





2016-2017 VIDO-INTERVAC ANNUAL REPORT

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VIDO-InterVac contributors (BACK COVER)



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

Building on unique strengths

Through another year, VIDO-InterVac continued to build its reputation as one of Canada's premier research institutions in the fields of human and animal health, focusing on vaccine and technology development.

VIDO-InterVac has been quick and agile in dealing with emerging threats to animal and human health, such as the Porcine Epidemic Diarrhea Virus (PEDV) in swine and (in cooperation with Canada's National Microbiology Laboratory in Winnipeg) the Zika virus in humans. VIDO-InterVac's commitment to the public good is evident in its work with several governments in Africa to develop vaccines for some of the most devastating animal diseases threatening the lives and livelihoods of Africans. Many other examples will be found in the pages of this annual report.

In April 2017, the Board of Directors enthusiastically approved VIDO-InterVac's updated strategic plan, which was developed by senior management with input and advice from the board. This plan confidently sets out an exciting path that builds on VIDO-InterVac's unique strengths: its remarkable team; its containment level 3 large-animal facility; and its location within the University of Saskatchewan, one of Canada's main centers of innovation.

The strategic plan calls for VIDO-InterVac to focus its unique capabilities and experience to fill the gaps that exist within Canada and abroad in the areas of vaccine research and development and associated technologies. It commits the organization to complementing and working with public and private sector partners to bring health, economic and other benefits to all stakeholders.

In 2017, the Board of Directors welcomed the confidence in VIDO-InterVac's future shown by both the Government of Canada, which awarded a \$19.3 million grant from the Canadian Foundation for Innovation's Major Science Initiatives Program, and the Government of Saskatchewan, which continues to provide significant financial support.

It has been an honour to chair the Board of Directors of this remarkable institution over the past two years and to work with Dr. Andrew Potter and his management group. We welcome Dr. Craig Vanderwagen as incoming board chair. ♦

Leonard Edwards

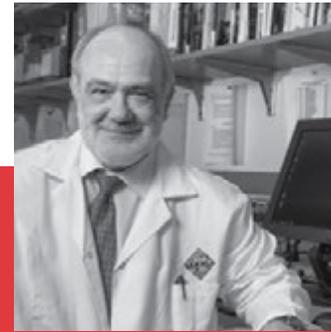
Board Chair




VIDO-INTERVAC 2016-2017 BOARD OF DIRECTORS

- | | |
|---------------------------------------|--------------------------------|
| A ALASTAIR CRIBB – AB | H PETER BRENDERS – ON |
| B ANDREW POTTER – SK | I REJEAN BOUCHARD – ON |
| C BILL KAY – BC | J RORY MCALPINE – ON |
| D CRAIG VANDERWAGEN – USA | K RYAN THOMPSON – SK |
| E DOUGLAS FREEMAN – SK | L TERRANCE OLEKSYN – SK |
| F KAREN CHAD – SK | M TIPPI MAK – SINGAPORE |
| G LEONARD EDWARDS (CHAIR) – ON | N WES JICKLING – SK |

Andrew Potter
Director and CEO



Filling the gaps

VIDO-InterVac, by carrying out a combination of basic and applied research and development, has occupied a unique niche for the past 42 years. This includes creating linkages between animal and human health long before “One Health” was topical, as well as translating laboratory findings through to regulatory approval to new products. A good example of the latter is the development of a vaccine for Porcine Epidemic Diarrhea Virus (PEDV), which started as a basic research project in the InterVac facility and resulted in private-sector licensing and experimental use in swine herds in both Saskatchewan and Manitoba.

Occupying a unique niche often has challenges as well, primarily where funding is concerned. We often find VIDO-InterVac caught between funding initiatives for either basic research or private-sector-related activities. We were fortunate in the past year to obtain additional operating funds for the InterVac facility from the Canada Foundation for Innovation’s Major Science Initiatives Program. This funding, combined with funding from the Government of Saskatchewan, through Innovation Saskatchewan, and the University of Saskatchewan, as well as user fees, means that InterVac will have sufficient funds to maintain operations for the next five years.

VIDO-InterVac’s niche also includes filling technology and infrastructure gaps in the Canadian infectious disease landscape. One of the current gaps is the availability of good manufacturing practice (GMP) compliant manufacturing for biologicals, including vaccines, which are necessary for conducting clinical trials. While Canada used to have a robust manufacturing sector, that has changed significantly since 2008 due to the economic downturn combined with consolidation in the vaccine and biologics industries. We have been working over the past year to raise funds from both public- and private-sector sources to establish mammalian-cell manufacturing capability within the InterVac facility. This initiative will not only be useful for internal research but also as a resource for partners in both public and private sectors. We are optimistic that we will be able to complete this fundraising over the next six to twelve months.

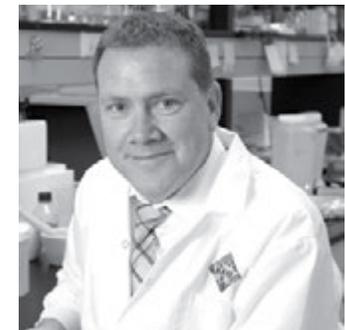
As a key player in the Canadian and global research environment, VIDO-InterVac will continue to address unmet needs and advance Canada’s leadership in infectious disease research and the development of innovative vaccines. ♦



RECOGNIZED AS LEADERS IN ZOO NOTIC DISEASES AND ANIMAL MODELING – OUR SCIENTISTS TRANSLATE LABORATORY FINDINGS TO NEW PRODUCTS



Volker Gerdts
Associate Director of Research



Bridging discovery and commercialization

VIDO-InterVac continues to be a global leader in research at the human-animal interface. Most of our activities are focused on the development of vaccines for humans and animals, supported by the development of novel animal models of disease.

In 2016 we successfully developed and licensed a vaccine for Porcine Epidemic Diarrhea Virus (PEDV) to a fast-growing European human and animal health company. Good manufacturing practice (GMP) compliant production of our experimental vaccine for Respiratory Syncytial Virus (RSV) in human infants is underway, with the goal of starting clinical trials in the next year. And a vaccine for lung plaque in African cattle, jointly developed with the Kenyan Agriculture and Livestock Research Organization (KALRO), is being scaled up for commercial development.

VIDO-INTERVAC'S UNIQUE STRENGTHS

World-class vaccine research requires a combination of factors including state-of-the-art infrastructure, enthusiastic and well-trained staff, and relevant animal models. VIDO-InterVac offers all of the above, which makes it unique in the world.

The International Vaccine Centre (InterVac) is one of the most advanced containment level 3 (CL3) facilities in the world. Available to researchers from around the globe, it provides a distinctive opportunity to use large animal models for CL3 research.

Our staff provides broad expertise, ranging from clinical medicine to epidemiology, microbiology and immunology to chemistry and vaccine formulation and delivery.

Because of our roots in animal health, we have developed one of the largest inventories of non-rodent animal models for infectious disease and vaccine research. This allows us to evaluate new vaccine candidates in their target species, or in species that closely resemble their target species.

Together, these unique strengths fortify our position as a leader in vaccines and technology innovation and ensure we are prepared for the next infectious disease threat.

WORLD-CLASS VACCINE RESEARCH REQUIRES A COMBINATION OF FACTORS INCLUDING STATE-OF-THE-ART INFRASTRUCTURE, ENTHUSIASTIC AND WELL-TRAINED STAFF, AND RELEVANT ANIMAL MODELS

2016 has been an exciting year for the organization. Over the last 24 months, VIDO-InterVac developed and commercialized a novel vaccine against PEDV, an emerging disease of swine responsible for more than eight million deaths in the last two years alone. This project received two awards—SaskPork’s Award of Distinction for Research Innovation and Saskatoon Regional Economic Development Authority’s Science, Technology, Innovation and Collaboration Project Award. While the vaccine technology is still in commercial development, we were able to supply thousands of doses, with permission of the Canadian Food Inspection Agency, to help control a PEDV outbreak in southern Manitoba.

ADVANCING TUBERCULOSIS RESEARCH

A novel animal model for human tuberculosis is being developed in young piglets. Not only are pigs easy to work with, this animal model closely resembles the various stages of the disease in humans, including reactivation and transmission. This novel pig model provides an alternative to non-human primates, which are currently being used for this type of research.

Similarly, bovine tuberculosis is a serious problem in cattle and many other wildlife species. Through a large international project, we are developing novel vaccines for both bovine tuberculosis and Johne’s disease, another mycobacterial disease significant to dairy and beef producers.

Our work in cattle and the novel pig model will provide valuable insight that will help design a more effective vaccine for human tuberculosis.

TACKLING EMERGING INFECTIOUS DISEASE THREATS

Our work on Zika virus is a noteworthy example of how a novel animal model can improve our understanding of a disease and help us develop novel mitigation strategies. Two weeks before the World Health Organization (WHO) declared a global public health emergency in response to Zika, VIDO-InterVac launched a project to develop a novel animal model for the disease and establish the link between fetal infection and microcephaly. In close collaboration with the National Microbiology Lab in Winnipeg, we were able to demonstrate that fetal pigs are susceptible to experimental infection with Zika virus, and that this infection leads to

abnormal brain development. This model is now available for use in the evaluation of novel drugs, vaccines and therapeutics for the prevention and treatment of Zika infections in babies.

Similarly, a novel animal model for the Middle-East Respiratory Syndrome Coronavirus (MERS-CoV) was developed at VIDO-InterVac using alpacas. Novel vaccines against the disease are now being developed in collaboration with researchers in Saudi-Arabia and the United Arab Emirates.

Avian influenza is yet another example of a disease originating at the human-animal interface. The frequent emergence of new types of viruses makes this disease particularly significant. Most avian influenza viruses are not dangerous to people, however, highly pathogenic viruses that emerge through recombination and re-assortment in pigs or ducks have the potential to cause severe pandemics. With financial support from the Public Health Agency of Canada we are working on novel vaccine technologies that could be used against a wide range of influenza viruses. Work with these highly pathogenic viruses must be done in high containment areas, such as the CL3 facility at InterVac.

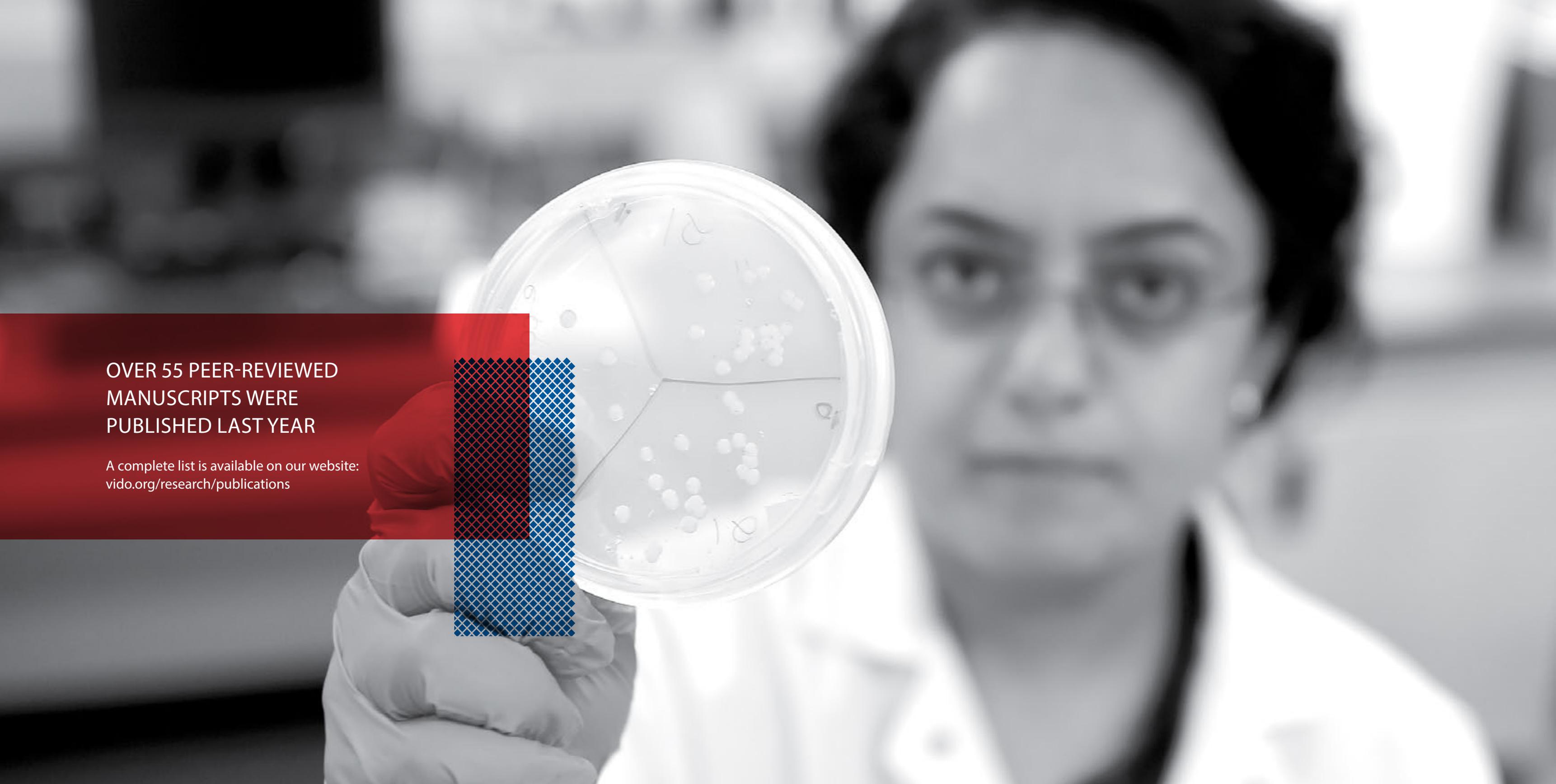
Other examples of novel animal models that are currently being developed are models for sexually transmitted infections like chlamydia and gonorrhea.

REMEMBERING OUR ROOTS

While new diseases often capture media and public attention, many existing livestock diseases also remain major issues. Working closely with the Canadian livestock industries has always been a priority and a source of pride for VIDO-InterVac. Much of our research remains focused on enteric and respiratory diseases in cattle, pigs and sheep, including infections with the Porcine Reproductive and Respiratory Syndrome Virus (PRRSV), swine influenza, Mycoplasma infections in cattle and bison, and bacterial and viral infections in poultry. Other examples include the development of vaccine formulations for in ovo vaccine delivery in poultry or the development of needle-free mucosal vaccines for pigs against ileitis. As Canadian livestock industries evolve, so will these diseases, and thus they will always be a priority for VIDO-InterVac. ♦



**MEMBERS OF THE
CROSS-ORGANIZATIONAL TEAM
THAT DEVELOPED A VACCINE FOR PEDV,
AN AWARD WINNING ACHIEVEMENT**



OVER 55 PEER-REVIEWED
MANUSCRIPTS WERE
PUBLISHED LAST YEAR

A complete list is available on our website:
vido.org/research/publications

Paul Hodgson
Associate Director of Business Development



Developing partnerships

During the past year increased community engagement, advanced strategic partnerships, and expanded outreach benefited business development and communication.

We engaged with our stakeholders through a diverse range of activities, including connecting with Canadian livestock producers, organizing the second Vaccine Innovation Conference with BIOTEC Canada's Vaccine Industry Committee, and supporting police and emergency services in dealing with suspicious packages discovered in Saskatoon. These actions help build public support for vaccines, infectious disease research, and high containment infrastructure.

Through strategic partnerships with industry, our Porcine Epidemic Diarrhea Virus (PEDV) vaccine was licensed for commercial development. Several other vaccines and related technologies developed at VIDO-InterVac are being evaluated for potential license, and we are validating multiple technologies for industry using our animal disease models. In addition, we established a new partnership with a company to develop vaccines to help protect Canada's

aquaculture industry from infectious disease losses. As continued evidence of our commitment to quality, we re-certified our management system to ISO 9001:2015, which made us one of the first organizations in the world to achieve this new standard.

To improve Canada's ability to commercialize innovative technologies and increase Canada's safety and security from infectious disease threats, we continue to pursue the establishment of a non-profit vaccine manufacturing facility. This investment opportunity was presented to the Standing Committee on Finance during the 2017 federal pre-budget consultation process. Additionally, funding from the Canadian Foundation for Innovation will help us expand access to our containment level 3 facility as part of our business development.

In the coming years, we will continue to help Canada remain a leader in vaccine research and development, enabling us to protect human and animal health. ♦

ADVANCING THE COMMERCIAL DEVELOPMENT OF NEW VACCINES AND TECHNOLOGIES



Joyce Sander
Associate Director of Human Resources



Strengthening our people

Talent drives innovation. VIDO-InterVac's world-class team allows the organization to reach its strategic objectives, which include mitigating emerging and re-emerging infectious disease threats. By working as a team we are able to accomplish extraordinary feats.

To remain at the forefront of science, one of our priorities must be training and development. This requires investment in our team by providing opportunities that inspire innovation and collaboration. We are dedicated to being an organization that allows our scientific staff and trainees to participate in knowledge transfer and speciality training, and helps them become effective communicators, a skill that is required for excellence.

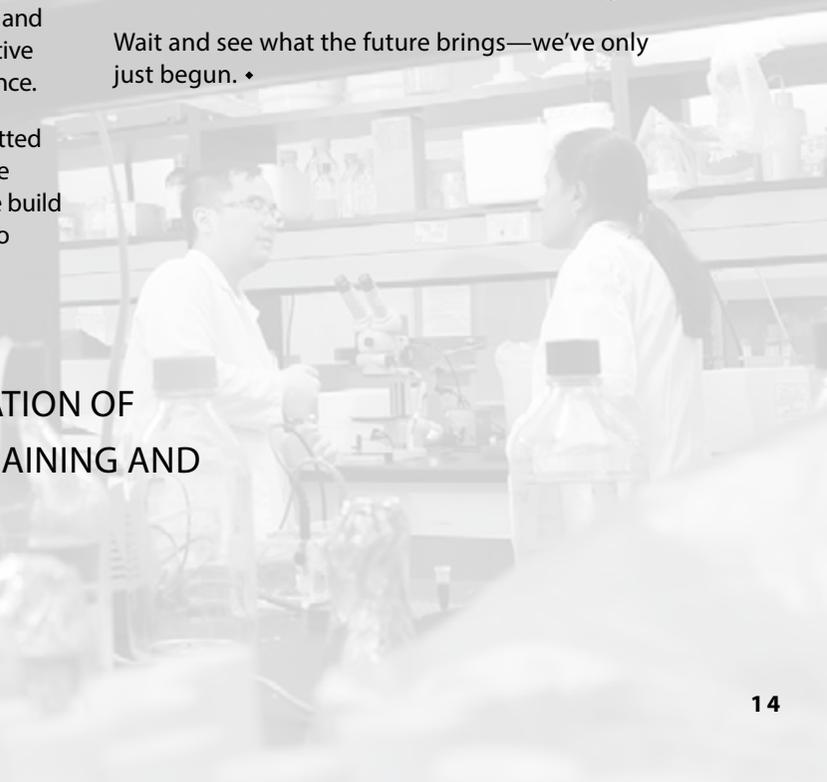
As part of our mandate, VIDO-InterVac is committed to training young scientists. Recognizing we are only as good as the opportunities we provide, we build a foundation of expertise that allows our team to

strengthen the global scientific community. As a result, our alumni hold senior positions in government, academia and industry in Canada and internationally. These leaders are helping to build a strong science sector and are one of VIDO-InterVac's greatest accomplishments.

Our organization is at the cusp of change. This will be my last report as part of the VIDO-InterVac team, and I am proud of what has been accomplished during my tenure. VIDO-InterVac has grown by innovating and, in doing so, has attracted the best people from around the globe.

Wait and see what the future brings—we've only just begun. ♦

INVESTING IN THE NEXT GENERATION OF RESEARCHERS BY PROVIDING TRAINING AND DEVELOPMENT OPPORTUNITIES



IMPROVING OUR INFRASTRUCTURE
TO ADDRESS PRESENT AND FUTURE
INFECTIOUS DISEASE THREATS



Cam Ewart

Associate Director of Operations
and Maintenance



Focusing on continuous improvement

VIDO-InterVac's unique infrastructure supports the scientific innovation of both our researchers and our partners. To enable world-class research, the design and construction of VIDO-InterVac's multi-user containment level 2 and 3 facilities focused on implementing new ideas and advanced technology.

This approach continued to be a priority as the operations team maintained and improved our research laboratories and animal holding suites during 2016/2017. Our reliability team increased the efficiency of InterVac, with continued infrastructure improvements that reduced the levels of energy consumed without compromising the integrity of the containment environments. We have also enhanced aspects of our infrastructure to allow greater life cycle performance for the components.

This year saw the completion of an operational upgrade to the solid waste decontamination system at InterVac. This remediation included modifications and upgrades to the equipment's software and will result in shorter processing times and an increased level of efficiency.

We also initiated a spatial and infrastructure analysis at InterVac to optimize the space allocation of a pilot scale vaccine manufacturing facility. This facility would fill a current gap in the ability to manufacture vaccines in Canada.

From our 160-acre research farm that enables large animal housing to our open concept laboratories to enhance collaboration, we remain committed to maintaining and improving our infrastructure to meet the changing needs of infectious disease research. ♦

Lorne Vanin
Associate Director of Finance



Valuing our stakeholder support

The success of VIDO-InterVac has always relied on collaborator and stakeholder contributions. Their financial support enables our organization to help reach our strategic goals. Our revenue, which increased 9% over the previous year, came from a range of stakeholders, including the Government of Canada, the Government of Saskatchewan, livestock industry councils and agencies, foundations and human and animal health companies (see graph and back cover). These investments are a sign of the value they place on our scientific research, and of their confidence in our resource management.

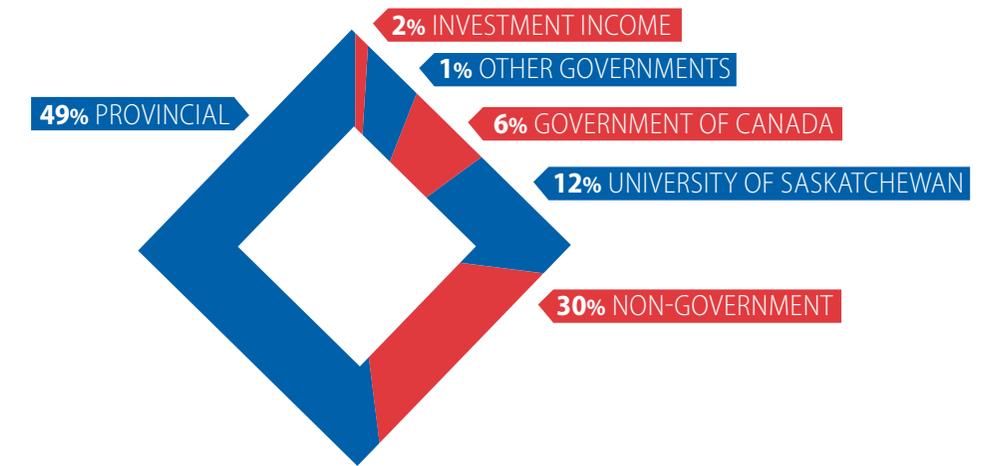
Staying at the forefront of infectious disease research requires unique assets like VIDO-InterVac's containment level 3 facility. As recognition of InterVac as a key national research facility we were awarded support from the Canadian Foundation for Innovation's Major Science Initiatives fund. Over the next five years this \$19.3 million grant will offset operating costs and enable Canadian researchers to undertake world-class research and technology development.

We also maintained our operational funding from the Government of Saskatchewan through Innovation Saskatchewan, and were successful in attaining approximately \$2.5 million in new grants and contract research.

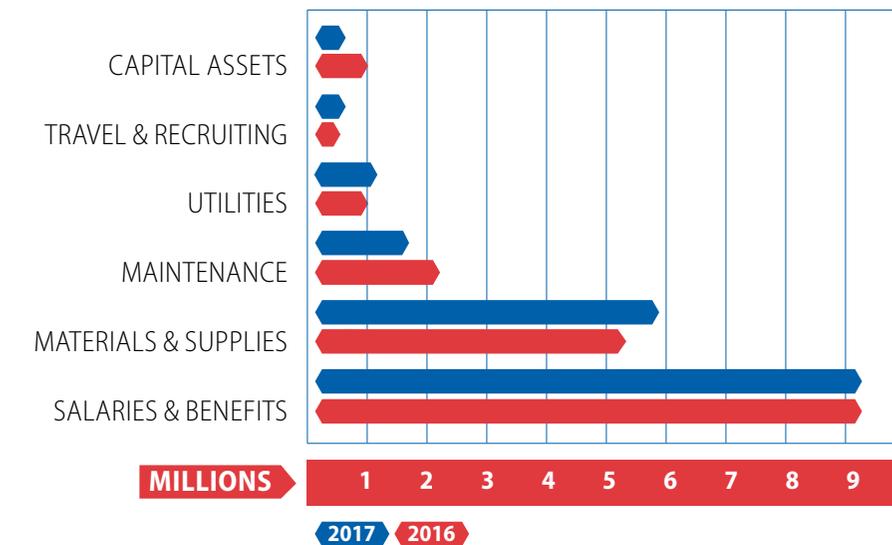
VIDO-InterVac continues to pursue funding from various sources to ensure expenses remain covered. Expenses decreased from the previous year as facility maintenance costs were reduced.

We appreciate the support provided by our partners. Their support ensures our organization's success and our ability to respond to new infectious disease threats. As always, the finance department will support the management of VIDO-InterVac to help ensure its future success. ♦

SOURCES OF REVENUE



ANNUAL EXPENSE COMPARISON



STATEMENT OF FINANCIAL POSITION

AS AT APRIL 30, 2017

	2017	2016
ASSETS		
CURRENT ASSETS		
Funds held – University of Saskatchewan	\$ 9,878,321	\$ 11,803,801
Accounts Receivable	4,822,169	3,523,027
Inventories	228,485	283,210
	<u>14,928,976</u>	<u>15,610,038</u>
LONG TERM ASSETS		
Long Term Accounts Receivable	365,212	813,722
Investments	11,787,004	12,362,941
	<u>\$ 27,081,192</u>	<u>\$ 28,786,701</u>
LIABILITIES		
CURRENT LIABILITIES		
Accounts Payable & Accrued Liabilities	\$ 138,802	\$ 249,940
	138,802	249,940
Long Term Liabilities	<u>–</u>	<u>–</u>
	138,802	249,940
EQUITY		
EXTERNALLY RESTRICTED FUNDS	\$ 8,691,857	\$ 11,151,836
INTERNALLY RESTRICTED FUNDS	18,250,533	17,384,924
	<u>26,942,390</u>	<u>28,536,761</u>
	<u>\$ 27,081,192</u>	<u>\$ 28,786,701</u>
Unaudited		

STATEMENT OF OPERATIONS & CHANGES TO FUND BALANCE

FOR THE YEAR ENDED APRIL 30, 2017

	2017	2016
INCOME		
Government of Canada	\$ 839,378	\$ 1,231,640
Provincial	6,941,994	6,992,012
Other Governments	154,734	595,617
Non-Government	4,206,738	2,837,942
User Fees	495,006	–
Investment Income	301,263	73,936
University of Saskatchewan	1,621,941	1,605,882
Miscellaneous Income	327,458	368,777
	<u>14,888,512</u>	<u>13,705,806</u>
EXPENDITURE		
Salaries and Benefits	9,217,630	9,209,685
Materials and Supplies	5,927,622	5,151,417
Maintenance	1,641,444	2,336,974
Utilities	758,799	714,201
Travel and Recruiting	340,408	323,197
Capital Assets	348,511	665,121
Internal Cost Recoveries and Transfers	(1,751,532)	(1,224,646)
	<u>16,482,883</u>	<u>17,175,949</u>
EXCESS OF INCOME OVER EXPENDITURE	(1,594,371)	(3,470,143)
FUND BALANCES, BEGINNING OF YEAR	<u>28,536,761</u>	<u>32,006,903</u>
FUND BALANCES, END OF YEAR	<u>\$ 26,942,390</u>	<u>\$ 28,536,761</u>
INTERNALLY RESTRICTED FUNDS	\$ 18,250,533	\$ 17,384,924
EXTERNALLY RESTRICTED FUNDS	8,691,857	11,151,836
	<u>\$ 26,942,390</u>	<u>\$ 28,536,761</u>
Unaudited		

REVIEW STATEMENT

August 17, 2017

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. ♦



COMMUNITY LIAISON COMMITTEE REPORT

Susan Lamb

Community Liaison Committee Chair

The VIDO-InterVac Community Liaison Committee (CLC), made up of community leaders, helps to create and maintain an atmosphere of trust, confidence and transparency between InterVac and the public by providing information about the safety and security at the facility. It is an example of best practices for biocontainment facilities.

While the committee has no authority over operations, it has a mandate from the University of Saskatchewan to report InterVac activities that might be of public interest.

This past year we received three incident reports that were all dealt with to the satisfaction of the committee. There were no risks to the public. In the interests of transparency, the committee was also alerted to several minor incidents, such as fire alarms and abrasions.

On three occasions the Saskatoon Fire Department Hazardous Materials team used the biocontainment facility to analyze the contents of suspicious packages delivered elsewhere in the city.

The committee remains educated on issues relating to infectious diseases. Members shared articles on infectious diseases and other biocontainment facilities, and sought out relevant experts to present information on topics.

In November, the committee held a public meeting in association with the Greater Saskatoon Chamber of Commerce. Dr. Andrew Potter spoke about a potential manufacturing facility at VIDO-InterVac. The committee plans to hold community meetings like this every other year.

Members of the public can contact the committee at (306) 270-1729. ♦



2016/2017 CLC MEMBERS

FROM LEFT TO RIGHT: Andrew Potter, Patricia Roe, Morgan Hackl, Susan Lamb, Noreen Jeffrey, Dick Batten

MISSING: Brian Gibbs, Simon Kapaj, Janice Hobbs



VIDO-INTERVAC CONTRIBUTORS

Alberta Cattle Feeders
Alberta Egg Producers
Alberta Livestock and Meat Agency
Alberta Research Chemicals
AnGes MG
Aquila Diagnostic Systems Inc
Boehringer Ingelheim
Bovicor Pharmatech Inc
Canadian Poultry Research Council
Canadian Swine Health Board
Chicken Farmers of Saskatchewan
Egg Farmers of Canada
Elanco
Genome Alberta
Genome Prairie
Government of Canada
 Canada Foundation for Innovation
 Canadian Institutes of Health Research (CIHR)
 Department of Foreign Affairs, Trade and Development
 Grand Challenges Canada
 International Development Research Centre
 Natural Sciences and Engineering Research Council (NSERC)
 Public Health Agency of Canada
Government of Saskatchewan
 Agriculture Development Fund
 Innovation Saskatchewan
 Saskatchewan Health Research Foundation (SHRF)

International Minerals Innovation Institute
Intervet Canada
Jarislowsky Chair in Biotechnology Management
Konkuk University
Krembil Foundation
Lumen Associates Inc
Meadow Ridge Enterprises
Merck Animal Health
Merial
Novartis Animal Health
Ohio State University
Ontario Cattlemen's Association
Ontario Pork
Ontario Sheep Marketing Agency
Pan-Provincial Vaccine Enterprise Inc (PREVENT)
Phileo Lesaffre Animal Care
Saskatchewan Pork Development Board
Saskatoon Poppy Foundation
SterileCare
Texas A & M University
The Banting Research Foundation
University of Alberta
University of British Columbia
University of Calgary
University of Saskatchewan
University of Toronto



UNIVERSITY OF
SASKATCHEWAN

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