Associates
Medicago
Merck Animal Health
Merial
National Institute of Health
National Sanatorium Association
Novartis Animal Health Canada
Ohio State University
Ontario Cattlemen's Association
Ontario Sheep Marketing Agency
Phileo-Lesaffre Animal Care
Saskatchewan Cattlemen's Association
Saskatoon Poppy Foundation
South China Vaccine Corporation
SterileCare
The Banting Research Foundation
University of Alberta
University of Saskatchewan

Vaccine and Infectious Disease Organization – International Vaccine Centre
120 Veterinary Road Saskatoon, SK Canada S7N 5E3 **www.vido.org**