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A Message from the Director

Networking of Laboratories: An Idea Whose Time Has Come

Judith Isaac Renton, MD, DPH, FRCPC

Networking of laboratories within British Columbia, across Canada and beyond is key to sustaining health services. It is the theme of my report this year. We all benefit when information and ideas are shared. Within British Columbia, the medical microbiology community has always worked well together and we meet regularly.

Laboratorians in British Columbia had already rationalized many of our microbiology services but, in the current BC environment of laboratory redesign, we have been working even more closely together to further optimise our services.

BCCDC is an agency of the Provincial Health Services Authority (PSHA). The PSHA laboratories of BCCDC, BC Cancer Agency (BCCA), Children’s and Women’s Hospital (C&W) and Riverview Hospital worked closely together last year planning our improved collaborations as an academic specialty-based group. Examples of recent, excellent PHSA collaboration include the development around Human Papillomavirus (HPV) testing with Cervical Cancer Screening Program (BCCDC and BCCA) and Virology Rapid Testing Program (VIRAP), a collaboration of C&W and BCCDC.

We will look for new network opportunities to increase our effectiveness by sharing best practices.

VIRAP was a real success story; phase 1 saw rapid antigen detection service enhancements, education on specimen collection, infection control collaborations and interface with a new Medical Microbiology project, “Drugs & Bugs.” Phase 2 will mean enhancing test access and education across BC and development of new molecular tools for the detection of respiratory pathogens. This is one response of PSHA laboratories to the SARS outbreaks of 2003.

BCCDC Laboratory Services also works closely with other Health Authorities, particularly with the hospital and community laboratories and Public Health staff in each region. Together we have done excellent work on Norovirus outbreak detection and management. We lead Canada, if not North America, in Norovirus molecular epidemiology - DNA sequencing the RT PCR genetic products. Norovirus is a common water and food borne viral illness. Its impact in BC in detailed in the Environmental Protection section of this report.

BC’s rapid response to SARS in 2003 is another example of the benefits of networking. Our colleagues in hospital and community laboratories responded with practicality and professionalism. This excellent response was reinforced when Laboratory Services launched a rapid response to a SARS-like illness in a
nursing home in Surrey, BC. We found it was not SARS, but a related coronavirus (OC 93). The broad scientific investigation that followed further strengthened our laboratory network in British Columbia and across Canada.

Working collaboratively within BCCDC and with our partners in public health, we continued to prepare for the emergence of West Nile virus in BC. Communicable Disease Epidemiology Services and Laboratory Services (thank you, Drs. Fyfe and Morshed!) partnered to develop a program for surveillance that was implemented in 2003. The Laboratory Services testing component required collaboration among technologists and leaders from Parasitology, Virology, and Zoonotic and Emerging Pathogens. Building on that experience we are better prepared for future mosquito seasons. We will more than double the mosquito collection traps throughout BC in 2004 and are working on better molecular methods for identifying West Nile virus.

BC’s rapid response to SARS in 2003 is another example of the benefits of networking.

Networking has not only been a success in British Columbia but has increased significantly across Canada. As Director of Laboratory Services, I am a member of the Canadian Public Health Laboratory Network (CPHLN). This active group meets regularly by teleconferences and convenes in a Canadian city twice a year. During the past year we worked to strengthen pan-Canadian collaboration on SARS, on West Nile virus, on bioterrorism and on drinking water safety. Our network partnerships are the subject of a feature report in this year’s annual report.

BCCDC Laboratory Services has moved ahead strategically with its several mandates, particularly that of enhancing Public Health. PulseNet is one example of electronic sharing of data in the interest of public health; we share molecular “fingerprint” information on microbes of public health importance. In collaboration with the National Microbiology Laboratory and the Canadian Public Health Laboratory network, this crucial information highway will be expanded to include more molecular testing methods and new organisms.

In our previous Annual Reports we have made note that Quality Assurance is a touchstone of all that we do. Work on our Quality Management Systems Program includes a focus on staff development, electronic document control and Internal Quality Audits. It is my privilege to report on the diversity and the volume of work that we carry out for our patients and our communities but also on the quality of the product. We have made great progress in the last year, as we strive for excellence; the coming year is sure to have as many challenges, but also as many opportunities. BCCDC is now a leader on the PSHA Laboratory Enterprises Quality Council.

We look forward to working with a new Canadian Public Health Agency in the coming year in a stronger, visionary public health network. BCCDC Laboratory Services, we are proud to say, is seen as network leader, within the PSHA, in BC and across Canada and we look forward to enhancing real-time and virtual multi-disciplinary partnerships with our expertise and our excellence. We particularly look forward to a significant role in a BC National Co-ordinating Centre.

None of the important work that we do would be possible without the dedication and hard work of Laboratory Services staff and the collaboration of colleagues from within and without BCCDC. My sincere thanks go out to all of them and to many of you.

[Signature]
BCCDC Laboratory Services

Vision
- We strive to be a competitive, knowledge-based enterprise committed to improving community health through innovation, education and research
- We value our people and their exceptional contribution
- We aspire to provide services in an accountable manner

Mission
To provide leadership in microbiology laboratory initiatives and activities for the detection and control of communicable disease through learning, sharing information and policy development.

Mandate
We practise public health by providing laboratory leadership and programs. The mandate of BCCDC Laboratory Services is to carry out public health, reference, medical, environmental and specialty microbiology. As part of this mandate, our highly trained staff carry out diverse tasks from disease surveillance and outbreak detection and management to analytical testing and interpretation of test results for individual patients and entire communities. We lead through integrated, program-based services. As an integral part of the PHSA laboratories, we are part of a team delivering province-wide solutions leading to better health.

As an integral part of the PHSA Laboratory Enterprises (PHSA LE), we are part of a team delivering province-wide solutions leading to better health

Leadership
BCCDC Laboratory Services is a leader in the microbiology laboratory network of British Columbia. We work closely with our partners in the public and private sectors and are leaders in network enhancement. All our efforts are focused on ensuring the health of the people of British Columbia through the four key components of our public health mandate:

- Disease detection
- Disease surveillance
- Disease prevention
- Health promotion
- Health protection
Laboratory Manager’s Report

Darrell Cook

It has been a very eventful year in Laboratory Services, particularly with respect to a number of Provincial Health Services Authority corporate initiatives in which we actively participated.

Laboratory Informatics
Early in 2003, we began work on a major PHSA project to integrate the laboratories of the PHSA agencies, namely, BCCDC, Children’s & Women’s, BC Cancer Agency and Riverview Hospital. The first step, and the major enabler for the project, is the acquisition of a new Laboratory Information System (LIS). A team of approximately 70 PHSA laboratory employees has been involved for the past 5 months in evaluating vendor systems and identifying gaps which will need to be filled by custom-built or bolt-on solutions. The goal is to have a fully integrated, functioning LIS within the next two years.

We have reconstituted our LIS support group as the Laboratory Informatics Program (LIP). Membership is Darrel Cook (chair), Peter Ng, Rob MacDougall, Doug Ruisaard and Cora Yee. The LIP is responsible for database maintenance activities and managing all other aspects of the LIS, including user support.

Requests from researchers, both outside and inside BCCDC, for data extracts and linkages have been growing rapidly and are expected to continue. The changes we have made help to address this growing need to share information. Considerable effort is devoted to ensuring that these activities are done in compliance with the Freedom of Information and Protection of Privacy Act.

Sharing data with PharmaCare ensures that patients treated for hepatitis C infection receive the appropriate therapy

Sharing data can reduce unnecessary expenditures. By sharing data with PharmaCare we ensure that patients treated for hepatitis C virus infection receive the appropriate therapy. We improve treatment and reduce the waste of scarce resources.

Cora Yee, Healthy Water Co-ordinator, supported by the LIP team is working with partners throughout the province to develop informatics for drinking water and will be an important part of the new PSHA LIS.
The Supply Chain Integration Project (SCIP) kicked off in May 2003 with three main objectives:

- To engage the services of a group purchasing organization to achieve better prices for supplies and pharmaceuticals across the PHSA. We are in the process of migrating many existing supply contracts to Medbuy.
- To implement the PeopleSoft Logistics module. The e-procurement system went live on May 25, 2004 to replace our manual purchasing system. The Logistics module is fully integrated with the PeopleSoft Finance module. The net effect will be to reduce supply chain paperwork.
- To consolidate agency staff as a corporate unit and supply chain functions within PHSA.

As we reflect on the activities of the past year full of significant changes and new initiatives, we see some real accomplishments. I wish to pay tribute to those dedicated individuals who manage a full workload, and in addition are willing participants in the changes that are taking place. Often, this means giving up personal time and we are grateful for their valuable contributions.

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Laboratory Services Feature Report

Education & Research

Responding to Unusual Events in BC: A Team Building Workshop

Laboratory Services was the proud host of a BCCDC Team Building Workshop that involved presentations by experts in infectious diseases, infection control, epidemiology and laboratory testing. A Centre-wide effort was required to pull together a three-day, intensive workshop that demonstrated the strengths of BCCDC and of Laboratory Services. The workshop was co-ordinated by Bruce Gamage, Provincial Infection Control Consultant. The workshop brought together infection control practitioners and public health professionals for an overview of how BC has prepared to respond to public health events. Evaluations were excellent and plans are underway to repeat the workshop this year.

A Centre-wide effort was required to pull together a three-day, intensive workshop that demonstrated the strengths of BCCDC

Dr. Isaac-Renton welcomed all the participants and outlined our goals for the workshop - networking and team building. She acknowledged Dr. Bill Moorehead, whose idea the workshop was and who inspired BCCDC Laboratory services to host this event.

BCCDC Tuberculosis Control Director Dr. Kevin Elwood and Dr. Gwen Stephens presented “New Developments in the Investigation of TB” and Shirley Rempel, TBC Nurse spoke about tuberculosis services to Aboriginals.

From BCCDC Epidemiology Services, Dr. Danuta Skowronski, Physician Epidemiologist, addressed Lessons Learned from SARS; Dr. Monika Naus, Associate Director, spoke about Two Outbreaks of Listeria while Dr. Leila Srour, Physician Epidemiologist, presented an Evaluation of Gastrointestinal Disease Surveillance: How are we doing? Laura MacDougall, Surveillance Epidemiologist provided a case study of a Field Investigation of Outbreaks.

BCCDC Laboratory Services staff were active throughout the workshop: the Staff Development Team led the visiting Environmental Health Officers and other participants on a tour of the laboratories facilities of BCCDC. Ed Ratnarajah and Neil Chin of Biohazard Containment Services updated the participants on Bioterrorism Response and Containment Level 3 Personal Protective Equipment. Ed also led a tour of the biohazard CL3 laboratories. Bruce Gamage, Provincial Infection Control Consultant, provided overviews of Respiratory Illness Agents and Gastroenteritis Agents and of Infection Control and Respiratory Outbreaks. Bruce also provided An Update on Antibiotic Resistant Bacteria, while Lorraine Mcintyre, GI Outbreak Coordinator, described new tools for Gastrointestinal Disease Outbreak Tracing and GIS Mapping by DNA Sequencing. Dr. Mel Krajden, Medical Virologist and Ron Gillies, Supervisor, Viral Isolation Laboratory, presented Current Testing in the Investigation of Respiratory Outbreaks.
Parasitology Workshop
Quantine Wong, Supervisor, Parasitology Laboratory, provided a parasitology workshop for BMLSc students. The training is a degree requirement at UBC. Five post-graduate medical residents received training. This is a highly specialized discipline requiring commitment to continuing education to maintain professional competency.

Infection Control Guidelines
BCCDC’s Infection Control Guidelines are available on our website at www.bccdc.org. Laboratory Services Provincial Infection control Services is working on enhancing the link between public health and acute care/long term care with an infection control network.

Mycology Workshop & Teaching
The General Bacteriology and Mycology Section hosted a 2 hour Mycology workshop for students enrolled in the UBC BMLSC program. A small group of postgraduate Medical residents spent an hour in the laboratory looking at macroscopic and microscopic characteristics of various opportunistic and dimorphic fungi.

STD Control Training Program
The General Bacteriology Section participated in the STD Control Training Program (primarily for public health nurses) by holding the laboratory sessions in February, May, and October.

STD Clinics & Outreach Program in Vietnam
As part of BCCDC’s longstanding relationship with Vietnam, Ingrid Pocock and Tazim Rahim travelled to Ho Chi Minh City for 2 weeks in August to visit potential laboratory sites for STD Clinics to be set up the Mekong Delta. Laboratory Services works with BCCDC STD Control to set up STD Clinics and an Outreach Program in Vietnam, a CIDA-funded project. The program is a source of pride to all of us at BCCDC.

Enhanced Water Quality Assurance Program (EWQA)
EWQA’s first Auditor Training Workshop was held on October 27, 2003 and all but 2 of EWQA’s 13 auditors participated. Their enthusiastic evaluation indicated that it was a success and the workshop will now become an annual event.

Three educational bulletins were also distributed to Provincial Health Officer-approved laboratories, MHO’s, EHO’s and others in 2003 dealing with a variety of drinking water issues.

Medical Microbiology and Infectious Diseases Education
Five physicians in post-graduate training for specialty certification by the Royal College of Physicians and Surgeons of Canada through the University of British Columbia spent four weeks at BCCDC Laboratories. Dr. Bill Black, Resident Training Site Director, worked with the Medical Microbiologists and Laboratory Supervisors to provide seminars and “hands-on” bench education.

Dr. Bill Black worked with the Medical Microbiologists and Laboratory Supervisors to provide seminars and “hands-on” bench education. He is our UBC Residency Site Director.

Other Academic Contributions
At the University of British Columbia, the MD Host Defences and Infection (Foundations of Medicine) block was chaired by Dr. M. G. Morshed, the BMLSc path 327 course on Bacteriology, Mycology, Virology and Parasitology by Dr. S. H. Goh and the BMLSc Path 301 course, “Introduction to Medical Laboratory Science, Biological Chemistry”, by Dr. C. Ong. Lectures in the UBC courses and others to postgraduate medical residents and pharmacy students were given by Drs. Isaac-Renton, Ong and M. Petric. Three UBC directed studies
students in the Pathology (Path 438) and Biology (Bio 448) Departments were also supervised by Drs. Goh and Ong. We currently have two graduate students in Pathology, supervised by Drs. Isaac-Renton and Ong and have trained six co-operative program students UBC, the University of Victoria and Simon Fraser University. Medical and senior scientific staff sit on graduate student research and thesis examination committees for students from as far away as Australia.

External Research Funding
External funding was obtained from the Canadian Institutes of Health Research ($500,000 to Drs. Skowronski (PI), Petric, Krajden and others for 2003-2004) the NCE Canadian Water Network ($260,000 to Drs. Isaac-Renton (PI), Ong and others for 2002-2004), the Natural Science and Engineering Research Foundation ($116,000 to Dr. Ong (PI) for 2003-2007) and the Michael Smith Foundation for Health research ($578,000 to Drs. Stephen (PI), Isaac-Renton, Morshed, Ong and others for 2003-2006 and $163,000 to Dr. Petric (PI) for 2003-2004. Topics of study for these externally funded research projects include drinking water surveillance, cryptosporidiosis, SARS and emerging zoonotic diseases.

Grant Reviews
Medical Staff and senior scientists were invited reviewers of grants for the Michael Smith Foundation for Health Research, the United States-Israel Binational Agricultural Research and Development Fund and the US Environmental Protection Agency.

Publications & Presentations
Besides a book chapter on the role of arthropod vectors in disease transmission (Anthology of Biosafety VI (ed. Richmond, JY) and a booklet on Cryptosporidium serology in human populations, published by the American Water Works Research Foundation, Laboratory Services staff authored thirty publications, of which twenty-five were peer-reviewed articles in international and North American scientific and medical journals including:

- Science
- The Journal of Infectious Diseases
- New England Journal of Medicine
- Clinical Infectious Diseases
- Morbidity and Mortality Weekly Report
- Journal of Clinical Virology
- Journal of Medical Virology
- Journal of Rheumatology
- Journal of Toxicology and Environmental Health
- Thorax
- American Journal of Respiratory and Critical Care Medicine
- Clinical Trials
- British Journal of Obstetrics and Gynaecology
- International Journal of Tuberculosis and Lung Disease
- Journal of Medical Entomology
- Ophthalmology
- Canadian Medical Association Journal
- Canadian Journal of Medical Laboratory Science
- Canadian Journal of Infectious Diseases
Presentations and Lectures
Staff made presentations or provided lectures by invitation to:

- 15th Biennial Congress of the International Society of Sexually Transmitted Diseases Research, Ottawa
- 58th International Northwestern Conference on Diseases in Nature Communicable to Man, Flagstaff, AZ
- United Kingdom Drinking Water Inspectorate/United Kingdom Water Industry research Ltd./American Water Works Research Foundation
- Canadian Association for Clinical Microbiology and Infectious Diseases (CACMID)
- 43rd Interscience Conference on Antimicrobial Agents and Chemotherapy (ICAAC)
- 103rd General Meeting, American Society for Microbiology (ASM)
- Northwest Branch Meeting, ASM
- 19th Pan American Society for Clinical Virology Symposium
- Rabies in America Meeting
- 38th Central Canadian Symposium on Water Quality Research
- Canadian Water Network 1st national Symposium on Connecting Water Resources
- Canadian College of Microbiologists Workshop, Montreal
- British Columbia Cancer Agency
- Vancouver Hospital
- Vancouver Coastal health Authority In-service
- North Island Hepatitis C Update for Health Professionals
- BC Food Protection Symposium
- Canadian Institute of Public Health Inspectors, BC Branch, Educational Conference
- 3rd Annual Collaborative Meeting on Zoonotic and Communicable Diseases

A complete listing of publications, conferences and abstracts for 2003 appears at the end of this report.
Laboratory Services Feature Report

Networks

International
- Centers for Disease Control and Prevention, Atlanta, GA.
- Washington State Public Health Laboratories
- ArboNET
- PulseNet
- CampNet

National and Pan-Canadian
- McGill Centre for Tropical Disease Malaria Proficiency Testing Program
- National Enteric Surveillance Program
- PulseNet Canada
- Canadian TB Laboratory Technical Network
- Canadian Public Health Laboratory Network
- Laboratory Biosafety Advisory Council
- Canadian Association for Clinical Microbiology and Infectious Disease
- Emergency Response Assistance Plan (ERAP) for British Columbia, ERAP NO: 2-0746-007
- National Enhanced Water Quality Assurance Program (NEWQA)

Provincial
- PSHA Laboratory Enterprises (LE)
- BC Chapter, Canadian Association of Medical Microbiologists
- BC Association of Laboratory Physicians
- British Columbia’s Health Authorities

BCCDC
- Bioterrorism Response Advisory Team (BRAT) and BTNet
- Laboratory Biosafety Advisory Council
- Executive Management Team

The National Enteric Surveillance Program is a federal-provincial network of laboratories that tracks the prevalence of organisms causing enteric illnesses, such as *E. coli, Salmonella* and *Norovirus*. Information is updated at least weekly.

PulseNet Canada Scientists post Pulsed Field Gel Electrophoresis patterns of specific serotypes of *Salmonella, Shigella* and *E. coli* and check the patterns against those of serotypes they are investigating. “Instead of shipping organisms from one end of the country to the other, we show pictures...less messy,” says Ana Paccagnella, Supervisor, Enteric Bacteriology, BCCDC Laboratory Services.
Canadian Public Health Laboratory Network
Laboratory surveillance is a focus of our pan-Canadian work as we move to standardize public health laboratory protocols critical to enhanced surveillance and information management. The National Enhanced Water Quality Assurance Program, a made-in-BC model, based on Provincial Health Officers’ leadership with laboratories across BC, is considered by other provinces as exemplary. Alberta has joined the initiative. This model, endorsed by the CPHLN, is considered a pan-Canadian Public Health Initiative. BCCDC Laboratory Services leads the Canadian Water and Food Safety Team.

The National Enhanced Water Quality Assurance Program, a made-in-BC model, is considered exemplary

Cross-border Networking
BCCDC Laboratory Services, in collaboration with our counterparts in Alberta and Washington State, has already set in motion joint ventures that will allow us to enhance our current services and make better progress towards our goals, but will allow us to make tangible strides in building a network. We have so far held two cross-border meetings and several teleconferences, focused on bioterrorism response, Norovirus and SARS. Additional meetings are planned for the coming year.

Canadian Tuberculosis Laboratories Technical Network (CTLTN)
The mission of the CTLTN is to promote excellence in Canadian mycobacteriology laboratory services by:

- providing a forum for exchange and discussion on all aspects of mycobacteriology laboratory issues
- working toward the standardization of current laboratory methodologies
- encouraging participation in the national surveillance and proficiency programs
- promoting the implementation of biosafety guidelines
- providing for exchange of services and information regarding new technologies

The memberships consists of mycobacteriology representatives from the provinces and territories, the National Reference Centre for Mycobacteriology, Tuberculosis Prevention and Control, CIDPC, Health Canada and the National Microbiology Laboratories, Health Canada.
Laboratory Services Programs

Biohazard Containment Services

Core Programs
- Biocontainment Level 3 operations & maintenance
- Biocontainment Level 2 operations & maintenance
- Biocontainment consulting services
- Biohazard emergency response services & leadership
- Biosecurity services

Over the past 4 years the Office of Biohazard Containment has gained valuable knowledge and experience in operating its high containment laboratories and responding to provincial biohazard emergencies. A key program initiative, to meet future national and provincial demands, has been networking and outreach to British Columbia’s First Responders and the assessment of current international issues effecting biohazards, biocontainment and biosecurity.

During a threat to public health, including those caused by agents of bioterrorism, each province is responsible for safeguarding the health, security and well-being of its people. British Columbia’s three certified Level 3 biocontainment laboratory facilities have become an integral part of the rapid response system. Emergency response processes and capabilities are continuously being evaluated and improved by the Office of Biohazard Containment in consultation with First Responders, Medical Health Officers, the Provincial Health Services Authority, the Provincial Health Officer and the Ministry of health’s Emergency Preparedness Program.

Recent world bioterrorism events and plausible threats related to infectious agents have increased the need for maintaining accountability of microorganisms that cause disease. The Canadian Public Health Laboratory Network (CPHLN) and the Office of Biohazard Containment are currently developing an “integrated approach” biosecurity initiative for laboratories. As a first step, BCCDC Laboratory Services has implemented a Materials Transfer Agreement to ensure both biological safety and biosecurity are accounted for before releasing biological materials to a facility for research or quality control purposes. We are one of the first laboratories in Canada to do so. The Director, the Head, Biocontainment Services and the Deputy Provincial Health Officer are collaborating to keep current our information on potential biological terrorism agents in clinical laboratories. In addition, the following biosecurity considerations will be applied as part of the BCCDC Biosecurity Initiative:

- Biosecurity Management
- Stock Culture Accountability
- Data and Electronic Tracking Systems
- Material Transfer Agreements
- Import/export Permit Procedures
- Transportation of Dangerous Goods (TDG)
- Facility Security Standards and Policies
- Risk Management Processes
- Countermeasure Assessment
In 2003 Health Canada's Population and Public Health Branch released two pilot training initiatives, Chemical, Biological, Radiological, Nuclear Emergency (CBRN-E) Response training and Tier 1 Laboratory Bioterrorism Recognition training. The CPHLN and the Office of Biohazard Containment Services were involved in the evaluation process for both training programs and simultaneously received the training required to improve emergency response capabilities for our Province. In 2004, BCCDC Laboratory Services will have another staff member trained for the Tier 1 training program and we plan to begin delivering the program to Tier 1 laboratories in British Columbia.

Vancouver Fire Department HAZMAT (Hazardous material) team members training on a decontamination line. These “First Responders” would be on scene in a bioterrorism event. They would sample materials that might be tested for biological agents at BCCDC.

The Office of Biohazard Containment works in close collaboration with staff from British Columbia Buildings Corporation to maintain the laboratories at BCCDC. Current work in the Containment Level 3 facilities includes SARS-CoV and *Mycobacterium tuberculosis* research and bacteriologic and virologic diagnostic work.

Edward Ratnarajah, Head, Biohazard Containment Services is a registered Biological Safety Professional with the American Biological Safety Association and is in his final term as the President of the American Biological Safety Association of Canada. Ed is a member of the BCCDC Bioterrorism Response Team, Bioterrorism Response Advisory Team and is the chair of the BCCDC Laboratory Biosafety Advisory Council (LBAC). Neil Chin, Biological Safety Officer is the co-chair of LBAC and is a key member of the Biohazard Containment Services Team. Ed and Neil respond to CBRN-E events on scene when requested by First Responders and have an active role in CBRN-E emergency co-ordination. They are working as liaisons in the newly developing PSHA program.
The BCCDC Bioterrorism Response Team includes Medical Microbiologist, Epidemiologists, Biological Safety Officers and specially trained Containment Level 3 laboratory staff. The BCCDC Team works closely with the members of Bioterrorism Response Advisory Team, the Provincial Health Officer, local Medical Health Officers, First Responders and the Provincial Health Services Authority.

Representatives from all laboratory sections and the Office of Biohazard Containment serve on Laboratory Biosafety Advisory Council. All laboratory safety concerns are addressed at meetings through policy development, training and education.

Emergency Response Assistance Plan (ERAP) for British Columbia, ERAP NO: 2-0746-007
BCCDC Laboratory Services participates by providing a Provincial Response Team and a Provincial Response Coordinator for the federal government’s ERAP for Risk Group 4 (RG4) infectious substances affecting humans. Edward Ratnarajah is the Provincial Response Team Leader. The Laboratory Services’ medical microbiologist on call (any one of Drs. Isaac-Renton, Krajden, Black and Stephens) is also a member of the Response Team and is responsible to appraise the situation in an Emergency Call Report and to identify critical response issues. In all RG4 incidents, primary responsibility rests with the federal Centre for Emergency Preparedness and Response and with Transport Canada; responsibility for spill containment and clean-up rests with the Provincial Response Team.

Biological Response Advisory Team (BRAT) was a response template developed by Vancouver Coastal Health Authority in collaboration with others, including BCCDC Laboratory Services. This template has been recognized province-wide and across Canada. Biohazard Containment Services is working to ensure the currency of the BCCDC component of the BRAT.

Laboratory Microbial Security
Working with the Canadian Public health laboratory Network (CPHLN), Health Canada’s Office of Laboratory Security and the BC Provincial Health Office, BCCDC Laboratory services has begun a review of laboratory stocks and procedures related to their secure handling and storage. Initially this project will be done in collaboration with BC’s laboratory professionals’ societies.

Bioterrorism Tier 1 Laboratory “Train the Trainer”
Ed Ratnarajah attended a “Train the Trainer” Tier 1 laboratory bioterrorism surveillance and detection session in Regina, hosted by the National Microbiology Laboratory. Ed will lead the CPHLN education and outreach program in BC. Staff in tier 1 laboratories will be trained to identify and report suspected agents of bioterrorism.
Laboratory Services Sections

Enteric Bacteriology

Core Services
- Outbreak investigation & surveillance
- Culture and identification of enteric bacterial pathogens
- Serotypes and subtypes enteric pathogens
- Investigates and assists in management of outbreaks of enteric disease
- PCR testing for Enterohaemorrhagic *E. coli* or Verotoxin producing *E. coli*, Enteroinvasive *E. coli* and Shigella and Enterodherent *E. coli*

In collaboration with others at BCCDC and with federal agencies, such as the National Enteric Surveillance Program and PulseNet Canada, the section provides laboratory support in the investigation of enteric disease across national and international boundaries. By sharing real-time Pulsed Field Gel Electrophoresis (PFGE) patterns via computer linkages, surveillance of enteric pathogens is possible, thus streamlining outbreak discovery and management, saving lives and money. The foundation of our success is our networking through PulseNet.

PulseNet Canada is a network of professionals in the provincial laboratories in BC, Alberta, Saskatchewan, Manitoba, Ontario, Quebec and New Brunswick. We are also networked via the National Microbiology Laboratory in Winnipeg to the PulseNet in the United States. PulseNet US has laboratory links to Europe, Asia and Latin America.

The foundation of our success is our networking through PulseNet.

**Molecular Subtyping**
*E. coli*, Salmonella and Shigella isolates are further subtyped or fingerprinted in real time by using the PulseNet Standardized Protocol. In 2003 we tested 1,245 isolates by this method. The results from this analysis are always used in conjunction with clinical, microbiologic and epidemiologic information rather than for individual patient diagnostic purposes.

**Outbreak Detection and Investigation 2003**
- *Salmonella* Heidelberg associated with chicken strips
- *Salmonella* Enteritidis associated with a restaurant
- *Salmonella* Typhimurium associated with a house party
- *Salmonella* Typhimurium associated with a bakery
- *E. coli* O157:H7 associated with a petting zoo at a farm

**Routine Testing**
Besides its standard procedures, the section uses PCR technology to test of Enterohaemorrhagic (Verotoxin producing) *E. coli* (EHEC), Enteroinvasive *E. coli* and Shigella (EIEC) and Enterodherent *E. coli* (EAEC). The percentage of Verotoxin producers isolated from stool that were not *E. coli* O157:H7 was 48% this year.
Top 10 Salmonella Serovars isolated in BC in 2003

<table>
<thead>
<tr>
<th>Isolate</th>
<th>Human Source</th>
<th>All sources</th>
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<tbody>
<tr>
<td>1 Salmonella Typhimurium</td>
<td>128</td>
<td>157</td>
</tr>
<tr>
<td>2 Salmonella Heidelberg</td>
<td>104</td>
<td>137</td>
</tr>
<tr>
<td>3 Salmonella Enteritidis</td>
<td>103</td>
<td>107</td>
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<tr>
<td>4 Salmonella Typhi</td>
<td>41</td>
<td>41</td>
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<td>5 Salmonella Hadar</td>
<td>29</td>
<td>43</td>
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<tr>
<td>6 Salmonella Agona</td>
<td>28</td>
<td>31</td>
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<td>7 Salmonella Paratyphi A</td>
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<td>9 Salmonella Saintpaul</td>
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<td>10 Salmonella Stanley</td>
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The complete breakdown of Salmonella serotypes can be found in the appendix.
Laboratory Services Sections

Environmental Services

Core Services
- Outbreak detection & investigation
- Public health surveillance
- Research & development in foodborne & waterborne disease
- Enhanced Water Quality Assurance Program
- Participation in national electronic surveillance for foodborne & waterborne disease
- Office of the Laboratory Outbreak Co-ordinator
- Reference & specialty water testing
- Leadership in national environmental health

The Environmental Services Section tests environmental samples for microbial contamination and clinical samples to identify microbial pathogens, such as E. coli H7:O157, for health protection purposes. The section is made up of two laboratories, Water Bacteriology and Foodborne Diseases.

Waterborne Disease
The Water Bacteriology laboratory carries out bacteriological examination of water for public health. We test samples from public and private drinking water sources, swimming pools, whirl pools, bathing beaches, raw water sources, sewage and sewage-contaminated water. The principal indicator used in determining sanitary quality of water supplies is the coliform group of bacteria. The laboratory also examines water samples to determine etiological agents of waterborne disease outbreaks.

Foodborne Disease
The Foodborne Diseases laboratory assists physicians in the diagnosis of food poisoning, including botulism, and health departments in the investigation and control of foodborne disease outbreaks. We examine food and clinical samples from outbreaks for the causative microbial agents and their toxins.

The Food Quality Check Program provides testing services to public health in assessing the sanitary quality of ready-to-eat food from food service establishments. Food samples received under this program are routinely tested for total aerobic mesophilic bacteria, coliform, fecal coliform and Staphylococcus aureus.
Special Environmental Health Investigations
A critical function of Environmental Health Food and Water staff is the detection, investigation and management of outbreak. Staff work closely with regional MHO’s and EHO’s. Non-outbreak incidents are also investigated.

Detection & Identification of *Legionella pneumophila*
In the summer of 2003, we participated in the investigation of an incident of waterborne *Legionella* pneumonia in the east Kootenay area. A resident from Cranbrook developed respiratory symptoms after visiting facilities in the neighbouring hot springs. The patient was hospitalized in Calgary and the laboratory there confirmed the presence of *Legionella pneumoniae* serogroup 1 in the patient’s specimen by culturing. Seven water samples were collected from the hot spring facilities, including hot plunge pool, hot pool, cool pool, spa whirlpool, surprise pool, source water and drinking fountain and were submitted to us for examination. *Legionella pneumoniae* was isolated from the hot plunge pool and from the source water samples. Both isolates were of serogroup 3 but were different from the patient’s isolate.

In the fall of 2003, a respiratory outbreak occurred in a fire fighting camp west of Cranbrook. 70 to 90 of the 300 plus fire fighters were sick, half with respiratory symptoms and the other half with gastrointestinal symptoms (vomiting and diarrhoea). Because of the pneumonia-like symptoms of some of the fire fighters, five water samples from different washroom showers were collected for *Legionella* examination. No *Legionella* was detected in the water samples.

Enhanced Water Laboratory Specialty Program
The Enhanced Water staff are trained in complicated, specialized water testing for the investigation of waterborne outbreaks involving *Giardia* and *Cryptosporidium*. Water utilities and health units throughout BC request testing for risk assessment/trend analysis to help ensure the supply of safe drinking water. The laboratory is also actively involved in research studies that contribute to source water protection and watershed management.

Working in collaboration with Molecular Services, the Enhanced Water Laboratory undertook development and optimization of a test to detect *Cryptosporidium* species oocysts from environmental water samples. The project team, led by Diane Eisler and including Dr. Corinne Ong, Selena Shay and Lorraine McIntyre, has developed a real-time PCR assay targeted at the 18S rRNA gene able to detect the DNA from a single oocyst. The team is exploring means of removing inhibitors from the samples, enhancing the concentration of oocysts from water and the efficient extraction of their DNA.

The seasonal trend in 2003 showed an increase in the number of parasites detected in the winter and fall months. This is a shift from the pattern seen in 2002 when the winter and spring months showed a marked increase in parasite numbers. The percentage of samples from 2003 in which either *Giardia* or *Cryptosporidium* were detected is approximately 25%.

Staff began to evaluate the new Filta-Max filtration system. This technology has demonstrated improved capture of parasites from water with significantly greater recoveries. Molecular methods (Nucleic Acid Amplification) for the detection of *Giardia* and *Cryptosporidium* in drinking water are underway and will contribute to determining the significance of parasitic contamination of drinking water to public health.
Food Poisoning and Gastroenteritis Outbreaks
Norovirus gastroenteritis outbreaks continued across the province. One predominant sequevar caused over 95 outbreaks and 2600 infections from May 2002 to September 2003, BCCDC 02-007 (see Figures 1 and 2). This sequevar is a Group II 4 Norovirus, and was first identified in March 2002 in Farmington Hills, Michigan. A summary table identifying the sequevar patterns for all outbreaks can be found in the Appendix.

Figure 1

Figure 2
Norovirus outbreaks occurred predominantly in long-term care facilities, however, hospitals, elementary schools, daycares, camps, restaurants, hotel conferences and other events were all affected as well (Figure 3).

Three *Salmonella* outbreaks were identified with two of these linked to a single bakery in the lower mainland. *Salmonella Typhimurium* was identified in a routine food poisoning investigation from cake in late September. In this investigation four people who ate the cake at a birthday party became ill with diarrhoea and nausea. Although the bakery was not directly implicated in the first large *Salmonella Typhimurium* outbreak of the year (a wedding with over 500 guests), health inspectors recognized that this bakery also provided desserts at the event. The operator has been told to use only pasteurised eggs at his facility.

Other gastroenteritis outbreaks included a swimming pool outbreak of *Cryptosporidium parvum*, locally produced cilantro as a possible food vehicle for *Cyclospora cayentenesis* infection and two Astrovirus outbreaks, identified in a day care and an elementary school. Like Rotavirus, which was identified in six day-care outbreaks, Astrovirus is common in children.

Several *Bacillus cereus* food poisoning incidents were linked to ethnic foods stored at incorrect temperatures. *Bacillus cereus* is a naturally occurring soil organism and is a spore former. Spores are resistant to heating and, if food is left out above 10°C and below 60°C, the spores may germinate and vegetative cells of *Bacillus* will colonize the food and elaborate toxins.
The most interesting routine food poisoning investigation in 2003 involved chicken nuggets. One family who purchased a large box of frozen chicken nuggets became ill, and one child was subsequently identified as having *Salmonella*. The leftover nuggets were submitted for testing and also found to contain the same strain of *Salmonella*, *Salmonella Heidelberg*. Other unopened packages of nuggets submitted to the laboratory for testing revealed that the same strain was again found in chicken strips from the same supplier. A different type of *Salmonella* (Kentucky) was found in a different supplier’s chicken nuggets. Are these raw or cooked? Frozen chicken nuggets, although they are browned, are still considered a raw product. Chicken nuggets are now considered a risk factor for contracting *Salmonella*. A report of this investigation will be published in the *Journal of Food Protection* in June, 2004.

**Molecular Methods**

To improve our identification of gastroenteritis outbreaks, we undertook a retrospective examination of archived specimens from outbreaks of unknown cause. We employed PCR methods to enhance detection of viral agents, specifically Norovirus (using a different primer site), Astrovirus and Rotavirus. Using Region A primers for Norovirus we identified an additional 12 outbreaks, previously of “unknown” etiology, and 2 Astrovirus outbreaks (already described) were identified. For 2003, etiologic agents in 138 of the 182 laboratory investigated outbreaks were detected, a “solve” rate of 76%. Of interest, Torovirus was a new agent identified in this analysis.

**Sequencing of Norovirus cDNA to determine molecular epidemiology of the virus**

Noroviruses continue to be the major cause of gastroenteritis outbreaks in the province of British Columbia, accounting for as many as 70% of all outbreaks. The continuation of a program, initiated in 2001, to sequence and track the virus strains within the province saw 250 samples submitted for sequencing during 2003. This number represented a decline of approximately 50% from the previous year, indicating the cyclic nature of the disease caused by the virus.
Laboratory Services Sections

General Bacteriology And Mycology

Core Services
- Outbreak detection, investigation and management
- Provincial bacterial reference testing
- Diagnostic testing for bacterial public health pathogens
- Molecular and other bacterial typing
- Antimicrobial susceptibility testing
- Mycology services; primary and reference testing
- Research

Bacteriology Containment Level 3 Testing
In 2003 six environmental specimens were submitted for examination for bacterial agents of bioterrorism. All specimens were collected using the Chain of Custody Protocol, tested in our CL3 facility and found to be negative. We work with local Medical Health Officer, First responders and BCCDC Biocontainment Services on agents of bioterrorism. An additional 4 cultures were submitted from other laboratories for examination for Risk Group 3 bacteria. One isolate of *Francisella tularensis* from a thumb abscess and one isolate of *Brucella melitensis* from a blood culture were identified.

![Anthrax](image)

**Agents of Bioterrorism**
General Bacteriology staff worked with Molecular Services to validate species-specific PCR techniques, developed by the National Microbiology Laboratory, to perform confirmatory testing for agents of bioterrorism. These tests are part of our Level 3 containment laboratory and Biosafety programs.

**Bacterial Identification**
General Bacteriology staff also worked with Molecular Services staff to develop our reference centre for the identification of bacterial isolates from clinical sources by sequencing of the 16S rRNA gene. Responsibility for the frontline sequencing of bacterial isolates for identification purposes was transferred to the General Bacteriology Section. Molecular Services maintains and upgrades the databases used for bacterial identification and assures the quality of sequencing and accuracy of the identifications provided by General Bacteriology Section.

**Molecular Services**
- PCR testing for detection of *Chlamydia trachomatis* and *Bordetella pertussis* from clinical specimens.
- Pulsed field gel electrophoresis to fingerprint methicillin resistant *Staphylococcus aureus* (MRSA) and *Neisseria meningitidis*.
- Validation and implementation of DNA sequencing for the 16S rRNA and Chaperonin genes is under way.
Sequencing of 16S rRNA gene
A study entitled Bacterial Identification by 16S rRNA Gene Sequencing: One Year’s Retrospective was undertaken, in collaboration with BCCDC Molecular Services, and presented at the 71st CACMID meeting held in Montreal November 2-5, 2003.

Gene Sequencing for Identification of Nocardia
During 2002 we began a joint project with the Molecular Services Program to expand the use of 16S rRNA gene sequencing to identify Nocardia species. To improve the way in which these isolates are identified a database was constructed from published GenBank sequences and the optimal fragment size for identification purposes determined. In collaboration with the Molecular Services and the Microbiology Laboratory of the London Health Sciences Centre, London, Ontario, clinical, reference and species type strains were sequenced and compared to our in-house database. To date 123 isolates submitted as Nocardia species have been DNA sequenced. Preliminary data indicates that 16S rRNA gene sequencing is an excellent means of identifying this group of organisms, providing both a more rapid and cost effective means of identification. To date we have been able to accurately identify most isolates to defined species, including some which have only recently been described in the literature. Our data indicates that the most commonly isolated pathogenic species, Nocardia asteroides, has in fact been misidentified using other techniques and these isolates are actually a mixture of species, with the majority of isolates belonging to N. abscessus, N. beijingensis, N. cyriacigeorgica, N. farcinica, N. nova or N. veterana. This work has been submitted to the 2004 conjoint meeting of the Canadian Society of Medical Laboratory Sciences, Saskatoon. During the preliminary stages of the study other aerobic acintomycetes isolated from humans were submitted for sequencing of the 16S rRNA gene and although only a small number of isolates have been analyzed, this method appears to be a promising identification method for other genera as well. The assessment of the technique continues as we expand our database.

Determination of identical PFGE patterns...is further evidence to help confirm the presence of an outbreak or cluster of infection.

MRSA/MSSA typing
Hospitals throughout BC submitted Staphylococcus aureus isolates for fingerprinting. Methicillin resistant S. aureus (MRSA) or Methicillin sensitive S. aureus (MSSA) isolates which have identical antibiograms and biochemical test results and come from patients where there is strong clinical and epidemiological evidence to indicate an outbreak or cluster of infections, are subjected to PFGE typing. Determination of identical PFGE patterns in such isolates is further evidence to help confirm the presence of an outbreak or cluster of infection.

In 2003 nineteen outbreaks or clusters from 11 different hospitals were investigated, using PFGE typing. Fourteen of the clusters were MRSA and five were MSSA.

Listeria monocytogenes 2003
Seventy-one clinical isolates of L. monocytogenes from invasive sources were received over a 10 year period from 1992 to 2001, the predominant serotype being 1/2a. In 2002 sixty-four isolates were received; the predominant serotype was 4b (Table 1.). Fifty-three of the 2002 cultures were isolated from contaminated cheeses produced by 3 different manufacturers and also from patients who had consumed the contaminated cheeses. In 2003 the number of L. monocytogenes isolates fell to pre-2002 levels. There were 9 clinical isolates from invasive sources and the predominant serotype was once again 1/2a.

| Table 1. Listeria monocytogenes serotypes 1992-2003 |
|----------|----------|----------|----------|----------|----------|
|          | 1/2a     | 1/2b     | 4b       | 4c       | Total    |
| 1992-2001| 44       | 15       | 11       | 1        | 71       |
| 2002     | 8        | 6        | 50       | 0        | 64       |
| 2003     | 7        | 2        | 2        | 0        | 9        |
Antimicrobial Susceptibilities
Minimal inhibitory concentration (MIC) testing using appropriate NCCLS protocols is carried out in this section. Tests include the E-test on Mueller Hinton agar (5% sheep blood) for *Neisseria meningitidis*, beta lactamase and MIC tests for *Neisseria gonorrhoeae*.

Mycology Testing Services
The Mycology service performed a total of 4,760 tests. The number of specimens examined for deep mycoses remained steady at 3,759 or 79% of specimens. The number of referred specimens also remained constant at 771 or 16.2% of specimens. Testing for dermatophytes dropped even further to 230 or 4.8% of specimens, as clients now routinely send their specimens to private laboratories.

Cryptococcus Outbreak, Vancouver Island
Subject of a feature report in last year’s annual report, the outbreak of *Cryptococcus neoformans var gattii* on Vancouver Island continued to be investigated. The number of *var gattii* isolates submitted for confirmation/serotyping in 2003 was 21, similar to the number submitted in 2003 (22 isolates). In 2003 all animal specimens were sent for testing to a laboratory at the University of British Columbia. This resulted in a decrease of primary isolates of *var gattii* seen at BCCDC from 22 (7 human and 15 animal isolates) in 2002 to 4 (all human isolates) in 2003. We collaborate with Vancouver Island Public Health and Medical Microbiologist Dr. Karen Bartlett, University of British Columbia.

Containment Level 3 Testing - Deep Mycoses
Six isolates were identified as *Coccidioides immitis*, 5 of which were recovered from primary specimens. The one referred isolate submitted from Victoria General Hospital was a very atypical strain. Colonies of this isolate were waxy rather than floccose and arthrospore formation was very poor. Identification of all *C. immitis* isolates was confirmed by nucleic acid hybridization testing at the Nation Reference Center for Mycology in Edmonton, Alberta.

Molecular Identification of Actinomycetes
Timely identification of *Nocardia* and other aerobic actinomycetes using biochemical tests has always been very difficult. Over 100 isolates have been sent to the molecular diagnostics laboratory where 16S rRNA sequencing has been used for the identification of *Nocardia* species and other related organisms. This technique is still under assessment in collaboration with Molecular Services.

Teaching and Education
The Section hosted a 2-hour Mycology workshop for students enrolled in the University of British Columbia’s BMLSc program. A small group of postgraduate medical residents spent an hour in the laboratory looking at macroscopic and microscopic characteristics of various opportunistic and dimorphic fungi.

The General Bacteriology Section participated in the STD Control Training Program (primarily for public health nurses) by holding the laboratory sessions in February, May, and October. The section also participated in several laboratory tours conducted for community college students.

As part of BCCDC’s longstanding relationship with Vietnam, Ingrid Pocock and Tazim Rahim travelled to Ho Chi Minh City for 2 weeks in August to visit potential laboratory sites for STD Clinics to be set up the Mekong Delta. The STD Clinics are part of Laboratory Services works with BCCDC STD Control to set up STD Clinics and an Outreach Program in Vietnam, a CIDA-funded project.
Laboratory Services Sections

Mycobacteriology

Core Services
- Molecular cluster analysis for Tuberculosis Control
- Reference laboratory for tuberculosis, non-tuberculous Mycobacteria (NTM)
- Drug Susceptibility testing for tuberculosis
- Validation trials & applied research

There were 319 confirmed active cases of tuberculosis reported in British Columbia in 2003. The Mycobacteriology Section works closely with Tuberculosis Control (BCCDC) as British Columbia’s diagnostic and reference laboratory for $M. tuberculosis$ (Mtb) and non-tuberculous mycobacteria (NTM). Tuberculosis is designated a risk group 3 pathogen and our work is carried out in one of BCCDC’s Containment Level 3 laboratories, following strict procedures for biocontainment.

Testing Services
The section tested 20,404 specimens for $Mtb$ and NTM. 366 cultures were referred from other laboratories for identification and confirmation. Of the 18,846 specimens examined by microscopy 862 (4.6%) were positive for acid fast bacilli, an indication of the potential for transmission.

Molecular Confirmatory Testing
The $M. tuberculosis$ Direct (MTD) GEN-probe method is used to confirm smear-positive specimens. A total of 460 MTD tests were performed in 2003: 177 tests were on sputa, 283 on other specimens. Negative and positive probe results were further confirmed by culture. A second GEN-probe method (Accuprobes) is used on positive cultures.

<table>
<thead>
<tr>
<th>Origins of $M. tuberculosis$ and Nontuberculous mycobacteria (NTM)</th>
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<tbody>
<tr>
<td><strong>Isolates From</strong></td>
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<tr>
<td>--------------------------</td>
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<tr>
<td>Clinical Specimens</td>
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<tr>
<td>Referred Cultures</td>
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<tr>
<td><strong>Total</strong></td>
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<tr>
<td>Note: TB : NTM ratio for clinical specimens is $1 : 1.2$ (764 : 943 )</td>
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</tbody>
</table>

Susceptibility Testing
All new $Mtb$ isolates are tested for drug susceptibility using the radiometric method. Isolates showing resistance to more than one drug are confirmed with the agar plate method. Isolates showing resistance to isoniazid or rifampin are automatically tested against pyrazinamide in addition to the second line of drugs. 504 susceptibility tests were performed. The section participates in the National Surveillance System for monitoring $Mtb$ drug resistance patterns.

Susceptibility testing for $M. avium-intracellulare$ (MAC) is available only following consultation. The section uses radiometric broth macrodilution method for determination of minimal inhibitory concentration (MIC). Mycobacteria that are rapid growers are tested for susceptibility to a standard panel of antibiotic agents using the e-test MIC method. NTM isolates are tested for drug susceptibility on request of the physician.
Special Projects: Identification of *Mycobacterium* species by partial sequencing of the 65KD Heat Shock Protein gene (*hsp65*)

The Section is actively involved with Molecular Services in the validation and implementation of the partial sequencing of the 441 bp *hsp65* gene fragment to speciate all known and putative *Mycobacterium* species type strains often associated with causing disease in humans. Sequencing provides rapid identification of all mycobacteria isolated at, or referred to, BCCDC. We have expanded our type and reference library to include 111 species and have sequenced a total of 689 isolates from 35 species or groups. Comparison of identification data indicates that *hsp65* sequencing was capable of identifying approximately 85% (587/689) of the isolates tested. The 102 discrepant isolates were attributable to defined taxonomic groups, putative species or unique sequences that were not present in our database at the time of analysis. The creation and addition of a further 29 database entries to cover these isolates allowed us to identify all isolates. BCCDC now has one of the most comprehensive *hsp65* databases for mycobacterial identification in the world.

**BCCDC now has one of the most comprehensive *hsp65* databases for mycobacterial identification in the world**

Collaborative Research Projects

In collaboration with Dr. Mark Fitzgerald (BCCDC TB Control) and the US Centers for Disease Control and Prevention, staff is involved in “A Pilot Study to Evaluate Nucleic Acid Amplification Tests to Predict Relapse of Tuberculosis and to Monitor the Effectiveness of Treatment.”

Education and Training

2 High School Students from Glen Eagle High visited the section for 0.5 hour fulfilling a biology assignment.

4 Postgraduate Medical Residents visited the section for a half-day.

Mabel Rodrigues gave Laboratory Services presentations on the use of Heat Shock Protein (HSP) 65K for routine identification of *Mycobacterium* species from clinical sources and the use of biochemicals along with probes and HSP testing in the identification of NTM at the BCCDC.

Continuous Quality Improvement Initiatives

- Procedural modifications to enhance diagnosis, improve service and cost recovery
- Safety awareness
- Education seminars for staff
- Improved reporting to Clients of procedural modifications
Laboratory Services Programs

Molecular Services

Core Programs
- Centre for molecular-based platform technologies
- Leadership in confirmation of agents of bioterrorism using PCR
- Bacterial identification development using DNA sequencing of the 16S rRNA gene
- Mycobacterium species identification development using DNA sequencing
- Genotyping, lamivudine resistance and pre-core determination of Hepatitis B virus
- Collaboration on detection and epidemiological assignment of Norovirus

The Molecular Services Program focuses on value added services, clinical and public health applications and the quality assurance of molecular procedures.

Agents of Bioterrorism
Molecular Services worked with General Bacteriology staff to validate species-specific PCR techniques, developed by the National Microbiology Laboratory, to perform confirmatory testing for agents of bioterrorism. These tests are part of our Level 3 containment laboratory and Biosafety programs.

Bacterial Identification
Molecular Services also worked with General Bacteriology staff to develop their reference centre for the identification of bacterial isolates from clinical sources by sequencing of the 16S rRNA gene. In discharging its mandate of technology transfer, Molecular Services transferred responsibility for the frontline sequencing of bacterial isolates for identification purposes to the General Bacteriology Section. Molecular Services maintains and upgrades the databases used for bacterial identification and assures the quality of sequencing and accuracy of the identifications provided by General Bacteriology Section.

Gene Sequencing for Identification of Streptococcus
The collaborative project with Dr. Swee-Han Goh to compare 16S rRNA and Chaperonin 60 gene (cpn60) sequencing for the identification of Streptococcus species continues. Thus far a comprehensive database for both gene sequences has been constructed and a clinical trial phase has started. We are independently sequencing and identifying isolates referred to us by collaborative investigators Dr. Richard Facklam at the Centers for Disease Control and Prevention, Atlanta, Georgia and the Microbiology Laboratory at St. Paul’s Hospital, Vancouver. Preliminary data indicates that both methods are capable of accurately identifying these organisms, with cpn60 perhaps being more discriminatory in some circumstances.

Gene Sequencing for Identification of Nocardia
During 2002 we began a joint project with General Bacteriology staff to expand the use of 16S rRNA gene sequencing to identify Nocardia species referred to the Mycology Section of the General Bacteriology Laboratory. Nocardia species are currently identified using biochemical test panels, which is difficult, costly and time consuming requiring as long as four weeks. To improve the way in which these isolates are identified a database was constructed from published GenBank sequences and the optimal fragment size for identification purposes determined. In collaboration with the Mycology Group of the General Bacteriology Section and the Microbiology Laboratory of the London Health Sciences Centre, London, Ontario, clinical, reference and species type strains were sequenced and compared to our in-house database. To date 123 isolates submitted as Nocardia species have been DNA sequenced. Preliminary data indicates that 16S rRNA gene sequencing is an excellent means of identifying this group of organisms, providing both a more rapid and cost effective means of identification. To date we have been able to accurately identify most isolates to defined species, including some which have only recently been described in the literature. Our data indicates that the most commonly isolated pathogenic species, Nocardia asteroides, has in fact been misidentified using other techniques and these isolates are actually
a mixture of species, with the majority of isolates belonging to *N. abscessus, N. beijingensis, N. cyriacigeorgica, N. farcinica, N. nova* or *N. veterana*. This work has been submitted to the 2004 conjoint meeting of the Canadian Society of Medical Laboratory Sciences, Saskatoon. During the preliminary stages of the study other aerobic acintomycetes isolated from humans were submitted for sequencing of the 16S rRNA gene and although only a small number of isolates have been analyzed, this method appears to be a promising identification method for other genera as well. The assessment of the technique continues as we expand our database.

**Molecular Services uses species-specific PCR techniques to perform confirmatory testing for agents of bioterrorism**

**Identification of Mycobacterium species by hsp65 sequencing**

We continue our collaborative project with the Mycobacteriology Laboratory Section to assess the use of partial sequencing of the 65 kilo Dalton Heat Shock Protein gene (*hsp*65) as a means for the rapid identification of all mycobacteria isolated at, or referred to, BCCDC. We have expanded our type and reference library to include 111 species and have sequenced a total of 689 isolates from 35 species or groups. Comparison of identification data indicates that *hsp*65 sequencing was capable of identifying approximately 85% (587/689) of the isolates tested. The 102 discrepant isolates were attributable to defined taxonomic groups, putative species or unique sequences that were not present in our database at the time of analysis. The creation and addition of a further 29 database entries to cover these isolates allowed us to identify all isolates and provides us with one of the most comprehensive *hsp*65 databases in the world.

The feasibility of using *hsp*65 sequencing to identify mycobacteria directly from Bac T Alert 3D bottles was investigated. 379 bottles were sequenced and determined to be positive for acid-fast rods. Primary comparison of the data indicated that *hsp*65 confirmed 95% (360/379) of the final identifications, directly from liquid medium. Discrepancies were found to be due to clerical errors, *hsp*65 sequence variants or incorrect biochemical identification, which brought the adjusted agreement to 99.7% (378/379). *Hsp*65 sequencing is less expensive than biochemical testing and can be completed in two days; biochemical testing requires 26.5 days on average (range 7-44 days) for identification after subculture onto solid media. Our current *hsp*65 database is more comprehensive than our biochemical identification database. The next stage of the identification of isolates directly from liquid detection entails a comparison of costs to identify each isolate and turnaround times to final identification.

The latest stage of this study entails the investigation of *hsp*65 sequencing to identify *Mycobacterium* species directly from clinical specimens or paraffin-fixed tissues. We adapted our culture and liquid medium amplification protocols to amplify mycobacterial DNA from these specimens. 21 specimens were tested with this protocol. 14 were found to be negative for target DNA, with 13 confirming traditional culture methods and one an apparent false negative. Of 7 specimens that produced mycobacterial sequence, 2 were from paraffin-fixed tissues and could not be confirmed by culture and 1 was sent for *hsp*65 sequencing only. Identification of the remaining 4 specimens was confirmed by culture. Although this study represents a limited sample size, *hsp*65 sequencing shows promise in identifying mycobacteria directly from clinical samples and paraffin-fixed tissues, when rapid identification is required.

Findings have been presented at the Conjoint Meeting of the Canadian Association for Clinical Microbiology and Infectious Disease, Montreal, Quebec and at the 103rd Annual Meeting of the American Society for Microbiology, Washington, D.C. These data have also been submitted for publication to the *Journal of Clinical Microbiology*.
Testing of Mosquito Pools for the presence of West Nile Virus

During the spring of 2003, Molecular Services, in collaboration with the Zoonotic and Emerging Pathogens Laboratory, undertook a test to detect the presence of West Nile Virus (WNV) in mosquito pools. This was accomplished using a previously published multiplex real-time reverse transcription-PCR (RT-PCR) designed to be performed on an ABI Prism SDS Taqman 7900 instrument in tandem with a set of primers and probe targeted at the 3’ noncoding region of the WNV. During the development of the assay, the laboratory recognized the need to determine the possibility of test inhibition and developed an internal positive control using a commercially available WNV RNA product and a set of primers targeted at another region within the virus and insured accuracy of our testing. This work was submitted and subsequently published in the *Journal of Clinical Microbiology*. In total, 685 mosquito pools, consisting of up to 50 mosquitoes each, were tested through the summer and early fall for the presence of WNV and found to be negative. Preparation began through the winter to allow for the detection of WNV in British Columbia during 2004.

Noroviruses continue to be the major cause of gastroenteritis outbreaks in the province of British Columbia

**Sequencing of Norovirus cDNA to determine molecular epidemiology of the virus**

Noroviruses continue to be the major cause of gastroenteritis outbreaks in the province of British Columbia, accounting for as many as 70% of all outbreaks. The continuation of a program initiated by molecular services in 2001, to sequence and track the virus strains within the province saw 250 samples submitted for sequencing during 2003. This number represented a decline of approximately 50% from the previous year, indicating the cyclic nature of the disease caused by the virus. The major sequevar of 2002 (BCCDC 02-007, or Farmington Hills Strain) remained prevalent in the early months of 2003, which indicated a change in the normal temporal migration of virus Sequevar in the province. Based on sequencing a 172 nt fragment of the 3’ end of the RNA dependent RNA polymerase gene, we detected 38 new sequevars during 2003, with 11/38 sequevars, (40.7%), attributed to Genogroup I and 27 to Genogroup II, with the majority of those attributed to the Bristol/Lordsdale clade. The high percentage of Genogroup I sequevars associated with gastroenteritis outbreaks in 2003 is unusual as the literature indicates that Genogroup I clades are not a common cause of disease in humans, accounting for between 5-10% of outbreaks and corroborated by the 4-9% of outbreaks caused by Genogroup I isolates the two previous years. A cumulative synopsis of this data was presented at the 2003 Pan American Virus Conference in Clearwater, Florida in poster format.

**Hepatitis B Virus Genotyping, Antiviral Resistance Testing and Pre-Core Mutation Determination.**

The testing of Hepatitis B virus for resistance to lamivudine, an oral antiviral drug, viral genotyping and pre-core mutation are performed by molecular services. Several point mutations within the YMDD region of the S gene domain of the virus can be detected by sequencing and the outcome of antiviral therapy predicted. Virus genotyping can also be determined using the same region of the genome used to determine lamivudine resistance with the resultant sequence being assigned to one of six genotypes. Similarly, disease outcome related to pre-core mutations can be determined by sequencing a second region of the genome and predicting the severity of the disease in a patient. During 2003, 20 samples were submitted for these determinations. Four of the submitted samples failed to amplify any Hepatitis B virus DNA, indicating that the virus was not present. Of the 16 samples submitted for Genotyping, two were assigned to Genotype A, one was assigned to Genotype B and 14 were assigned to Genotype C, making it the most prevalent Genotype in the province. Of the 16 samples that lamivudine resistance testing was requested, seven were found to have point mutations indicating lamivudine resistance whereas the remaining nine were found to be susceptible to the antiviral agent. Of the eight specimens where pre-core mutation testing was requested only two were able to be amplified and the pre-core mutation status determined, with both lacking pre-core
mutations. This inability to amplify and detect pre-core mutations is not unexpected as up to 25% of all isolates will fail to amplify that region of the virus.

**Testing for the Agent of Severe Acute Respiratory Syndrome (SARS)**

Molecular Services assumed a collaborative and support role with Virology Services during the SARS outbreak of 2003. The adoption and application of pan-Corona virus polymerase specific primers as one of the tests in our diagnostic armamentarium dictated that all specimens positive by these primers required sequencing to determine the relationship of the amplified RNA within the Corona virus family. This allowed our laboratory to help rule out or confirm the presence of the SARS agent in respiratory specimens. This ability became particularly important during the early spring when a late season respiratory outbreak was indicated by preliminary testing to be caused by the SARS agent. Rapid sequencing of the target amplicons produced by the pan Corona virus primers determined the presence of OC43, another corona virus related to SARS.

**Detection of Cryptosporidium species oocysts from environmental source by real-time PCR**

Molecular Services in collaboration with the Enhanced Water Laboratory, Environmental Services, undertook development and optimization of a test to detect *Cryptosporidium* species oocysts from environmental water samples. The project team, led by Diane Eisler and including Dr. Corinne Ong, Selena Shay and Lorraine McIntyre, has developed a real-time PCR assay targeted at the 18S rRNA gene, which under analytical conditions has been able to detect the DNA from a single oocyst. The team is exploring means of removing inhibitors from the samples, enhancing the concentration of oocysts from water and the efficient extraction of their DNA.
Laboratory Services Sections

Parasitology

Core Services
- Outbreak investigation & surveillance
- Mosquito surveillance for West Nile virus
- Public health parasitology
- Provincial Reference Laboratory
- Diagnostic & medical consultative services
- Molecular testing services
- Education & training

Automation and new technologies have had a relatively minor impact on medical parasitology, although the section uses some PCR and rapid immunological technologies. A skilled team of medical, technical and scientific experts provide provincial leadership in parasitology, particularly in outbreak detection and management.

Mosquito Surveillance for West Nile Virus in BC

In the spring of 2003, the Parasitology Section, in collaboration with the Zoonotics and Emerging Pathogens Section, Molecular Services, BCCDC Epidemiology Services and Health Authorities throughout British Columbia, began an intensive surveillance for mosquitoes, the vector of West Nile virus. Mosquito surveillance, like the corvid (bird) surveillance carried out at the Animal Health Centre in Abbotsford, serves as an indicator of West Nile virus activity. It will also be used to determine which mosquito species serve as vectors for West Nile virus in BC.

No West Nile Virus was detected in any of the mosquito pools in BC during the 2003 surveillance

At the beginning of the surveillance season, mosquito traps were set at predetermined locations within each Health Authority. Contents of each mosquito trap were frozen and submitted to the Parasitology Section each week. Traps having no contents (due to malfunction, trap not being operated or trap operated) were not submitted to the laboratory but the information was faxed and recorded.

By the end of the surveillance season (June 2003 - November 2003), there were 1006 submissions. In 188 instances, submissions indicating that there had been no insect contents collected. In 818 submissions, 6,840 mosquitoes were identified. The following genera of Culex speciated of mosquitoes were identified: Aedes, Anopheles, Coquilletidia perturbans, Culex spp., Culex pipiens, Culex tarsalis, Culex territans, and Culiseta and Coquilletidia were identified down to the species level. Mosquitoes were sorted on a chill table (to prevent denaturation of the RNA) and identified to the genera/species level in the Parasitology Section. Mosquitoes from the same genera/species were pooled and forwarded to the Molecular Services for molecular testing (RTPCR). No West Nile Virus was detected in any of
the mosquito pools in BC during the 2003 surveillance. During the 2004 surveillance season, the number of submissions is expected to double. New staff have been recruited and training is underway.
Testing Services
From January 1, 2003 to December 31, 2003, medically significant parasites were detected in 29% of all patient specimens. Five parasitic infections are reportable by BC legislation: cryptosporidiosis (Cryptosporidium), amoebiasis (Entamoeba histolytica/dispar), giardiasis (Giardia lamblia) cyclosporiasis (Cyclospora) and malaria (Plasmodium vivax, P. falciparum, P. malariae, and P. ovale). The following graph shows this year’s analysis of protozoa detected.

**Pathogenic Protozoa Identified**

![Protozoa Graph](Image)

**Malaria Reference Service**
Malaria reference services is an area where BCCDC Laboratory Services takes a leadership role in the BC laboratory network. As malaria can be a life-threatening illness, our colleagues rely on the expertise of the staff of the Parasitology Section to identify and speciate rapidly and accurately this non-endemic parasite. With the approval of a medical microbiologist, the Section offers reference PCR services, when microscopy is ineffective. The following malaria species were identified in 2003. Of note, the deadliest species, *P. falciparum*, was the most common.

<table>
<thead>
<tr>
<th>Malaria Species Identified</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Plasmodium falciparum</em></td>
<td>11</td>
</tr>
<tr>
<td><em>Plasmodium vivax</em></td>
<td>10</td>
</tr>
<tr>
<td><em>Plasmodium malariae</em></td>
<td>0</td>
</tr>
<tr>
<td><em>Plasmodium ovale</em></td>
<td>0</td>
</tr>
<tr>
<td><em>Plasmodium species</em></td>
<td>1</td>
</tr>
</tbody>
</table>
Blood & Tissue Parasites
In our role as a specialty laboratory, we receive specimens submitted for the examination of exotic blood and tissue parasites. These require complex procedures. *Toxoplasma*, *Babesia*, microfilariae, *Trypanosoma* and *Leishmania* were cultured or detected from blood and tissues specimens and *Acanthamoeba* from eye (corneal) specimens. Of the specimens cultured, 1 specimen was positive for *Leishmania* and 6 specimens were positive for *Acanthamoeba*.

Quality Assurance Activities
The Section participates in College of American Pathologists (CAP) External Proficiency Testing Programs and Canadian Medical Proficiency Testing (CMPT). We are a founding participant in the McGill Centre for Tropical Disease Malaria Proficiency Testing Program and is a parasitology reference centre for the CMPT Program. The Section also submits on a weekly basis, aggregated totals of new cases of common pathogenic protozoa (*Cryptosporidium, Entamoeba histolytica/dispar, Cyclospora* and *Giardia lamblia*) to the National Enteric Surveillance Program (NESP). The NESP examines the feasibility of national monitoring of reporting trends for enteric pathogens. The program also distributes summaries of aggregated national data derived from the Canada-wide surveillance.

Continuous Quality Improvement Initiatives
- Increase mosquito surveillance (more than double) for West Nile Virus in 2004
- Education seminars for staff
- Increased safety awareness
- Computer enhancements
- Participating in the BCCDC Laboratory Bioterrorism Response Team
- Participating in the Environmental Services and Outbreak Leadership Cluster groups
- Procedural modifications to enhance diagnosis, improve turn-around-times and cost recovery
- Development of educational programs in the community related to Medical Parasitology

Education and Training
- During the past year, five physicians - Pathology Residents, Microbiology Residents, Adult Infectious Disease and Pediatric Infectious Disease Residents - were trained in this section.
- Parasitology staff led laboratory tours for six student groups and for visiting Environmental Health Officers, as part of an overall community service plan developed to broaden understanding of BCCDC Laboratory Services.
- The Section hosted a parasitology workshop for Bachelor of Medical Laboratory Science (BMLSc) students at UBC’s Department of Pathology and Laboratory Medicine Pathology Program, in the Spring.
Laboratory Services Programs

Provincial Infection Control & Prevention Program

Bruce Gamage, Infection Control Consultant, Laboratory Services, serves as provincial infection control practitioner and consultant for long-term care and community facilities, industry, public health professionals and rural acute care facilities. Some of the program’s activities are detailed below.

Infection Control Education
The Program provides education sessions for hospitals, community facilities, schools, universities and public health professionals. On-site education sessions are provided. In October of 2003, Bruce coordinated a Team Building Workshop at BCCDC offering an opportunity for infection control professionals from both acute and community care facilities, as well public health personnel, to come together in a workshop setting led by Laboratory Services, Epidemiology Services, Biohazard Containment Services and Tuberculosis Control. The workshop received a very favourable evaluation and will be repeated in 2004. The workshop provided a unique, post-SARS opportunity to establish firmer network links with Environmental Health Officers and local and regional public health.

The workshop provided a unique, post-SARS opportunity to establish firmer network links with Environmental Health Officers

Infection Control Guidelines
Several evidence-based infection control guidelines have been developed by the provincial program. The guidelines have been reviewed by both infection control professionals and end users in the field and are available for download from our web site, www.bccdc.org.

In 2003, Bruce Gamage coordinated the development of a guideline on the use and selection of disinfectants in health care facilities and a guideline on the management of outbreaks of gastroenteritis was revised. During the SARS outbreak, Bruce was an integral member of the BC SARS Scientific Committee and worked to develop infection control guidelines for the management of SARS patients in acute care facilities. He was a member the Health Canada Infection Control Working Group and participated in the development of national guidelines.

Communication and Consultation
The Program works closely with the Environmental Services Laboratory, Medical Microbiologists, Biohazard Containment Services, PSHA Medical Microbiologists at Children’s and Women’s Hospital and the Provincial Epidemiology Services to provide consultation to health professionals in the prevention and control of infectious disease outbreaks. Information on general and specific infection control practices and procedures is available for infection control professionals and other health care professionals in hospitals, residential care facilities and community organizations.

The Program maintains an e-mail distribution list, used to circulate important disease and public health information, to answer questions and to facilitate discussion of infection control issues. The list also serves as a research and consultation tool.

The Program provides direct infection control consulting services to Health Authorities, primarily through telephone and e-mail contact, but also through direct involvement in outbreaks through site visits. Bruce participates in regional infection control meetings, as a provincial resource and to facilitate communication between the regions.
Molecular Fingerprinting for Infection Prevention
The molecular typing of bacteria causing nosocomial infections is performed at BCCDC Laboratory Services. This molecular fingerprinting enables infection control professionals to investigate clusters or outbreaks of disease. An essential part of this service is the consultation with clients who use and interpret the results of these laboratory procedures. The Program co-ordinates fingerprinting of bacterial isolates, using PFGE, for laboratory outbreak or cluster investigations of Methicillin Resistant Staphylococcus aureus (MRSA). Testing requests are made through the Infection Control Consultant.

Viral Rapid Detection Program (VIRAP)
Following the SARS outbreak of 2003, rapid viral diagnosis for respiratory infections has been identified as a high priority need. The aim of this new and successful program, developed and led by PHSA Microbiologist, Dr. Eva Thomas, is to assist hospitals, long term care facilities and community physicians in best practice for the rapid diagnosis of viral respiratory disease. In our experience the best specimen for the rapid diagnosis of viral respiratory infections is a nasopharyngeal wash (NPW). VIRAP maximizes patient and health care benefit by ensuring collection of proper specimens, quick laboratory turnaround time, extended laboratory opening hours and timely reporting. Infection Control Nurses at BC Children’s and Women’s Hospitals, in conjunction with the provincial infection control program, have developed teaching guidelines and NPW collection kits. The kits include instructions for collecting specimens from infants, older children and adults. With a good specimen we were able to provide a turnaround time for results in approximately 4 hours. An instructional video has also been produced and is available on request. Hats off to Dr. Thomas! BCCDC continues to appreciate this collaboration with C&W Laboratories.

A multidisciplinary study examined the best practices for protecting the faces of health care workers providing care for patients with infectious respiratory diseases

Research
Infection control guidelines and practice are evidence-based. The Infection Control Program at BCCDC participates in research initiatives aimed at improving practice. In 2003, a multidisciplinary study examined the best practices for protecting the faces of health care workers providing care for patients with infectious respiratory diseases.
Laboratory Services Programs

Quality Management Systems

Core Programs
- Quality Team initiatives and activities
- ISO 15189:2003 Leadership
- Continuous Quality Improvement
- Staff Development
- External Proficiency Testing
- Validation and Implementation Team
- Enhanced Water Quality Assurance (EWQA)
- Internal Quality Audits

Quality Team
The Quality Team, led by Amelia Trinidad, continues to work towards our goal of ISO 15189:2003 compliance. Major Quality Management System activities included:
- Implementation of the QSI Document Control System is ongoing. QSI training is almost completed. The Quality Manual Volumes I and II, the Biosafety manual and approximately 80% of laboratory SOPs have been input into QSI.
- Completion of the Introduction and Validation of New Laboratory Methods Protocol for Laboratory Services. Documentation of project approval requests implemented.
- Author and facilitator of a course module for the Quality Manager’s Certificate Course offered through the Program Office for Laboratory Quality Management (POLQM) at the UBC Department of Pathology and Laboratory Medicine. This is a fully on-line certificate course offered yearly.
- Participant in the PHSA LE Quality Plan.
- Development and implementation of Occurrence Management Program.
- Development of the Continuing Education strategic plan for Laboratory Services personnel.
- Development and implementation of an Equipment Management Program.
- Lorna Tom confirmed as Laboratory Quality Specialist – Drinking Water in October 2003.
- Development of distance education course for water purveyors, Medical Health Officers, Environmental Health Officers and Drinking Water Officers.

Laboratory Quality Specialist - Drinking Water
Under Quality Management, Lorna Tom works with Amelia Trinidad, Head, Quality Management, the Medical Microbiologist for Environmental Services, the Supervisor of Environmental Services, the Healthy Water Program Coordinator, Ms. Cora Yee, and the Enhanced Water Quality Assurance Program (EWQA) Coordinator on drinking water testing quality initiatives. This Drinking Water Team works with the Ministry of Health and Regional Health Authorities to ensure best practices in the microbiology testing of drinking water for public health purposes, from source to tap.

Activities we are currently working on include;
- Development of best practices related to drinking water testing
- Education and training related to drinking water quality
- Public Health Audit program development and management
- Analysis and communication of quality incidents
Informatics related to drinking water, with the Ministry of Health Drinking Water Information Management Program (DWIMP)

Quality network for drinking water testing

Support of Provincial Health Officer’s EWQA Program

On March 3-4, 2003, BCCDC Laboratory Services hosted an In-service Water Training session for Environmental Health Officers. It was a collaborative effort between BCCDC Environmental Services, the Fraser Health Authority, and the Vancouver Coastal Health Authority. We are currently developing a distance education course program similar to this event, in collaboration with the British Columbia Water and Waste Association (BCWWA).

Internal Quality Assessment (IQA) and Accreditation
The IQA team led by Quantine Wong and Amelia Trinidad audited the Environmental Microbiology (Water Laboratory), and General Bacteriology Laboratory. Follow-up audit was also conducted in the Environmental Services (Water Laboratory) in preparation for the Enhanced Water Quality Assurance accreditation.

Quality is the touchstone of all that we do. We continue to work toward our goal of ISO 15189:2003 compliance

Continuous Quality Improvement Team
Continuous Quality Improvement Team is led by Gail McNabb, Supervisor, Virology Services. The team is comprised of representatives from each section of the laboratory, a Laboratory Information Services representative and the Laboratory Quality Coordinator.

Team members are Frances Seward, Belinda Wong, John Chan, Bruce Alexander, Alan McNabb, Rupinder Khunkhun, Claudia Sutherland, Wilfred Burgess, Janet Burgoyne, Peter Ng, Lorna Tom and Amelia Trinidad.

The team reviews problems and identifies methods to improve laboratory competency, efficiency and service use. At each meeting Quality Incident Reports, involving all areas of the laboratory, are reviewed and corrective action is discussed. Some of the accomplishments of this team in 2003 were:

- Improvement in the submission of specimens correctly focusing on biosafety
- Computerized documentation of report errors
- Development of computerized monitoring of the number of educational hours for laboratory staff
- Standardized data entry conventions for proficiency test specimens in the laboratory

Some important continuous quality improvements made in different sections of the laboratories included:

Enteric Bacteriology
- Developed pre-printed labels for QC organisms saving labour time. Reviewed usage and shelf life of media, providing cost savings
- Evaluation of outsourced media to save labour costs in Technical Support
- Chaperonin 60 PCR and sequencing of final product to provide a quick (3 day) and accurate ID of Campylobacter/Arcobacter/Helicobacter isolates
Environmental Health Protection
- Cross-training of laboratory staff in the Food laboratory, Enhanced water laboratory and Water Bacteriology to improve work flow and flexibility
- Critical results reporting to improve client service and to fulfill regulations requirements
- Faster turnaround times to confirm fecal coliform results by direct transfer of fecal coliforms to EC medium

General Bacteriology
- Continued collaboration with Molecular Services to validate and implement sequencing for the 16S rRNA and Chaperonin genes for the identification of a broad range of bacterial genera
- Achieved cost savings for pertussis culture by reducing the number of culture plates and number of swabs taken per patient from two to one
- Introduction of processing of Mycology specimens on weekends

Molecular Services
- Training of Environmental laboratory technologist in Norovirus sequevar sequencing identification to enable technology transfer
- SOP Sequencing of 23S-5S ITS region for Borrelia identification
- SOP Sequencing of 16S rRNA gene for bacterial identification

Mycobacteriology Laboratory
- Heat shock protein project on OT, MGITs and direct specimens
- MTD/RFLP clean room assessment and implementation of dedicated supplies, equipment, no entry without gloves, sticky mats
- Three technologists trained for CL3 so that level 3 staff can rotate for certain benches

Parasitology
- Special bench staff to check posted list for cultures in process to ensure a prompt TAT
- Created a data entry and reporting protocol for WNV mosquito surveillance to be consistent with existing data entry and reporting policies and to allow extraction of data by Epidemiology
- Training of staff in mosquito identification to assist in West Nile surveillance

Technical Support
- Costing in-house media, inspecting potential suppliers and testing supplier’s samples. Outsourcing of media provided a cost saving and elimination of one FTE
- Improved workflow documentation
- All STAT specimens are placed into “STAT bags” to ensure STAT specimens are assessed first and to eliminate the possibility of STAT specimens being mixed in with the regular specimens

Virology
- Consolidation of prenatal testing from 4 requisitions to 1 new prenatal requisition to enable requests for HBsAg, Rubella, HIV, syphilis, ParvoB19, Varicella, Toxoplasma. This saves approximately $300,000/year by providing only one report and efficiencies from accessioning once instead of 4 times
- Implementation of a 7 day a week operation of the Virus Isolation section. This permits completion of time-delimited testing on the earliest possible
date and results in earlier validation of test results and improved turnaround times
- Implementation of the week 12 assessment program for testing of HCV patients which allows a saving to the PharmaCare program of $400,000/year for treating 650 BC patients
- Bar-coded numbers for HIV accessioning which reduces typing for data entry, result entry, validating and specimen inquiry

Zoonotic Emerging Pathogens
- Arbovirus testing (Flaviviruses) by haemagglutination inhibition method by in-house testing instead of referring tests out. This provides better service and turnaround times for clients
- Perform Cryptococcus test on all CSF specimens sent in for Mycology
- Evaluated and implemented Bartonella testing with Euroimmune IFA kit to provide better service and turnaround times
- Introduction of stool culture and stool antigen detection to improve public health surveillance for H. pylori

Staff Development Team (SDT)
The team is made up of seven dedicated individuals passionate about continuing education and lifelong learning: Lorraine McIntyre, Annie Mak, Gail McNabb, Swee-Han Goh, Yvonne Simpson, Debbie Southerby and Richard Sevigny, the new chair. We would like to thank the many “behind the scenes” volunteers who helped us with our projects. Our thanks to Lorna Tom, Selena Shay, Sophie Tran and Teresa Lo for coordinating the lectures, to Irene Yan for creating posters, and to Diane Eisler and Kathy Adie for their work on the Literature Search Manual.

Some of the Staff Development Team’s activities in 2003 included
- Completed and distributed the Literature Search Binders to individual laboratory sections.
- Completed a General Interest Microbiology lecture series
- Organized 12 audio conferences, including one on ISO 15189:2003 conducted by Dr. Harold Richardson, Managing Director, Ontario’s Quality Management Program - Laboratory Services (QMP-LS)
- Organized and led 18 tours (a total of 233 visitors) of our laboratories for laboratory assistants, technologists, epidemiologists, medical students and visitors from public and private institutions.
- Completed keyboarding training for Laboratory Assistants
- Registered 9 Laboratory Assistants for MLA Education Day
- Offered a job shadowing experience for selected Grade 12 students from West Vancouver Secondary School.

Some continuing efforts of the team begun last years:
- Production of a PC-based “Virtual Tour” for BCCDC Laboratory Services.
- Collaboration with Vancouver Community College for Microbiology practicum for student laboratory assistants to meet new CSMSL guidelines.
Enhanced Water Quality Program - UBC EWQA/BCCDC/CMPT Partnership

The Enhanced Water Quality Assurance (EWQA) program reports to British Columbia’s Provincial Health Officer. The program works in partnership with the Canadian Microbiology Proficiency Testing (CMPT) program under the auspices of the University of British Columbia and is key to public health in British Columbia. It is a program based on peer-review and education.

The EWQA program audited 5 new laboratories in 2003 and 8 approved laboratories were re-audited on the new 2-year cycle. The Quality Assurance Working Group (QAWG), and the team of EWQA auditors devoted extra effort through reviews and consulting to assist laboratories to meet approval requirements. QAWG, among its achievements, drafted a new audit checklist, reviewed new requests for approval and recommended approval of 6 laboratories for E. coli testing. The Steering Committee chaired by the Director of BCCDC Laboratory Services, organized the first EWQA auditor training workshop, which was evaluated and judged a success by the participants. The committee continues to meet external challenges and has embarked on a program toward International Standards Organization (ISO) registration.

EWQA Review
The Deputy Provincial Heath Officer conducted a review of the EWQA program on behalf of the Ministry of Health Planning and the terms of reference were revised and approved.

EWQA Committee Work
The Steering Committee reviewed 12 auditors’ reports, met in person, as well as “met” many times and dealt with issues electronically over the net. The Quality Assurance Working Group (QAWG) met and, among their activities, they reviewed and approved 6 laboratories for E. coli testing, prepared lists of minor and major deficiencies referenced to Standard Methods (Technical Reference Standard) and drafted a comprehensive checklist, which will provide a more consistent audit process in future.

The Enhanced Water Quality Assurance Program is key to public health in British Columbia. It is a program based on peer-review and education

Laboratory Audits
Our group of peer review expert volunteers continues to perform admirably and conducted 12 laboratory audits in 2003 including review of pre-inspection questionnaires, laboratory SOPs and preparation of the written reports.

Communications and Education
Three educational bulletins dealing with drinking water issues were distributed to approved laboratories, MHO’s, EHO’s and others in 2003.
Training
EWQA’s first Auditor Training Workshop was held on October 27, 2003 and all but 2 of EWQA’s 13 auditors participated. Their enthusiastic evaluation indicated that it was a success and the workshop will now become an annual event.

Laboratory Approvals and Application Packages
There were 11 new enquiries about the laboratory approval process and 5 new application packages were sent from UBC EWQA. There are currently 13 Ministry of Health Provincial Health Officer (PHO) approved laboratories. This is an increase of 4 over 2002. A further 3 were inspected and are under consideration for approval by the PHO.

E. coli Testing
8 Laboratories were approved for E. coli testing prior to December 2003 and another 3, inspected in December 2003, are under consideration for approval. E. coli is a parameter that is specified under the Drinking Water Protection Act and may be requested by Medical Health Officers. The Steering Committee thanks the BC Clinical Microbiology Proficiency Testing (CMPT) program for their extra efforts in setting up the proficiency testing program that made these approvals possible and recognizes the commitment of laboratories that have sought approval for this parameter. Implementation of this testing continues across BC.

Harmonization for Clients
The Canadian Council of Independent Laboratories, British Columbia division, (CCIL (BC)) made representations to UBC EWQA on behalf of their clients, initially, for harmonization of auditing since their laboratories may be subject to two processes: approval by EWQA and accreditation by CAEAL for drinking water microbiology. As a follow-up to this idea, a working group comprising of representatives from EWQA, CAEAL, CCIL (BC) and the BC Clinical Microbiology Proficiency Testing (CMPT) met. It was agreed that further work would assist all parties and the terms of reference for this ad hoc working group have been drafted. The group will work on items identified for harmonization.
Laboratory Services Sections

Virology

Core Services

- Disease surveillance & outbreak detection
- Comprehensive public health diagnostic and consultative services
- Provincial reference laboratory
- Clinical trials & applied research

The Virology section provides services in virus isolation, virus serology, HIV and molecular diagnostics. In 2003 we investigated 386,682 specimens and performed a total of 693,550 tests. The largest increases in testing were seen in virus isolation and molecular assays.

Virus Isolation/Molecular Detection

During the respiratory season, January-March, 2003 staff in Virus Isolation used the previously developed rapid plate assay using R-Mix cells, direct fluorescence and tube cultures. The plate R-Mix assay provided an improvement in turn around time, management of large specimen handling and improved sensitivity. On March 14, 2003 the SARS epidemic required an immediate change in the handling of possible SARS specimens. With the cooperation of BCCDC Biohazard Containment Services’ team, all staff were immediately trained to work with level 3 precautions in a level 2 laboratory and fit tested with N95 masks. The SARS response also included a rapid development of SARS PCR assays, Pancoronavirus assays, set up of the 4th floor level 3 laboratory, purchase of additional dedicated equipment and training of four Virology staff in the level 3 laboratory. The current algorithm that arose from evaluation of the SARS assays includes a pan-coronavirus RT-PCR (Tellier primers) and a SARS-CoV specific RT-PCR (Goh primers). Confirmatory testing is further performed by the Roche real-time RT-PCR assay. The SARS emergency has resulted in greatly improved capabilities in the Section to be able to respond to future emergencies such as pandemic influenza, avian influenza and other emerging pathogens.

In response to the possibility of Bioterrorism events additional assays were also developed for Poxviridae PCR (all pox viruses including smallpox) and Herpesviridae PCR (all Herpesviruses including Herpes simiae).

West Nile virus (WNV) PCR assay was added to our current protocol for transplant patients. We began testing July 1, 2003 for organ donors, living kidney and liver donors and stem cells recipients. This required increased STAT 24-hour coverage for the British Columbia Transplant Society. An on-call technologist from virus isolation is now available WNV testing as well as for HIV testing for organ donors.
The testing of all cerebrospinal fluids required a change in protocol to add WNv PCR to the current Herpes and Enterovirus molecular testing.

During August, 2003 an extensive investigation was required to rule out a possible SARS epidemic in a long term care facility, Kinsmen Place Lodge. The Virology Section in collaboration with Molecular Services worked on this outbreak by performing pan-coronavirus PCR and SARS-specific PCR. Sequencing results showed that the outbreak was caused by Coronavirus OC43.

For the respiratory season from October-December, 2003 the respiratory protocol for virus was expanded to include a comprehensive battery of tests. We expanded coverage from 6-day service to 7-day service to provide same day results. We developed additional nucleic acid tests, RT PCR and NASBA to ensure the most sensitive rapid test is available for respiratory viruses.

HIV
Effective April 30, 2003, HIV patients have a legal right to choose a nominal or non-nominal reporting option. We changed the HIV requisitions to accommodate these options. Working with other microbiologists and STD Control, we are assessing the impacts of this change.

HIV laboratory staff participated in a clinical trial of the Biolytical INSTI HIV rapid point-of-care test according to the protocols and guidelines used by Health Canada. Once trials are successfully completed, the test will be licensed in Canada.

Staff also participated in clinical trials of the ADVIA Centaur HIV 1/0/2 test. We evaluated additional serology markers using the ADVIA Centaur which can handle high volumes of serological testing more efficiently.

As of April 30, 2003, HIV patients have the right to choose a nominal or non-nominal reporting option.

Virus Serology/Hepatitis
We instituted a 12-week assessment program to manage testing of HCV patients undergoing treatment with pegylated interferon and ribavirin. The program reduces unnecessary HCV quantitative testing and saves costs of unnecessary pharmacotherapy. The estimated cost saving to PharmaCare for the appropriate treatment of 650 BC Hepatitis C patients is $400,000.

A new requisition was designed for proper ordering of HCV tests by the physicians. The treatment response can now be monitored by the laboratory tracking results and reporting directly to PharmaCare. Quantitative HCV PCR is now only performed for genotypes 1, 4,5, and 6 and not for genotype 2 and 3 patients.

In September, 2003, Canadian Blood Services (CBS) moved its laboratory to Calgary. BCCDC Virology now processes an additional 50,000 hepatitis BsAg tests on prenatal patients that had been previously performed by CBS. This increase in prenatal testing offered an opportunity to change the current procedures by developing a “prenatal” requisition to consolidate the test requests. This change has offered cost savings by reducing the duplicate accessioning of specimens and minimizing the number of tubes drawn per patient. Physicians now receive one report of all prenatal tests rather than four individual reports.

Because of the increase in testing we added the Abbott Architect for testing anti-HCV. This provides an additional AxSYM instrument that can be used to run prenatal screens.
**Molecular Assays for Hepatitis**
The use of molecular assays in hepatitis testing continued to increase in 2003, particularly for HCV PCR (qualitative and quantitative) and HCV genotyping. To accommodate this volume and to improve the turnaround time an automated Roche Ampliprep instrument was installed for extraction of specimens for HCV PCR. An assay to genotype and fingerprint HCV by a sequencing protocol is being developed in collaboration with Molecular services. This genotyping method would offer a cost saving to the current commercial genotyping method.

**Laboratory Results Line**
Virology staff on the results line field questions and laboratory result inquiries for all clients in BC. This area received an upgrade of computers in order to expedite the retrieval of laboratory reports. The staff on the result line phones has received recognition from the public regarding the excellent quality of their service.

**Clinical Trials and Applied Research**
The Pegasys Project moved into phase II in 2003. The Pegasys project is funded by Roche Canada to provide testing services for an extended access program for pegylated interferon/ribavirin for the treatment of Hepatitis C. The Virology Section coordinated the laboratory testing of Hepatitis C for the current 53 sites with 2,104 enrolled patients across Canada. The project is forecasting 80 to 100 sites with 3,000 enrolled patients. P. Tsang, A. Mak, K. Gunadasa, K. Chu, H. Rowe, G. McNabb, M. Krajden.

HCV - Innogenetics Inno-Lipa HCV II versus sequenced based HCV genotyping. This project was initiated to evaluate the performance of sequence-based HCV genotyping procedure that could provide cost savings. The project has shown that the sequencing procedure provides valid results and we are currently continuing to work on the system to ensure reliable results in the routine diagnostic laboratory. A. Mak, M. Petric, G. McNabb, A. McNabb. M. Krajden.

Enhanced STD Surveillance in Canadian Street Youth Study is a nationwide survey sponsored by Health Canada. These patients are tested for anti-HBs, anti-HBc, syphilis, Chlamydia and gonorrhoea. The project is to expand knowledge of STD’s in marginalized difficult-to-reach populations. G. McNabb, Q. Wong, C. Shaw, D. Cook

HCV profile study of 500 patients comparing the HCV Antibody, HCV core Antigen, and Nucleic Acid testing (TMA Transcription mediated assay, b-DNA branched chain) was performed. This study also showed the limitations of the core antigen as a second line supplemental test in the diagnosis of active HCV infection. R. Shivji, K. Gunadasa, A. Mak, G. McNabb, D. Cook, M. Petric, M. Krajden

ADVIA Centaur HIV Evaluation for Canadian Clinical Studies was started in December, 2003 to provide the data required for submission to the Canadian Medical Devices Bureau for

Biolytical INSTI rapid HIV-1/HIV-2 Evaluation for Canadian Clinical Studies began in September, 2003 to provide the data required for submission to the Canadian Medical Devices Bureau for clearance of this method in Canada. L. Di Francesco, J. Burgoyne, G. McNabb, D. Cook, M. Krajden.

Evaluation of a rapid antigen test for detection of SARS and other respiratory tests was performed. This rapid test marketed by *Pritest* was designed to detect an immunocomplex using a bioluminescent process which could provide a rapid sensitive method. The preliminary findings of this evaluation showed that the *Pritest* assay was not performing adequately for use in a clinical laboratory. D. Lawrence, M. Petric, M. Krajden.

Evaluation of Nucleic Acid testing for respiratory viruses was performed by comparing DFA, rapid R-mix, tube cultures with RT-PCR and NASBA. 598 respiratory specimens were compared and it was found that nucleic acid testing combined with the application of robotics for specimen processing was shown to have the highest sensitivity and turnaround time of approximately 6 hours.

Valuation of the Safe Injection Site (e-SIS) is a study where approximately 1000 patients will be enrolled and specimens will be sent for HIV and HCV baseline antibody testing and follow up testing. J. Burgoyne, G. McNabb, M. Krajden.

SAVI (SARS Accelerated Vaccine Initiative). In this program, which is funded by SAVI and CIHR, SARS-CoV Tor-2 is routinely grown in the CL-3 laboratory. This allows laboratory to offer a viral micro-neutralization test for determination of neutralizing antibody to SARS-CoV, which is the most specific assay for SARS-CoV antibody. The ability to grow SARS-CoV in cell culture has allowed us to provide reagents such as SARS-CoV RNA and protein to other laboratories developing tests and to perform retrospective testing for the neutralizing antibody in patient specimens for other sites. D. Lawrence, M. Petric.
Laboratory Services Sections

Zoonotic Diseases & Emerging Pathogens

Core Services
- Diagnostic & medical consultative services
- Outbreak investigation & surveillance
- Research & development for zoonotic & emerging diseases
- Reference laboratory services for zoonotic and exotic diseases
- Molecular testing services
- Education & training

Bacterial and Parasitic Serology
The Section provides specialty testing, public health tests, research and development and consultative services in microbial serology (including bacterial, parasitic, viral and fungal serology) for the province of British Columbia. The focus is on diseases of public health importance, including sexually transmitted diseases (syphilis), zoonotic infections (diseases of animals that can be transmitted to humans such as West Nile virus, Toxoplasmosis, Lyme Disease and Brucellosis) and diseases caused by emerging pathogens (Helicobacter pylori). The Section provides reference and consultative services to all Regional Health Authorities. We are a reference laboratory for several other provinces and territories, particularly on spirochetal (Lyme disease) and rickettsial diseases.

Syphilis (Treponema pallidum)
Over 102,000 specimens were tested for syphilis (an increase of >2.7% from 2002) using the Rapid Plasma Reagin test (RPR), the Immutrep-TPHA (Treponema pallidum Hemagglutination Assay), the Serodia TP-PA (Treponema pallidum Particle Agglutination Assay) and the Hemagen FTA-Abs test (Fluorescent Treponemal Antibody Absorption).

Detection of T. pallidum from genital ulcer and molecular fingerprinting of T. pallidum isolates continues in collaboration with CDC Atlanta. Most of the isolates from BC were typed as 14D.

Molecular fingerprinting of T. pallidum (syphilis) isolates continues in collaboration with CDC Atlanta

New Initiatives
A new commercial test by Fujirebio Diagnostics (Serodia TP-PA) was evaluated and, after a business case had been approved, was implemented to replace the Immutrop-TPHA test. This has reduced the number of further confirmatory FTA-Abs and INNOLIA tests performed on discrepant results.

The distribution of Hemagen FTA-Abs tests was discontinued in November 2003. The Section is in the process of evaluating a new FTA kit by Scimedx Corporation.

The Section is also planning to evaluate various new commercial enzyme immunoassays for syphilis in 2004, in collaboration with STD Control and others. While automation of this test has some process advantages, medical implications and ramifications are also being considered.
**Helicobacter pylori**
A collaborative study with BC Children’s Hospital on isolating *Helicobacter pylori* from paediatric gastric patients was completed. We developed the capacity to culture *H. pylori* from stomach (endoscopic) biopsy specimens. Validation of a stool antigen test is also underway as an alternative, less expensive test. A commercially available stool antigen kit, Premium Platinum HpSA (Meridian), is currently being evaluated in the Section. A strong program of surveillance and virulence and drug resistance testing is under development. We are also working on validating drug susceptibility testing on cultured isolates to help resolve treatment issues for patients throughout BC.

**West Nile Virus**
West Nile Virus (WNV) is a mosquito-borne arbovirus (Flavivirus) and a member of the family Flaviviridae. The spread of West Nile Virus both eastward and westward from southern Ontario indicates the likelihood of the virus and the associated disease being present in British Columbia by 2003. One of the means of predicting the presence of the virus in a geographical location and the possibility of human disease is detecting WNV in mosquito pools. This is of further importance as mosquito surveillance allows for timely insect control and is recognized as a means to predict and prevent future outbreaks.

In 2003, BCCDC began testing human sera for WNV in the Zoonotic Diseases & Emerging Pathogens Section. The Section used the Focus Technologies Flavivirus (West Nile) ELISA IgG and IgM assays to test for WNV. A haemagglutination inhibition (HI) test was also used as an adjunct test to determine the status of infection. All probable cases of WNV were referred to the National Microbiology Laboratory in Winnipeg for the confirmatory Plaque Reduction Neutralization Assay (PRNT). Twenty travel-related WNV cases were diagnosed in BC using serological tests.

Renovations are underway to accommodate more molecular testing, including the transfer from the Molecular Services of the PCR testing for WNV on mosquito pools from Health Authorities throughout BC.

**Cat scratch disease (*Bartonella henselae)*
Cat scratch disease (CSD) is caused by the bacterium *Bartonella henselae*. Most people with CSD have either been bitten or scratched by a cat, developing a mild infection at the point of injury. Lymph nodes, especially those around the head, neck, and upper limbs, become swollen. Additionally, a person with CSD may experience fever, headache, fatigue, and a poor appetite. People with immunocompromised conditions, such as those undergoing immunosuppressive treatments for cancer, organ transplant patients, and people with HIV/AIDS, are more likely than others to have complications of CSD.
We evaluated a commercial serological test using characterized sera. The test was validated and implemented in the Section. Our thanks to Drs. Rusung Tan (BC Children and Women’s Hospital) and Harvey Artsob (National Microbiology Laboratory in Winnipeg) for providing characterized sera for this evaluation.

**Lyme Disease (Borrelia burgdorferi)**
Dr. Muhammad Morshed has received a research grant as co-investigator from Health Canada’s Climate Change Action Fund. He will carry out research on the impact of climate change on Lyme disease. Work to begin in 2004 will include data gathering and field studies.

**Continuous Quality Improvement Initiatives**
- Education seminars for staff
- Increased safety awareness
- Computer enhancements
- Participating in the BCCDC Laboratory Bioterrorism Response Team
- Participating in the Zoonotic Diseases & Emerging Pathogens cluster group
- Participating in West Nile virus planning sessions
- Strategic Planning and Visioning Activities
- Procedural modifications to enhance diagnosis, improve turn-around-times and cost recovery

**3rd Annual Zoonotic and Communicable Diseases Meeting**
Dr. Muhammad Morshed organized the 3rd Annual Collaborative Meeting on Zoonotic and Communicable Diseases held at the Plaza 500 Hotel in Vancouver on October 21, 2003. The meeting was hosted by BC Ministry of Agriculture, Food and Fisheries (BCMAFF) Animal Health Branch and BCCDC Laboratory Services and was sponsored, in part, by Animal Determinant for Emerging Diseases Unit, a funded research unit of the Michael Smith Foundation. Ten papers were presented by staff of BCMAFF, BCCDC and the Centre for Coastal Health Scientists. Sixty participants attended, including Medical Health Officers, Environmental Health Officers, Epidemiologists, Microbiologists, Veterinarians, Wild Life Biologists, Entomologists, Communication Specialists and other health professionals.

**Education & Teaching**
- Morshed, M. G. 2003-2006, Block Chair, HDI, Foundation of Medicine. Faculty of Medicine, UBC
- Zoonotics & Emerging Pathogens workshop for post-graduate medical residents. Dec. 2003
International Zoonotic Outbreaks

West Nile Virus
A seasonal outbreak and huge upsurge of West Nile Virus (WNV) continued in North America. WNV was first identified in the blood of a woman in the West Nile District of Uganda in 1937. WNV is maintained in nature in a mosquito-bird-mosquito transmission cycle primarily involving Culex mosquitoes. Humans, mammals, and reptiles are incidental hosts.

WNV is a spherical enveloped RNA virus belonging to the family Flaviviridae and the genus Flavivirus. It has been serologically classified within the Japanese Encephalitis (JE) virus antigen complex. Morphologically it is about 50nm in diameter and consists of a host-derived lipid bilayer membrane surrounded by a nucleocapsid core containing a single stranded, positive sense RNA genome of approximately 11,000 nucleotides.

WNV was first introduced in North America in 1999. Viral spread was very fast and is now described in most parts of North America. This virus has been reported from seven provinces in Canada (Quebec, Ontario, Saskatchewan, Manitoba, Alberta, New Brunswick and Nova Scotia) and all states of the USA except for Alaska, Oregon, Washington and Hawaii. Massive avian (mostly corvids - crows and jays) and a large number of equine, reptile and some human deaths have been reported. The presence of WNV in breast milk, infection of WNV from human-to-human via organ transplantation, blood transfusion, and intrauterine transmission and laboratory-acquired infections have been reported.

Ilnesses caused by WNV have increased year to year as the virus has spread westward. In 2002, WNV caused 4161 illnesses and 277 deaths in the USA and 416 illnesses and 20 deaths in Canada. In 2003, the number of illnesses in Canada rose to 1315 (most of them from Saskatchewan and Alberta) with 10 deaths and in the USA illnesses rose to 8,694 with 206 deaths (mostly from the Great Plains). 737 presumptive West Nile viremic blood donors also have been reported to ArboNET in the USA.

WNV is an emerging pathogen in North America. It continues to be a challenge globally. Through surveillance and research, we are obtaining new information. The impact of the highly virulent nature of the North American isolates of WNV will almost certainly continue over the next several years. It may indeed become one of North America’s predominant arboviral diseases.

SARS
An unusual atypical respiratory disease surfaced in Foshan, Guangdong Province, China in November 2002. Designated Severe Acute Respiratory Syndrome, SARS subsequently caused large outbreaks in several countries in the first half of 2003, resulting in infection in more than 8000 people and more than 800 deaths worldwide, including 44 in Toronto.
A novel coronavirus (SARS-CoV) was identified as a causative agent. The first complete sequence of the SARS-CoV genome (RNA, 29,621 bp) was reported by Canada’s Michael Smith Genome Sciences Centre, located at the BC Cancer Agency, Vancouver on April 12th, 2003. Civet cats are suspected to be carriers of SARS. The weasel-like mammals are considered a delicacy in Guangdong and are served in wild-game restaurants. The estimated incubation period for SARS is in the range of 2-10 days. Symptoms include high fever (>38°C/100.4°F), dry cough, shortness of breath or breathing difficulties and changes in chest X-rays indicative of pneumonia. SARS may be associated with other symptoms, including headache, muscular stiffness, loss of appetite, malaise, confusion, rash and diarrhoea.

Based on current evidence, close contact with an infected person is required for the infective agent to spread from one person to another. Contact with aerosolized (exhaled) droplets and bodily secretions from an infected person appear to be important. Fomites of infected individuals also play a role in transmission.

This deadly virus has been contained in China thanks to the tireless efforts of international scientific communities. However, re-emergence should not be ignored.

**Monkey pox**
Human monkey pox, a sporadic smallpox-like zoonotic viral exanthema that occurs in the rain forests of Central and West Africa, was discovered in 1970. The illness is caused by an orthopoxvirus, monkey pox virus, which was first isolated from primate tissues. Animal antibody surveys in the Democratic Republic of Congo (DRC; former Zaire) suggest that squirrels play a major role as a reservoir of the virus and that humans are sporadically infected. Human-to-human transmission occurs with an incubation period of 12 days (range 7-21 days).

During the 2003 outbreak of human monkey pox in the United States, a shipment of infected African rodents that contained Gambian rats and dormice is thought to have resulted in secondary infection of prairie dogs. Exposure to infected prairie dogs resulted in 37 human infections involving exotic pet dealers, pet owners and veterinary care workers in the United States.

**Other Zoonotic Diseases**
A number of other zoonotic diseases were also reported in 2003: Ebola in the Republic of Congo; Legionella in France; Plague in Algeria; Yellow Fever in Brazil; Crimean-Congo Haemorrhagic Fever in Mauritania and Pertussis in Afghanistan.

Sources: ProMed and World Health Organization
Laboratory Services

Publications, Conferences & Abstracts


S. Shay, M. Khan, A. Li, C. Ong, J. Ross, J. Isaac-Renton. The Impact of Rainfall on Community Waterborne Cryptosporidium Infections. Presented at the Canadian Association for Clinical Microbiology and Infectious Diseases (CACMID) Montreal, Quebec. Nov. 2003


Louie Ken, Gustafson Larry, Fyfe Murray, Gill Jeet, MacDougall Laura, Tom Lorna, Wong Quantine, Isaac-Renton Judy, An Outbreak of *Cryptosporidium parvum* in a Surrey Pool With Detection in Pool Water Sampling

Williamson JM, Ong CS. Examining polymorphisms and diversity in the *Cryptosporidium* genome. American Society of Microbiology Northwest meeting, Vancouver, BC, Aug 2003.

Ong CSL. What's new about the old *Cryptosporidium*? BC Centre for Disease Control Grand Rounds, Vancouver, BC, Jan 2003.


L. McIntyre. BC Epidemiology and Laboratory Investigation of Norovirus (Norwalk-like viruses). BC Food Protection Symposium. May 6, 2003


Mabel Rodrigues joined provincial and territorial colleagues in Ottawa for the 9th annual meeting of the Canadian TB Laboratory Technical Network in February, 2004.


Mosquito Identification Workshop, St. Catharines, Ontario: Linda Verpoorten.


Detection of RNA in purified cytomegalovirus virions. E. Sarcinella, M. Brown, R. Tellier, M. Petric and T. Mazzulli. *Virus Research,* (Accepted)


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