FIFTEEN YEARS

Annual Report
1989-1990

VIDO

THE GOALS OF VIDO

1) To serve the livestock industry through research on the common infectious diseases of farm animals and poultry.

2) To help provide higher quality food to consumers through research on non-residue forming animal health and performance enhancement products, preventive medicine programs and improved livestock management techniques.

3) To fill the gap between scientific discoveries in the laboratory and their practical application on the farm.

4) To use science, technology and innovation to improve the economic well-being of the agri-food system.

5) To reduce the suffering and wastage of animals caused by disease.

6) To improve human health by encouraging the application of results from animal health research to developing human health products and by reducing diseases that are directly transmissible from animals to man.

In 1975, VIDO was established at the University of Saskatchewan in Saskatoon with a grant provided by the Devonian Group of Charitable Foundations of Calgary. The Foundation was joined by the Provinces of Saskatchewan and Alberta, and the University which supported the original development of the Organization. As a self-reliant Organization of the University, it receives on-going funding from governments, charitable foundations, the livestock and poultry industries, federal and provincial granting agencies, contracts and other private sources. The Provinces of Saskatchewan and Alberta, and the University of Saskatchewan continue to be important supporters of VIDO.

VIDO's mandate is to serve livestock and poultry producers and consumers by developing safe and effective animal health and performance enhancement products, preventive medicine programs and improved livestock management techniques and information.

Established in 1975, as a cooperative venture between the Devonian Group of Charitable Foundations, the Provinces of Alberta and Saskatchewan, and the University of Saskatchewan, the Veterinary Infectious Disease Organization (VIDO) has become a recognized world leader in animal health. VIDO's motto "Serving the Livestock Industry Through Research" is a tribute to the vision of those dedicated individuals who turned the sod for the Organization and to those who have worked so hard to make VIDO a world class animal health research organization.

The Veterinary Infectious Disease Organization (VIDO) has become a recognized world leader in animal health.

R. B. Church
Chairman

B. G. Larson
Chairman

E.D.Thiessen
Vice Chairman

VIDO's approach in identifying health problems that are of concern to livestock and poultry producers and then developing vibrant and productive research teams to tackle these problems is unique. VIDO's staff don't stop there. Their philosophy is to produce a tangible result; whether through development of a vaccine, a building design, or management scheme which addresses producers' animal health problems. The research activities of VIDO continue to shift in a focused manner to reflect the new animal health challenges faced by Canadian livestock and poultry producers.

During the past year, one of the major challenges which must be met to ensure the successful utilization of VIDO's research efforts has been the development of BIOSTAR Inc. as an active participant in the animal health industry. The management team have spent many hours in defining the best way of using BIOSTAR Inc. as an outlet for R&D done at VIDO. Assessment of opportunities for joint ventures with multinational companies which could provide the market pull and financing necessary for the future success of animal health products developed from VIDO's research has been a priority. By analogy, this process represents the "harvest" of the investment in a research crop grown over the last few years.

In this process, the urgent need for the traditional support of VIDO research is not diminished, and must be maintained if the Organization is to continue to fulfill its mandate. Traditional supporters of VIDO can be assured that research which they supported at VIDO will not be left undeveloped and will be taken to commercial application through BIOSTAR.

VIDO has had, since its inception, the cooperation and support of government, agribusiness, and, most importantly, livestock and poultry producers. This special relationship with these various stakeholders provides a unique two-way interaction. Producers delineate their animal health problems and changing needs. Through its research programs, VIDO provides essential extension information, technology, and products to producers. This mutually beneficial relationship is also reflected in the people who have donated their time as members of the Board of Directors. It reads like a "Who's Who" of Canadian agriculture! To all of the Members of the Board may I express a special thank you for your hard work, guidance, and support over my term as Chairman.

I would also like to extend a special note of appreciation to the management team for their skillful dedication and commitment to the research, management, and extension activities of VIDO. Director Stephen Acres, Associate Director (Research) Lorne Babiuk, Executive Officer Paul Hodgman, Financial Manager Ken Barteski, and the entire staff are to be congratulated on VIDO's success during the past year. The cooperation and support of Dean Hamilton of the Western College of Veterinary Medicine and President Ivany of the University of Saskatchewan is also acknowledged with sincere appreciation by the entire VIDO organization.

As I leave the VIDO Board, may I say what an exciting time the last five years have been—the eighties were a time of impressive research and development change at VIDO. I am confident that the future, a decade of challenge, will be met successfully by the VIDO Board and Management. To Chairman Garth Larson, the Board, Management, and staff best of luck and continued success to all on the road "From Vision to Reality."* * title of *I Am VIDO* by C.H. Bigland

R. B. Church

Report from
the Chairman – B.G. Larson
Chairman May 15, 1990 - September 30, 1990

The casual observer, upon visiting the VIDO facilities, might wonder what the General Agreement on Tariffs and Trade (GATT) has to do with VIDO's intense dedication to the solving of livestock and poultry disease problems.

While the world grain trade is the focus of talks on agriculture at GATT, the world meat trade is no less important to the well being of farmers in countries such as Canada. The outcome of the present negotiations, in whatever form they take, will have far reaching consequences for our livestock and poultry producers.

VIDO's mandate, "...to undertake research that will improve the economic well-being of the livestock and poultry industries...", could be stated "...to undertake research that will improve the competitive well-being of the livestock and poultry industries...". Any new management tools which come out of the laboratories of VIDO that contribute to the ability of producers to reduce their costs and improve their margins will help sustain a vigorous domestic meat industry. With the rapid globalization of all industrial sectors, including agriculture, there will be continuing pressure to identify innovative ways to reduce costs. Hence, the outcome of all international trade talks, particularly the GATT, will have an indirect impact on VIDO.

The VIDO Board and Management are very much aware of the economic pressures faced by producers and are strongly motivated to identify sources of financial support for the Organization. This very valuable funding from our traditional supporters has allowed VIDO to continue to strive toward its self imposed goals.

One of these traditional supporters has been the producers themselves. Over the years, the financial support of various producer groups representing all the livestock commodities has been significant. Without this kind of commitment by producers, it would be virtually impossible to convince other funding agencies of the importance of research into economically important diseases of farm animals.

Hence, there will be continuing efforts put into identifying the research needs of the industry, needs which if solved will place our industry in a much improved position relative to the competitiveness imposed by international trading realities.

B. G. Larson

1988-89 VIDO BOARD OF DIRECTORS

Back Row - Left to Right
G. Larson, G.Huffman, J. Doherty, C. Rennie, L.A. Babiuk (Associate Director, Research), A. Rampton, S. Kramer, K.Barteski (Manager, Financial Operations)

Front Row - Left to Right
D. Rowlatt, P.G. Hodgman (Executive Officer), R. Christian, G. Hamilton, S.D. Acres (Director), E. Thiessen (Vice Chairman), R. Church (Chairman) Missing: B. Hunsberger

VIDO CELEBRATES 15TH ANNIVERSARY

September 1990 marked VIDO's 15th Anniversary, and a gathering of staff and guests from the Saskatoon area was held to mark the occasion. Looking back to 1975, it is worth remembering that VIDO was one of three research and development institutes originally established with support from the Devonian Group of Charitable Foundations of Calgary. The other two institutions are the Centre for Cold Ocean Resources Engineering (C-CORE) at the Memorial University of Newfoundland, St. John's, which was also established in 1975, and the Centre for Frontier Engineering Research (C-FER) established in Edmonton in 1983. Each of these institutes has made a major contribution towards strengthening Canada's R&D infrastructure in specific areas. In addition to strengthening their universities and making R&D discoveries which support their primary industrial sectors, VIDO and C-CORE have created spin-off companies that have further strengthened Canada's industrial base (Fig. 1). This figure illustrates the industrial impact which targeted R&D institutes can have, and the timeframes required for industrial benefits to occur. In VIDO's case, the Organization has established a national and international reputation, assembled a critical mass of skilled R&D talent which now totals 25 researchers with advanced research and/or clinical degrees, and created BIOSTAR which subsequently established BIOWEST as a manufacturing subsidiary.

VIDO was one of three research and development institutes originally established with support from the Devonian Group of Charitable Foundations of Calgary.

S.D. Acres

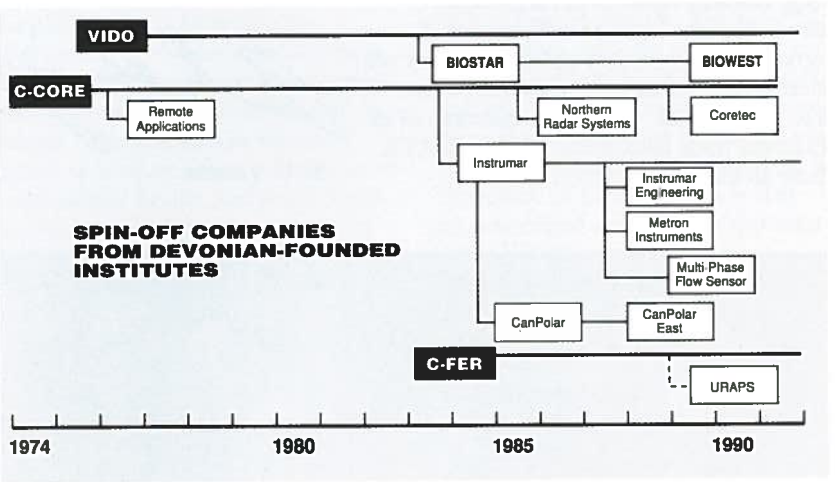


Figure 1

CHALLENGES OF THE 1990'S

The central issue facing Canada's industries during the next decade is the need to increase productivity in order to remain internationally competitive. Resource based industries, including agriculture, are under increasing pressure from countries with lower cost structures, protective trade barriers, and lucrative subsidy programs. Manufacturing industries, including the biopharmaceutical sector, which rely on a constant stream of new products and processes are forced to compete with continuous foreign innovation, increasing R&D costs, and mounting regulatory restrictions on the use of new techniques, such as those of biotechnology.

R&D institutions, such as VIDO, which work to support the livestock and biopharmaceutical industries cannot escape these competitive forces. While we do not compete in the international marketplace, we do compete nationally for resources to carry out R&D which we hope will improve the international competitiveness of our industries. Therefore, the international forces which affect Canada's businesses also impact on Canada's R&D infrastructure, and we must respond to them if we are going to return value to society for the resources which have been invested in us.

In responding to this challenge, R&D institutions during the nineties will have to deal with increased demands in several areas.

COMPETITION FOR FUNDING. Because our industries are facing increased competition, they are demanding new information at an ever increasing rate. However, the demand for innovation and our ability to financially support the R&D required to produce it is widening. Paradoxically, and counterproductively, both private sector and public sector spending on R&D has declined relative to total national output over the past few years. This means that research institutions and individual researchers must compete harder for fewer R&D dollars. Another potentially dangerous trend is the increasing tendency by governments to place increasing restrictions on the use of grant funds, or in some cases to replace grants with contracts which provide little flexibility to pursue innovative developments and which have a tendency to discourage scientific entrepreneurism. The solution is for both governments and the private sector to increase R&D expenditures while creating a climate in which researchers have the freedom to be creative and innovative in addressing market needs.

COMPETITION FOR SKILLED MANPOWER. There is now an international shortage of trained researchers in a variety of disciplines, and this is predicted to become worse as we move towards the year 2000. This will make finding and attracting high quality researchers even more difficult than it has been in the past. As a market-driven R&D institution, we not only look for individuals who are technically trained and scientifically skilled, but for those who also have a vision of how to carry out "value-added" science. In the future, these types of individuals will be in very short supply and, given funding limitations described above, difficult to attract.

COMPLEX AGENDA BASED ON PUBLIC INTEREST AND INPUT. As an R&D institute, we are supported by, and interact with, many groups and agencies. Collectively, these make up our "external environment", which not only provides financial support but also sends us the signals about which trends we should be monitoring and in which areas we should be focusing our research resources. As we enter the 90's, the external environment is very changeable, and a diverse range of public interests further complicates the research agenda. These include a variety of legitimate issues, such as food safety, animal welfare, sustainable development, and a sustainable environment. Increasingly, R&D decisions must take into account the legitimate issues of these areas.

REGULATORY REQUIREMENTS. Both the carrying out of R&D and the application of R&D findings face increasing regulatory pressures. For example, personal safety in the workplace is justifiably receiving increasing attention through such initiatives as WHMIS (Workplace Hazardous Materials Information System). On the output side, as the products of biotechnology move from the laboratory into commercial use, regulatory issues become a major issue. The need for clear and consistent regulations to protect people and the environment is a major priority. However, in some cases, they can be over defined or over administered beyond the point which serves the public interest. As we gain more experience in translating these new technologies into commercial application, the long-term objective should be to simplify and reduce regulatory barriers wherever possible.

WHAT DO THESE CHANGING ENVIRONMENTAL ISSUES MEAN FOR VIDO? They mean that we must continue to strengthen and develop many of the operating principles which have served us well in the past. There will be an even greater need for us to *communicate* with and be *accountable* to, not only our financial supporters, but other groups which represent societal needs and interests. They also mean that we will have to *collaborate* more in order to rationalize scarce resources and also to interact with other disciplines which can complement and amplify our internal capabilities. In this regard, note the Highlight Box on page 15 regarding VIDO's membership in the Canadian Bacterial Diseases Network Centres of Excellence. They will also require us to

strive for *continuous innovation,* not only scientifically but also in institutional management and operation. Finally, they will require us to continue to emphasize the *transfer of technology* from the laboratory into application on livestock operations and in commerical companies. We must do all of these things in order to increase our productivity which is the only way to help maintain and improve the Canadian standard of living. In short, today the key to higher productivity is the application of science and technology to product and process innovation in all sectors of our economy. VIDO will continue to strive to achieve this for the livestock sector.

THE EVOLUTION OF BIOSTAR INC.

In last year's report, I described the challenge we face in commercializing some of the R&D being done at VIDO. We started this process in 1978 when we licenced the commercial rights to our first vaccine to Connaught Laboratories. The process continued when, in 1983 and with the legal assistance from the University of Saskatchewan, we incorporated BIOSTAR Inc. as an R&D and technology transfer company. Another step was taken in 1989 when BIOSTAR incorporated BIOWEST, a wholly owned manufacturing subsidiary. Still another major step was taken towards the end of this year when the University, the major shareholder in BIOSTAR, agreed to "privatize the Company".

In July 1990, the University signed an Agreement with ExtraCare Corporation of Calgary which would see ExtraCare acquire ownership of BIOSTAR and amalgamate the two companies. As part of the amalgamation, ExtraCare will change its name to BIOSTAR and the head office of the new company will be located in Saskatoon. The University will continue to be a minor shareholder, and BIOSTAR will continue to have a first right of refusal to commercially develop research discoveries made at VIDO. ExtraCare is in the process of raising a substantial amount of new equity required to complete the acquisition and to provide BIOSTAR with working capital. We look forward to this being completed early in 1991.

Following the sale of BIOSTAR, VIDO will continue to earn royalty revenue from products produced by BIOSTAR. However, I want to stress that in the past, product royalties earned by VIDO have amounted to only two to three percent of our total operating budget. While we hope that this will increase in the future, product royalties will not be sufficient to sustain the Organization. Therefore, the sale of BIOSTAR will not replace our need for ongoing funding from VIDO's long-term supporters, and we will continue to depend on donations from livestock and poultry groups, charitable foundations, government grants, and contracts to support our activities.

NEW PRODUCT DEVELOPMENT

Towards the end of the year, VIDO started field testing three new vaccines which will ultimately be produced by BIOSTAR. PNEUMO-STAR is for the prevention of shipping fever pneumonia in cattle. It contains the first recombinant DNA subunit antigen produced in a heterologous organism. This is in the form of a non-toxic, but immunologically protective form of *Pasteurella haemolytica* leukotoxin which is produced in a genetically engineered strain of *E. coli.* SOMNU-STAR is a bacterial extract for the prevention of *Haemophilus somnus* in cattle. SOMNU-STAR Ph provides protection against both *Haemophilus somnus* and *Pasteurella haemolytica.* If these field trials are successful, these vaccines should be available to producers next year.

BOARD OF DIRECTORS

VIDO's Board is comprised of 13 people representing the following sectors: five primary producers, two "at-large" members usually selected from the business community, three representatives from provincial and federal governments, and two from the University of Saskatchewan. The unique mixture of perspectives and talents which the Members of the Board contribute has been one of the strengths of the Organization over the past 15 years.

Courtesy G. Winslow, Cattlemen Magazine

It is my privilege on behalf of the Organization to extend grateful thanks to Dr. Bob Church of Calgary, Alberta, who retired from the Board after five years of service. Dr. Bob, as he is known, spent most of the last year as Chairman of the Board but resigned from this position in July so that he could devote his energies to assisting with the privatization of BIOSTAR. Special thanks also go to Garth Larson who became Chairman of the Board when Dr. Church resigned, and who will continue in that position during the next year. I would also like to thank another retiring Board Member, Mr. Ed Thiessen of Strathmore, Alberta, and welcome to the Board the following new Directors: Dr. Ed Moss from Bassano, Alberta, Mr. Bob Hunsberger of Breslau, Ontario, and Mr. George Schoepp of Stoney Plain, Alberta. I look forward to working with all Members of the Board during the next year.

STAFF

Of our two main resources, financial capital and human capital, human capital is the most valuable and precious. Again this year, I have the privilege of working with a highly dedicated and committed staff who are the essence of the Organization. It is a pleasure to thank them for their continued commitment to VIDO.

Stephen D. Acres

S. D. Acres

Great thinkers throughout the ages have disagreed on many things, but one thing that they have all agreed on is that a man becomes what he thinks about. The same can be said for any organization providing it has a strong and focused vision. VIDO is blessed with many great thinkers—our staff, Management, and Board of Directors. Their thoughts are focused on a vision and established purpose of improving the economics of food production and helping maintain the high quality of meat, milk, and eggs. In essence, VIDO's research is an integral part of a sustainable food production system.

VIDO's research is an integral part of a sustainable food production system.

In order to attract financial support from a broad range of groups which include the livestock and poultry industries, charitable foundations, governments, and granting agencies, VIDO must attack major disease and performance problems in a well-thought-out manner. We research those areas that producers identify as being of significant economic importance, develop animal management information and innovative products that are safe and efficacious, and practice high-quality, cutting-edge science. Over the past three years, VIDO has been extremely fortunate to attract funds in excess of four million dollars per year to carry out its vision.

P.G. Hodgman

As referred to in the Director's Report, one funding trend that is causing concern is the increasing restrictions placed on the use of funds by some governments, granting agencies, and producer groups. In fact, over the the past five years, the percentage of VIDO's funds that are unencumbered or unconditional has declined from 40 percent to 22 percent (see Fig. 2). There are several aspects of this trend that are detrimental to VIDO. Firstly, conditional grants and contracts often do not pay for all aspects of the research and the necessary infrastructure costs. Secondly, research as specified in a conditional grant must be completed as described in the application. However, this does not leave funds available to pursue new developments or promising leads that have arisen during the research. In essence, promising new research directions cannot always be pursued for lack of funds. Often these promising leads make the greatest progress towards the solution being sought. Thirdly, the terms of reference of most grants and contracts do not allow for research projects which focus on developing new animal management information. We feel that management research issues play an extremely important role in the prevention of disease and the enhancement of performance. Hence, VIDO will continue to seek unencumbered funds from a variety of sources.

Producers and their organizations continue to play a significant role in the financing of the Organization. Producer funds traditionally have represented approximately 10 percent of the total revenue in any one year. However, the significance of this money cannot be underestimated as these funds enable VIDO to lever up the contributions through other organizations, government, and agencies as much as six to eight times the original amount.

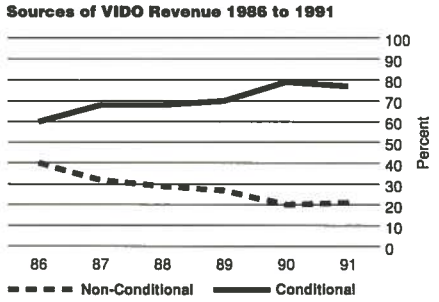


Figure 2

In the past year, VIDO has received either new funds or significant increases in funding from several groups. The Manitoba Cattle Producers' Association, after having their check-off funds reinstated, have contributed $5,000.00. The Alberta Milk Producers' Society, who traditionally have supported VIDO even without having a check-off have now initiated a research check-off plan and have contributed $10,000.00. The turkey marketing boards in Manitoba, Saskatchewan, Alberta, and British Columbia all recognized that *E. coli* septicemia is becoming a major problem in turkey flocks. After approaching VIDO to see if we would be interested in researching this problem, they agreed to financially contribute $37,000.00 towards this project. This money was subsequently used as industry support to obtain a matching grant from the Alberta Agriculture Research Institute. The four western turkey marketing boards recognize that *E. coli* septicemia is more than a regional problem and are currently working with other provincial and national agencies to try and increase this financial support.

COMMUNICATIONS

As mentioned above, management information is of prime importance to producers. One method that VIDO uses to make such information available is to develop and distribute Fact Sheets on specific diseases. These are available

Courtesy C. Paulson, Fraser Valley Milk Producers' Co-operative Association

through veterinarians, government extension services, producer associations, the media, and others in the animal health care field. This year we revised our most popular Fact Sheet on *Calf Scours.* Approximately 80,000 copies have been distributed, and special thanks goes to the Alberta Cattle Commission and *Cattlemen* magazine for their assistance. Currently under development is a Fact Sheet on *Enzootic Pneumonia* with particular emphasis on dairy cattle. Also under consideration are new Fact Sheets on *Streptococcus suis* in swine and *Haemophilus somnus* in cattle.

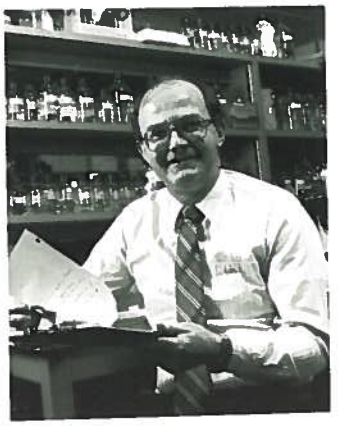
PEOPLE

Without excellent personnel an organization such as VIDO will accomplish little. Our staff are dedicated to the research development of new, innovative products and techniques that will benefit livestock and poultry producers, the animal health care industry, and consumers. Significant progress in all areas would not have been achieved without their dedication, interest, vision, and imagination. As Albert Einstein once said, "Imagination is everything. It's a preview of life's coming attractions."

P. G. Hodgman

Since inception, VIDO's mandate has been to undertake research that will improve the economic well being of the livestock and poultry industries by developing new, innovative, non-residue forming animal health and performance enhancement products, preventive medicine programs, and improved management techniques. In order to achieve this mandate, VIDO's philosophy has been to plan and focus its research activities into a selected number of areas where significant progress can be made. We have always felt that the producers involved in the various sectors of food agriculture have a vital role to play in VIDO's research programs, not only in providing financial support, but also in helping to identify priority areas for research. In this Report, I will describe research activities that are being conducted on each of the food-producing animal species.

VIDO's philosophy has been to plan and focus its research activities into a selected number of areas where significant progress can be made.



L.A. Babiuk

SWINE RESEARCH

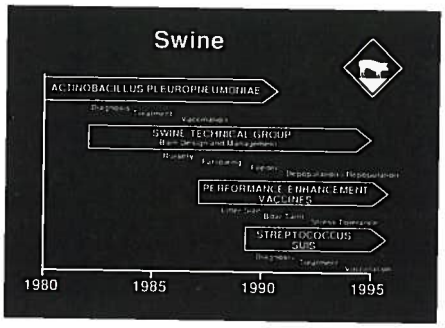
For several years, our main activities in swine research have been focused on *Haemophilus pleuropneumoniae*, now renamed *Actinobacillus pleuropneumoniae*. This is a disease which is estimated to cost the swine industry in excess of 25 million dollars per year. In the last few years, we have studied the pathogenesis of this disease, compared different methods of treatment, and developed an improved diagnostic test to help identify infected pigs and herds. We now anticipate that the final step in our long-term research plan, the development of an improved vaccine, will be complete by late 1991 or early 1992.

Therefore, as this research project is coming to an end, we began this year to plan where VIDO should focus its research activities in the swine area over the next three to five years. In keeping with the tradition of involving the industry in helping identify research priorities, VIDO sent out a questionnaire to help identify areas that were perceived to be economically important and where research could make a significant impact. This was followed up by a planning meeting which included approximately 50 swine producers, researchers, diagnosticians, veterinarians, representatives from the feed industry, and government representatives. During this planning session, a number of suggestions were made as to areas of research that might be pursued at VIDO.

In selecting the new research targets, we asked several questions.
1) Is the disease of significant economic importance to the swine industry?
2) Does VIDO have the technology to make a significant impact in this area?
3) Is similar work being done at other institutions and can we avoid duplication of effort?
4) Can funding be assembled to carry out the project in a reasonable timeframe?

Based on these criteria, VIDO selected two new research programs.

STREPTOCOCCUS SUIS – Although *Streptococcus suis* is a relatively recent disease problem in the Canadian swine industry, it is becoming a major problem. This organism causes a variety of clinical diseases in swine including meningitis (inflammation of the membranes which enclose the brain), early neonatal death, endocarditis, arthritis, abortion, vaginitis, and secondary bronchopneumonia. In farrow-to-finish operations, it can spread from the farrowing barn into the nursery and eventually into the feeder barn where death losses up to 10 percent can occur. In some cases, the losses are greatest in top producing, "high-health" herds. In addition to being a problem in swine, this organism can also infect humans. Many of the most recent isolates are resistant to the commonly used antibiotics, and therefore it is a difficult disease to treat and control. VIDO has designed a comprehensive research program which will describe the epidemiology of the infection in commercial herds, characterize the strains of *S. suis* involved, explore improved methods of diagnosis, and ultimately develop methods of prevention. The technology that VIDO has developed by working with other bacterial infections of swine and cattle, appears to be appropriate for dissecting the protective components of this bacterium and developing effective vaccines.



PERFORMANCE ENHANCEMENT – Many major production parameters, such as reproductive efficiency, growth, stress adaptation, lactation, and some carcass characteristics are controlled by hormones. In collaboration with the University of Saskatchewan "Growth and Reproductive Immunology Program" and BIOSTAR Inc., VIDO is participating in a program aimed at developing methods to modulate some of these production parameters by regulating the endocrine system. This is being done by developing methods to immunize animals against specific hormones which regulate the level or activity of other natural hormones present in the body.

Two hormones that we are presently investigating include somatostatin, a hormone involved in controlling the level of growth hormone (somatotropin), and gonadotropin releasing hormone (GnRH). In addition to improving growth, Dr. Bernard Laarveld in the Dept. of Animal and Poultry Science has shown that immunization against somatostatin results in improved reproductive efficiency in gilts. Based on these observations, we feel that the benefits of immunization against somatostatin are substantial.

A second example of where vaccination against a hormone may be beneficial is in reducing boar taint. Surgical castration has been used to prevent boar taint and aggression in male pigs, but results in a lower growth rate, and in addition animal welfarists are concerned about the use of surgical castration. Controlling GnRH levels may eliminate the need for surgical castration. Therefore, as an alternative, VIDO is exploring GnRH vaccination. This approach may allow producers to achieve the increased efficiency of growth associated with male pigs while eliminating the risk of boar taint and the need for surgical castration. An additional benefit would be the reduction of aggression in male pigs which results in carcass damage due to fighting.

The major problem to be overcome in this approach is in regulating the immune response so that it will respond to these natural hormones. Because they are normally present in the body, the immune system does not normally develop antibodies to them. More research must be done to identify the most appropriate immunostimulants and to formulate these into vaccines with hormones which will produce the desired response.

SWINE TECHNICAL GROUP – VIDO established the Swine Technical Group in 1980 to assemble practical information which could be used by swine producers on their farms. This multidisciplinary group includes swine producers, veterinarians specializing in swine practice, agricultural engineers, feed industry personnel, government representatives, and researchers from the five western provinces. The Group has published three different booklets on swine management entitled:

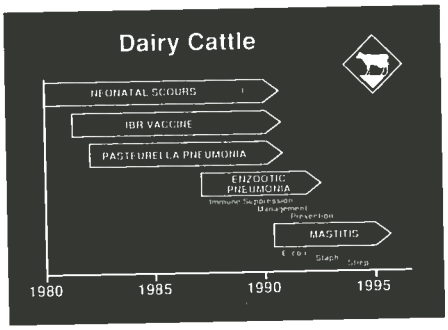
1) Swine Nursery Design,
2) Farrowing Barn Design and Management, and
3) Feeder Barn Design and Management.

They are presently revising and upgrading the booklet on *Swine Nursery Design and Management*, as well as conducting new studies on 1) depopulation and repopulation of swine barns, 2) standard growth rates for nursery pigs, and 3) farrowing crate design. They also publish articles called *Profit Tips*, designed to help producers improve the efficiency of their operation.

DAIRY CATTLE RESEARCH

VIDO's research program in dairy cattle includes work on calf scours, Pasteurella pneumonia, and the virus which causes infectious bovine rhinotracheitis (IBR). Progress in these areas is discussed in the section on beef cattle since these diseases occur in both beef and dairy herds. In addition, there are two other major areas of research on the dairy cattle diseases of enzootic pneumonia and mastitis.

ENZOOTIC PNEUMONIA – This year, VIDO sent a questionnaire to dairy producers in the Saskatoon area to collect information on the prevalence and importance of enzootic pneumonia on their farms. Based on this



questionnaire, 20 herds were selected for further indepth studies to understand the epidemiology and immunology of this disease entity. Enzootic pneumonia was reported on 68 percent of dairy farms, which was a higher prevalence than originally anticipated. Seventeen percent of calves were treated for this disease, and 3.4 percent died.

The objective of the epidemiological studies is to determine the importance of various factors in predisposing calves to this disease. The factors being investigated include the prevalence of various infectious agents, the level of colostral immunity, the occurrence of immune suppression during the first few weeks of life, and concurrent infection with coccidiosis. Although all the data are not yet analyzed, it appears that suppression of immunity in the calf increases its susceptibility to various viral and bacterial pathogens which then overwhelm the calf, resulting in pneumonia. The results also suggest that a very significant portion of calves do not ingest sufficient colostrum since over 25 percent of calves in local herds had low to moderate levels of maternal antibody. In parallel with our field investigations, Dr. Joyce Van Donkersgoed is preparing a Fact Sheet to help inform producers about the occurrence, economic importance, and prevention of enzootic pneumonia.

MASTITIS – This is the major cause of economic loss in adult dairy cattle which is estimated to be 35 billion dollars annually worldwide. In Canada, the disease is estimated to cost producers approximately $300/cow per year. These losses occur from clinical mastitis and subclinical disease, treatment costs, production losses, and culling of top producing dairy cows.

Mastitis occurs most frequently immediately following drying off and around the time of calving. One of the main reasons for this increased frequency appears to be suppression of the immune mechanisms in the udder. Therefore, mastitis research at VIDO has focused on two objectives: 1) identifying immune factors within the udder that provide protection against mastitis-causing bacteria, and 2) developing ways to enhance the immune potential of these factors during times of increased susceptibility.

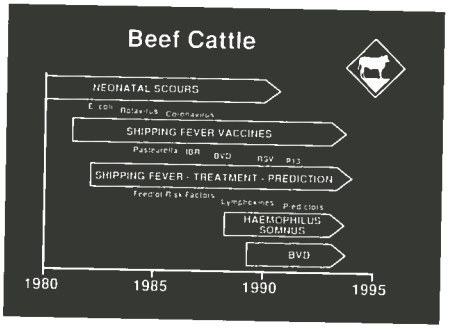
During the past year we have focused on determining whether it is possible to enhance the immune mechanisms in the udder using cytokines. Preliminary data indicate that cytokines can stimulate immune cell function in the mammary gland and increase the animal's ability to resist infection. Studies are in progress to identify the dose, route of administration, frequency of administration, and efficacy of different cytokines against the different forms of clinical mastitis. The evidence collected to date indicates that these cytokines will have an impact in management of various forms of mastitis in dairy cattle.

A possible future research target for VIDO is to develop vaccines for the common causes of mastitis. Attempts have been made in the past to develop mastitis vaccines, but they have not been very successful. We feel that the new techniques of molecular biology, which can be used to define the virulence factors of the bacterium which allow them to colonize the udder, genetic engineering, which allows us to manipulate the genes which control the production of virulence factors, and immunology, to control the immune response in the udder can be combined to provide new advances in this area. VIDO is currently exploring this approach to determine if dairy producers and funding agencies will support it.

BEEF CATTLE RESEARCH

A major focus in beef cattle is in the area of bovine respiratory disease (shipping fever). Since shipping fever is a complex of diseases, involving infection with a number of different pathogens (*Pasteurella haemolytica, Haemophilus somnus,* bovine herpesvirus-1, parainfluenza-3 virus, bovine respiratory syncytial virus, and bovine viral diarrhea virus), VIDO is trying to develop effective vaccines against all of these pathogens using the modern methods of genetic engineering. Using experimental models, we have identified individual proteins

from several of these pathogens which induce protection and which may serve as a basis for effective vaccines. This year we conducted several experimental trials using genetically engineered proteins from *Pasteurella haemolytica* and bovine herpesvirus-1 (BHV-1). These included an immunogenic but non-toxic form of toxin from *P. haemolytica* and a single protein (gIV) from BHV-1.



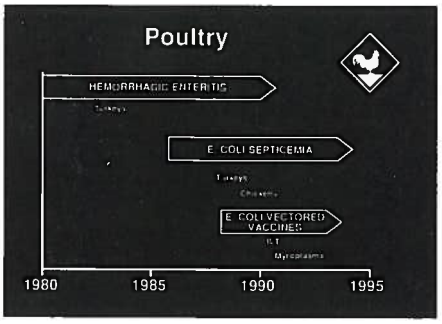
Both proteins were very protective in experimental vaccine trials, and therefore they were used in a large trial in a commercial feedlot. In this trial, the genetically engineered *P. haemolytica* vaccine was administered to calves at entry into the feedlot, either in combination with the gIV vaccine for BHV-1 or with a conventionally produced modified-live virus vaccine. The combination of the genetically engineered vaccines for *P. haemolytica* and BHV-1 was very protective against shipping fever pneumonia. In addition, the trial also showed that those animals which received the modified-live virus vaccine in combination with the *P. haemolytica* subunit vaccine, developed poorer immunity to the Pasteurella toxin than those animals immunized with subunit Pasteurella and subunit BHV-1 vaccine. This suggested that the modified-live virus vaccine may have been immunosuppressive. This is important information upon which cattlemen can make decisions regarding the use of various vaccines. We are continuing these studies to confirm this observation and to determine how important the immunosuppression may be.

A new project was started on diseases caused by the bacterium *Haemophilus somnus*, which bacterium causes a wide variety of clinical signs in cattle. When this organism was first diagnosed in cattle about 15 years ago, it caused an inflammation of the membranes enclosing the brain and the brain itself, known as ITEME (infectious thromboembolic meningoencephalitis). This caused infected calves to appear to be blind and in a stupor, and cattlemen referred to it as the sleeper syndrome. In the past few years, the ITEME form of *H. somnus* has become less common, but other problems such as infection of the heart muscle (myocarditis), lungs and lung cavity, and joints have become more common. In some feedlots, *H. somnus* now kills more calves than shipping fever.

A vaccine was made by extracting from the bacterium the surface proteins thought to be important in protection. The extract vaccine was shown to be more protective than currently available bacterins in several experimental trials. At the same time, good progress is being made through cloning and expressing the genes for the production of the protective proteins. This work will form the basis of a more improved vaccine which may be ready as early as 1992-93.

Based on experimental investigations involving both the experimental *Pasteurella haemolytica* and *Haemophilus somnus* vaccines, VIDO transferred the new technology to BIOSTAR Inc. The company produced about 30,000 doses of *P. haemolytica, H. somnus*, and combined *P. haemolytica-H. somnus* vaccines for field testing during the winter of 1990-91. The data will not be available until 1991; however, we hope that the results of these extended field trials will indicate the superiority of the vaccines over those presently being used. If so, BIOSTAR plans to have them licenced for commercial use by the fall of 1991. These vaccines will form the foundation for VIDO's ongoing development of improvements and combinations with other pathogens involved in inducing shipping fever.

In addition to the work on bovine herpesvirus-1, *P. haemolytica, and H. somnus* described above, VIDO has also initiated projects to develop animal models and vaccines for parainfluenza-3, bovine respiratory syncytial virus, and bovine viral diarrhea. VIDO and its collaborators have identified some of the important protective proteins on these viruses and have cloned the genes which code for them. We are now attempting to produce large quantities of these individual proteins with the hope of combining the protective components of the two bacteria and the four viruses involved in inducing shipping fever into one broad spectrum vaccine. This work will be ongoing to 1994 or 1995.



POULTRY

During the past year at the request of turkey producers in Western Canada, VIDO initiated a project in colisepticemia. This disease is caused by the bacterium *E. coli*, and occurs in two forms: a generalized septicemia or infection of the blood and internal organs, and airsacculitis. Many of these infections occur as a secondary event subsequent to mycoplasma or viral infections. This disease has become very prevalent since the discontinuation of antibiotics such as Cloramphenicol.

In an attempt to reduce the economic losses due to colisepticemia, the objective of the research in this area is to produce a live *E. coli* vaccine which could be delivered in the drinking water. With the assistance of provincial diagnostic laboratories in the four western provinces, a large number of strains were collected and analyzed for the specific serotype and antibiotic resistance profiles. These studies indicated that although three serotypes were more common than others, there were a large number of isolates of different serotypes. With the help of Dr. Craig Riddell from the Dept. of Veterinary Pathology, Western College of Veterinary Medicine, we have also studied the pathological lesions caused by some of these isolates. These studies suggest that a number of different strains will be needed in a vaccine in order to provide broad spectrum protection.

The research is now focusing on crippling selected strains of *E. coli* by introducing various mutations which will prevent them from causing disease, but which will not interfere with their ability to immunize birds when administered through the drinking water. We hope that a number of these "attenuated" vaccines will be developed and tested during the next year.

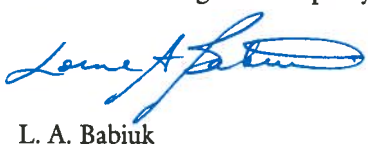
IMMUNE MODULATION FOR ALL SPECIES

Modulating the immune response is pivotal to enhancing the animal's resistance to a variety of infections. This can either be done specifically by vaccination against an individual organism as described above, or nonspecifically by enhancing the animal's overall resistance to infection. Since cytokines are natural molecules produced by the body to modulate or regulate the immune system, it seems possible that altering the level or activity of cytokines would have an impact on the animal's ability to respond to vaccination or infection. Therefore, during the past year we have continued our studies designed to investigate the role of cytokines in increasing the animal's resistance to infection, as well as increasing the animal's response to vaccination.

SUMMARY

As a result of our activities during the past year, we have not only begun large scale field testing of three new vaccines, we have also moved a series of other vaccines closer to field testing. Therefore, we are very optimistic that over the next two to three years, a series of vaccines will be introduced to control some of the most economically important diseases of livestock and poultry in Canada. These new vaccines are amongst the first genetically engineered vaccines produced in the world and establishes VIDO's reputation as a world leader in the area of animal biotechnology. We have also continued research on the epidemiology of several diseases and continue to work towards better methods of diagnosis, treatment, and control.

In addition to thanking all of VIDO's supporters, I would also like to thank the dedicated staff that continue their commitment to these research projects and to Canada's livestock and biotechnology industries. It is the dedication and focus of these individuals that VIDO is extremely proud of. Therefore, in closing, I offer a special note of thanks to the entire staff at VIDO for their continued dedication throughout this past year. Your labors are now paying dividends.



L. A. Babiuk

VIDO - A MEMBER OF NATIONAL CENTRES OF EXCELLENCE PROGRAM

In October 1989, the Honourable William Winegard, Minister of State (Science and Technology), announced the establishment of 14 Networks of Centres of Excellence. These were selected from among 158 R&D proposals submitted to the federal government. VIDO is proud to be a member of one of the selected networks, the Canadian Bacterial Diseases Network (CBDN). The CBDN is a network of researchers with related interests in bacterial diseases of animals, man, fish, and plants. Within CBDN, various research projects include work on disease pathogenesis, diagnostics, vaccines, antibiotics, and host modulation. VIDO scientists which are members of CBDN include Dr. Andrew Potter (Program Manager - Bacteriology) and Dr. Lorne Babiuk (Associate Director, Research).

The Networks of Centres of Excellence represent a new approach to promoting excellence in Canadian scientific research. They will encourage the integration of research communities in industry, universities, and government into integrated grids stretching across Canada. This initiative represents a unique opportunity for some of the nation's top researchers to work together in a coordinated, multi-year effort which is integrally linked to Canada's long-term industrial competitiveness.

Courtesy B. Waters, Manitoba Turkey Producers' Marketing Board

VIDO FINANCIAL SUPPORTERS

The following groups and agencies contributed funds to VIDO over the course of the past fiscal year through donations, grants, or contracts. Their support is acknowledged and greatly appreciated.

Agriculture Canada

Alberta Agricultural Research Institute (AARI)

Alberta Cattle Commission

Alberta Milk Producers' Society

Alberta Pork Producers' Development Corporation

Alberta Turkey Growers' Marketing Board

BIOSTAR Inc.

British Columbia Cattlemen's Association

British Columbia Hog Marketing Commission

British Columbia Turkey Marketing Board

Canada-Manitoba Agri-Food Development Agreement (ERDA)

Canada-Saskatchewan Subagreement on Agriculture (ERDA)

Canadian Bacterial Diseases Network

Farming for the Future Council of Alberta

Fraser Valley Milk Producers' Cooperative Association

Kamloops Stockmen's Association

Manitoba Cattle Producers' Association

Manitoba Milk Producers' Marketing Board

Manitoba Pork est.

Manitoba Turkey Producers' Marketing Board

Natural Sciences and Engineering Research Council of Canada (NSERC)

Province of Alberta - Alberta Agriculture

Province of British Columbia - B.C. Ministry of Agriculture and Fisheries

Province of Manitoba - Manitoba Department of Agriculture

Province of Ontario - Ontario Ministry of Agriculture and Food and Agriculture Research Institute of Ontario

Province of Saskatchewan - Saskatchewan Agriculture and Food

Saskatchewan Agriculture Development Fund

Saskatchewan Cattle Marketing Deductions Fund

Saskatchewan Dairy Producers' Co-operative Ltd.

Saskatchewan Pork Producers' Marketing Board

Saskatchewan Turkey Producers' Marketing Board

Swine Improvement Services Co-operative (SISCO)

University of Minnesota

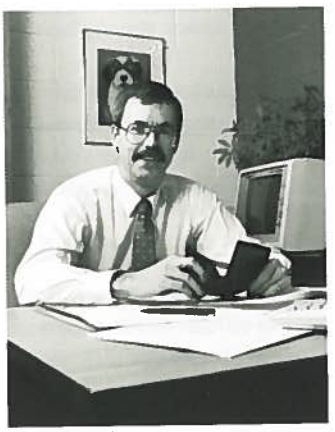
W. Garfield Weston Foundation

FINANCIAL COMMENTARY

To be successful over the long term, a research organization such as VIDO must be able to attract financial contributions from as broad a base as possible, and it must be accountable on a continuing basis to all of its supporters. The organization's fortunes can be enhanced by planning and organizing its funding effort in relation to a long-range master research plan.

This is the ninth consecutive year in which VIDO's total income has increased.

This philosophy, coupled with its strong international reputation in the scientific community, has enabled VIDO to maintain its financial stability.



K. B. Barteski

1990 HIGHLIGHTS

A dedicated fund raising effort resulted in a 25.5% increase in total income for the year. Total revenue in 1990 surpassed the $4,000,000 mark reaching $4,265,031, compared to the previous high of $3,397,922 in 1989. This is the ninth consecutive year in which VIDO's total income has increased (see Fig. 3). This year's growth was achieved largely because of increases in conditional grant income as detailed in Schedule 2 of the accompanying Audited Financial Statements.

The concerted effort to raise additional funding in 1990 was directly related to a planned increase in the magnitude of the Organization's strategic research plan. Total expenditures increased 26.2% in 1990, reaching an all time high of $4,145,260. This is an increase of $859,451 over 1989. Salaries and fringe benefits accounted for $636,782 of this increase and continue to be the dominant expense item in VIDO's operating budget (51.9% in 1990).

Excess of income over expenditures for the year was $119,771, which is comparable to the $112,113 achieved in 1989. This year's transfer of $189,268 to the Capital Trust Fund completes the financing of the construction of new laboratory and office space which was completed in 1988. The net effect on the Research Trust Fund balance after the increase of $119,771, due to the excess of income over expenditure for the year, and the decrease of $189,268 due to the transfer to the Capital Trust Fund, is a reduction of $69,497. This leaves a balance of $1,297,199 in the Research Trust Fund at September 30, 1990.

1991 OUTLOOK

VIDO's 1991 operating budget is projected to increase by 7.5% over 1990 total expenditures. This increase will require a corresponding increase in revenue. Additional income from new and innovative sources will also be required to replace funds from current programs which will no longer be available for one reason or another. Every effort will be required to maintain VIDO's ever changing funding mosaic.

10 Year Summary

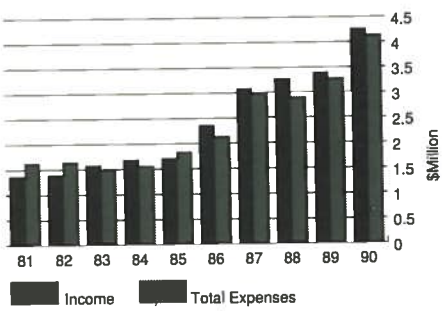


Figure 3

SUMMARY

The extent of VIDO's research program has virtually doubled in the last five years. This increased activity has required modifications to VIDO's accounting and financial reporting systems. Efforts are continually being made to make existing systems more efficient or to implement new and innovative ideas. Throughout this process, accountability remains an important aspect of VIDO's financial reporting process. The entire staff at VIDO have been extremely supportive as changes have been implemented.

Systems are only as good as the people who provide input into them. To this end, I am particularly grateful to Deanna Kirchmeier and Marilee Hagen for their dedication and commitment in the performance of their respective responsibilities. I am also appreciative of the support and advice provided by Paul Hodgman and Drs. Acres and Babiuk. Their knowledge and guidance has been most helpful.

K. B. Barteski

TO THE BOARD OF DIRECTORS OF THE VETERINARY INFECTIOUS DISEASE ORGANIZATION (VIDO) UNIVERSITY OF SASKATCHEWAN

We have audited the combined balance sheet of the University of Saskatchewan - Veterinary Infectious Disease Organization as at September 30, 1990 and the statements of income, expenditure and fund balance (Research Trust and Capital Trust) and combined statement of changes in financial position for the year then ended. These financial statements are the responsibility of the Organization's management. Our responsibility is to express an opinion on these financial statements based on our audit.

We conducted our audit in accordance with generally accepted auditing standards. Those standards require that we plan and perform an audit to obtain reasonable assurance whether the financial statements are free of material misstatement. An audit includes examining, on a test basis, evidence supporting the amounts and disclosures in the financial statements. An audit also includes assessing the accounting principles used and significant estimates made by management, as well as evaluating the overall financial statement presentation.

In common with many non-profit organizations, the Organization derives part of its income in the form of donations and certain grants the completeness of which is not susceptible to satisfactory audit verification. Accordingly, our verification of revenues from these sources was limited to the amounts recorded in the records of the Organization, and we were not able to determine whether any adjustments might be necessary to donations and grant revenue, excess of income over expenditure, assets and fund balance.

In our opinion, except for the effect of adjustments, if any, which we might have determined to be necessary had we been able to satisfy ourselves concerning the completeness of donations and certain grants referred to in the preceding paragraph, these financial statements present fairly, in all material respects, the financial position of the Organization as at September 30, 1990 and the results of its operations and the changes in its financial position for the year then ended in accordance with accounting policies described in Note 2.

Deloitte & Touche

Deloitte & Touche
Chartered Accountants
December 4, 1990
Saskatoon, Saskatchewan

RESEARCH TRUST
Statement of Income, Expenditure and Fund Balance

Year Ended September 30, 1990

	1990	1989
INCOME		
Donations and unconditional grants (Schedule 1)		
Livestock industry- beef	$ 120,700	$ 114,062
- dairy	71,000	63,000
- swine	101,154	100,598
- turkey	37,000	—
Provincial governments	230,500	402,300
Other foundations, companies and individuals	100,000	100,000
	660,354	779,960
Conditional grants (Schedule 2)	2,180,501	1,618,732
Contract research		
Commercial	879,194	642,672
Government	150,000	—
Contract services	49,373	67,000
Royalties	29,768	42,488
Interest	168,020	176,281
Animal services	111,821	34,688
License fees	36,000	36,101
	4,265,031	3,397,922
EXPENDITURE		
Salaries and fringe benefits	2,109,581	1,472,799
Materials and supplies	853,044	702,890
Animal services	304,952	304,447
Equipment and service agreements	336,557	342,664
Travel and recruiting	172,828	175,306
Other (Note 7)	368,298	287,703
	4,145,260	3,285,809
EXCESS OF INCOME OVER EXPENDITURE	119,771	112,113
FUND BALANCE, BEGINNING OF YEAR	1,366,696	1,497,048
	1,486,467	1,609,161
TRANSFER TO CAPITAL TRUST	(189,268)	(242,465)
FUND BALANCE, END OF YEAR	$1,297,199	$1,366,696

CAPITAL TRUST
Statement of Income, Expenditure and Fund Balance

Year Ended September 30, 1990

	1990	1989
EXPENDITURE		
Site and improvements	$ —	$ 10,288
Furnishings, fixtures and equipment	12,969	8,020
Buildings	49,235	20,765
	62,204	39,073
FUND BALANCE, BEGINNING OF YEAR	(127,064)	(330,456)
	(189,268)	(369,529)
TRANSFER FROM RESEARCH TRUST	189,268	242,465
FUND BALANCE, END OF YEAR	$ —	$(127,064)

Approved by the Board

Director

Trustee

COMBINED BALANCE SHEET

September 30, 1990

	1990	1989
ASSETS		
CURRENT ASSETS		
Cash on hand	$ —	$ 5,000
Funds held by University of Saskatchewan	262,303	742,946
Due from University of Saskatchewan -operating fund	865,082	809,406
Accounts receivable (Note 3)	785,234	412,521
Inventories (Note 4)	104,463	100,648
	2,017,082	2,070,521
INVESTMENTS (quoted market value $554,440; 1989 - $622,970)	558,701	628,689
PLANT ASSETS		
Site and improvements	146,503	146,503
Furnishings, fixtures and equipment	459,752	446,783
Buildings and facilities	5,036,996	4,987,761
	5,643,251	5,581,047
	$8,219,034	$8,280,257
LIABILITIES		
CURRENT LIABILITIES		
Accounts payable	$ 26,010	$ 38,386
Deferred revenue (Note 5)	1,177,574	1,310,280
Due to University of Saskatchewan -capital fund	—	10,912
Current portion of loan payable	25,000	25,000
	1,228,584	1,384,578
LOAN PAYABLE (Note 6)	50,000	75,000
	1,278,584	1,459,578
EQUITY		
CAPITAL ASSETS	5,643,251	5,581,047
RESEARCH TRUST	1,297,199	1,366,696
CAPITAL TRUST	—	(127,064)
	6,940,450	6,820,679
	$8,219,034	$8,280,257

COMBINED STATEMENT OF CHANGES IN FINANCIAL POSITION

Year Ended September 30, 1990

	1990	1989
OPERATING ACTIVITIES		
Working capital from operations		
Research Trust excess of income over expenditure	$ 119,771	$ 112,113
Changes in non-cash operating working capital		
Due from University of Saskatchewan	(66,588)	(378,637)
Accounts receivable	(372,713)	34,088
Inventories	(3,815)	(24,121)
Accounts payable	(12,376)	(72,175)
Deferred revenue	(132,706)	51,229
Cash used in operating activities	(468,427)	(277,503)
INVESTING ACTIVITIES		
Reductions in investments	69,988	204,240
Capital Trust excess of expenditure over income	(62,204)	(39,073)
Cash provided by investing activities	7,784	165,167
FINANCING ACTIVITIES		
Repayment of loan payable	(25,000)	(25,000)
Cash used in financing activities	(25,000)	(25,000)
(DECREASE) IN CASH	(485,643)	(137,336)
CASH, BEGINNING OF YEAR	747,946	885,282
CASH, END OF YEAR	$ 262,303	$ 747,946

Cash represents funds held by the University of Saskatchewan and cash on hand.

NOTES TO THE FINANCIAL STATEMENTS

September 30,1990

1. ESTABLISHING AGREEMENT

The Organization was established by an Agreement dated August 11, 1975 between the Devonian Foundation of Calgary, Alberta, the Province of Alberta, the Province of Saskatchewan and the University of Saskatchewan to conduct research on indigenous infectious diseases of food producing animals.

Effective April 1, 1980 the above Agreement was replaced by a Constitution which provides for a Board of Directors to assume the responsibilities formerly performed by the Board of Advisors and the Governing Committee.

2. SIGNIFICANT ACCOUNTING POLICIES

These financial statements have been prepared in accordance with the following policies:

FUND ACCOUNTING

Transactions of the Organization are accounted for by fund accounting principles which require classification of resources into "funds" to reflect the various designated uses. The Research Trust fund consists of those revenues and expenses used in the general operations of the Organization. The Capital Trust fund consists of grants, interest and authorized transfers from the Research Trust for the purpose of acquiring capital assets. Funds are transferred from the Research Trust to operations and to the Capital Trust as approved by the Board of Directors. The balance sheet and statement of changes in financial position have been presented on a combined basis reflecting the activities of both funds.

CAPITAL ASSETS

Capital assets are recorded as Capital Trust expenditures when purchased. The same assets are included in the balance sheet as plant assets offset by the "equity in capital assets" account. No depreciation is recorded on the capital assets.

Equipment purchased with Research Trust monies is expensed as purchased, and is not included in the balance sheet as assets.

The Constitution referred to in Note 1 states that all buildings and facilities constructed for the Organization shall be used by it in accordance with the Constitution and upon termination of the Organization, the buildings, facilities and equipment therein shall remain the absolute property of the University of Saskatchewan.

INVENTORIES

Inventories of materials and supplies are valued at the lower of cost and net realizable value. Animal inventory is valued at cost.

INVESTMENTS

Investments are recorded at cost. The difference between cost and par value of bonds is not amortized but is treated as income or expense in the year of disposal.

GRANTS AND DONATIONS

Grants and donations are recognized in these financial statements in the period defined in the terms or conditions of the respective grants or donations.

Grants and donations received without terms or conditions as to the period in which the grant or donation is to be used are recognized in the financial statements when received.

Deferred revenue consists of unexpended funds relating to specific grants and donations and is determined on the percentage of completion basis.

LICENSE FEES AND ROYALTIES

License fees and royalties are recognized as they are received or earned under the terms of the agreements with licensees.

3. ACCOUNTS RECEIVABLE

	1990	1989
Donations and unconditional grants	$ 18,500	$ 36,400
Conditional grants (Schedule 2)	255,965	181,533
Contract research	423,604	159,021
Contract services	—	17,563
Royalties	26,805	6,139
Accrued interest	24,360	11,865
License fees	36,000	—
	$785,234	$412,521

4. INVENTORIES

	1990	1989
Animals	$ 58,905	$ 57,149
Materials and supplies	45,558	43,499
	$ 104,463	$ 100,648

5. DEFERRED REVENUE

	1990	1989
Donations and unconditional grants	$ 25,000	$ 175,000
Conditional grants (Schedule 2)	1,044,647	961,659
Contract research	107,927	173,621
	$1,177,574	$1,310,280

6. LOAN PAYABLE

The loan payable is interest free and repayable to the University of Saskatchewan in equal installments of $25,000 per annum ending October 1, 1993.

7. OTHER EXPENDITURES

Other expenditures consist of VIDO operating accounts which include repairs and maintenance, equipment rental, annual report and technical bulletins, professional fees and Board expenses.

8. INCOME TAXES

The Organization is not subject to either federal or provincial income taxes.

9. RELATED PARTY TRANSACTIONS

a) VIDO is a research affiliate of the University of Saskatchewan. The University of Saskatchewan maintains, as part of its normal operations, various financial and administrative functions relating to VIDO. The financial statements do not include expenditures for administrative and ancillary services, or in-kind support provided by the University of Saskatchewan.

b) The University of Saskatchewan owns 82% of BIOSTAR Inc., whose primary purpose is to assist VIDO in both research and development of its products and technologies. During the year VIDO had the following transactions with BIOSTAR Inc.:

	1990	1989
Income from BIOSTAR Inc. to VIDO		
Contract research	$158,185	$160,324
Contract services	49,373	67,000
Material purchases	7,714	3,589
Sponsorship of two industrial research chairs at VIDO in conjunction with NSERC	106,518	60,275
Expenditure by VIDO to BIOSTAR Inc.		
Management service fees	27,600	27,217
Research and veterinary services	114,906	52,959
Equipment lease	20,400	10,200

At September 30, 1990 the Organization has a receivable from BIOSTAR Inc. of $56,946 (1989 - $46,982).

10. COMPARATIVE FIGURES

Certain of the prior year's figures have been reclassified to conform to the current year's presentation.

Schedule 1

Schedule of Donations and Unconditional Grants

	1990	1989
LIVESTOCK INDUSTRY		
Beef		
Alberta Cattle Commission	$ 35,000	$ 33,362
British Columbia Cattlemen's Association	5,000	5,000
Kamloops Stockmen's Association	700	700
Manitoba Cattle Producers Association	5,000	—
Saskatchewan Cattle Marketing Deductions Fund	75,000	75,000
	120,700	114,062
Dairy		
Alberta Milk Producers' Society	10,000	3,000
Fraser Valley Milk Producers Cooperative Association	1,000	—
Manitoba Milk Producers' Marketing Board	10,000	10,000
Saskatchewan Dairy Producers Co-operative Limited	50,000	50,000
	71,000	63,000
Swine		
Alberta Pork Producers Development Corporation	41,738	41,745
B.C. Hog Marketing Commission	6,431	6,095
Manitoba Pork est.	33,187	33,435
Saskatchewan Pork Producers Marketing Board	18,644	18,275
Swine Improvement Services Co-operative (SISCO)	1,154	1,048
	101,154	100,598
Turkey		
Alberta Turkey Growers' Marketing Board	10,619	—
B.C. Turkey Marketing Board	12,654	—
Manitoba Turkey Producers' Marketing Board	8,991	—
Saskatchewan Turkey Producers' Marketing Board	4,736	—
	37,000	—
PROVINCIAL GOVERNMENT		
Alberta	50,000	75,400
British Columbia	15,000	11,400
Manitoba	15,500	15,500
Saskatchewan	150,000	300,000
	230,500	402,300
OTHER FOUNDATIONS, COMPANIES AND INDIVIDUALS		
The W. Garfield Weston Foundation	100,000	100,000
	$660,354	$779,960

Schedule 2

Schedule of Conditional Grants

	September 30, 1989		1990	September 30, 1990			
	Accounts Receivable	Deferred Revenue	Funds Received	Accounts Receivable	Deferred Revenue	1990 Income	1989 Income
Natural Sciences and Engineering Research Council of Canada (NSERC)							
- Co-operative Research Development Agreement	$ —	$ 570,493	$ 654,000	$ —	$ 481,115	$ 743,378	$ 675,780
- Industrial Research Chairs	—	117,571	207,232	—	67,018	257,785	204,358
- Operating, Strategic and Equipment	—	35,400	348,740	—	74,787	309,353	199,752
- Industry Matching	—	—	53,142	—	53,142	—	—
BIOSTAR Inc.							
- NSERC Industrial Research Chairs	—	48,343	133,511	—	75,336	106,518	60,275
Canadian Bacterial Diseases Network	—	—	149,539	—	61,944	87,595	—
Agriculture Canada/NSERC Research Partnerships Grants	—	150,000	200,000	—	150,000	200,000	50,000
Farming for the Future Council of Alberta	—	28,512	129,000	—	70,343	87,169	9,488
Alberta Agricultural Research Institute (AARI)	21,579	—	84,188	13,356	10,962	65,003	33,358
Province of Ontario (OMAF) and Agriculture Research Institute of Ontario	85,124	—	59,705	104,314	—	78,895	107,503
Canada - Manitoba Agri-Food Development Agreement (ERDA)	19,830	—	65,000	35,000	—	80,170	23,951
Canada - Saskatchewan Subagreement on Agriculture (ERDA)	5,000	—	5,000	—	—	—	102,520
Saskatchewan Agriculture and Food -Agriculture Development Fund (SADF)	50,000	11,340	100,000	52,607	—	113,947	89,578
Agriculture Canada - Livestock Productivity Improvement Program	—	—	—	—	—	—	62,169
University of Minnesota	—	—	—	50,688	—	50,688	—
	$181,533	$961,659	$2,189,057	$255,965	$1,044,647	$2,180,501	$1,618,732

RESEARCH PUBLICATIONS IN SCIENTIFIC JOURNALS

Bielefeldt-Ohmann, H., Campos, M., Snider, M.G, Rapin, N.E., Beskorwayne, T.K., Popowych, Y.I., Lawman, M.J.P., Rossi-Campos, A. and Babiuk, L.A. 1989. Effect of chronic administration of recombinant bovine tumor necrosis factor to cattle. Vet. Pathol. 26: 462-472.

Bielefeldt-Ohmann, H., Campos, M., McDougall, L.J., Lawman, M.J.P. and Babiuk, L.A. 1990. Expression of tumor necrosis factor-α receptors on bovine macrophages, lymphocytes and polymorphonuclear leukocytes, internalization of receptor-bound ligand, and some functional effects. Lymphokine Res. 9:43-58.

Fitzpatrick, D.R., Redmond, M.J., Attah-Poku, S.K., van Drunen Littel-van den Hurk, S. and Babiuk, L.A. 1990. Mapping of 10 epitopes on bovine herpesvirus type-1 glycoproteins gI and gIII. Virol. 176:145-157.

Griebel, P.J., Bielefeldt-Ohmann, H., Lawman, M.J.P. and Babiuk, L.A. 1990. The interaction between bovine herpesvirus-1 and activated bovine T cells. J. Gen. Virol. 71:369-377.

Griebel, P.J., Gajadhar, A.A., Babiuk, L.A. and Allen, J.R. 1989. Trypanosome theirleri associated with T-lymphocytes isolated from a latently infected cow. J. Protozol. 36:415-421.

Hughes, H.P.A., Campos, M., Godson, D.L. and Babiuk, L.A. 1990. Immunity to viral infections. Current Opinion in Infectious Diseases. 3:343-350.

Hutchings, D.L., van Drunen Littel-van den Hurk, S. and Babiuk, L.A. 1990. Lymphocyte proliferative responses to separated bovine herpesvirus-1 proteins in immune cattle. J. Virol. 64:5114-5122.

Ijaz, M.K., Dent, D.L., Haines, D.M. and Babiuk, L.A. 1989. Development of a murine model to study the pathogenesis of rotavirus infection. Exper. and Moleular Path. 51:186-204.

Ijaz, M.K., Dent, D.L. and Babiuk, L.A. 1990. Neuroimmunomodulation of anti-rotavirus humoral immune response *in vivo*. J. Neuroimmunology. 26:159-171.

Parker, M.D., Yoo, D., Cox, G.J. and Babiuk, L.A. 1990. Primary structure of the E2 peplomer protein gene of bovine coronavirus and its surface expression in insect cells. J. Gen. Virol. 71:263-270.

Parker, M.D., Yoo, D. and Babiuk, L.A. 1990. Expression and secretion of the bovine coronavirus hemagglutinin/esterase (HE) protein by insect cells infected with a recombinant baculovirus. J. Virol. 64:1625-1629.

Tikoo, S.K., Fitzpatrick, D.R., Babiuk, L.A., and Zamb, T.J. 1990. Molecular cloning, sequencing, and expression of functional bovine herpesvirus-1 glycoprotein gIV in transfected bovine cells. J. Virol. 64:5132-5142.

Willson, P.J. 1990. Haemophilus, Actinobacillus, Pasteurella: Mechanisms of resistance and antibiotic therapy. Can. J. Vet. Res. 54:S73-S77.

Van Donkersgoed, J., Janzen, E.D. and Harland, R.J. 1990. Epidemiologic features of calf mortality due to hemophilosis in a large feedlot. Can. Vet. J. 31:Oct./Nov. issue.

van Drunen Littel-van den Hurk, S., Hughes, G. and Babiuk, L.A. 1990. The role of carbohydrate in the antigenic structure of bovine herpesvirus-1 (BHV-1) glycoproteins gI and gIV. J. Gen. Virol 71:2053-2063.

van Drunen Littel-van den Hurk, S., Gifford, G. and Babiuk, L.A. 1990. The epitope specificity of the protective immune response induced by individual bovine herpesvirus-1 (BHV-1) glycoproteins. Vaccine 8:358-368.

van den Hurk, J.V. 1990. Propagation of group II avian adenoviruses in turkey and chicken leukocytes. Avian Dis. 34:12-25.

van den Hurk, J.V. 1990. Efficacy of a virulent hemorrhagic enteritis virus propagated in turkey leukocyte cultures for vaccination against hemorrhagic enteritis in turkeys. Avian Dis. 34:26-35.

Yoo, D., Parker, M.D. and Babiuk, L.A. 1990. Analysis of the S spike (peplomer) glycoprotein of bovine coronavirus synthesized in insect cells. Virol. 179:121-128.

Yoo, D., Parker, M.D. and Babiuk, L.A. 1990. Expression and transport of the recombinant S2 subunit of the bovine coronavirus spike glycoprotein in insect cells with a baculovirus. Proceedings of the 11th World Congress of the Korean Scientists and Engineers: Biotechnology. pp. 931-936.

RESEARCH PRESENTATIONS, POSTERS AND ABSTRACTS PRESENTED AT MEETINGS

Attah-Poku, S.K., Redmond, M., Frenchick, P.J., Ho, K. and Babiuk, L.A. 1990. Synthesis and applications of rotavirus binding peptide. 73rd Canadian Chemical Conference and Exhibition. Halifax, Nova Scotia. July.

Babiuk, L.A., Campos, M., Sordillo, L.M., Hughes, H.P.A., Rossi-Campos, A. and Harland, R.J. 1990. Interaction of cytokines and leukocytes in infectious disease. American Dairy Science Association Annual Meeting. Raleigh, North Carolina. June.

Babiuk, L.A. and Redmond, M.J. 1990. The development of an immunological carrier for the delivery of vaccine antigens. International Conference on the Impact of Viral Diseases on Health Care and Medical Services in Saudi Arabia and the Middle East. Riyadh, Saudi Arabia. March.

Godson, D.L., Campos, M. and Babiuk, L.A. 1989. Lymphokine-activated cytotoxicity mediated by intestinal intraepithelial leukocytes. 70th Conf. Res. Workers Animal Dis. Chicago, Illinois, U.S.A. November.

Harland, R.J., Smart, M., Campos, M. and Janzen, E.D. 1989. Plasma zinc as a prognostic indicator in bovine respiratory disease. 70th Conf. Res. Workers Animal Dis. Chicago, Illinois, U.S.A. November.

Hughes, H.P.A., Campos, M., Godson, D.L. and Babiuk, L.A. 1990. Immunity to viral infections. The Seventh International Lymphokine Workshop "Lymphokines 1990: Cell Biology, Physiology, Therapy." San Antonio, Texas, U.S.A. October.

Ijaz, M.K., Attah-Poku, S.K., Redmond, M.J., Frenchick, P.J., Sabara, M.L. and Babiuk, L.A. 1990. Synthetic peptide vaccine confers passive protection against experimental rotavirus infection in neonatal mice. International Congress of Virology. Berlin, Federal Republic of Germany. August.

Liang, X., Zamb, T.J., Fitzpatrick, D.R. and Babiuk, L.A. 1990. Generation and *in vitro* characterization of a glycoprotein III-deletion mutant of bovine herpesvirus type-1. 15th International Herpesvirus Workshop. Georgetown University, Washington, U.S.A. August.

Martinod, S.R., Peel, J., Sordillo, L.M. and Voirol, M.J. 1990. Recombinant bovine interferon gamma reduces local and systemic tumor necrosis factor production in acute *Escherichia coli* mastitis. International Conference on Mastititis. Ghent, Belgium. September.

Peel, J., Sordillo, L.M., Voirol, M.J. and Martinod, S.R. 1990. Recombinant bovine interferon gamma reduces local and systemic tumor necrosis factor production in acute *Escherichia coli* mastitis. International Symposium on Bovine Mastitis. Indianapolis, Indiana, U.S.A. September.

Potter, A.A., Fodor, K. and Lawman, M.J.P. 1990. Identification of a plasmin receptor on *Pasteurella haemolytica*. IUMS Congress: Bacteriology and Mycology. Osaka, Japan. September.

Potter, A.A. and Harland, R.J. 1990. Development of a recombinant subunit vaccine for *Pasteurella haemolytica*. American Society for Microbiology Biotechnology Conference. Chicago, Illinois, U.S.A. June.

Redmond, M.J., Attah-Poku, S.K., Ijaz, K.M., Bielefeldt-Ohmann, H., Hughes, H.P.A., Laarveld, B. and Babiuk, L.A. 1989. Rotavirus particles function as immunological carriers for the delivery of peptides from infectious agents or endogenous proteins. Connaught 75th Anniversary Conference. Toronto, Ontario. October.

Redmond, M.J. and Babiuk, L.A. 1990. Rotavirus particles serve as the basis of a new vaccine delivery system. International Congress of Virology. Berlin, Federal Republic of Germany. August.

Sordillo, L.M. and Babiuk, L.A. 1989. Effects of recombinant bovine interferon gamma on bovine mammary neutrophil function *in vitro*. Mastitis Research Workers' Conference. Louisville, Kentucky, U.S.A. October.

Sordillo, L.M. and Babiuk, L.A. 1990. Use of recombinant bovine interferon gamma against *Escherichia coli* mastitis. National Mastitis Council. Louisville, Kentucky, U.S.A. February.

Sordillo, L.M. and Babiuk, L.A. 1990. Controlling acute experimental *Escherichia coli* mastitis with recombinant bovine interferon gamma. American Dairy Science Association Annual Meeting. Raleigh, North Carolina, U.S.A. June.

Sordillo, L.M. and Babiuk, L.A. 1990. Enhanced resistance to acute coliform mastitis following *in vivo* exposure to recombinant bovine interferon gamma. International Conference on Mastitits. Ghent, Belgium, U.S.A. September.

Sordillo, L.M. and Babiuk, L.A. 1990. Modulation of bovine mammary neutrophil function during the periparturient period following exposure to recombinant bovine interferon gamma. International Symposium on Bovine Mastitis. Indianapolis, Indiana, U.S.A. September.

Styrt, B., Walker, R., Dahl, L. and Potter, A.A. 1989. Time dependence of bovine granulocyte damage by crude and purified *Pasteurella haemolytica* leukotoxin. 70th Conf. Res. Workers Animal Dis. Chicago, Illinois, U.S.A. November.

Tikoo, S.K., Fitzpatrick, D.R., van Drunen Littel-van den Hurk, S., Zamb, T.J. and Babiuk, L.A. 1990. Antigenic analysis of BHV-1 glycoprotein gIV using deletion mutants. 15th International Herpesvirus Workshop. Georgetown University, Washington, U.S.A. August.

van den Hurk, J.V. and van Drunen Littel-van den Hurk, S. 1989. Immunization with the hexon protein of hemorrhagic enteritis virus protects turkeys against hemorrhagic enteritis infection. Sixth International Conference on Comparative and Applied Virology. Banff, Alberta. October.

van den Hurk, J.V., Allan, B.J., Riddell, C.E. and Potter, A.A. 1990. The effect on *E. coli* susceptibility of turkeys following exposure to hemorrhagic enteritis virus. Guelph, Ontario. June.

van Drunen Littel-van den Hurk, S., Parker, M.D., Fitzpatrick, D.R., Zamb, T.J., van den Hurk, J.V. and Babiuk, L.A. 1990. Synthesis, processing and immunogenicity of bovine herpesvirus-1 glycoproteins gI and gIV expressed in baculovirus. ASV Annual Meeting. Salt Lake City, Utah. July.

Yoo, D., Parker, M.D. and Babiuk, L.A. 1989. Bovine coronavirus: Production and characterization of the E2 glycoprotein in baculovirus expression system. Sixth International Conference on Comparative and Applied Virology. Banff, Alberta. October.

Yoo, D., Parker, M.D. and Babiuk, L.A. 1990. The S2 peplomeric subunit glycoprotein of bovine coronavirus mediates fusion in insect cells when expressed by a recombinant baculovirus. Eleventh World Congress of the Korean Scientists and Engineers. Seoul, Korea. June.

REPORTS AND PRESENTATIONS TO THE LIVESTOCK INDUSTRY, EXTERNAL GROUPS AND ORGANIZATIONS

Acres, S.D. 1990. VIDO's research and development programs in dairy production. Presented to the Alberta Agricultural Research Institute Dairy Research Review. Edmonton, Alberta. June.

Acres, S.D. 1990. VIDO's research and development programs in poultry production. Presented to the Alberta Agricultural Research Institute Poultry Research Review. Edmonton, Alberta. June.

Acres, S.D. 1990. An update on vaccines for *Pasteurella haemolytica* and IBR. Feedlot Health Management Services Annual Research Seminar. Calgary, Alberta. June.

Acres, S.D. 1990. The impact of respiratory disease on the cattle industry in Western Canada. The WCVM June Conference. Saskatoon, Saskatchewan. June.

Acres, S.D. 1990. Putting vaccines into perspective. The WCVM June Conference. Saskatoon, Saskatchewan. June.

Acres, S.D. 1990. Bovine respiratory disease. British Columbia Veterinary Medical Association 83rd Annual Conference and General Meeting. Kelowna, British Columbia. September.

Acres, S.D. 1990. Animal health research and development at VIDO. Presented to the Board of the Saskatchewan Agriculture Development Fund. Saskatoon, Saskatchewan. September.

Campos, M. 1990. Cytokines in infectious diseases. VIDO Swine Focus Research Seminar. Saskatoon, Saskatchewan. April.

Harland, R.J. 1990. *Haemophilus somnus:* Epidemiology, model development and vaccine testing. Feedlot Health Management Services Annual Research Seminar. Calgary, Alberta. June.

Hodgman, P.G. 1989. Animal health research at VIDO. Saskatchewan Agriculture Development Fund Conference. Regina, Saskatchewan. October.

Hodgman, P.G. 1989. Beef cattle research update. Alberta Cattle Commission Annual Meeting. Edmonton, Alberta. December.

Hodgman, P.G. 1989. Advanced technology and beef cattle research. Manitoba Cattle Producers' Association Annual Meeting. Winnipeg, Manitoba. December.

Hodgman, P.G. 1989. Technology use and impact on animal research. Agro-Forum Conference, University of Manitoba. Winnipeg, Manitoba. December.

Hodgman, P.G. 1990. Advanced technology and beef cattle research. Saskatchewan Cattle Feeders' Association Annual Meeting. Saskatoon, Saskatchewan. January.

Hodgman, P.G. 1990. Advanced technology and turkey research. Manitoba Turkey Producers' Marketing Board Annual Meeting. Winnipeg, Manitoba. March.

Hodgman, P.G. 1990. Dairy cattle research update. Manitoba Milk Producers' Marketing Board. Winnipeg, Manitoba. March.

Hodgman, P.G. 1990. Advanced technology and swine research. Saskatchewan Pork Producers' Marketing Board Annual Meeting. Saskatoon, Saskatchewan. April.

Hodgman, P.G. 1990. Advanced technology and swine research. Alberta Pork Producers' Development Corporation Annual Meeting. Edmonton, Alberta. April.

Hodgman, P.G. 1990. Technology use and impact on animal research. 1990 Adventure in Technology Program sponsored by Rotary Clubs of Saskatoon. Saskatoon, Saskatchewan. May.

Hodgman, P.G. 1990. Beef cattle research update. British Columbia Cattlemen's Association Annual Meeting. Kamloops, British Columbia. May.

Hodgman, P.G. 1990. Advanced technology and beef cattle research. Saskatchewan Stock Growers' Association Annual Meeting. Weyburn, Saskatchewan. June.

Hodgman, P.G. 1990. Advanced technology and dairy cattle research. Alberta Milk Producers' Society Annual Meeting. Red Deer, Alberta. June.

Hodgman, P.G. 1990. Advanced technology and beef cattle research. Saskatchewan Cattle Feeders' Association Short Course. Saskatoon, Saskatchewan. June.

Hodgman, P.G. 1990. Advanced technology and beef cattle research. Manitoba Cattle Producers' Association Semi-annual Meeting. Russell, Manitoba. July.

Hodgman, P.G. 1990. Advanced technology use and impact on animal health research. Ontario Advanced Agricultural Leadership Program. Saskatoon, Saskatchewan. July.

Potter, A.A. 1990. Overview of VIDO's swine vaccine research. VIDO Swine Research Focus Seminar. Saskatoon, Saskatchewan. April.

Redmond, M.J. 1990. Presentation of new methods of enhancing performance in swine. VIDO Swine Research Focus Seminar. Saskatoon, Saskatchewan. April.

Redmond, M.J. 1990. Report on new vaccination method for immunocastrating livestock. Industry/Government Workshop on the Production and Marketing of Pork from Intact Males. Ottawa, Ontario. June.

van den Hurk, J.V. 1989. Development of an improved vaccine for hemorrhagic enteritis in turkeys. Saskatchewan Agriculture Development Conference. Regina, Saskatchewan. October.

Willson, P.J. 1990. Vaccine development for pleuropneumonia of pigs. VIDO Swine Research Focus Seminar. Saskatoon, Saskatchewan. April.

Yoo, D. 1990. Prospects of the use of live-modified recombinant viruses as an animal vaccine. Veterinary Research Institute. Rural Development Administration. Seoul, Korea. July.

Yoo, D. 1990. Characterization of the recombinant membrane glycoproteins of bovine coronavirus expressed with baculoviruses. Genetic Engineering Center, Kyungbuk National University. Taegu, Korea. July.

CHAPTERS IN BOOKS, EXPOSITORY AND REVIEW ARTICLES

Babiuk, L.A. 1989. Viral induced gastroenteritis in ruminants. In: *Viral Infections of Ruminants.* Eds. Z. Dinter and B. Morein. Elsevier Science Publishers, Amsterdam. pp. 555-566.

Ijaz, M.K., Dent, D.L. and Babiuk, L.A. 1990. Modulation of the *in vivo* anti-rotavirus humoral immune response by neuroendocrines and neuropeptides. In: *Advances in Mucosal Immunology.* Eds. T.T. MacDonald, S.J. Challacombe, P.W. Bland, C.R. Stokes, R.V. Heatley and A.M. Mowat. Kluwer Academic Publishers, London. pp. 255-261.

Kurstak, E., Marusyk, R., Salmi, A., Babiuk, L.A., Kurstak, C. and van Regenmortel, M. 1989. Detection of viral antigens and antibodies: enzyme immunoassays. In: *Subcellular Biochemistry.* Vol. 15. Virally Infected Cells. Ed. J.R. Harris. Plenum Press, New York. pp. 1-37.

Parker, M.D., Yoo, D., Fitzpatrick, D.R., Cox, G.J. and Babiuk, L.A. 1990. The hemagglutinin of bovine coronavirus exhibits significant similarity to the HE of type C influenza viruses. In: *Coronaviruses and Their Diseases,* Proceedings of the Fourth International Congress on Coronaviruses. King's College, Cambridge, United Kingdom. Plenum Publishing, New York, N.Y.

RESEARCH COLLABORATORS

Dr. R. Duncan, Animal Disease Research Institute, Agriculture Canada, Nepean, Ontario

Dr. J. Files, CODON Inc., San Francisco, California, U.S.A.

Dr. D.M. Haines, Dept. of Veterinary Microbiology, Western College of Veterinary Medicine, University of Saskatchewan, Saskatoon, Saskatchewan

Dr. R. Koganty, Biomira Inc., Edmonton, Alberta

Dr. M. Longenecker, Biomira Inc., Edmonton, Alberta

Dr. M. Sabara, Lederle-Praxis Biologicals, Rochester, New York, U.S.A.

Dr. G. van Nest, CHIRON Corp., Emeryville, California, U.S.A.

Canadian Bacterial Diseases Network - A network of 54 investigators from seven Canadian universities, a number of industrial companies, and government laboratories interested in bacterial diseases of humans, animals, and fish.

- Dr. F. Graham, Dept. of Biology, McMaster University, Hamilton, Ontario
- Dr. R. Kirkwood, Dept. of Animal and Poultry Science, College of Agriculture, University of Saskatchewan, Saskatoon, Saskatchewan
- Dr. B. Massie, Biotechnology Research Institute, National Research Council, Montreal, Quebec
- Dr. C. Richardson, Biotechnology Research Institute, National Research Council, Montreal, Quebec
- Dr. C.E. Riddell, Dept. of Veterinary Pathology, Western College of Veterinary Medicine, University of Saskatchewan, Saskatoon, Saskatchewan

University of Saskatchewan Growth and Reproductive Immunology Program - A multidisciplinary group of investigators from VIDO, WCVM, and the Colleges of Medicine and Agriculture with the mandate of improving livestock production through the immunoregulation of hormone activity.

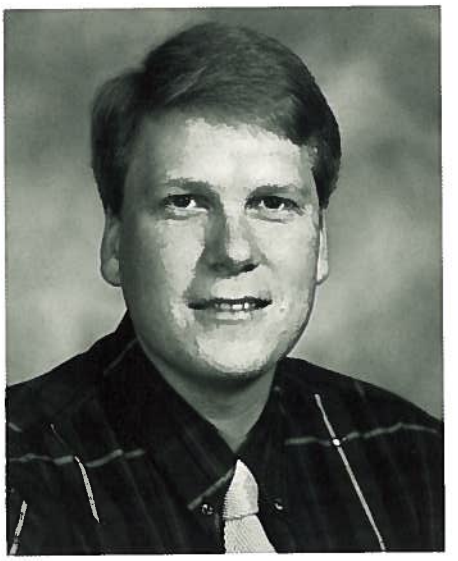
- Dr. A. Gonzalez, Reproductive Biology Research Unit, Dept. of Obstetrics and Gynecology, Royal University Hospital
- Dr. D. Kerr, Dept. Veterinary Physiology, Western College of Veterinary Medicine
- Dr. B. Laarveld, Dept. of Animal and Poultry Science, College of Agriculture
- Dr. R. Mapletoft, Dept. of Herd Medicine and Theriogenology, Western College of Veterinary Medicine
- Dr. B. Murphy, Reproductive Biology Research Unit, Dept. of Obstetrics and Gynecology, Royal University Hospital

VIDO AWARDS

FIRST C.H. BIGLAND FELLOWSHIP

VIDO established the C.H. Bigland Fellowship Fund in 1984 to acknowledge the Organization's first Director. The objective of the Fund is to provide financial support to Canadian veterinarians wishing to pursue graduate training towards a PhD degree in veterinary microbiology or epidemiology. The Fund now contains approximately $170,000 which was accumulated by VIDO through donations from individuals, many of whom are friends, colleagues and former students of Dr. Bigland, charitable foundations, and other groups. Selected candidates receive financial and research support for a period of three years. Fellowships are tenable at institutions in Canada or abroad within departments providing suitable training in the candidate's selected discipline. The Fund does not provide the total amount of the student's stipend, but rather provides $2.00 for each $1.00 provided by the Department in which the candidate is enrolled up to a maximum level equivalent to the current Medical Research Council Fellowships.

Dr. C.H. Bigland graduated with a DVM degree from the Ontario Veterinary College in 1941. He subsequently worked in private veterinary practice in Calgary, with the Health of Animals Branch of Agriculture Canada, and as a veterinary pathologist in the Alberta Department of Agriculture. In 1964 he became the first Head of the Department of Veterinary Microbiology in the then newly established Western College of Veterinary Medicine at the University of Saskatchewan. In 1974 he became Director of VIDO and during the next ten years helped to build it into an internationally recognized research organization. Dr. Bigland retired in 1984 and he and his wife Eva now live in Victoria.



This year, VIDO awarded the first C.H. Bigland Fellowship to Dr. Lorne Jordan. Dr. Jordan is enrolled in a PhD program in the Department of Veterinary Microbiology and Immunology at the Ontario Veterinary College. He is interested in Virology, particularly in enteric infections, interferons, and mucosal immunity. In pursuing his PhD degree, Dr. Jordan will study the role of Type I interferons in the pathogenesis of transmissible gastroenteritis of swine. Dr. Jordan's supervisor is Dr. J.B. Derbyshire, a professor who has conducted research in this area for many years. Dr. Jordan began research in virology during the summer of 1986, when he received an NSERC Under-Graduate Research Award. Following completion of his DVM degree in 1988, he began a Master's program and transferred into a PhD program in January 1990.

VIDO
University of Saskatchewan
124 Veterinary Road
SASKATOON, Saskatchewan, Canada
S7N 0W0
TELEPHONE: (306) 966 7465
FAX: (306) 966 7478