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# CANADIAN LEADERSHIP IN HEALTH BIOTECHNOLOGY



## HEALTH BIOTECHNOLOGY

The sequencing of the human genome has led to further understanding of how to detect and treat diseases. Health biotechnology has had a direct impact on the daily lives of Canadians. Vaccines, antibiotics, cancer therapeutics, genetic testing, and innovative diagnoses and treatments for diseases such as diabetes and cystic fibrosis are just some of the biotechnology health innovations improving Canadians' health.

The majority of biotech research in Canada is health-based, and over 80 percent of Canadians overwhelmingly support research and the use of products and processes that use biotechnology. Canadians see the benefits biotechnology offers to our health, the environment and economy, with most expecting to benefit from biotechnology in their lifetime.<sup>1</sup>

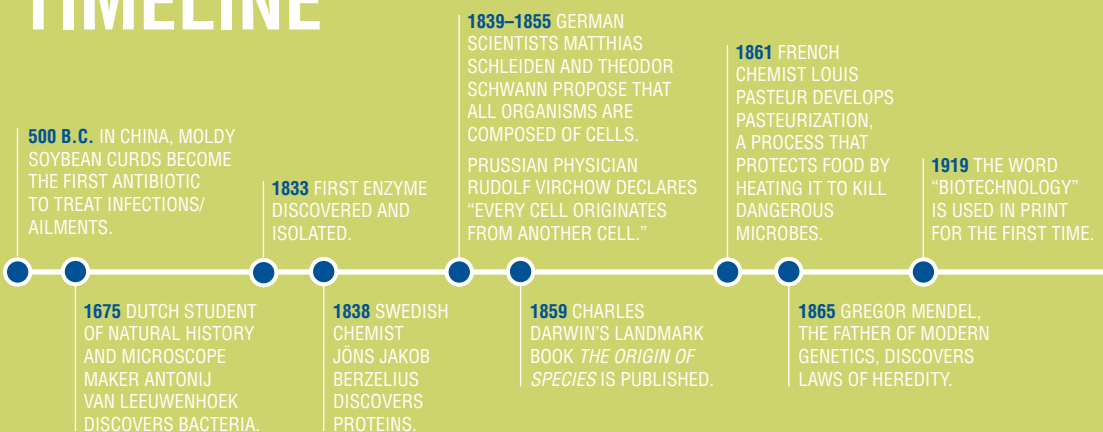
Biotechnology plays an important role as a preventative tool in the health care system. Screening patients for susceptibility to disease and providing vaccinations against the onset of disease has benefitted millions of Canadians. Improved diagnostic tools help doctors and researchers detect disease and design targeted treatments for patients. The occurrence of side effects can be minimized by understanding how a person's genetic makeup affects their capacity to metabolize medicines. We can target the right treatment for the right person more efficiently, easing the strain on an overburdened health care system. In the future, biotechnology will improve your health by using and understanding your genetic code to diagnose and fight disease.

As research continues, Canadian leadership in biotechnology will grow and offer global solutions with expertise in:

- Cancer therapeutics and vaccines
- Treatments for heart disease, arthritis, rare diseases, Alzheimer's and diabetes
- HIV and AIDS treatments
- Stem cell research
- Infectious disease treatments

<sup>1</sup> Pollara for BIOTECanada, September 2007.

## TIMELINE



## CANADA'S LEADING HEALTH BIOTECHNOLOGY COMPANIES

### CARDIOVASCULAR

Biovail Pharmaceuticals Inc.	Mississauga
Cardiome Pharma Corp.	Vancouver
Forbes Medi-Tech Inc.	Vancouver
Liponex Inc.	Ottawa
Medicure Inc.	Winnipeg
Milestone Pharmaceuticals	Montreal
Resverlogix	Calgary
SemBioSys Genetics Inc.	Calgary
Technologie Biolactis Inc.	Laval
Vasogen Inc.	Mississauga
Xenon Pharmaceuticals Inc.	Burnaby

### DIABETES

Biovail Pharmaceuticals Inc.	Mississauga
Ceapro Inc.	Edmonton
Diamedica Inc.	Winnipeg
enGene Inc.	Vancouver
iCo Therapeutics Inc.	Vancouver
SemBioSys Genetics Inc.	Calgary
Sernova Corp.	Kelowna
Technologie Biolactis Inc.	Laval
Theratechnologies Inc.	Saint-Laurent
Transition Therapeutics	Toronto

### GLOBAL LEADERS – HEALTH

Alexion Pharmaceuticals	Cheshire
Ambit Biosciences Corp.	Toronto
AMGEN Canada Inc.	Mississauga
AstraZeneca Canada Inc.	St-Laurent
Baxter Corporation	Mississauga
Bayer Inc.	Toronto
Biogen Idec Canada	Mississauga
BioMarin Pharmaceutical Inc.	Novato
Bristol-Myers Squibb Canada Inc.	Montreal
Celgene	Oakville
Eli Lilly Canada Inc.	Scarborough
EMD Serono	Mississauga
Genzyme Canada Inc.	Mississauga
Gilead Sciences Canada Inc.	Mississauga
GlaxoSmithKline Inc.	Mississauga
Hoffmann-La Roche Limited	Brampton
Merck Frosst Canada Ltd.	Kirkland
Novartis Pharmaceuticals Canada Inc.	Dorval
Novo Nordisk Canada Inc.	Mississauga
Nycomed Canada Inc.	Oakville
Ortho Biotech	North York
Pfizer Canada Inc.	Kirkland
Procter & Gamble Pharmaceuticals Canada Inc.	North York
Sanofi Pasteur Limited	Toronto
Schering-Plough Canada Inc.	Kirkland
Shire Human Genetic Therapies	Saint-Laurent
Solvay Pharma Inc.	Markham
Talecris Biotherapeutics Limited	Mississauga
UCB Pharma Canada Inc.	Burlington
Wyeth Pharmaceuticals	Markham

**1928** SCOTTISH BACTERIOLOGIST SIR ALEXANDER FLEMING DISCOVERS PENICILLIN AS AN ANTIBIOTIC.

**1943** CANADIAN SCIENTIST OSWALD THEODORE AVERY ISOLATES PURE DNA.

**1953** JAMES WATSON AND FRANCIS CRICK ARE THE FIRST TO DESCRIBE THE DOUBLE HELIX STRUCTURE OF DNA.

**1955** THE SALK POLIO VACCINE IS LICENSED IN NORTH AMERICA. CONNAUGHT LABORATORIES (NOW SANOFI PASTEUR LIMITED) ESTABLISHES A GLOBAL GOLD STANDARD FOR THE SALK POLIO VACCINE AND THE VACCINE'S INTERNATIONAL EXPORT IN 1957.

**1922** IN TORONTO, DR. FREDERICK BANTING AND HIS ASSISTANT CHARLES BEST DISCOVER INSULIN AS A TREATMENT FOR DIABETES.

**1942** PENICILLIN IS FIRST MASS-PRODUCED USING MICROBES.

**1944** OSWALD THEODORE AVERY, ALONG WITH FELLOW CANADIAN SCIENTISTS COLIN MACLEOD AND MACLYN MCCARTHY, LAY THE GROUNDWORK FOR MODERN GENETICS AND MOLECULAR BIOLOGY. THEY PROVE CONCLUSIVELY THAT DNA CONTAINED WITHIN THE NUCLEUS OF A CELL IS GENETIC MATERIAL. PRIOR TO THEIR WORK, GENETIC MATERIAL WAS ASSUMED TO BE PROTEIN.

**1971** FIRST COMPLETE SYNTHESIS OF A GENE. FIRST GENE-SPLICED DNA FROM DIFFERENT ORGANISMS.

## INFECTIOUS DISEASE

Ambrilia Biopharma Inc.	Verdun
Cangene Corporation	Winnipeg
Emerillon Therapeutics Inc.	Montreal
GangaGen Life Sciences Inc.	Ottawa
iCo Therapeutics Inc.	Vancouver
Inimex Pharmaceuticals Inc.	Burnaby
Kane Biotech Inc.	Winnipeg
Liponex Inc.	Ottawa
MethylGene Inc.	Montreal
Mistral Pharma Inc.	Dorval
Pacgen Biopharmaceuticals Corporation	Vancouver
Receptor Therapeutics Inc.	Toronto
Sirius Genomics Inc.	Mississauga
Thallion Pharmaceuticals Inc.	Montreal
Transition Therapeutics	Toronto
Ulysses Pharmaceuticals	Sherbrooke

## INFLAMMATORY

Aquinox Pharmaceuticals Inc.	Vancouver
enGene Inc.	Vancouver
Milestone Pharmaceuticals	Montreal
Sirius Genomics Inc.	Mississauga
Vasogen Inc.	Mississauga
Viron Therapeutics Inc.	London

## MEDICAL TECHNOLOGY/SPECIALITY/ DIAGNOSTICS

Adnavance Technologies Inc.	Saskatoon
Amorfix Life Sciences Ltd.	Mississauga
Angiotech Pharmaceuticals Inc.	Vancouver
Augurex Life Sciences Corp.	North Vancouver
Axela	Toronto
BioSyntech	Laval
Biovail Pharmaceuticals Inc.	Mississauga
Caprion Proteomics	Montreal
Ceapro Inc.	Edmonton
Clera Inc.	Vancouver
Covalon Technologies Ltd.	Mississauga
Critical Outcome Technologies	London
Genizon BioSciences	Saint-Laurent
Haemacure Corporation	Montreal
Interface Biologics	Toronto
Kane Biotech Inc.	Winnipeg
Med BioGene Inc.	Vancouver
MedMira Laboratories Inc.	Halifax
Miraculins Inc.	Winnipeg
Mistral Pharma Inc.	Dorval
Phenomenome Discoveries Inc.	Saskatoon
Rimon Therapeutics Ltd.	Toronto
Sirius Genomics Inc.	Mississauga
Trillium Therapeutics	Toronto
Z-Tech (Canada) Inc.	Toronto

## METABOLIC

Technologie Biolactis Inc.	Laval
SemBioSys Genetics Inc.	Calgary
Xenon Pharmaceuticals Inc.	Burnaby

## MUSCULOSKELETAL

Augurex Life Sciences Corp.	North Vancouver
Enobia Pharma	Montreal

**1972** DNA LIGASE, WHICH LINKS DNA FRAGMENTS TOGETHER, USED FOR THE FIRST TIME.

FIRST SYNTHETIC RECOMBINANT MOLECULE CREATED BY COMBINING DNA FROM TWO VIRUSES.

**1978** RECOMBINANT HUMAN INSULIN IS FIRST PRODUCED.

**1987** GENETICALLY ENGINEERED HEPATITIS B VACCINE APPROVED FOR USE IN CANADA.

**1990** WORLD'S FIRST HUMAN GENOME PROJECT LAUNCHED.

**1973** STANLEY COHEN AND HERBERT BOYER DEVELOP RECOMBINANT DNA TECHNOLOGY, CONSIDERED TO BE THE BIRTH OF MODERN BIOTECHNOLOGY. THEY COMPLETE THE FIRST SUCCESSFUL GENETIC ENGINEERING EXPERIMENT BY INSERTING A GENE FROM AN AFRICAN CLAWED TOAD INTO BACTERIAL DNA.

**1986** UNIVERSITY OF TORONTO PROFESSOR JOHN C. POLANYI RECEIVES THE NOBEL PRIZE FOR THE DEVELOPMENT OF REACTION DYNAMICS, A NEW FIELD OF RESEARCH IN CHEMISTRY THAT GIVES A DETAILED UNDERSTANDING OF HOW CHEMICAL REACTIONS TAKE PLACE.

**1989** DISCOVERY OF DEFECTIVE GENE FOR CYSTIC FIBROSIS BY DR. LAP-CHEE TSUI AT TORONTO'S HOSPITAL FOR SICK CHILDREN.

**1992** CANADA'S HUMAN GENOME PROJECT ANNOUNCED.

## NEUROLOGY/CNS

Allon Therapeutics	Vancouver
Amorfix Life Sciences Ltd.	Mississauga
ANGIOCHEM INC.	Montreal
Bellus Health Inc.	Laval
BioMS Medical Corporation	Edmonton
Biovail Pharmaceuticals Inc.	Mississauga
Cannasat Therapeutics Inc.	Toronto
Cervelo Pharmaceuticals Ltd.	Mississauga
NeuroImage Inc.	Toronto
Neuromed Pharmaceuticals	Vancouver
PainCeptor Pharma Corp.	Saint-Laurent
Stem Cell Therapeutics Corp.	Calgary
Vasogen Inc.	Mississauga
Wex Pharmaceuticals Inc.	Vancouver
Xenon Pharmaceuticals Inc.	Burnaby

## ONCOLOGY

Abraxis BioScience Inc.	Richmond Hill
AEterna Zentaris Inc.	Quebec
Aquinox Pharmaceuticals Inc.	Vancouver
Arius Research Inc.	Toronto
Bioniche Life Sciences Inc.	Belleville
Celator Pharmaceuticals Inc.	Vancouver
Chemaphor Inc.	Ottawa
Chemokine Therapeutics Corp.	Vancouver
Constab Pharmaceutical Inc.	Toronto
Liponex Inc.	Ottawa
MethylGene Inc.	Montreal
Mimetogen Pharmaceuticals	Montreal
OncoGenex Technologies Inc.	Vancouver
Oncolytics Biotech Inc.	Calgary
ProMetic Life Sciences Inc.	Montreal
Prottox Therapeutics Inc.	Vancouver
QLT Inc.	Vancouver
Receptor Therapeutics Inc.	Toronto
Saponin Inc.	Manotick
Thallion Pharmaceuticals Inc.	Montreal
ViRexx Medical Corp.	Edmonton
YM BioSciences Inc.	Mississauga
Z-Tech (Canada) Inc.	Toronto

## RESPIRATORY

Topigen Pharmaceuticals Inc.	Montreal
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## STEM CELL

enGene Inc.	Vancouver
Inspection BioSciences	Mississauga
Stem Cell Therapeutics Corp.	Calgary

## VACCINE INDUSTRY COMMITTEE

ImmunoVaccine Technologies	Halifax
International Centre for Infectious Diseases	Winnipeg
Medicago Inc.	Sainte-Foy
Merck Frosst Canada Ltd.	Kirkland
Sanofi Pasteur Limited	Toronto
Saponin Inc.	Manotick
Solvay Pharma Inc.	Markham
Vaccine and Infectious Disease Organization	Saskatoon
Variation Biotechnologies Inc.	Gatineau
Wyeth Pharmaceuticals	Markham

As of May 23, 2008.



**1993** CANADIAN SCIENTIST DR. MICHAEL SMITH WINS THE NOBEL PRIZE IN CHEMISTRY FOR HIS PIONEERING WORK ON A METHOD OF REPROGRAMMING SEGMENTS OF DNA.

**1997** THE WORLD MEETS DOLLY THE SHEEP, THE FIRST CLONED MAMMAL. UNESCO ADOPTS THE UNIVERSAL DECLARATION ON THE HUMAN GENOME AND HUMAN RIGHTS.

**2000** SUCCESSFUL IMMUNIZATION (PREVENTION AND IMMUNOTHERAPY) OF MICE AGAINST ALZHEIMER'S BY DR. PETER ST. GEORGE-HYSLOP AT THE UNIVERSITY OF TORONTO.

**2003** THE HUMAN GENOME PROJECT, AN INTERNATIONAL 13-YEAR EFFORT TO DETERMINE THE SEQUENCES OF THE THREE BILLION CHEMICAL BASE PAIRS THAT MAKE UP HUMAN DNA, IS COMPLETED. RESEARCHERS AT CANADA'S MICHAEL SMITH GENOME SCIENCES CENTRE IN BRITISH COLUMBIA BECOME THE FIRST TO SEQUENCE THE SARS GENOME. THEY IN TURN MAKE IT AVAILABLE ON THE INTERNET, THEREBY HELPING THE DEVELOPMENT OF A POTENTIAL TREATMENT AND POSSIBLE VACCINE.

**2006** THE FIRST VACCINE AGAINST CERTAIN TYPES OF THE HUMAN PAPILLOMAVIRUS IS APPROVED FOR USE FOR GIRLS AND WOMEN IN NINE COUNTRIES AND THE EUROPEAN UNION.

CALGARY-BASED SEMBIOSYS GENETICS INC. PRODUCES COMMERCIAL QUANTITIES OF HUMAN INSULIN FROM GENETICALLY MODIFIED SAFFLOWER PLANTS, POTENTIALLY CHANGING THE WAY THE WORLD MEETS INSULIN DEMANDS AND INCREASING ACCESS TO TREATMENT BY DIABETES PATIENTS WORLDWIDE.

**2007** CANADIAN AND U.S. RESEARCHERS DETECT A NEW GENE (K1AA0350) INVOLVED IN TYPE 1 DIABETES THAT COULD HELP IN EARLIER DETECTION AND TREATMENT.