Canadian Academy of the History of Pharmacy

History of Pharmacy in Canada
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Introduction

Why is the history of pharmacy relevant for pharmacy students?

History defines who we are and influences what we do. Many movies use a theme of a person with amnesia who doesn't know his identity. This is portrayed as a depressing and demoralizing situation; the individual is desperate to find out who he is and where he fits into society. On an international level, various countries remain antagonistic towards or in alliance with each other for historical reasons.

In general, older Canadians have a greater interest in history than younger individuals do. For the most part Canadians do not have a strong knowledge of Canadian history although they do think that it is important that people know their own history. To become Canadian citizens, immigrants are required to learn some of its history. It is intriguing that although many students state they have little interest in history and resist learning Canadian and pharmacy history, they often go to Europe upon graduating to see all the historical sights!

Students in pharmacy tend to bond with their class to create a sense of unity with a loyalty to the Faculty. When they graduate, they become part of provincial and national pharmacy organizations and can influence the direction of the profession. They also become part of the international pharmacy community. In Canada, although efforts to harmonize certain areas (e.g. pharmacist licensing) are being made, there are still inter-provincial differences in practice and legislation. Differences between the practice of pharmacy in Canada and other countries are more obvious. The reasons for these differences are the result of some historical decisions that were made. The decisions are usually reflected in legislation and regulations that govern pharmacy practice. By knowing about these decisions and their impact, pharmacists can better appreciate the social and economic forces that influence pharmacy practice.

We can learn valuable lessons from studying our history. For example, in the period from 1867 - when Canada became a country - to the 1940, there was little health insurance and patients had to pay for whatever services they needed. Because physician services were relatively expensive, many patients came to the pharmacy with their health problems to see if they could be resolved with medication. Pharmacists were the "poor man's doctors" and many pharmacists were referred to as "doc". This close link to the patient and the recommendation of medication was lost in the period from 1950-75 as a result of pharmacists dispensing the new expensive pharmaceutical products and being prevented from giving patients information about them, a practice that evolved for reasons that are not entirely clear. When pharmacists again began to provide more information to the patient it was helpful to have the historical relationship to fall back on rather than appear to be moving into a new area and competing with the physician. Fortunately, many older people remembered the former role of the pharmacist and were prepared to work closely with their pharmacist.

The historical events that have resulted in our current situation are often still relevant. It is generally true that social and cultural change is slow - much slower that technological or economic change. The way we practice pharmacy today reflects the decisions that were made yesterday and in turn those depend on the decisions made the day before, ad infinitum. There are, however, some momentous events that clearly mark a change in direction or method of practice. For example, on 1 April 2007 the pharmacists in Alberta were given the right to prescribe certain medications. This kind of change is a response to events and attitudes in society and each society will have different priorities and events. However, the initiative in this case stimulated and justified similar action in other provinces.

The aim of this overview is to provide some background to the evolution of pharmacy as a profession and specifically within Canada. References are provided for those who wish to gain more information on a particular topic.

The Origins of Pharmacy

How did the role of pharmacist evolve?

In primitive times people learned to control some facets of their life but there were many others that they could not influence: disease, weather, availability of food, accidents, etc. People attributed these uncontrollable events to outside forces or spirits. Within their society, they designated individuals to assist them in dealing with the supernatural world. These people performed the functions we now designate as spiritual minister, medical practitioner, and pharmacist. The three roles were combined until society evolved to a more sophisticated level. Even now there are some intermingling elements.

What were some of the early medications?

Herbal mixtures, minerals and animal (and insect) parts were used medicinally early in human history. Primitive societies were regularly faced with food shortages and it is conceivable that during these times individuals experimented with various plants. This learning process introduced them to alternate food supplies and to various plants that had pharmacological effects, usually vomiting and diarrhea. Perhaps some botanicals were used topically for their soothing effects. It is also possible that innate human curiosity led to the use of some plants. In any case humans used a variety of substances as medication when they were ill or injured. It is likely that many plants had properties attributed to them incorrectly but the power of the placebo and the ability of Mother Nature to heal produced positive results often enough that they continued to be used. Some, such as opium, were found to be consistently and dramatically effective and became widely used (and abused).

A surprising number of preparations have been used for thousands of years. In Egypt, pharmaceutical prescriptions have been dated back to 3700 BCE and jars with plant-derived ingredients and wine residue dating back to 3150 BCE have been found. This would indicate that wine/alcohol was used medicinally in addition to being used as a beverage. Even earlier evidence of alcoholic beverages was found in China (7000 BCE).

How was pharmaceutical knowledge passed down?

Much of the pharmacy lexicon has ancient Greek origins, beginning with the term pharmacy - derived from the term Pharmakon, which meant "to mix". Greek contributions to the sciences were substantial and well documented and formed the basis for study in European universities during the following centuries.

The Egyptians recorded various medical remedies. For example, the Ebers Papyrus (1552 BCE), named after the German Egyptologist Georg Ebers who purchased it around 1873, contains invocations for driving away disease as well as recipes mentioning over 700 ingredients. Some of the ingredients are well known to us: vinegar, turpentine, figs, castor oil, mastic, wormwood, aloes, opium, peppermint, cassia, caraway, coriander, anise, fennel, saffron, linseed, henbane, poppy, gentian, colchicum, squill, grapes, onions, etc. These plus other substances were in use for thousands of years, as we can see from pharmacopeias of the 16th and 17th centuries.

Other ancient societies such as China, Sumeria, India, and indigenous people in the Americas and Africa had their own formulae. Some of these have been documented and there is a literature on them; for others, we can only assume that they existed. All societies have searched for remedies to help them deal with illness. The most reliably effective preparations were those used as laxatives and purgatives.

The 15th and 16th century were characterized by the development of complex compounding procedures for the widening array of herbs, spices, minerals, chemicals and many other, sometimes bizarre, substances finding their way into practice. These formulae were printed in books called formularies. Soon after the printing press was invented, the first pharmacopeia was printed in Florence in 1498 - in Italian rather than Latin - by physicians at the request of the Apothecary Guild. Florence was a major trading site with connections throughout the known world and various practices and medicines were used. The intent behind compiling a pharmacopeia was to simplify and standardize therapy. A number of pharmacopeia, formularies and dispensatoria were developed in Europe over the following two centuries.

In 1618, the Apothecary Guild prepared the London Pharmacopeia, listing the traditional

medicinal products, some of which were of Greek and Roman origin. This project was supported by the physicians. It was written in Latin and this made it useful in several countries. Several editions were published at intervals of 20-30 years. Over the next century or two, many new substances were introduced as wonderful remedies and were listed. Cinchona - for the treatment of malaria - was introduced from South America. Tea, coffee and chocolate were incorporated into the listing as they became known and used. Various techniques were used for extracting the active ingredients from botanical sources. Roots, bark and woody stems were broken up and ground to a fine powder in a mortar. Hard inorganic substances were placed in a metal contusion mortar and pounded down to small bits by the apprentice. Infusion - the same process used to make tea - and percolation (in which hot water or other liquid was poured over herbs in a funnel-shaped cone and the liquid percolated through) - the same process used to make coffee — were also employed. Tea and coffee are palatable extracts of caffeine, a drug. The differential solubility of aromatic oils, caffeine and tannins results in the aroma being released first, then the caffeine and, after a longer period, the tannins, which make the beverage more bitter and astringent.

What do we know about the predessessors of the modern pharmacist?

The life of Hippocrates (460-370 BCE) is of particular interest to us because he was a dominant force in ancient science. In the realm of pharmacy, he developed fomentations (warm lotions applied topically often with medication), gargles, poultices (topical semi-solid medication applied locally in a fabric container), lozenges (a hard, compressed dosage form that releases medication slowly in the mouth and is to be sucked rather than swallowed), suppositories (a rectal dosage form that releases medication), pills (a round solid oral dosage form that contains medication), ointments, cerates (a wax for topical use), collyria (solution for the eye), and inhalations of vaporized liquids.

In Greek mythology Asklepios, the god of healing, had a daughter Hygeia, who was the goddess of health. His other daughter, Panacea, was the goddess of medicine. She is often depicted with a serpent of miraculous powers on her arm and a bowl. The serpent is thought to represent Asklepios, as at the time harmless snakes were found inside the

temples. These serpents were dormant and appeared to be dead. However, when picked up and dropped, they slithered away. The ancient Greeks thought the snakes were brought back to life by the healing powers of Asklepios. The staff (caduceus) and serpent are now the symbol of medicine while the bowl, often depicted with a serpent on it, is the symbol of pharmacy. This symbol is on many pharmacy signs and is recognized internationally as the symbol of pharmacy, e.g. it is associated with the International Federation of Pharmacy (FIP).

Galen taught pharmacy and medicine in Rome from about 162 CE. He was a physician to gladiators and Roman emperors (Marcus Aurelius, Commodus). His research on plants was the basis for teaching for the next 1500 years. He wrote extensively and his intelligently formulated preparations were in widespread use. Although known for his role in medicine, he also made a major contribution to pharmacy in his study and use of medicinal plants. In pharmacy, medications obtained from plants are known as "galenicals". The study and use of plants as medicine is called pharmacognosy. The identification and characterization of medicinal plants in past pharmacy programs was often referred to by students as "weeds and seeds".

In the third century CE, the twin brothers Damian and Cosmos practiced medicine in Asia Minor. They were Christians, living in the Roman world. Their advanced level of practice and reports of miraculous cures brought patients from the whole empire. They are the patron saints of pharmacy and throughout Christian history they are depicted in paintings and there are references to sanctuaries in their name.

During the Dark Ages in Europe, the art and practice of science, including pharmacy, was kept alive in the Arabian world. The cosmopolitan cities of Cordoba, Baghdad, and Damascus had huge libraries and schools that collected and studied the writings of Greek, Indian, Persian and Roman scholars. This learning was returned to Europe following the Crusades. The names of Maimonides (Code of Ethics), Avicenna, and Avenzoar are linked to this period. In Europe during the 8^{th} to 10^{th} centuries, the monasteries were instrumental in preserving and translating historical knowledge from Greek and Arabic books. They also cultivated and named herbs. For example, rosemary is derived from Rose of St. Mary. In the same period the word "drug' - meaning "dry herb" - was derived

from the Teutonic language. It was almost 500 years later in the 16th century that the term druggist as a seller of drugs came into use. The monasteries provided care to the sick based on good food, rest, and decoctions of simple medications from their gardens. The few hospitals in the cities that existed at the time were places one went to die rather than treatment centres.

What's in a name?

1300s - Apothecary (from Medieval Latin *apothecarius,* from Late Latin, shopkeeper, from Latin *apotheca* storehouse, from Greek *apothēkē*, from *apotithenai* to put away, from *apo-* + *tithenai*)

1500s - Druggist (from the Teutonic word drug meaning dry herb)

1500s - Chemist (New Latin *chimista,* short for Medieval Latin *alchimista*; still used in Britain and Australia)

1800s - Pharmacien in France and Quebec

1800s - Pharmacist

The Oath of Maimonides (Moses Maimonides 1135-1204)

May the love for my art actuate me at all times: may neither avarice nor miserliness, nor thirst for glory, or for a great reputation engage my mind: for the enemies of truth and philanthropy could easily deceive me and make me forgetful of my lofty aim of doing good to our children. May I never see in the patient anything but a fellow creature in pain. May I have the strength, time and opportunity always to correct what I have acquired, always to extend its domain: for knowledge is immense and the spirit of humanity can extend infinitely to enrich itself daily with new requirements.

Here am I ready for my vocation, and now I turn unto my calling.

In the early 1500s Paracelsus played a major role in disturbing the formal, complex

system of healing and prescribing in Europe. He travelled widely to study various ways of healing. This experience led him to use simple, effective methods and drugs, but his style of practice alienated him from the established practitioners. At that time, the works of Galen and others were memorized by students and accepted uncritically, even when it was clear that they were in conflict with what was observed. Perhaps this uncritical acceptance of knowledge was influenced by the system of teaching in the church. Paracelsus' negative attitude toward physicians and apothecaries constantly landed him in trouble and required that he move frequently. For example, in Basle, he denounced the apothecaries and their drugs, "The apothecaries are my enemies because I will not empty their boxes. My recipes are simple and do not call for forty or fifty ingredients". During his travels, he wrote many books and explained the use of chemicals for internal use. Because of the large number of drugs that he used and the influence of his writing, his name is often seen in historical tracts.

During the succeeding centuries, there was a complex, active quasi-scientific movement that spread across various disciplines, combining science, religion, alchemy, ancient historical tracts, charlatanism and politics. This gave rise to a flood of ideas that could now be widely circulated due to the invention of the printing press. In this era science was surrounded by myth, religion and superstition. The advances in science were often easier to achieve than overcoming the erroneous beliefs that were firmly held. Many of the old apothecary shops in Europe date from this time and are interesting places to visit. It was in this period that the practice of limiting the number of pharmacies in an area was developed and continues to this day. In England and much of the English-speaking world, this practice was not adopted.

Pharmacists, chemistry and 'pop' culture

During the period from1600-1800, there were many inventors who were pharmacists. Nicolas LeFebvre introduced the use of a thermometer and Antoine Baume introduced hydrometers (1768). Although chemistry began in the 1600s, it hit its stride in the 1800s. It underwent a major transformation as alchemy was discredited. There was a widespread interest in chemistry, with several pharmacists establishing laboratories in their

pharmacies. Many pharmacists applied science, primarily chemistry, to healing. They discovered elements and chemicals and coined words such as gas and electron that are still in use today. The tremendous advances in chemistry enabled scientists to identify many of plant constituents and to search for medicinal properties in plants. (The book Kremers and Urdang's History of Pharmacy contains a substantive description of pharmacists' involvement in chemistry, botany and physiological discoveries).

In 1718 Guillaume Rouelle solved the problem of the nature of salts, a product of the union of an acid with a base. His student Lavoisier did further research on acids and bases and is credited with the discovery of oxygen. Carl Wilhelm Scheele, a Swedish apothecary, made major contributions in chemistry. He is credited in the period 1771-1775 with the discovery of cream of tartar and tartaric acid, the isolation of phosphoric acid from bones, and the discovery of many other substances including hydrofluoric acid, potassium permanganate, manganese dioxide, barium oxide, chlorine, arsenic acid, hydrogen sulphide, and, most importantly, oxygen. His discovery of oxygen was independent from that of Priestly and Lavoisier (executed in 1794 by guillotine).

Pharmacists discovered the halogens: chlorine by Scheele (1774), iodine by Courois (1811), bromine by Balard (1826), and fluorine by Moissan (1886), which won him a Nobel prize. Indeed, many elements were discovered by pharmacists and pharmacists made a substantial contribution to the development of the periodic table.

In 1830, the German pharmacist Friedrich Moldenhauer was the first to produce chloroform. The correct chemical formula was assigned to it by the Swiss pharmacist J.B.A. Dumas, who replaced the designation "formyl chloride" with "chloroform". During this period the most respected chemists were the German pharmacists Klaproth and Marggraf. In addition to their many discoveries that led to a number of chemical industries, they also set the standard for describing their experiments in detail so that others could duplicate their results. This policy eventually curtailed the publication of questionable research. Klaproth did all his research in his pharmacy while continuing as a pharmacy practitioner. Marggraf introduced the use of the microscope into chemistry to examine various crystalline structures. Marggraf's discovery of sugar in beets was important. During the Napoleonic war, Britain, which had a virtual monopoly

on cane sugar, blocked the import of this and all other products from the areas under Napoleon. Sugar from beets became widespread in Europe, not only for the rich, but for all people and the monopoly of Britain was broken. Catalysis was discovered and utilized by Johann W. Dobereiner in 1816. This enabled the hydrogenation of fats to a desired consistency.

Friedrich Wilhelm Serturner, a German apothecary, is credited with the discovery of alkaloids, with morphine the first (1815). He named the substance morphine after Morpheus, the god of dreams who in mythology was the servant of Somnos, the god of sleep. Following this came quinine, strychnine, brucine (used until recently to denature rubbing alcohol), narceine, veratrine, atropine, nicotine, codeine, and picrotoxin, all discovered by pharmacists. Extensive research in plant chemistry by research groups in Europe identified many substances including cocaine isolated from coca leaves (1855). Caffeine was isolated from coffee bean by F.F. Runge in 1821. Separation and purification was a vital step in understanding the structure and properties of the compounds. Pharmacists made a major contribution to this area and that of analytical analysis.

In 1767 Joseph Priestly, the English scientist and theologian, was intrigued by the gases given off by the brewing process and captured the gas - called fixed air - in water, producing a pleasant sparkling water he termed soda water. The use of baking soda and tartaric acid to produce soda water became widespread. This formula had some laxative properties. In the next decade a Manchester apothecary, Thomas Henry, offered artificially carbonated water as a medicine. He claimed that it had health benefits for "putrid fevers, dysentery, bilious vomiting, etc.". He recommended taking it in combination with lemonade and this is likely the first sweet, artificially fizzy drink. The success of artificial mineral waters led to many commercial products in Europe. In Geneva a mechanic, Nicholas Paul, and a financier, Jacob Schweppes, developed a method for carbonating water. Schweppes took the invention to Britain and it was a commercial success, and by 1802 the drink was widely recommended by physicians. Later, carbon dioxide under pressure was used to make soda water. Seltzer and soda water were considered medicinal and became popular, leading in turn to their use as a

social drink in Europe and later North America. Soda fountains became trendy in the US and then in Canada at the end of the 18th century and their popularity continued to grow through the 19th century. In America the natural carbonated mineral waters were very popular and led to the development of processes to make artificial soda water. Dispensing systems were developed and adopted by apothecaries so that by 1820 they were common. Soda fountain equipment was soon available for distribution. Wine was initially used to flavour the drink, now called a spritzer, then fruit syrups (strawberries, raspberries, pineapples, sarsaparilla) replaced wine.

The Eli Lilly Company, founded in 1876, created a market for medicinal products from plants. In this era most medicinal products were of botanical origin that represented a mix of the pharmaceutical heritage of European immigrants and the First Nations. As a result they had a wide range of flavouring agents and used them to create a line of flavoured drinks, many of which contained alcohol. The firm followed the practice of the times and sold a variety of pills. Later it began developing capsules as a dosage form and also sold empty capsules to other firms, a tradition it maintained for over a century. It was at this time that the term 'ethical manufacturer' was coined, in order to differentiate firms that established quality standards, disclosed ingredients and made claims based on medical practice from those that did not disclose ingredients and advertised based on anecdotes.

In 1886, John Pemberton, a pharmacist who was creating patent medicines, made a sweet syrup and then added coca leaves (cocaine had been identified in the leaves in 1855) and kola nuts to make it invigorating (the stimulant property of kola nuts was published in 1864 and shortly thereafter caffeine was identified as the active ingredient, about 2% by weight. In comparison, coffee has ½-2% caffeine and tea ½-3½% caffeine). Hence CocaCola® was born. The discovery was taken over by others and became a commercial success although the coca (containing cocaine) had to be removed in 1906 with the introduction of narcotic legislation. Other popular drinks also developed by pharmacists in this era included: Pepsi-Cola®, A&W Root Beer®, Dr. Pepper's®, and Canada Dry Ginger Ale®.

How did the regulation of pharmacy and pharmaceuticals develop?

1240 is a key date that pharmacists all over the world recognize and refer to in their history because it was when Emperor Frederick of the Holy Roman Empire enacted 5 Articles that separated medicine and pharmacy as professions. Apprentice physicians usually spent time compounding as part of their training and this made separating the two professions difficult. Notably, much of Canada's legislation in pharmacy came about due to the threat of medical legislation that sought to control pharmacy.

In England in the 16t^{h} century, the Faculty of Medicine gave members the right to practice medicine, pharmacy and surgery. The assistants and apprentices of these medical men were called apothecaries and performed minor medical and surgical duties as well as compounding of prescriptions. As these assistants became more skilled they broke away and formed their own organization jointly with the Grocers Guild in 1606. In 1617, they formed an independent guild. King James I is quoted as stating in 1624, "Grocers are but merchants; the business of the apothecary is a mystery; wherefore I think it fitting that they should be a corporation of themselves". The term mystery in this context refers to a profession as the knowledge base was not known to the public. This was an important beginning to the concept of the "art and profession of pharmacy".

In the discovery process some products were found to be highly toxic and became used as poisons. This in turn led to France establishing a poison register in which certain substances could only be sold to known individuals who then had to sign for them and indicate the purpose for which they were going to be used. This procedure was adopted in Britain and its colonies and continued for a long period. In 1557 the "Grocers and Apothecaries Act" came into force in England. It required the apothecary to determine the honesty of the purchaser of a poison, inquire about the purpose for which it was going to be used, and record the name and time of purchase. Poisoning was a serious offence in England and a person convicted of poisoning another individual suffered the punishment of being boiled in oil.

Nicotine, the alkaloid found in tobacco, received its name in 1559 from Jean Nicot, the French ambassador to Portugal. He introduced tobacco to Europe and touted it as a plant

with many virtues. Following its identification and extraction, nicotine was listed as a poison for many years. In Canada poisons were used to kill wolves and other carnivores for their pelts and later to kill pests that destroyed crops or farm animals. The requirement for maintaining a poison register in each Canadian pharmacy was discontinued only a few decades ago.

In 1815, the apothecaries in Britain joined with the physicians to become general practitioners (the building housing the British Medical Association is known as Apothecary Hall) and the chemists and druggists took over the role of dispensing medication to the public. Pharmacy practice in various countries began to assume distinctive forms, with Germany establishing a limit on the number of pharmacies in an area. This continues to the present day. They also established a high level of professionalism and refused to sell patent medicines, did not sell drugs to the public without a prescription and would only dispense medication for physicians who were listed as qualified practitioners. Nonprescription drugs were sold in other stores called drogerie. In Britain the system was much more open and there was widespread use of various medications, much of it being sold outside pharmacies. France was between these two systems.

How did the term 'patent medicine' arise?

In 1673 the first patent medicine was introduced in England and protected by letters patent, protecting the product from competition. In the 1700s, a 'cure' could be sold to members of the royalty who often, in turn, allowed the products to be sold with financial rewards going to the formula holder. In fact, the patent, or exclusive use of a formula, by the King was a common process for several centuries. For example, LaWall describes Louis XVI purchasing a cure for tapeworm for 18,000 livres from Madame Nouffer who had inherited the formula from her husband, a physician in Switzerland. This was later found to be the well-known taenifuge, male fern, which had been known since the days of Galen. Later the term patent medicine was applied to any product promoted to the public without disclosure of the ingredients. In Canada, there was a Proprietary or Patent Medicines Act from 1908 until 1964. Currently, to promote modern research and development of pharmaceuticals, manufacturers are guaranteed exclusive patent

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protection of a new trade-marked medication for a set number of years.

The Germination of Pharmacy in Canada

Because Canada was a British colony it followed British legislation and culture. To all intents and purposes, the people living in a colony considered themselves to be living in the home country, but just a little further away. Individuals of higher social standing moved easily from one country to another and looked to the colonies as a means to make their fortune, either through obtaining land or trade grants from the Crown or through serving in a senior capacity and using their position to collect a substantial salary. In the case of healthcare, the legislation for licensing healthcare professionals and for selling goods was British and only after Canada became a self-governing Dominion in 1867 did this slowly change.

Who were the first pharmacists in Canada?

Louis Hebert, an apothecary from Paris, accompanied Pierre Dugua, Sieur de Mons, who established a settlement at Port Royal, near Annapolis Royal, in Nova Scotia in 1605. Later (1617), Louis Hebert went to Quebec City (established in 1608 by Champlain) and played a vital role in its growth, mainly in promoting agriculture. He is recognized as the father of agriculture in Canada.

Healthcare in Canada prior to 1759 was primarily hospital care for seriously ill patients, provided by religious orders and by some physicians from France. Perhaps surprisingly, women had a significant role in the early history of pharmacy in Canada. In Quebec City, the Nursing Sisters of St. Augustine at Hotel Dieu included some individuals trained in pharmacy. This religious order was established early in the 1600s and the lay missionaries, mostly women, played a crucial role in providing healthcare to the First Nations in the area. This was the origin of the Ursuline and Augustinian Hospitalieres. In Montreal, Jeanne Mance was a lay-worker who performed the duties of a pharmacist. She was among the initial colonists to found Ville Marie, now Montreal, in 1642. Her dispensary was the first in Canada after Quebec City, and she established the hospital

Hotel Dieu in 1642. She was an exceptional person who exemplified bravery in the face of Iroquois attacks and commitment to the colony (a federal government building in Ottawa that houses Health Canada is named after her). As late as 1734 there was still no other dispensary in the colony and the Sisters continued to compound and dispense medication to the sick, including the First Nations peoples. Medication at the time consisted of relatively few substances of varying quality and availability and their use was based more on hope than effectiveness. The majority of the population at that time were First Nations and they had their own traditional methods of healing, although they looked to missionaries and traders for care and medicine when available.

In early Canada, it was the normal situation to have physicians operate dispensaries to sell drugs. Only after there was a larger population and trained pharmacists did pharmacists become the main owners of pharmacies. When Canada was founded in 1867, almost one-quarter of all pharmacies were owned by physicians.

Jean Baptiste McLoughlin (later known as John) was a doctor/apothecary who studied with Dr. James Fisher, the father of medical legislation, in Lower Canada. His maternal uncles were Alexander, explorer, and Dr. Simon Fraser, who served in the Black Watch during the Napoleonic wars. John McLoughlin became qualified to practice in 1803 and worked for the fur company at Fort William and later in life was stationed for many years at Fort Vancouver (just outside Portland, OR) on the Columbia River. Because of his activities in that period he is popularly referred to as the "Father of Oregon".

Pharmacies were established early in Nova Scotia. The earliest apothecary in Nova Scotia was established in 1778 by a Dr. Philips who came from England and then returned a few years later. Several other dispensaries were then opened by physicians in the Halifax area. Dr. James Avery opened an apothecary shop in Halifax in 1824. Dr. John Naylor engaged exclusively in the drug trade and created remedies to sell, such as the very popular Naylor’s Pectoral Balsam.

In 1828 JDB Fraser advertised: drugs, medicines, patent medicines, perfumery, spices, dye stuffs, etc. in the Pictou, Nova Scotia, newspaper. There is a record of him ordering: turpentine, saltpetre, alum, linseed oil, lard, sugar, castor oil, snuff, berries, and four

gallons of rum along with other sundry supplies from Walker and McCrea, Saint John Merchants. He was very successful and sold products to Prince Edward Island and the northern area of Nova Scotia. In 1848 he was selling chloroform that he had made to physicians - a product that had only just been used as an anaesthetic in Scotland in 1847. An amputation of a thumb was the first Canadian surgical operation performed while chloroform was used to anesthetize the patient. This then led to more extensive use. Fraser's wife used chloroform when she gave birth to their seventh child. Initially there was some religious opposition to the use of anaesthetics at childbirth and it did not become accepted until 1853 when used by Queen Victoria. In addition to selling medication, Fraser also sold surgical supplies such as abdominal supporters, lancets, male catheters, bladder and water pipes, and injection bags to the Board of Health. To support the pharmacy it was necessary to sell other products such as vegetable seeds, ketchup, minor hardware items, coffee, varnish, spices, candles, and gunpowder. As a side-line he pulled teeth. Fraser was a businessman, healthcare professional, and community leader and is recognized as a leading citizen and pharmacist of Nova Scotia. The sparse population in the Canadian colonies required that pharmacists sell a wide array of products in order to exist and this situation continued, especially in rural areas, until fairly recent times. This is in contrast to Europe where pharmacies were able to confine their scope to health products and still be profitable.

Charles Tupper, who graduated in Medicine from Edinburgh, opened a pharmacy in Amherst, Nova Scotia, in 1843. His brother Nathan then operated the pharmacy when Charles Tupper entered politics and Charles had a distinguished career serving as Premier in 1864 and Prime Minister of Canada in 1896. He played an influential role in Confederation.

The first pharmacist in Newfoundland was Thomas McMurdo, who arrived from Scotland to establish a pharmacy in 1823. He and his son-in-law John McNeil educated pharmacists in their pharmacy for several decades and their firm remained a major force in pharmacy for over a century.

Leonard Tilley, later Sir Leonard Tilley, operated a pharmacy in St. John, New Brunswick in 1853 and advertised a range of products that he had imported from London,

England. He served as Governor of New Brunswick, was a father of Confederation, and a Finance Minister of Canada.

Advances in medicine and pharmacy

During the period 1759-1815 in Canada the majority of people lived a demanding life, working hard for long hours, and injury and disease were always prevalent. Discomfort and pain were part of life and not seen as something that required treatment or bed rest. Few people were educated and even fewer had knowledge of medication. More highly educated people often served in several roles in communities. In rural areas and small towns, priests were usually the most educated individuals and they were often the ones who dispensed medication. It was at this time that literacy became more common and more people began reading the newspapers that were appearing and books on self-care became popular. Various remedies were concocted at home and people who could afford to imported medications from Britain. There were relatively few products and the physician could easily carry them in a bag when he went to visit a patient. The few medications used had little efficacy in today's context but were considered valuable by those who became sick or injured and needed some form of therapy, particularly for children or during incapacitating illness.

Top Treatments

1795: opium, senna, aloes, tartar, cinchona, licorice, mercurial, jalap, blistering agents

1880 : cupping, opium, tartar emetic, chloroform, bromide/ergot, aconite, chloral hydrate, enemas, and milk

2014 : lipid-lowering agents, ACE-inhibitors, proton pump inhibitors, anti-depressants; opioids

The 18th century was a dynamic period for new pharmaceutical formulae. Some remedies were based on ancient knowledge while others reflected the discoveries made in science. It also marked the transition from exotic remedies such as viper's blood and extract of the castor (castor is the Latin name for beaver) gland. The beaver gland product called castoreum was harvested in the West along with the beaver pelts and exported to Europe (since beavers had become extinct in Europe). Pharmacists also made use of the more widely known botanic and mineral substances.

There were a large number of Pharmacopoeia and Dispensatoria in this century with a wide range of formulae. The first American pharmacopeia was published in 1778 by William Brown in the US.

In the field of medical science there were developments in the study of anatomy, physiology and pathology. Early in the 19th century the advent of physical diagnosis was based on advances in anatomy and clinical medicine. Diseases could be linked to anatomical changes and clinical terminology became more scientific. Early in the 19th century, studies on the symptoms and mortality of various diseases were conducted to better understand the disease process and the success rates of treatment, a forerunner to evidence-based medicine. Digitalis was introduced to medical practice in 1789 as a diuretic for the treatment of cardiac disease and its properties and usefulness were studied and improved over the next two centuries. Jenner published the results of his work on smallpox vaccination in 1798 but vaccination uptake was uneven. The vaccination process did not use vials of sterile product but exudate from infected tissue that was collected and rubbed into a cut in the skin. While most of the affluent English-speaking population was vaccinated, there were some groups that opposed vaccination and smallpox outbreaks continued to occur, with an outbreak in Montreal that killed over 3000 people.

In the period 1812-14, the main diseases encountered in Canada were: typhus/typhoid; ague (shaking caused by fever, often malaria); dysentery; malaria; measles; mumps; tuberculosis; and wound infections. Infectious diseases were the major health problems in society until anti-microbials were introduced in the late 1930s. Despite the relative paucity of effective remedies, the availability of medication was considered important.

One example of this was demonstrated during the 1812-14 war. When the British evacuated Fort George at Niagara they buried some medicine nearby. Later, when the Americans were occupying the fort, the British required more medicine so they initiated an assault on Fort George to divert the American troops while a work party dug up the buried medicine and took it away.

Tea, coffee, tobacco and soda water were hailed as wonderful medicines or, in some cases, prohibited. Many of the original drugs - antimony, mercury, strychnine, arsenic - are now thought of as poisons but their pharmacologic activity led to their use in a variety of diseases. In the early part of the century drugs were classified by their action. If they induced urination they were a diuretic, irrespective of their therapeutic use. There were ongoing efforts to use the purest available form of drug, especially in France, as it was seen as being more modern and scientific. Hence, morphine was used instead of opium. This trend has continued until today with research to identify the active ingredients of many medicinal plants.

There were few apothecary shops or drug stores and those that did exist carried a wide variety of products, mainly non-drug. The medication stocked consisted of chemicals, crude drugs, spices and patent medicines. Some of the medications in use at this time were opium, purgatives (jalap, rhubarb root, senna, castor oil) as well as salts such as Glauber's Salts and Epsom salts, emetics (ipecac and tartar emetic), blistering plasters (cantharides, known as Spanish Fly that were used for topical diseases and deeper pain), camphor for the treatment of venereal disease along with arsenic, potassium nitrate for fevers and delirium, and mercury for the external treatment of wounds. Turlington's Balsam of Life was a popular patent remedy used at this time. This was a compound infusion of several botanicals used on wounds and officially known in pharmacopeia as Traumatic Balsam. It was effective and had a long shelf-life and was sold in a small angular bottle that only held a tablespoonful of ingredient. A patent for this product was received in 1744. It arrived in America in 1746 and was widely distributed. Hudson Bay traders carried it into the interior of the country and it remained popular for many years. There were even reports of it being used in the American Civil War a century later.

Generally, these English patent medicines were popular in Canada and New England and

they were sold in various outlets including post offices in New England. Some apothecaries refilled the containers. Many products were named after their inventors: Plummer's Pills, Matthew's Pills, Starkey's Pills, etc. Over time many of these received a patent and their formulae were disclosed. Some became official in the compendia.

Single-entity medication

Advances in chemistry had an impact on medical practice. Rather than administering crude extracts, isolated active ingredients could be used. This gave greater precision to dosage and more consistency in patient response. Up to this point the description of drugs was based on their physiological properties. Both opium and nightshade (atropine) were classed as sleep-inducing narcotics. Willow bark (salicylic acid) was an astringent. Substances that caused vomiting were emetics. Sudorifics made people sweat. Stimulants woke them up. Digitalis was first described as a diuretic as it increased urine flow but we now know that the effect was on the heart not the kidney. Many of the drugs used into the 19th century as medications are now recognized as poisons. These drugs in large doses cause catharsis, vomiting, sleep, or stimulation and were used in conjunction with restrictive diets, potent enemas or clysters, bleeding, leeches, and cupping. These were known a heroic measures and were used when people were not responding to less dramatic therapy. Heroic was an appropriate term not only because of the large doses of drugs involved but also because the drugs were often combined with measures such as placing a patient in a hot room under blankets, bleeding the patient, and administering large doses of laxatives and emetics for several days. With more knowledge about drugs and the introduction of surgery with anesthesia, heroic therapy began to fade. Pharmaceutical firms began to produce medications that had a more rational basis and were more acceptable.

During the Industrial Revolution, 1815-40, in Europe, but especially Britain, cities grew with kilns, mines, foundries and factories, which polluted the atmosphere, land, and water. The homes of the worker were crowded slums between the industrial sites. Public health initiatives were begun with examination of the health of the laboring class and the incidence of disease and death. Alcoholism was widespread. In England, gin was the most common spirit ingested and it was said that 'drink was the curse of the working

class'; more recently this has been turned to 'work, the curse of the drinking class'. It was noted that lifespan was short and that most workers were not in good health. The average age of death for the working class was under 20 years, with most deaths occurring before 1 year of age. Skilled workers and gentry had significantly higher average age for deaths but they were usually under 45 years.

Infectious diseases were prevalent and exacerbated by the crowded living conditions. The main diseases were consumption (tuberculosis), typhus, smallpox, and cholera epidemics. Bloodletting and cupping were common practices. It was thought to be useful to draw blood from patients and often up to 30 ounces would be removed, a large quantity even for a healthy donor. Cupping was the process of drawing blood to the surface of the skin by burning alcohol in a jar to remove the oxygen and make it warm then placing this on the skin. The vacuum created as it cooled would pull the tissue into the cup. This was then either left as a protruding mass (the poison had been drawn out) or cut to release the blood (wet cupping). This procedure continued in folk medicine well into the 1900s and is being revived by some practitioners today.

The Maturation of Pharmacy in Canada

What system of measurement was used?

The Apothecary system of weights was used in early Canada. It was based on the ancient system of weights and measures used in Europe for centuries. The basic unit was the grain (grain of wheat).

1 grain = 65 mg

20 grains = 1 scruple = 1.3 Grams

3 scruples = 1 drachm = 3.9 Grams

8 drachms = 1 ounce = 31.1 grams

The Apothecary ounce contains 480 grains. The Avoirdupois ounce used in commerce today has 437.5 grains. Notably, the number of Apothecary ounces to a pound is 12 while the Avoirdupois system has 16 ounces to a pound.

In measuring precious metals, the grain, ounce, and pound are the same as the

Apothecary system. What weighs more a pound of gold or a pound of feathers?

An ounce of gold is 480 grains and there are 12 in a pound.

An ounce of feathers has 437.5 grains in an ounce and 16 ounces in a pound.

So the pound of feathers is heavier that a pound of gold.

The Imperial system, based on the minim as the smallest unit, was used for measuring liquids. The minim is roughly one drop and prescription instructions written as minims were given to the patient as "drops". For example, 'Put 3 drops in a glass of water and take before meals'.

1 minim (one drop) = 0.06 millilitres

60 minims = 1 fluid drachm = 3.55 millilitres

8 fluid drachms = 1 fluid ounce = 28.4 millilitres

20 fluid ounces = 1 pint = 0.57 litres

2 pints = 1 quart = 1.14 litres

4 quarts = 1 gallon = 4.55 litres

One Imperial liquid ounce of water has a mass of 437.5 grains.

The Apothecary system was used in compounding prescriptions until the Second World War. Afterwards, the metric system replaced it. The new medications being developed and marketed always measured the drug dosage in metric and the containers were increasingly metric. This shift to modern medication also reflected the demise of compounding as a generally applied skill of pharmacists. Physicians trained in the use of the new medication no longer knew the Apothecary system and the old compounding favorites.

How did dosage forms evolve in early Canada? Powders, pills, and fashion

Many of the medical ingredients for prescriptions were brought to Canada in crude form.

Bottles of herbal and chemical ingredients were carefully packed and brought in wooden cases. Powders and pills were the two main types of solid dosage forms. The powders were usually composed of two or more ingredients that were combined and triturated in a mortar until they were a fine uniformly mixed powder. The powder was then poured onto a dispensing slab and carefully divided into equal portions. Each portion was then folded into a square sheet of paper in a specific manner so that it would fit into a powder box. Usually there were about 12 to 15 powder papers in a box. To use the powder, it was poured into a glass of water, mixed and drunk.

Pills were prepared by mixing the active ingredients with a liquid binding agent or with a solid binder and a suitable liquid additive. This mixture was kneaded into a dough-like mass that was rolled out onto a tile and cut into single doses using a pill cutter or a spatula. Each dose was then rounded into a ball using a pill roller, a round piece of wood that had a recessed centre, or it could be rolled in the palms of the hand. (Hence the reason pharmacists were referred to as 'pill rollers'). The pills were then allowed to dry. To protect them and make them more stable, they could be coated. In Europe, the popular custom was to coat them with precious ingredients, but this is unlikely to have occurred in Canada. Pills were dispensed in a pillbox, usually a small round paper box. Similar types of plastic or metal containers are again being used to carry capsules or tablets. Interestingly, a round, defense structure for ground troops was termed a pillbox by the British army during World War l (http://en.wikipedia.org/wiki/Pillbox_hat accessed October 9, 2014). Military hats that were round and flat on top, without a brim and often with a chin strap, were called pillbox hats. Pillbox hats are still a part of some military ceremonial dress, particularly for Commonwealth nations, and indeed the Royal Military College of Canada dress uniform includes a pillbox hat. Like other military fashions, pillbox hats were appropriated for civilian wear and were especially popular in women's fashion from the 1930-60s.

Liquids were also prepared and were popular, more so in urban areas than in smaller centres. Preparation usually required concentrated fluid extracts that were imported from Britain. In some areas the local medicinal plants, based on First Nations tradition, were used to prepare medication. A tea made from spruce needles was used early on to treat

scurvy. Juniper was used for stomach aches and colds. Seneca or arrowroot steeped in tea, was an Indian medicine used as a tonic. Tobacco was often used topically or orally as a medicine.

Counter irritants to mask or diminish pain were prepared as a liquid and then placed on a piece of cloth, a plaster consisting of a semi-solid mixture spread on paper or in some cased bread, or as an ointment. These products were either purchased in bulk from Britain or prepared locally. Topical products as solutions, suspensions or lotions were used for skin conditions, a common problem in early Canada. They were applied without friction and usually covered with a bandage made of cloth.

For the most part the population and healthcare professionals used what was available and this varied from place to place and from time to time. Often people just used household remedies that had been passed down in the family. To this was added local native remedies.

The evolution of legislation

The first Canadian legislation following the Conquest (1759) was the Medical Act in Quebec (1788), which set out requirements for the practice of medicine, surgery, pharmacy and for apothecaries. Each was a separate registration. After the creation of Upper Canada, legislation to regulate the practice of medicine and surgery was passed in 1795. This act was later repealed and new legislation appeared in 1815 but it did not mention drugs or vendors of drugs. The regulations were focused on having physicians obtain a good knowledge of drugs (materia medica) and compounding. In forming the medical school in Toronto during the 1820s and 1830s (the first secular university in Canada), there was a requirement that one of the six professors be in materia medica and pharmacy. This was the beginning of medical legislation that attempted to control pharmacy up to Confederation.

The Opium and Narcotic Drug Act of 1920 was a major achievement for government and the profession. Pharmacists had long advocated having legislation of this kind and after some provinces initiated legislation the federal government followed suit. Pharmacists

were pleased at the outcome of this endeavor and their role in making it a reality. One aspect, however, caused some problems. Pharmacists recommended that codeine not be listed as a narcotic due to its low potential for abuse. The government accepted this but in the US it remained a narcotic and exports needed to meet the requirements for narcotics. The requirement was for the Government of Canada to issue a certificate to import the narcotic but the Government would not do so as it was not a narcotic. This continues to have an impact today with American tourists often keen to purchase non-prescription codeine-containing products when visiting Canada. As of 2017, there is some push to move all codeine-containing products to prescription status (http://www.cbc.ca/news/politics/codeine-opiate-prescription-health-canada-juurlink-pharmacists-ban-sales-1.4284013).

How did drug wholesale companies arise?

Prior to the 1800s, pharmacists experienced difficulty in obtaining medication due to irregular shipments from Europe. Boats would often be held up for months or be lost at sea. Some manufacturers and wholesalers in Britain would send out trunks full of assorted medication to pharmacies in Canada on speculation. These were welcome and pharmacies would immediately accept them and use the contents. Usually there was an excess to current needs and the medication could then be shared with other pharmacies. This could lead to an arrangement in which the local pharmacy would place larger orders in Britain and then distribute the goods on arrival, in effect becoming a wholesaler. They could also become a wholesaler by manufacturing larger quantities of some items and selling them to other pharmacies or physicians.

There was a rapid increase in population and wealth, which created a dynamic marketplace for the individual pharmacists and small wholesalers that was characterized by an explosion of patent medicines and growing demand for traditional medications, cosmetics and toiletries, health supplies of various sorts, and some of the new pharmaceuticals based on medical sciences.

In 1800 Lymans Ltd. (Wadsworth and Lyman) began in Montreal and had their head

office at Place d'Youville, near the site of the first dispensary in Montreal. In 1853 the earliest recorded wholesale company in Canada was formed in Toronto when Eliot and Thornton in Dundas joined with Lymans to form Lyman, Eliot and Company. This firm lasted until 1870.

In 1860, Mr. Barker joined his pharmacy with that of Leonard Tilly (later premier and then Lieutenant Governor of New Brunswick). Silas McDairmid was also operating a pharmacy at this time and in 1902 began a wholesale company known as McDairmid Drug Co. The Baird Company in New Brunswick established itself as one of the early drug wholesale companies. The drug wholesalers Estey and Curtis were established at the end of the 19th century in St. John and Fredericton, New Brunswick.

In BC, Arthur Langley, an English pharmacist who started in Nova Scotia, moved to San Francisco and then to Victoria to open a wholesale in 1858 as Langley and Company. It became Langley and Henderson and, later, Henderson Brothers, with a branch in Vancouver.

Dr. James Avery's Apothecary became the first wholesale firm in Nova Scotia, operating as Avery, Brown and Company.

In the period 1820 to 1900, especially in the latter period, a large number of wholesale firms were established across Canada, such as Kerry, Watson and Co. (Montreal), 1815; Evans and Sons (Montreal), 1820; Brown and Webb (Halifax), 1824; and J. Winer & Co. (Hamilton), 1830. Over the next 50 years a large number of wholesalers appeared in cities across Canada. Winnipeg was the distribution hub for the West and drug wholesales were established early. The first record of a wholesale firm in the West was 1873 when J.F. Caldwell opened a wholesale and retail operation in Winnipeg. This was followed by Langridge and Wilson in 1882 and Martin, Rosser and Company in 1884. Over the century the population growth and demand for medication resulted in the drug wholesale firms becoming full-time wholesale operations with no retail component.

The most interesting initiative, however, was that of David Bole. He was born in Ontario and graduated from the Ontario College of Pharmacy in 1880. He opened a pharmacy in Ontario but decided to head west and took the train to Regina in 1882 where he began

one of the first pharmacies in the Northwest Territories. Business opportunities were limited in the territories so he moved to Winnipeg in 1895 and with his brother-in-law he established the Dawson, Bole Company, which was both a retail and wholesale company. He also developed a number of patent medicines, with Gin Pills the most popular. It was very successful but he was a very ambitious person. Wholesale pharmacies at that time were small retail-wholesale operations that made many of the standard drug products used in pharmacies. As a result the quality and consistency varied considerably. Bole brought together all the major wholesalers in Canada and in a grand merger combined 18 companies into the National Drug and Chemical Company of Canada in 1905. This was not only the pre-eminent drug wholesale company in Canada, it was also the largest drug manufacturer of pharmaceuticals and patent medicines as well as cosmetics. It maintained a leading position as a drug wholesale company for many years. Bole retired in 1922 as the leader of the firm. In addition to this accomplishment he also served in many civic organizations in Winnipeg and as a Member of Parliament (MP).

These regional wholesale firms found it difficult to maintain a stock of the expanded product lines and to deal with the growing national manufacturing firms. There was a sense that major changes were needed if they were to remain in business and compete. A major burden was the need to manufacture standard products for pharmacies. The wholesale firms did not have the staff, equipment, facilities, or packaging/labeling requirements for the growing demand. The products distributed tended to vary substantially from firm to firm and the quality standards were criticized by the federal government analysts. For example, laudanum was to contain between 0.7 and 0.8% morphine but samples tested ranged from 0.19 to 1.48%! This was the impetus for combining to form a single national wholesale firm to produce high-quality products for distribution to pharmacists across Canada. This was a late development compared to the US, where large regional wholesale/manufacturing plants were established as early as 1807 in Philadelphia and gave their home remedies (patent medicines) trade names. This marked the beginning of trade names for pharmaceuticals in North America.

How did research-based pharmaceutical companies develop?

Research-based pharmaceutical firms began in the US, with those such as Eli Lilly hiring a chemist and botanist before 1880 and having a separate research building in 1911. J.K. Lilly, son of the founder Eli Lilly, graduated in pharmacy from the Philadelphia College of Pharmacy in 1880. At the time, Joseph P. Remington was teaching there and many of his graduates moved into the pharmaceutical industry with a focus on producing high-quality products. In Europe, the Swiss and German firms were developing research departments and developing new drugs such as Salvarsan (1910), with assistance from the University of Toronto.

In 1872 a young pharmacist in Philadelphia, Henry K. Wampole, opened a business to manufacture and sell pharmaceuticals. He opened a plant in Toronto in 1893 to serve the Canadian market and was very successful with several expansions of the plant. The plant was later moved to Perth, Ontario where it remained for many years until the firm was purchased by Aventis. Charles E Frosst was the pharmacist hired in Philadelphia to open the plant and run the Canadian operation. In 1899 Frosst moved to Montreal and established his own firm, Charles E. Frosst & Co. William S. Ayerst, Frank W. Horner, Gerald Dillon, and Samuel Thompson were hired as associates. Both Ayerst and Horner later established pharmaceutical firms in competition with Frosst. Frosst built his business on excellence, affordability, and reliability. He stressed the fact that the firm was Canadian. It had a major influence on Canadian pharmacy and held a leadership position until a fire destroyed its research laboratory. Frosst researchers were investigating the use of medical isotopes at the time. The company was purchased by Merck in 1964 and existed as Merck-Frosst until 2009 when the name was shortened to Merck.

The American firms established branch plants in Canada during this era (parentheses represent Canadian operation): Pfizer 1849 (1951), E.R. Squibb 1860? (1925), Parke Davis 1866 (1887), Abbott Laboratories 1888 (1929), Smith Kline and French 1841 (1950), Warner Chilcott 1856, A.H. Robins 1866 (1949), Eli Lilly 1876 (1938), Searle Pharmaceuticals 1888 (1951), Purdue Fredrick 1892, Wyeth 1860 (1883), Cutter 1903 (1920)), Cyanamid 1903 (1934), Merck ,then Merck, Sharpe and Dohme (1911), (1929), Merrell 1905 (1947), Norwich – Eaton (1944), Purdue Frederick 1892 (1956), Ortho (part

of Johnson and Johnson) (1951), Rorer 1910 (1968), Mead Johnson 1900 (1923), and Syntex 1944 (1962), and Upjohn 1885 (1935).

British firms also established Canadian operations: Burroughs and Wellcome (1906) and Glaxo, which began as Allen and Hanbury in 1715 (1902).

In this period the Canadian firms of E.B. Shuttleworth, later Dow Pharmaceuticals, (1879), Charles E. Frosst (1899), Sharpe and Dohme (1911), Mowatt & Moore (1920), Winthrop laboratories, later Winthrop-Stearns (1919), Rougier Desbergers and Ayerst, McKenna and Harrison (1925) were established. Connaught Laboratories, part of the University of Toronto, produced immunizing agents for public health but also operated a research laboratory that developed insulin in 1923. It was purchased by Canada Development Corporation in the 1970s.

A full list of pharmaceutical manufacturers in Canada can be found in the Appendix.

Patent Laws and the innovative pharmaceutical industry.

Pharmaceutical Manufacturers Association of Canada, name change to Rx&D, then to Innovative Medicines of Canada) and Patent Laws

The Pharmaceutical Manufacturers Association of Canada (PMAC) celebrated its 75th anniversary in 1989. The organization describes itself as "the representative of research-based pharmaceutical industry" in Canada.

The anniversary was a happy occasion as the hated compulsory licensing legislation of 1969 was repealed in 1987. Compulsory licensing was strongly pushed by federal government bureaucrats in the Restrictive Trade Practices Commission and later the Department of Consumer and Corporate Affairs based on a commitment to lower drug costs and defeat an arrogant industry (according to Ronald Lang in his book The Politics of Drugs). A core of senior bureaucrats from six departments briefed ministers, supported advocates and generally created a wave of support for action to reduce prices. After many debates and studies the Report of the House of Commons committee on drug costs and prices chaired by Dr. Harry Harley recommended that the Patent Act be amended to provide for "compulsory licences to import drugs in all forms". Compulsory licenses were issued with a very low licence fee of 4% (negotiated fees in the industry were

normally around 20%). Popular products were targeted and revenue for the firms dropped dramatically resulting in staff reduction, research facilities closed and a virtual stop in investment. After several years this situation became a threat to Canadian research and an effective pharmaceutical system. This added strength to the ongoing conflict between the firms and the federal government and eventually the forces wanting stronger patent protection (including foreign governments) isolated the bureaucrats in Consumer and Corporate Affairs. Andre Oullet, a Montreal Liberal MP, was sensitive to the loss of major research laboratories in Montreal due to compulsory licensing and tabled a discussion paper in 1983 on compulsory licensing to rebalance drug policy. The next year the Tories came to power and Prime Minister Mulroney pushed for changes to compulsory licensing in order to muster more political support from Quebec. Although the Minister of Consumer and Corporate Affairs was charged with making legislative and administrative changes regarding compulsory licensing, the bureaucrats in the Department were so reluctant and obstructive to change that the minister was compelled to bring in a Special Advisor to deal with compulsory licensing changes. The bureaucrats believed that they had a higher responsibility to the public than to the elected government, an interesting perspective because at the same time the pharmaceutical industry was being condemned for excessive lobbying. For a more detailed description of this issue see *Anatomy of a Lobby* in the CPJ, November 1989.

With the end of compulsory licensing, the research-based pharmaceutical firms made a commitment to spend 10% of sales on research. This led to several research labs being established, for example the R.W. Johnson Pharmaceutical Research Institute of Ortho Pharmaceutical Canada and a $2.5 million research unit at Upjohn Company of Canada. In 1990 Astra Pharma expanded its Mississauga plant to 11.500 m^2 at a cost of $20 million plus $10 million for equipment. Each firm was held to a commitment to 10% of sales for research in Canada by the research-based pharmaceutical industry (comprising the members of the innovative industry association). This continued until 2011, when the 10% proportion for research began to slip. Critics of the industry loudly denounced the reduction in spending. Despite the decline in the proportion of research to sales, industry research funding reached $1.3 billion in 2012 and supported a number of institutes, clinical research and academic positions. Some of this funding did not meet the tax

definition so that the official funding level was less than 10%, but the amount is still substantial, especially compared with federal health research funding.

Consolidation in the industry accelerated, with Ciba and Sandoz combining to form Novartis; Hoechst-Marion-Roussel combined then added Rorer before becoming Aventis Pharmaceutical then Sanofi-Aventis. Bristol-Meyers-Squibb; Glaxo Wellcome later became Glaxo Smith Kline; Nordic Merrell Dow combined and Whitehall Robins with Wyeth. All these changes reflected the international consolidation of the industry so that there were fewer firms. A rationale was that research and regulatory costs were so high that they needed a larger and international market and a longer product pipeline.

The pace of change was rapid, although the number of new chemical entities declined. In 1994 there were 32 new chemical entity drugs introduced to the Canadian market. In 2003 none of them remained on the market; they had all been replaced by newer products. In the new millennium the pace of new product introductions increased as firms developed biological products and the research in genetics resulted in a flood of new drugs for rare diseases. While the number of patients who have a rare disease is small, there are several thousand rare diseases, most of which have a genetic cause which might be treatable.

In 1990 the pharmaceutical industry was subject to the control of the Patented Medicines Prices Review Board (PMPRB). This Board was given responsibility for ensuring that the prices charged were not 'excessive' and to collect information on pharmaceutical research funding by the industry. Both of these requirements flowed from the removal of compulsory licensing. Although well-meaning, the price review is a very demanding and complex undertaking that consumes an enormous amount of time in the industry and creates a large bureaucratic organization in government (in 2012, 76 staff and a budget of almost $12 million). The demands are so invasive that in the period 1993-95, there were 12 Voluntary Compliance Undertakings - agreements that the firms will not enforce its patent rights for a particular product (Robert Elgie, chairman of the PMBPB). In six of these cases, the firm did so to prevent PMPRB from controlling its current and future prices, seeing the unpatented market as being more lucrative than one under PMPRB guidelines (CPJ December/January 1995). PMPRB plans to close this loophole and hold

firms accountable even if they no longer hold a patent. The definition of excessive prices has been interpreted to mean that the prices in Canada should not be higher than in several European countries and the US. The definitions and interpretations of prices and international comparisons have spawned a lengthy legal quagmire. The outcome is that for all marketed patented drugs, the prices charged are deemed not to be 'excessive' but the government agencies paying for these new drugs refuse to place them on benefit lists as they are 'too expensive' in most cases. The PMPRB is now located in the Department of National Health and enjoying a rapidly increasing budget to examine wholesale mark-ups, pharmacy fees, industry product pipelines and other cost drivers of interest to the provinces. In the meantime the funding of drug regulatory activities to protect the public are delayed and ignored. This kind of focus on one aspect of the pharmaceutical system makes drug supply a complex, expensive, unresponsive system.

One legacy of compulsory licensing in Canada was that the products sold under license in Canada were sold at a lower price than in other countries then began to flow across the border to the US. A number of pharmacists began to establish international sales. This was a problem for brand-name pharmaceutical firms and they attempted to suppress it by limiting the quantity of medication available to pharmacies, with the result that occasionally there were shortages. Pharmacy licensing authorities also initiated practice guidelines that attempted to halt the practice. Regulatory agencies in the US also took action against firms that sold drugs into the US that did not have regulatory clearance and those drugs sold without a valid prescription. Burroughs Wellcome in Canada took legal action against Apotex to prevent the sale of its products to customers in the US through InterPharm, a firm linked to Apotex.

The lucrative generic market following the end of a drug patent led firms to begin copying the physical appearance of the brand product. In 2001 the federal court gave Novopharm, Nu-Pharm and Apotex the right to market similar versions of Eli Lilly's anti-depressant, fluoxetine (Prozac®). This process has now become the norm.

Pharmaceutical firms also began to work closely with pharmacists in the period 1980-2000 by offering continuing education support, information to help with patient care and printed material to distribute to patients. Firms during this era hired pharmacists to guide

them in their links to the profession. Unfortunately as time passed this era ended with an erosion of communication, perhaps due to the impact of chain pharmacies that claimed a greater focus by the firms and the chains' initiation of their own patient information systems and continuing education for their staff. The leadership of the PMAC played a major role in pharmacy–industry collaboration. Judy Erola, the president and past MP, was largely responsible for this during her 12-year term.

The pharmaceutical industry was a strong partner with pharmacy in the Efficient Consumer Response initiative to have a bar code for all pharmaceutical products by 2000, years after the grocery industry. This was a major step towards efficient distribution but it was also an important step in patient safety when it was used in hospitals to track products.

Another sector of the pharmaceutical industry consists of firms that produce alternative (complementary) health products. In addition to nutritional supplements a number of herbal products, minerals and topical miracles were marketed to the Canadian public with substantial success. Medication review became a more important tool for pharmacists, especially for the elderly patients, as they consume an increasing number of pharmacologically active substances.

Related to drug use in society and the concerns over drug prices, a number of governmental initiatives were put in place. Assessment of drug technology was to be monitored by a Federal/provincial/territorial organization – the Canadian Agency for Drugs and Technologies in Health (CADTH), which was formed in 1989. Its main focus was technology assessment but the need for a review mechanism for drug prices led to a Common Drug Review (CDR) program under its mandate in 2003. The review was to recommend whether new drugs are cost-effective. The rationale was that the provinces would list the cost-effective drugs in their benefit programs. If this did occur, it would result in a common listing of benefit drugs in all provinces – in effect a Canadian formulary. The reality was that each province continued to conduct its own evaluation of new drugs, taking into account the recommendations of CDR. This produced a wide range of benefit lists. The CDR has become efficient in making recommendations in a timely fashion and in incorporating input from various sources, including some patient

groups. Over time the number of positive recommendations has remained constant at about one half, but the provincial restrictions have decreased patients' access to new, effective medication. This has led to discussion of the process and its purpose (2012).

In 1997 pharmaceutical firms began to advertise their products directly to consumers, as is allowed in the US. The Canadian government asked them to stop on a voluntary basis and there was an active discussion with various groups taking a position on the issue. Eventually the advertising was restricted, even though the mass media overflow from the US continued to pour into Canada and influence consumers. Although advertising prescription drugs is against the law in Canada, the overflow advertising from the US is continually present. Organizations of health professionals and the Consumer Association of Canada oppose this advertising but to no avail. In one study in BC, it was found that up to 10% of patients exposed to the advertising requested medication from their physician (van den Engh & Bonertz. CPJ 2010 :126-33). This places physicians in an awkward situation in that they would like to help their patients but usually the requests are not appropriate and turning the patient down creates a negative climate for care.

As part of the North American market, there was a 14% growth in 2000 to $363 billion. This represented 43% of the world market for pharmaceuticals. Generics represented 15% of pharmacy sales but 40% of prescriptions.

In 1999 the Food and Drug Directorate received criticism for firing senior staff and not being even-handed in handling drug approvals. This led to public consultations that were acrimonious and divided. While pharmacists gave their trust to government to ensure the drugs were safe, the fine print in many of the monographs put them at risk. One of the concerns was that the payments firms made to have their drug product assessed for marketing was leading to firms having too much say in the process.

The innovative firms in Canada, represented by their association now titled Rx&D, faced a sharp decline in membership with the consolidation of the industry. Policies and direction were increasingly short-term responses to current issues. The year 2015 was the centennial year for the organization, whose first president was a pharmacist. A number of

internal review activities were undertaken and resulted in a change of name to Innovative Medicines of Canada in 2016, but no substantive celebration of their history.

By 2000, there were concerns about the rapid rate of increase in health expenditure, the role of pharmaceuticals, and the outdated and inflexible structure of the healthcare system. By 2016 nothing had changed.

Aspirin – still going strong

Aspirin was successfully marketed by the Bayer company of Germany prior to World War l. Before the US entered the war, the Bayer Company in the US purposely bought up carbolic acid to make Aspirin, thereby preventing it from going to Canada to be made into explosives. When the US did enter the war, Bayer's assets were seized and sold to Sterling Drug, which advertised it heavily and insisted on maintaining copyright protection. It continued to do well and recently celebrated 100 years on the market.

The birth of pharmacy organizations and national pharmacy publications

Canadian Pharmaceutical Association and Provincial Associations

Pharmacy licensing bodies were organized in response to the growth of towns and cities from the flood of immigrants. This reflected the increased number of pharmacies and the desire of the pharmacists to have some regulatory control so that 'quacks' and untrained people would not be providing a service. This was to protect the public and also to protect the livelihood of the pharmacists. Later the organizations would split into two separate organizations: one to protect the public and one to represent the interests of the pharmacists (or pharmacy owners).

In Quebec prior to 1864, compounding and dispensing were performed and controlled by physicians and a number of pharmacies were owned by physicians. Pharmacists in Montreal formed the Montreal Chemists Association in 1864 and they held meetings in 1868 following Confederation to create the Quebec College of Pharmacy. The physicians were opposed to the use of this name so the Quebec Pharmaceutical Association was created in 1870 to regulate pharmacy practice. Examinations began the next year with 11 candidates.

In Ontario, the Toronto Druggists Association fought against medical control in 1867 and expanded their organization to become the national Canadian Pharmaceutical Society. The Canadian Pharmaceutical Society attempted to have legislation enacted similar to that in Britain for the regulation and unification of pharmacy (Federal Pharmacy Act) but were not successful. After several attempts to obtain provincial legislation, a Pharmacy Act was passed in 1871. It established the Ontario College of Pharmacy and dissolved the Canadian Pharmaceutical Society, which had been involved in pharmacy education. Education was mainly apprenticeship and more than 20 years would pass before a 2-year course under the direction of the Ontario College of Pharmacy was established.

During this period pharmacists were active in lobbying the federal and provincial governments to avoid unfair taxes and unnecessary regulations. The high cost of alcohol due to taxes was to be a major issue for pharmacists for many decades. Pharmacists were upset at the unfairness of manufacturers paying only half the tax that they had to pay.

The Nova Scotia Pharmaceutical Society was formed in 1875 and a Pharmacy Act was passed in 1876. Pharmacists were required to pass an examination in order to practice but there was no requirement for a person to be a pharmacist in order to operate a pharmacy (this was changed in 1892). The first examination was held in 1878. In 1879 physicians were allowed to become members if they were operating a pharmacy.

In 1878 the Manitoba Pharmaceutical Association was formed. In order to educate pharmacists the Manitoba College of Pharmacists was created in 1899 in a building built for that purpose and which also housed the Association.

Although the New Brunswick Pharmaceutical Society was formed in 1873, it did not officially become the regulatory body until 1884. Licensure required 5 years of practice of which 2 years in dispensing were mandatory. The first examinations in 1885 had six candidates. The Society did not engage in pharmacy education.

The Northwest Pharmaceutical Association was formed in 1892 and was located in Regina. In the territories, pharmacists from Ontario had migrated along with the settlers.

Alberta and Saskatchewan formed pharmacy associations in 1911 and were removed from the jurisdiction of the Northwest Pharmaceutical Act of 1892. (British Columbia had a Pharmacy Act in 1891). British Columbia later found a way of funding its professional association by negotiating a 9 cent per prescription check-off system. This generated enough funds to provide services to their members and initiate new programs Unfortunately, the provincial government discontinued the program in 1989 with little notice and the association was reduced to requesting funding from pharmacists to stay afloat.

The Newfoundland Pharmaceutical Association was formed in 1910.

The Canadian Pharmaceutical Association (CPhA) was resurrected in 1907 by a progressive group of pharmacists from across Canada, under the leadership of G.A. Burbidge, Dean of Pharmacy of Nova Scotia, and George Gibbard, editor of the Canadian Pharmaceutical Journal. The driving force was the need to have an avenue for lobbying the government regarding important issues such as tax legislation that pharmacists found oppressive. George Gibbard was the first president. At the first annual conference held in Toronto, 1908, the CPhA formed five committees to deal with issues. One committee was to study educational standards amongst provinces with a view to adopting a uniform standard and establishing a national Board of Examiners (it was about 1970-80 that common academic standards were reached; the Pharmacy Examining Board of Canada [PEBC] legislation was passed in 1963). At the time the CPhA was founded, the major concerns of pharmacists were: 25% of pharmacies were owned by physicians, Sunday closing of pharmacies, prevalence of quack remedies, replacement of compounded products by proprietary medicines, and worst of all, the threat of cut-rate pricing policies. While there was some cost cutting in Canada, the profession was stimulated to take action by the situation in the US. Pharmacies in the US were seen to be virtually small department stores, stressing the sale of patent medicines and having only a small dispensary with a pharmacist. To some extent this situation has now come to pass in Canada.

There were some early successes. The CPhA was responsible for recommending changes to the Patent Medicine Bill in 1908 and making it more practical from a pharmacy

perspective. The Association was a major influence in establishing the Anti-Cocaine Bill in Ontario that restricted the sale of cocaine to pharmacies. This legislation was then enacted in other provinces and incorporated into federal legislation. In the discussions of the association, the conflict between commercial and professional interests was identified and attempts made to clarify the role of the pharmacist in society.

The second national conference was held in Banff in 1909. It dealt with price-cutting, education, and the Canadian Formulary (a standardized list of formulae that the pharmacist would prepare on prescription and which physicians were encouraged to prescribe). For many years - until the early 1950s - the Canadian Formulary was an important project for the CPhA as it set out standardized formulae that were pharmaceutically stable, elegant, and therapeutically accepted. In maintaining this formulary the association engaged the staff of the pharmacy schools. The last edition of the Canadian Formulary was issued in 1949.

The following year J.P. Remington of the Philadelphia College of Pharmacy, a leader in pharmacy education in the US, addressed the CPhA conference on "Pharmacy Today" as part of the continuing endeavor to improve professional activities and public perception. There was a resolution passed to tighten narcotic regulations.

At the 1912 conference it was recommended that the association publish a magazine and that the association manufacture and control a line of medicinal and toiletry items as in Britain. This led to a decision to endorse the products of Drug Trading (DT) Co. At the time DT was owned by some 200 pharmacists in Ontario. Under the agreement, the election of members to the DT Board was subject to approval of the CPhA.

There were no meetings of the CPhA during the Great War. The justification for this was given by the editor of the Journal, "Patriotism justifies postponement. The social features of the convention are not a minor factor, and with the Old Motherland fighting for the integrity of empire…social functions and entertainment should find no place in our community or fraternal life."

After the War, the 1919 national pharmacy conference was held in Winnipeg. The long gap of 5 years since the previous meeting meant that there were many issues to be dealt

with. A Committee of Commercial Interests formed. The role of the CPhA in lobbying the federal government was confirmed. It was successful in obtaining a reduction in the Excise tax on alcohol used in dispensing. As this was quite a large tax it represented a substantial saving to pharmacists. The members also agreed to a national pricing code - PHARMOCIST, representing the numbers 1 to 0. This was used on prescriptions with the price charged on the prescription in code. In this case a prescription selling at $2.95 would have the code HSM. In the 1950s the use of this code was proscribed by the federal government (Restrictive Trade Practices Commission).

The CPhA conference in 1920 described the sale of liquor through pharmacies as being a major problem for the profession. However, most of the physicians and pharmacists opposed prohibition and were willing to supply their patients with a quart (40 oz) of whiskey with little regard to the health aspects. In 1917 there were 180,000 prescriptions for alcoholic beverages in Vancouver alone. Regulations continued to be enacted to regulate the flow of whisky through this channel so that prescriptions became restricted to 26 and 12 oz bottles instead of 40 oz bottles. Over time these quantities also shrunk. There were many patent medicine tonics at this time that contained alcohol and which were very popular both with prohibitionists and boozers. Rexall's Rheumatic Remedy had 9% alcohol and Hamlin's Wizard Oil contained 32.5%. Although the end of prohibition resulted in the sale of liquor through government stores, restrictions on public drinking places continued in some places for a long time (1961 in New Brunswick). Some provinces allowed pharmacies in small towns to sell liquor.

Also at the 1920 Conference, the Education Committee headed by George A. Burbidge (subsequently Dean of the Maritime College of Pharmacy, 1925-43) recommended that there be equivalence among the provinces rather than uniformity. To achieve this they recommended a uniform matriculation standard for entry, a minimum of a 2-year program with 1,000 hours of instruction, and a committee to set out the syllabus for the 2-year program. There was also a restatement of the need for preceptors of apprentices to be diligent in their teaching of the application of scientific material learned in class. A commercial course in the curriculum was seen as essential (this issue continued for many years as pharmacy schools believed that the commercial aspects should be taught in the

pharmacy). These recommendations of the Education Committee followed from three earlier meetings of pharmacy educators beginning in 1917 (Halley Hamilton Gaetz – Alberta; Alexander Campbell – Saskatchewan; and Henry E. Belcher – Manitoba). The educators did not meet again until 1937.

In 1921 a new office was built for CPhA on Church Street in Toronto. The Secretary was finally given a wage and a budget of $5000 - $6000. Previously these expenses were out of Mr. Gibbard's own pocket.

In 1924 the CPhA conference was held in Calgary. It was recommended that apprentices be obliged to sign a code of ethics. Of more significance was the decision to invite Sir Wm. Glyn-Jones from Britain to explain the British Patented Articles Trade Association (PATA) with a view to establishing a similar organization in Canada to establish a "fair price" regimen. This endeavor was a high profile issue that galvanized the profession and Glyn-Jones was seen as a savior. Unfortunately he died in Vancouver while helping Canadian pharmacists. The fight for resale price maintenance lasted several decades and consumed a lot of money and time only to fall afoul of the Combines Investigation Act. The profession has had the dilemma of price competition since its origin in Canada. Those who sell at a low price are seen as lowering the image of the profession and in many cases lowering the level of service to the public. (An excellent review of the history of resale price maintenance in pharmacies is in the book Store Wars, David Monod, University of Toronton Press, 1996.)

Patient safety was an issue that the professional association addressed by recommending that qualified pharmacists be employed in pharmaceutical manufacturing and in hospital dispensaries, as was the requirement in France. This was not accepted.

One resolution of the CPhA conference in 1929 was that a licensed pharmacist must show proof of British nationality. In Canada, citizens were British subjects rather than Canadians until the 1950s.

In 1967, the CPhA formed a Commission on Pharmaceutical Services and set out the terms of reference: "The Commission shall inquire into and report on all aspects of the practice of pharmacy, the provision of pharmaceutical services to the public, the

profession's role in health care, and its relations with and services to the other professions". The Commission was headed by John B. Macdonald, a dental academic with experience in health planning as Executive Director of the Council of Ontario Universities. The members of the Commission were: Professor Ross M. Baxter of the Faculty of Pharmacy, University of Toronto (served as Dean); Prof. Bernard Blishen, Dean of Graduate Studies and Head of the Department of Sociology, Trent University; Donald M. Cameron, Registrar, Alberta Pharmaceutical Association; Roger Larose, Vice-Rector (Administration), University of Montreal and President of Ciba-Geigy Canada Ltd (also served as Dean of Pharmacy); J. Keith Lawton, President, Lawton Drug Stores, Halifax N.S. (served as President of CPhA); Jack L. Summers, Professor of Hospital Pharmacy, University of Saskatchewan (served as President of CPhA, CSHP and AFPC),; R. Ernest Wilton, Wilton's Pharmacy, London Ontario (died during the Commissions work in September 1970); and A. Whitney Matthews, Registrar, Pharmacy Examining Board of Canada (served as Director of Pharmacy program at University of Alberta and as Dean of Pharmacy at UBC). Whit Matthews was the Executive officer of the Commission and organized the data collection and writing of the report. In addition there were several staff members: Dr. Harold Segal, Pharmacy Administration, University of Toronto; George M. Torrance, Sociology, G.W. (Pete) Fairley, Secretary; and Dr. John Bachynsky as Consultant on loan from the Department of National Health and Welfare.

Major studies were conducted of: the occupational role of the pharmacist, pharmacist manpower resources, economics of providing pharmaceutical services, the laws and regulations pertaining to pharmacy (conducted by legal experts at the University of Toronto, Faculty of Law), and the utilization of nonprofessional assistants. Submissions of material were also made by many pharmacy organizations. The final report submitted in 1971 was entitled Pharmacy in a New Age. It consisted of 15 chapters, 97 recommendations and a detailed appendix, totaling 463 pages in all. It presented a perspective on the future of pharmacy and the changes needed to prepare pharmacy for the future. It was a useful document for both provincial and national organizations, with many of the recommendations being put into practice over the next few years. The research and ideas put forward shaped the profession over the next two decades.

While the Commission was conducting its study, CPhA had engaged a management consultant firm, Stevenson-Kellogg to report on the CPhA organization, operation and administration. This was the first major review since the organization was formed 60 years earlier. The governance of CPhA consisted of four delegates from each province sent by the licensing body (except Quebec, which had opted out). Over time there was growing representation (one person) from other pharmacy groups (AFPC, CSGP, CSHP, and CSIP). Ontario initiated a discussion on the imbalance between its large number of pharmacists and its representation. This imbalance continued to be discussed in the context of the plan proposed by Stevenson-Kellogg. They proposed a House (later changed to Council) of Delegates with representation of one delegate from each province's affiliated body (licensing) plus an additional delegate for every 500 pharmacists belonging to a nonaffiliated body (professional organization). It should be kept in mind that at this time all the licensing bodies required pharmacists to be members of CPhA. The Stevenson Kellog report also proposed council members from government and lay organizations. This resulted in a large unwieldy structure including an Executive Committee and a Board of Governors.

The Commission on Pharmaceutical Services had recommended that CPhA be organized with a voluntary membership structure rather than having delegates from licensing bodies. It would also be transformed into an umbrella organization for all the various pharmacy organizations. As a result, CPhA had a wide range of activities and services but no longer had automatic membership fees from each pharmacist. The recommendations of the Commission on Pharmaceutical Services were in line with those of Stevenson-Kellogg, with a stronger emphasis on individual membership.

Patient records were a major issue through the 1970s as they were seen as imperative for appropriate patient care. When dispensing, a pharmacist would review the patient record to determine whether the medication had been dispensed previously and record any information on allergies, untoward reactions, etc. This reinforced the concept of pharmacy as a helping profession instead of a business. As the use of computers began, the potential benefits were recognized. Many pharmacists became involved in electronic record keeping and later computerized dispensing programs. While there were substantial

developments over the next two decades, it wasn't until the turn of the century that there was a requirement that all prescriptions dispensed for third-party payment be submitted electronically. During the 1970s the number of prescriptions rose substantially and continuously with the introduction of new products.

In 1978 CPhA moved to Ottawa and sold the Toronto building, which provided enough money to build a new building in Ottawa. In preparation for the move and as a transitional endeavor, an office was rented in Ottawa and the Executive Director, John Turnbull, came to Ottawa one day each week to meet with federal officials, politicians, and pharmacy groups. As part of the office rental he employed Lois Bachynsky as the office manager to maintain communication and arrange meetings. For the new pharmacy building an ideal site in a park-like setting was obtained from the National Capital Commission. This arose through the efforts of Jean-Paul Desjardins, an influential Ottawa pharmacist, and the Hon. Gerry Weiner, a pharmacist cabinet minister. The building was located next to the Canadian Medical Association and Canadian Dental Association on Alta Vista Drive with the national Red Cross building across the street. The ground-breaking ceremony took place on 21 October 1985 and the building was completed the following year.

Concern over drug toxicity was reflected in the development in 1980 of the Drug Caution Code in Manitoba and then upgraded and implemented in Alberta in 1984 where over seventy per cent of the pharmacies participated. Nonprescription medication was labeled with a code indicating its potential for harm. Saskatchewan and Nova Scotia also implemented the program which consisted of self-talkers in the pharmacy, pamphlets for customers, decals in the pharmacy, and stickers for nonprescription drug products. A survey of pharmacy customers reported in the October 1987 CPJ showed that customers became aware of the program by the information in the pharmacy and that the code influenced their choice of medication, notably the decision not to purchase by a third of the customers influenced. This program generated a great deal of public education and professional good will but over time the enthusiasm, supplies, and support decreased, and the program passed out of existence.

Patient safety was also the aim of having the public get rid of outdated and unneeded medication by turning it in to a pharmacy. A program called the Great Drug Roundup in Alberta began the program with the support of most pharmacies, drug wholesale companies, and provincial government. A surprisingly large collection of medication resulted, some of it going back to the early 1900s. This program grew to the point where almost 20 tonnes of medication is taken to the provincial incinerator for destruction and by 2016 over 100 tonnes were collected. The discovery of persistent levels of medication in community drinking water as a result of it being flushed down toilets into the rivers has been a reminder of the value of the program.

Changing Pharmacy Environment from 1990

Pharmacists were buffeted by a number of major changes. Drug benefit programs initiated by provincial governments rapidly increased expenditures due to many new, expensive products, increased utilization and new benefit programs for certain diseases. As the drug budgets grew the need for action to constrain their growth became more important and this had an impact on pharmacy. In order to control expenditures, provinces were reluctant to include new, expensive drugs on the benefit list but over time the backlog and growing demand led to their inclusion. A more dramatic impact was the governments' decision to unilaterally reduce the reimbursement price of most generics. This not only reduced pharmacy revenue but also dropped the value of their inventory. In 1970 pharmacy dispensaries had a gross margin of about 50% but by the 1990s this had dropped to less than 25%. Pharmacists were able to compensate for this change by increasing dispensing efficiency with computers and nonprofessional staff but there was still a major drop in net income. Other less dramatic changes were made in the public drug benefit programs, and while they did not directly affect revenue, they did require pharmacists to spend more time on administrative activities and patient communication. These changes had a greater effect on independent pharmacies than large corporate organizations.

Drug therapy became more complex and new products had smaller potential patient groups. Use of these products often required authorization and more ancillary tasks such as the use of diagnostic tests for monitoring. Biological products emerged, some of which

need to be administered by intravenous infusion. This led to pharmaceutical firms, wholesalers, and specialist medical clinics entering the pharmaceutical marketplace. It also led to a range of patient support activities that had a direct impact on improved patient outcomes.

Pharmacy education was forced to adjust to the changing pharmaceutical advances and rapidly growing knowledge base of the biomedical sciences. Curricula were overwhelmed by the changes and the traditional factual instruction was replaced by problem-based learning in which students were taught to assess and use the literature in providing pharmaceutical advice. The research in pharmacy faculties was also shifted from pharmaceutics to molecular biology.

In pharmacy practice the need for continuing professional education became more crucial and the process more professional, with the increasing exclusion of pharmaceutical commercial information. Certification in a number of disciplines for pharmacists evolved but there was no progress in creating pharmacy specialization as in the United States.

A national survey funded by the Upjohn company on pharmacist counseling activities was published in 1900. It showed that the median number of patients counselled in a week by a pharmacist was 75, which was about half the patients seen. In a 3-hour period, pharmacists estimated that they spent 20 minutes counseling. The main barriers to counselling were time, lack of information on diagnosis and patient resistance.
In 1993-94, the CPhA conducted a major study of community pharmacist interventions involving 534 pharmacies across Canada. It looked at both prescription and nonprescription drugs. For prescription drugs two per cent required intervention but overall 1.2 % with prescription renewals requiring fewer interventions. A major intervention involved distribution and supply including inadequate prescription information as the drug benefit programs were undergoing changes, mainly by delisting products. Therapeutic problems, patient information, interactions and formulation issues were also reported. The result of the intervention was to dispense the medication as written in 36.6% of cases, change the prescription in 56.3% and not dispense the product in 7.1% of cases. In the case of nonprescription drugs, the main intervention was to provide information on the drug product (84.1%), provide information on a nondrug

treatment (22.7%) and advise on a herbal/homeopathic product (1.8%). In 8.3% of the cases, the patient was referred to a physician. Mainly the patient was educated as to the condition or the product. While the proportion of prescriptions calling for intervention was small, the number of interventions was large and provided a measure of safety for the patients. The study showed a wide variance from pharmacy to pharmacy. This report documented the importance of pharmacists in patient safety and the need for more technical staff to deal with the increasing administrative issues in providing pharmacy service.

In 1992, a draft mission statement paper for pharmacy was circulated at CphA : *The mission of Pharmacy is to promote health and serve society as the profession responsible for the safe and appropriate use of medications and health care devices.* The profession began an examination of the role of pharmacy in the health care system. Research areas in pharmacy were identified and some activities begun: post-marketing surveillance, patient counseling, pharmaceutical care, health promotion, hypertension, and alternative methods of reimbursement.

In 1994 a CPhA resolution to change the name of the organization was passed. Two alternatives were suggested. In 1996 a resolution to change the name of the Canadian Pharmaceutical Association to the Canadian Pharmacists Association was presented at an annual general meeting. The rationale was that there was confusion in the media and public as to who was being represented when the word “pharmaceutical” was used to designate the organization. At this time an incident occurred that involved this misunderstanding and there was more acceptance of the change. This event and earlier discussion began a process of change including a survey of members conducted through the CPJ. There was little interest in the issue, as shown by the low response to the survey, with only a few votes submitted (the result were never released). At a poorly attended meeting a vote on the issue was taken and a name change approved. Several provincial pharmacy organizations made similar changes. In Britain and the US, the term pharmaceutical association is still used, apparently without any confusion in the media or public. It would seem that the poor communication with outside organizations and the public were more a problem than the name itself.

In 1998 the CPhA amended its constitution and created new bylaws to reorganize and simplify the organizational structure by changing from a federation model to an individual membership model, as had been recommended by the Commission on Pharmaceutical Services in 1972. This entailed removing the unwieldy Council of Delegates and holding member-wide elections of the Board of Directors. To indicate their awareness of the need for a better advocacy process a new position was created for public affairs and Elizabeth Turbayne was hired in 1992. It was noted that while the Association had good contacts at the government bureaucracy level there was a need to develop political contacts. Unfortunately her stay at CPhA was short and the political responsibility was assumed by the Executive Director at the federal level.
The move to voluntary membership did decrease membership drastically; in 1970 almost every pharmacist was a member whereas in 1990 only 50% were.
Leroy Fevang was the Executive Director of CPhA for 21 years. He developed an effective lobbying process to keep federal politicians aware of pharmacy contributions and problems.

Activities of the CPhA in the early 1990s included active international professional activities, a submission to the Pharmaceutical Inquiry of Ontario (Lowy Commission), development of a universal electronic insurance claims standard and a workshop on the new goods and services tax introduced to replace the manufacturers' tax. In the late 1990s the Canadian Senate Standing Committee on Social Affairs, Science and Technology examined health care and produced both an interim and final report "The Health of Canadians - The Federal Role: Issues and Options. The committee was chaired by Michael Kirby and is referred to as the Kirby Report. With respect to pharmacy and pharmaceuticals it advocated a national formulary (drug benefit list), a national program to provide medication to the public (with an emphasis on expensive "catastrophic" medication with some cost saving from bulk buying of drugs by a national procurement system). Although CPhA submitted proposals for an expanded pharmacist role in the healthcare system, there was no support for this approach by the committee. There was no financial support from the federal government for a national drug system and the provinces continued to expand their drug benefit systems in differing ways. A

federal/provincial system of bulk buying was finally launched in 2013 based on five generic drugs.

Dr. Jeff Poston, formerly Director of Research, became the Executive Director in 1999 and continued until he retired in 2013. To combat erosion of membership numbers, efforts to improve services based on member surveys took place in 1999 and resulted in a strategic plan to improve communications, reimbursement, pharmacists' image, and recognition of pharmacists in health planning. He identified, in 2000, the major changes of the last century as: emergence of the modern pharmaceutical industry, changes in our understanding of disease, and the development of consumerism with reference to retailing. Based on this the future will reflect advances in genetics and immunology that will lead to newer approaches to care. Diseases linked to aging will be a major challenge. For the profession the expanding science base will require major changes in education, research linked to practice and distribution. Somehow all of the areas of change will need to be harnessed with a focus on better health outcomes for the patients.

In 2005 the CPhA initiated the Blueprint for Pharmacy. It was a long-term, multi-stakeholder strategy "designed to catalyze, coordinate and facilitate changes to align pharmacy practices with the health care needs of Canadians". The intent was to unite the pharmacy sector and in this they were successful in getting the various pharmacy organizations (77 organizations) to support the process in principle. The more difficult aspect was getting agreement on the actions needed for the future. There were widespread consultation and meetings supported by funding from the Government of Canada. Research and discussion devolved onto nine strategic project areas over the period 2005-2015. This identification of a common vision has provided some commonality in direction for pharmacy as the rapid pace of change pulls the profession in several directions. Encouragingly membership in CPhA has been bolstered by the recent (2015) re-organization with professional organizations now linking their members to CPhA.

The CPhA celebrated its 100th year in 2007 with special events and a book, *Canadian Pharmacists Association 1907-2007: 100 Years of Leadership in Pharmacy*. A list of 100 pharmacists was compiled as representing the most influential pharmacists in this period. In addition to the list of the 100 Distinguished pharmacists, a list of the CPhA founding pharmacists was highlighted. As a spin-off from this effort the Canadian Academy of the

History of Pharmacy undertook, as a Centennial Project, to prepare a further list of notable pharmacists in Canada.

Communication requires publication

To improve communication, the Canadian Pharmaceutical Journal was inaugurated in 1868, with E.B. Shuttleworth - a visionary for pharmacy - as editor. He was later the Dean of the Ontario College of Pharmacy and then a drug manufacturer executive. The journal became an important form of communication among pharmacists in a period when transportation was slow and there were few forms of communication other than publications. It reprinted relevant material from British and American publications and advocated for reform of pharmacy practice in Canada.

In 1923 after the death of its editor G. E. Gibbard, the Canadian Pharmaceutical Journal was acquired by the CPhA. In addition to conference, news and information on provincial affairs and some legislation, the journal also presented scientific tidbits and humor that would be of interest to pharmacists. For example, in September 1923 it described the use of scopolamine in convicts to get them to tell the truth about their crimes. (It was used successfully on three convicts in San Quentin Prison in California.) There were also jokes, market reports on crude and chemical drugs, poems, business advice, and letters to the editor.

In the 1970s, there was a growing requirement for much more communication and publications in the form of newsletters, reports, drug information and formal continuing education programs, all of which were costly at the same time the membership was declining. To some extent, publication of the Compendium of Pharmaceuticals and Specialties (CPS) generated income to help balance the budget. Publication became a key element in CPhA operations and a committee was formed under the President Chuck Meagher to guide activities. The CPS had now been established as a valuable resource to physician and pharmacists with strong support from industry, pharmacy and medical associations, and hospitals in the form of assistance in distribution. Revenue from the other publications (Canadian Pharmaceutical Journal, Canadian Journal of Pharmaceutical Sciences, PharmaNEWS, Pharmaceutical Price Book for Retail Practice

and various reports) generated losses rather than contributing to revenue. A companion to the CPS - Canadian Self Medication – was first published in 1980.

Following the change in terminology of the CPhA, the Canadian Pharmaceutical Journal was renamed the Canadian Pharmacists Journal (CPJ) in 1985 and it is the longest continously published periodical in Canada. Early issues can be viewed on line at http://eco.canadiana.ca/view/oocihm.8_05106 while the current journal can be found at http://cph.sagepub.com. CPJ has been indexed on Pubmed since 2012. With the current mission 'to attract, disseminate and discuss resarch and contemporary healthcare issues and link knowledge to practice', it continues to be a relevant way for Canadian pharmacists to communicate with and learn from each other.

CPhA has been heavily dependent on its publications in the new millenium. In addition to the CPJ, the CPS, and the very successful book on drug therapy Therapeutic Choices, the CPhA has developed drug information web sites and an electronic version of the CPS. Notably, in 2016 the CPJ was distributed to all pharmacists. The CPhA also published the book Pharmacy Management in Canada, for pharmacy managers and students. It was sponsored by the Upjohn Company and was edited by Dr. John Bachynsky and Dr. Harold Segal. A second edition was published under the direction of Dr. Wayne Hindmarsh.

The Canadian Society of Hospital Pharmacists

The Canadian Society of Hospital Pharmacists (CSHP) had its first meeting in 1947, set up a constitution and bylaws in 1948, and was incorporated by Letters Patent and given a Charter in 1950. The web site has an overview of the history of the CHSP (http://www.cshp.ca/aboutUs/history_e.asp). In 1940 the CPJ included a monthly column pertaining to hospital pharmacy. It became necessary to have a separate publication and the Canadian Journal of Hospital Pharmacy (CJHP) was established. It has been indexed on PubMed since 1975 and is available on-line at http://www.cjhp-online.ca/index.php/cjhp/index. The Journal was published in Saskatoon from 1961 to 1981, under the direction of Jack Summers. It was then moved to the CSHP offices in Toronto.

From 1970-90, the CSHP evolved from an organization with a part-time executive secretary with several provincial branches to a larger, broader organization with branches in all provinces and an active educational program. By the late 1980s the organization was facing serious organizational problems while attempting to transform the organizational structure, initiate a new journal editorial structure, become bilingual, and hire a new Executive Director. A Task Force to Examine Restructuring of CSHP and New Definitions of Membership Eligibility, chaired by Roy Steeves, held meetings and invited submissions from members.

The organization faced financial problems at this time and the move to Ottawa exacerbated this situation. CSHP moved ahead, however, and added full-time staff, supported research programs and initiated 3-day professional practice conferences in Toronto (by 1975 over 300 members attended and a decade later there were over 700). CSHP membership reached 1000 in 1977 and almost 2000 by 1989.

A national Workload Measurement Study was initiated in the mid 1970's by CSHP with funding from the National Health and Development Program. It was conducted by Dr. Bruce Schnell from the College of Pharmacy, University of Saskatchewan, and was designed to define efficient and optimal hospital pharmacy service. A hospital pharmacy manual was developed.

Medication errors accompanied the increased use of medication in hospitals. In the US, medication errors were reduced by using a unit-dose medication system. Progress was slower in Canada. In 1972, a research study, also conducted by Bruce Schnell and funded by the Department of National Health and Welfare, investigated the value of dispensing unit doses for patients. This study was important because it was the first major research project and it showed a close relationship between the profession and the national government. Four hospitals participated and the results led to increased use of the unit-dose system across Canada.

Staff members were hired throughout the 1980s and expanded educational programs, research studies and a more comprehensive planning process came into being as the organization matured and met the needs of hospital pharmacists. It was a remarkable

transition based on the flood of new effective medications and the construction of new hospitals that required the services of a pharmacist. In 1979 a decision was made to move to Ottawa and this was accomplished two years later. The move was a difficult decision as the key staff and many members were in the Toronto area. At the time of the move there were 2056 members and about 1000 were attending the annual professional practice conference (PPC). National guidelines and standards were developed, task forces were formed to deal with current issues, and $200,000 was raised for research.

The annual meeting of CSHP in 1984 revealed the dramatic advancement of the profession as it discussed: computers in pharmacy, control of investigational drugs, policies set by committees for quality service, drug monitoring in elderly patients, and professional ethics. CSHP as an organization was active in studying the labeling and packaging of drugs, improving communication with members and orientation of elected officers in the branches (provincial).

Total parenteral nutrition (TPN) whereby a variety of nutrients are administered intravenously to nourish patients who are unable to eat was a notable therapeutic advance in the early 1980s. Pharmacists became more knowledgeable in nutrition and more adept at complex intravenous therapy. Soon after this a home care system of TPN for patients evolved. The pharmaceutical industry greatly contributed to this scientific innovation, especially the Travacare Centres in major hospitals operated by Baxter Travenol managed by Jim Mann.

Membership exceeded 2000 for the first time in 1990. The society was extremely active in their communication with other organizations including pharmacy organizations in Canada and abroad, government organizations, and commercial organizations. Formal communication activity with 16 organizations was reported on in their annual report. A document on Standards, Statements and Guidelines was produced and distributed. A discussion paper on IV admixtures and Unit Dose distribution was published and circulated to members.

Association of Canadian Community Pharmacists

Formed in the mid 1970s, the Association of Canadian Community Pharmacists represented the need for CPhA to create an organization for community pharmacists since it no longer functioned solely as a community pharmacy organization. At first the new organization was part of CPhA but later it broke away. The major issues to be discussed were reimbursement systems for prescriptions and related medication. In addition they conducted public relations to improve the image of community pharmacy.

The Association with Don Manore as Executive Director was active for over a decade but with the withdrawal of Ontario in 1982, the organization began to decline. CPhA was urged to continue the task of funding studies to examine the area of economic and professional services.

Canadian Association of Chain Drug Stores (CACDS)

The association was formed in 1989 and became an associate organization under CPhA. The first chairman of the organization was David Bloom. In 1995 the Canadian Association of Chain Drug Stores dissociated itself from the umbrella of CPhA in order to be more autonomous but expected to continue to work co-operatively with CPhA. In this they were following the example of the chain store pharmacies in the US. It also developed strong ties with the professional pharmacy associations in the provinces.

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International Affiliations

Canada has a long history of close professional relations with the US in the field of pharmacy. Many Canadian pharmacists obtain pharmacy education in the US, especially in graduate studies, and attend American conferences. There have been a few joint conferences and some meetings of the American Pharmaceutical Association (APhA) have taken place in Canada. There is now a regular meeting of APhA and CPhA executive officers. Similar meetings take place between CSHP and ASHP as well as AFPC and AACP.

In the 1970s and 1980s, the CPhA was active in Federation Internationale Pharmaceutique (FIP; https://www.fip.org) activities, with the President attending the conferences. A meeting of the FIP was held in Montreal in 1985. This meeting was

notable because graduate education in clinical pharmacy was first discussed at an international level. US educators were leaders in this field and played an important role in FIP activities.

Participation in the Commonwealth Pharmaceutical Association (CPA) and Pan-American meetings also took place. For financial reasons membership in the CPA lapsed for several years beginning in 1970 and a senior pharmacist in the Canadian government attended the Regional meetings as the CPhA representative (Dr. John Bachynsky). The CPA had a number of regional groupings (Canada was a member of the Americas Region). Countries that had links to the British Commonwealth were eligible to be members. For the Americas Region, most member countries were in the Caribbean and a meeting was held annually. In 1989, for the first time a regional meeting, coordinated by Dr. Bachynsky, was held in Canada. Every 4 years a world-wide meeting, which included all of the regional meetings, was held.

The 1990s saw Canada return to an active involvement in international pharmacy: FIP, the Commonwealth Pharmaceutical Association, and Pharmaintercom (a group comprising the US, Great Britain, New Zealand, Australia, Ireland and South Africa).

In 1991 the Commonwealth Pharmaceutical Association held its worldwide meeting in Hamilton (Pharmacy World Congress), because Alf Scales, a pharmacist from the Hamilton area and a former president of the CPhA (1982-83), had been elected president of the CPA in 1987. This was a very successful conference, with Canadian pharmacists contributing many presentations to the program. The follow-up by Ernest Stefanson at the Executive Committee meeting of CPhA in August 1994 was to introduce a number of recommendations for enhanced support for CPA activities (a CPA Foundation in Canada, a Fellowship Scheme to Promote Commonwealth Understanding, to send representatives to the CPA Regional meetings and to encourage Canadian pharmacists to attend the CPA regional meetings). Although the Executive supported these recommendations, there was little progress. Only the commitment to send a representative to regional meetings and to continue to send CPhA publications to the Caribbean pharmacy schools was continued. The sending of publications was a result of the program initiated in the late 1980s by the Association of Deans of Pharmacy of Canada to assist the Caribbean pharmacy schools

develop a uniform curriculum for their 3-year diploma program (with the assistance of a grant from the Canadian International Development Agency). The Deans, with CPhA, also initiated a project to develop a regional examining board, based on PEBC, to enable reciprocity. Despite the development of a workable system by Dr. Dave Biggs and Dr. Wayne Hindmarsh, there was little interest in the countries affected as they did not support the concept of reciprocity of pharmacy licensure among the countries.

Canada rejoined the FIP in 1988 and quickly assumed leadership positions in the organization. In 1992 Francois Schubert was elected vice-president of the FIP Bureau, Leroy Fevang, the Executive Director of the CPhA, served as an executive member of the FIP's Commission on Pharmacy Administration and Ernest Stefanson, CPhA president in 1992, served on the council as well as on the community practice steering committee. Dr. Kamal Midha, academic staff of the University of Saskatchewan was actively involved in FIP over a long period and served as chairman of pharmaceutical sciences and later as President of FIP. Dr. Dieter Steinbach, Professional Secretary to the FIP addressed the CPhA conference in Charlottetown in 1994. He announced that the 1997 FIP Congress would be held in Vancouver, BC. The conference, held in the new Pan Pacific Hotel, was a resounding success, due in large part to the efforts of the Faculty of Pharmaceutical Sciences in Vancouver and local pharmacists.

Various sections of FIP such as the Academic section, the Pharmacy Practice Section, Hospital Pharmacy Section, Military Pharmacists Section, and the History of Pharmacy Section held meetings. There were also various sections of the pharmaceutical sciences. The breadth of the conference offerings at these meetings, which are held in different cities around the world, is impressive and reflect the evolving professional stature of pharmacy. Recommendations on pharmacy practice standards are invaluable to developing countries as they use them as guidelines for program development.

How did formal pharmacy education emerge in North America?

Pharmacy education as a formal process based in educational institutions, rather than an apprenticeship augmented by lectures, was initiated early in a few locations thereby

setting an example to be followed by other sites. Pharmacy colleges were established by pharmacists in the US beginning with the Philadelphia College of Pharmacy (1821), Massachusetts College of Pharmacy (1823), and Maryland College of Pharmacy (1841). The move to universities was later. The first pharmacy department established in a university was at the University of Michigan in 1868, the second at Wisconsin in 1883. Wm. Proctor in at the Philadelphia College of Pharmacy published the first pharmacy textbook - *Practical Pharmacy* - which described the techniques of making various dosage forms and the equipment to be employed. In the UK the Pharmaceutical Society of Great Britain was founded in 1841. The American Pharmaceutical Association began in 1852. In Canada, university programs in pharmacy did not begin until 1905 in Montreal.

Once a province was formed and it began to implement legislation, the pharmacists began to press for legislation to control the profession. In most cases this was modeled on British legislation. Becuase of the close connection between pharmacy and medicine – indeed physicians learned to compound as part of their education and also served as pharmacists in small communities where there was no pharmacy (there continue to be dispensing physicians) – medical legislation often attempted to cover pharmacy practice. In any case, once pharmacy legislation was in place, pharmacists began to lobby for educational programs that would qualify apprentices to pass a licensing exam.

Ontario

The Ontario College of Pharmacy required a 4-year apprenticeship as of 1889, with compulsory attendance at some lectures for one year. A 2-year program was not a requirement until 1927. The Ontario College of Pharmacy had a building of Gerrard Street in Toronto and it was expanded in 1891 to accommodate more students. This building was used into the 1940s. Dean Heebner was appointed in 1892 and served on staff for a period of 45 years having a strong influence on pharmacy education. One of his first acts was to obtain an affiliation with the University of Toronto. He then instituted a Phm.B. degree program, which required university courses and was examined with oral, written, and practical examinations.

A second school of pharmacy was begun with the first class being admitted to the University of Waterloo in 2008. The first class of 92 students was admitted into a program that has a co-op component, the first in Canada. The school will be in the health sciences campus in downtown Kitchener. The director of the program is Dr. Jake Thiessen, former Associate Dean of Pharmacy at the University of Toronto.

Quebec

Laval University in Quebec City operated a branch in Montreal that provided a pharmacy program taught in French from 1906-1920 when the University of Montreal was organized as an independent university. It continued the pharmacy program, which is the oldest continuing univeristy pharmacy program in Canada. The Montreal College of Pharmacy, which was operating independently and providing education in English, offered instruction from 1864 to 1918 when the program was transferred to McGill University. Unfortunately, in 1925 the program at McGill was discontinued due to financial problems. In 1924, Laval University in Quebec City began a pharmacy program.

Nova Scotia

In Nova Scotia a night class course for drug clerks was initated at the Halifax Technical College in 1908. There had been joint meetings of pharmacists in Nova Scotia and New Brunswick and agreement that one educational institution, the Maritime College of Pharmacy, be formed. However, when Nova Scotia wanted to go ahead neither New Brunswick nor PEI were prepared to join with them. As a result the Nova Scotia Pharmaceutical Society initiated the establishment of a College of Pharmacy in 1911 in conjunction with Dalhousie University. The link with Dalhousie pushed the one year program to two years to meet educational standards leading to a Bachelor of Pharmacy degree. Students from all provinces were welcome to enroll and some came from New Brunswick and Prince Edward Island. Additional sponsorship from the New Brunswick Pharmaceutical Society in 1917 resulted in the transfer of the Nova Scotia College of Pharmacy, which was transformed into the Maritime College of Pharmacy in Halifax with both pharmacy organizations contributing to its operation. (Dispensing

Knowledge :One Hundred Years of the College of Pharmacy, 1911-2011. Mary E. McCara).

Manitoba

From the early 1870s, there was an apprenticeship system in Manitoba. The Pharmacy Association was teaching students in its new building from 1899 onwards. The University of Manitoba offered a one-year Bachelor of Pharmacy program from 1905 onwards. This lasted until 1914 when a University Department of Pharmacy was established to take responsibility for pharmacy education. The program became a two-year University Diploma in Pharmacy with university lectures accompanied by professional practice education provided by the College of Pharmacy. A Bachelor of Science in Pharmacy was initiated in 1920 with the College still participating in providing professional instruction until 1932.

Saskatchewan

The School of Pharmacy began in 1913 as part of the College of Arts and Science. Classes started in January 1914 with 22 students under the direction of Alexander Campbell, a Saskatoon pharmacist. In 1921 the School became a College (a Faculty) with Campbell as Dean. It offered a 1-year Certificate course, increased to 2 years in 1924. A 4-year degree course was available on a voluntary basis with one graduate in 1923. In 1920 there was a surge of student apprentices back from the war with 66 enrolled in the program. It is interesting in that the number of pharmacists registered in Saskatchewan in 1920 consisted of 40 by examination, 47 physicians, 13 graduates of OCP, one graduate of New Brunswick, and 2 graduates of the Northwest Territories (this region later became Saskatchewan and Alberta).

Alberta

The pharmacy program at the University of Alberta began in 1913. Entrance requirements consisted of three years of apprenticeship and Grade 10 for students who were at least 14 years of age. Students could enter into a 1-year Diploma or a 2-year Phm.B. By 1917 students were required to be at least 15 years of age and complete a 2-

year diploma. A 4-year Bachelor of Science degree in Pharmacy was also implemented and saw the first graduation class of three students in 1921, the first 4-year degree program in the British Empire. One of the graduates, A. Whitney Matthews, played a strong leadership role in pharmacy for the next 60 years. The program for licensure, however, was a 3-year degree program that lasted into the 1960s.

British Columbia

British Columbia continued their apprenticeship program with a certificate as Certified Clerk after two years and as a Licentiate in Pharmacy after two more years. Articles were published in the B.C. Pharmaceutical Record to broaden the education of apprentices. To assist pharmacists returning from the war, examination after one year of apprenticeship was allowed. A private school began in 1920 with instruction by pharmacists twice weekly in botany, pharmacy, chemistry, and material medica. Two additional private schools and a pharmacy program by the Victoria School Board, which offered night courses, were initiated soon afterward. The University of British Columbia offered courses through its Extension Department and later established a Pharmacy Program in 1946 under Dean E.L. Woods. This came about only when substantial funding was offered by G.T. Cunningham, owner of a chain of pharmacies, and by the BC Pharmaceutical Association.

Newfoundland

The first academic program for pharmacy began in the College of Arts, Science and Technology as a 3-year degree program. This was later replaced with a 4-year program at Memorial University. The first students were admitted to the Memorial University Pharmacy Program in 1986-87 and construction on the building was completed in 1990. Funding for construction had been solicited from pharmaceutical companies and this initial funding enabled the school to be built.

The move to a common core curriculum transparency

The pharmacy conference in 1924 passed a resolution that the entry level for pharmacy be the same as that for university entrance. It also stated that a degree program in

pharmacy must be 4 years in length. The 4-year degree definition caused some problems later on when the PEBC adopted this same requirement. After 1940 all pharmacy schools were committed to a 4-year degree program. The Canadian Conference of Pharmaceutical Faculties (CCPF) began in 1944 and later changed its name to the Association of Faculties of Pharmacy of Canada (the initials AFPC served both the English and French name of the Association). Its goal is to discuss educational issues, establish uniform standard, and undertake activities that improve pharmacy education. The faculties had decided that from 1940 onwards all pharmacy programs had to be degree programs. With almost 500 pharmacy apprentices serving in the armed forces, these people would be continuing their studies on discharge. In addition, many servicemen and women would want to enter pharmacy with their studies paid by the government. Pharmacy schools were not prepared for the deluge of incoming students after the war, with classes several times larger than normal.

Alberta had a 3-year degree program and when PEBC demanded a 4-year program they then moved to a 4-year program. Newfoundland also had a 3-year program but it was a college program with a 10-month academic year containing as many hours of instruction and was not recognized. This led to a long controversy as Newfoundland pharmacists were unable to practice in other provinces since they could not write the PEBC examination. To practice outside the province many pharmacists sought employment in the federal government as the provinces extended professional recognition to federal employees (armed forces, narcotic control, drug laboratory).

Continuing Education in Pharmacy

Following an invitational conference on continuing pharmacy education, the Canadian Council on Continuing Education in Pharmacy (CCCEP) was formed in 1973. Whether continuing education should be voluntary or mandatory was hotly debated for several years and in 1975 Alberta made it a requirement for annual licensing.

It was in this period that CPhA initiated pharmacy practice workshops in Halifax and Regina but they were not supported by pharmacists for some reason. More successful was the 6th Annual Pharmacy Refresher Course led by CPhA past president Joe Despot, it was

a 3-week tour of Japan along with some continuing education. Over the next two decades this form of learning was very popular and some trips were sponsored by pharmaceutical firms, notably Frank Horner Ltd.

Pharm D Programs

The Pharm D program began initially in California in 1953 as an entry level program. All US pharmacy programs became entry level Pharm D programs in 2000. Canada followed the US in establishing Pharm D programs but as postgraduate 2-year programs at the University ofToronto and the University of British Columbia.

Several universities across Canada have moved to the Pharm D as the only pharmacist entry stream. This will almost certainly affect patterns of practice and business models. Entry level Pharm D programs were first adopted in Quebec, then Ontario and British Columbia, with the other programs to follow suit by 2020.

Drug Information Centres

Drug Information Centres were established in some provinces and hospitals to assist healthcare providers in accessing the massive complex literature that accumulated as the number of new drugs marketed and brand names generated each year increased, some of which had novel mechanisms of action combined with each brand of a product having a unique name. In 1986 there were nine regional drug information centres and 23 drug information centres in major hospitals. Pharmaceutical firms established drug information centres pertaining to their products. Some provinces also created Poison Control Centres, often linked to drug information services that provided information on the severity and treatment of drug toxicity. Although physicians were the main target user of these centres, pharmacists and nurses also made extensive use of them. Commercial drug information systems were sold to hospitals using cards and loose leaf books. Regional centres sponsored by a group of hospitals evolved and later both governments and universities also participated. In the 1980s, computers began to be used to access the drug literature and specific databases, e.g. Toxmed, were developed. Drug Information and

Poison Centres can now also be accessed by members of the public as well as healthcare providers.

A drug information service for consumers was initiated in Saskatchewan in 1991. An assessment of its effectiveness was conducted in 1999. The Saskatchewan Consumer Drug Information Service (SCDIS) is located In the College of Pharmacy and Nutrition at the University of Saskatchewan and is funded by the Department of Health. Its goal is to improve drug utilization by the public by providing accurate and timely information. Of 106 people requesting information, 99 completed a survey. The majority of calls requested information on side effects or adverse reactions. The respondents found the information provided to be useful and timely. Although most of the respondents relied on their pharmacists for information, they called the Centre because the information was unclear or inadequate or they desired a second opinion. This service was seen to be a valuable contribution to the pubic. Since then other provinces have established information sources for the public.

Public perception and professional image of pharmacists in Canada

Pharmacy as a profession carried the burden of a large retail operation that distorted public perception about its professional role. The reality was that in North America carrying retail products was necessary for survival. Over time the size of stores and the breadth of products grew to the point of hiding the professional aspect. Surveys in this period revealed the shocking statistic that a third of the pubic did not know that pharmacists were university graduates. Since then various pharmacy organizations have launched public campaigns to educate the public about the role and value of pharmacists. This seems to have paid off in that pharmacists are now seen to be the most trusted health professional, perhaps in part because people don't really know what they do.

The 1981 annual general meeting of CPhA was held in Winnipeg. One resolution dealt with passport guarantors, individuals from an approved list of professions that have known the applicant for at least two years and well enough to be confident that the statements made in the application are true. Pharmacy as a profession requested that they

be listed as guarantors but were turned down by the federal government on the basis that there were enough groups listed to meet the needs of the public.

The resolution called on pharmacists to urge their member of parliament to make representation on behalf of the profession. In all likelihood this generated little communication with the members of parliament. What did stir the issue was that shortly afterward veterinarians were listed as passport guarantors. Apparently, animals had more influence than health professionals! With the election of the Progressive Conservative government Mr. Gerry Wiener, a pharmacist, was appointed as Minister of Immigration and responsible for passports. Soon after pharmacists were guarantors. Gerry was proud of being able to make this change on behalf of the profession.

The image of pharmacists did not move as quickly as the changes in pharmacy practice. A survey of physicians in 1985 reported that they saw the role of pharmacists as: dispensing prescriptions 38%, providing information on nonprescription drugs 30%, advising patients on medication 27%, providing patients with information on allergies and side effects 22%, as a back-up for physicians 11%, and providing drug information 10%.

An Upjohn survey of consumers in 1988 (CPJ July 1988), repeating some questions asked in 1982 was positive with 80% reporting “a great deal” or “quite a lot” of confidence in pharmacists, up from 73% in 1982. What made this particularly important was that there were lower scores for physicians (67%), nurses (73%), and dentists (72%). Pharmacists were increasingly seen as a health professional rather than a retailer but they still carried a heavy retail image. When asked if they discussed their prescriptions with the pharmacist 48% said they did, up from 37% in 1982.

Pharmacy Awareness Week (PAW) was initiated by the Ontario branch of the Canadian Society of Hospital Pharmacists in 1989 and then adopted by CPhA, Canadian Society of Hospital Pharmacists and the Canadian Society of Pharmacy Students and Interns (CAPSI). Publicity events are developed in March of each year. Financial support is normally provided by pharmaceutical firms.

In the 1990s, there was increased interest in assessing the public perception of pharmacy and pharmacy services. One study funded by the Canadian Foundation for Pharmacy and

funded by Altimed in 1997 had useful results. It found that consumers visited a pharmacy an average of 26 times a year, the majority of patients (62%) purchasing nonprescription medication stated that they were offered advice less than three times in a year, and respondents classed pharmacist services as being a major not minor function of the pharmacist. While the usual dispensing activities were classed as major functions, it was surprising to see that "Providing advice on your health condition and how to deal with it" was classed as "Not a Pharmacists Function" by 39% compared to "Providing referral information for other healthcare providers"and "Follow up with Customers to ensure medication is working" as not pharmacist functions by 36% and 42%, respectively. The features that impacted choice of pharmacy were led by "The pharmacist takes the time to explain how the medication works and possible side effects" (76%). In comparison location was important to 54%, waiting time to 39%, and counselling area 23%. Patients believed that prescriptions were priced on a markup basis with pharmacists receiving about 45% of the price. Patients reported that they would be willing to pay for additional services.

Major Influences on Pharmacy in Recent Years

The expansion of public drug benefit programs has had a major influence on pharmacy practice in recent years. As the drug market shifts to chronic disease, the government has assumed a greater role in treating specific disease states such as diabetes, cystic fibrosis, organ transplants, HIV/AIDS, and cancer. Not only are there more patients with these diseases, but modern therapy is keeping them alive longer. Political pressure has also resulted in drug coverage for other populations, notably the elderly.

Scientific advances in genomics and biochemistry has produced biological products and specialty products for rare diseases. These products have not only been extremely effective but they are also extremely expensive.The combination of more patients and more expensive medication has pushed governments to focus on means of reducing drug expenditures.

Historically public programs have controlled costs by not covering more expensive products when there are less expensive products available. The newer products, however, do not have as many competitive products that are equally effective. Despite this the

public programs continue to focus on generic prescribing and province-wide purchasing to control expenditures. Although medication is only about 8% of public health spending, it has been growing more quickly in the 1990s and does not have the constraints of hospital and physician expenses that fall under the Canada Health Act. This allows provincial program to impose cost sharing, notably the draconial deductible feature that requires patients to pay full price for medication up to a certain level before being qualified to receive public support.

The impact on pharmacy is that governments have unilaterally reduced generic prices and thereby reduced pharmacists' and wholesale companies' income. The generic rebates constituted a substantial or major income flow to pharmacies. Price controls at the federal and provincial levels have also had an impact on pharmacy operations.
A pervasive flood of complaints about high drug prices and the role of the pharmaceutical industry, demonized as 'Big Pharma'has conditioned the public to rail against the firms and their products even though they represent substantial advances in therapy. A bizarre situation has resulted in that the firms making new therapies available are the 'bad guys' and the governments who refuse to supply them to patients are the 'good guys'.

Pharmacists are caught in the middle and have only recently accepted a role in improving patient access to needed medication.

Shortages of medication, particularly generic products, have had a significant negative impact on pharmacy practice. The problem stems in large part from the drive to lower drug prices, forcing Canadian firms to outsource their manufacturing to China and India. For diverse reasons these firms have had supply and regulatory problems. Exacerbating the problem is that firms have dropped some products from their product line due to their unprofitability at the government reimbursement price. For pharmacists, trying to obtain products for patients is a time-consuming process with little financial reward. In hospitals the problem is more serious and even more time-consuming and roles such as 'drug-procurement pharmacist' have been created in some health authorities.

As public drug benefit programs grew, the policies enacted also influenced the private insurance market with corresponding changes there. Most recentlly, some private

insurance programs have initiated caps on expenditures, either on an annual or aggregate level. This means that the beneficiary would no longer receive any benefits from the program. Some private insurance programs are deleting expensive products, which is putting pressure on government to provide them as they are often life-saving therapies.

Pharmacy organizations have attempted to negotiate equitable and fair reimbursement but when governments face rapid increases in expenditure and declining revenue the negotiation becomes decisions by fiat. This has resulted in wide variations in professional reimbursement from province to province, with pharmacists finding alternate compensation from rebates, group purchasing, daily dispensing, consulting and patient monitoring (drug review).

The other major impact on pharmacy has been the legislative changes in professional scope of practice. For each profession, the scope has been narrowed allowing other professions to compete for some activities. In the case of pharmacy, this has allowed pharmacists to prescribe, extend prescription order renewals and administer injections. Pharmacists have also negotiated reimbursement for monitoring therapy ,which has made therapy more appropriate and safer.

As in other economic sectors, there has been consolidation in the pharmaceutical area. There are fewer, but larger major pharmaceutical firms, wholesale firms and corporate pharmacy chains. The consequence of this is that pharmacists are increasingly employees and have less say in pharmacy services and policies. As a consequence the profession is diminished and the decision-making on prices, service and ethics is left to the corporate world.

Current Roles and Future Opportunities

While it is possible to trace the history of pharmacy in Canada, it is more difficult to predict the future of the profession. At present the primary activity of the pharmacist is to ensure appropriate therapy and outcomes. This entails discussing the prescribed medication with the patient to ensure that the intent of the prescriber is clear and that the

patient's benefits are understood. It also encompasses evaluating therapy to ensure that the risk to the patient is minimized. To perform this function well the pharmacist requires a strong background in pharmacology and therapeutics among other sciences and have excellent communication skills. She must also develop skills from her practice that enable ascertainment and resolution of drug-related problems. These problems may involve allergies or sensitivities to certain drugs; appropriate dosage; adherence issues including: taste, dosage regimen, or ease of administration, and affordability; drug interactions and interference with laboratory tests. Taking these factors into account, the pharmacist works with the patient to set out a treatment plan that will achieve specific goals. This process is recorded and the outcomes are monitored. Ensuring patients are involved in their own care is key to improving health.

What will the pharmaceutical care of the 1990s and 2000s transition to? Advances in automation, point-of-care testing and diagnosis, on-line access to information, and genetic engineering will impact the roles of all healthcare professionals. Certainly pharmacists will need to continue to move away from a product-oriented approach to a patient-centred and service-oriented model. Many pharmacists are embracing new skills such as administering immunizations, conducting travel medicine clinics, becoming certified educators in diabetes and asthma, and obtaining advanced prescribing authority. Pharmacists will need be skilled at evaluating literature to sift through the evidence and separate it from the anecdotes to help patients interpret the ever-broader array of digital information. Pharmacogenomics will play a greater role as the genetic basis of more diseases is teased out and sophisticated pharmacotherapy with narrower therapeutic targets will evolve. The legalization of marijuana in Canada will have ramifications for pharmacists even if they are not directly involved in dispensing it. Research into its individual components will expand and more cannabinoid-based prescription products may become available. The beneficial and adverse effects of marijuana will become better understood and its interactions with other medications will be elucidated. Pharmacists will expand their roles in combatting the ongoing crisis of opioid overdoses.

The population demographics of Canada are changing. The average age of Canadians is

increasing and many elderly individuals have a high medication burden, including some medications that may not have been specifically studied in their age group, they metabolize medication differently than younger adults, and may have difficulty manipulating drug delivery devices. It is known that there are not going to be enough trained geriatricians to help manage this demographic. Ongoing immigration presents interesting challenges (e.g. immunization catch-up for some refugees, increased risk of diabetes in southeast Asian individuals). There is ever increasing pressure on healthcare budgets at all levels and pharmacists can help fill in gaps if they seize the opportunity. Billing for consulting services is needed and measures of outcome (clinical, functional, mental index, quality of life, etc.), especially for complex patients, are needed. Educators, legislators, and pharmacists will have to be proactive and innovative to meet the healthcare-related needs of Canadians.

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Appendix: Research-Based Pharmaceutical Firms

Deleted:

The list below describes firms operating in Canada in 1980. This reflects the market place in that era. Since then the number of firms has shrunk due to consolidation as there was a perceived need for firms to be larger in order to operate internationally and to conduct clinical research in a large number of sites

Abbott Laboratories

The company Abbott Laboratories has been in Canada since opening a sales office in 1929. Since then it has constantly enlarged its facility and it initiated manufacturing in 1947. In 1973 a large manufacturing, sales and warehouse site was built in Montreal. The bulk and weight of the intravenous solutions required two distribution centres, one in Toronto and one in Winnipeg. Intravenous solutions have been a major product category for Abbott but the company has also marketed a line of pharmaceuticals including antibiotics, cardiovascular and mental health drugs.

Adria Laboratories of Canada Ltd.

Adria Pharmaceuticals of Canada was established in 1974. It is a subsidiary of Hercules Inc. and Arethusa Trading Corp, an American affiliate of Montedison of Milan, Italy. The parent company acquired Warren-Teed Pharmaceuticals in 1977, which had been established in 1920 in Columbus, Ohio. The company produced several lines of pharmaceuticals and established a sales office in Toronto in 1975.

Alcon Laboratories

Alcon Laboratories is an American company that began as a pharmacy and small manufacturing company in 1945 but soon after specialized in ophthalmic products. Its products were introduced in Canada in 1959. A merger with Owen Laboratory of Dallas introduced a line of dermatological products. A new office and manufacturing complex was built in Toronto area in 1975.

Allergan Canada Ltd.

Allergan is a wholly owned subsidiary of Allergan Pharmaceuticals Inc. in the US. It was founded in 1948 in California and established a Canadian sales office in Dorval in 1964. In 1970 a manufacturing operation was begun in Pointe Claire. Further expansion of manufacturing and a sterile products laboratory were added in 1976 and a quality control laboratory in 1979. Its product line were primarily ophthalmics and dermatologicals.

Anca Inc.

Anca Inc. began in the mid 1930s in Oshawa as Anglo-Canadian Drugs founded by John Gordon of St. Catharines. In 1959, it was sold to the Wander Company of Switzerland

and renamed Anca Pharmaceuticals and later Anca Laboratories. The Wander company merged with Sandoz Group of Basle. In 1979 Sandoz (Canada) acquired Anca's assets and formed a wholly-owned subsidiary, Anca Inc.

Astra Pharmaceuticals Canada Ltd.

Astra Pharmaceuticals Canada Ltd. is a subsidiary of AB Astra of Sweden, established in 1913. Astra Canada began manufacturing and sales in Canada in 1954. Subsequently it moved to Mississauga, where a large manufacturing site is located. An active clinical research program is conducted in Canada.

Ayerst, McKenna and Harrison Inc.

Ayerst, McKenna and Harrison Inc. was founded in 1925 in Montreal. Its first two products were Elixir of Pepsin and Aromatic Cascara. The firm grew and moved several times. It emphasized its Canadian roots and hired pharmacists for its sales force. In 1934, it was purchased by American Home Products, and by this time it had established a successful American subsidiary. A subsidiary Ayerst Organics was established in Brandon, Manitoba to extract estrogenic hormones from the urine of pregnant mares. This is the basis of Premarin® (**Pre**gnant **Mar**e Ur**in**e). This product, introduced in the early 1940s, was used for a very long period and, despite recent controversy, is still being produced. One story is told of the Ayerst sales representative who was taking a bottle to the home of a pregnant woman to collect urine when he was arrested as a bootlegger. The police were told to be more observant as the sales rep was taking in an empty bottle and coming out with a full bottle.

Baxter Travenol Laboratories of Canada

Baxter Travenol Laboratories of Canada is a subsidiary of Baxter Travenol US, which was started in Glenview, Illinois, in 1931 to produce intravenous solutions. Canadian production began in 1937 in Toronto. During the war, the Toronto plant was taken over by the government and the firm operated out of Acton, Ontario. In 1957, a large manufacturing facility was built in Alliston, Ontario. Offices and warehouse facilities were later built in Malton. In 1981 Baxter made a major plant expansion, adding 80,000 sq. feet. Baxer also produced a small line of pharmaceuticals and diagnostic reagents. Baxter and Abbott were the two main suppliers of intravenous solutions in Canada. Due to the volume of the intravenous solutions and the need for timely delivery, distribution centres were established in Montreal, Calgary, and Vancouver.

Beecham Laboratories Inc.

Beecham Laboratories Inc. is a subsidiary of the international firm Beecham Group of the United Kingdom. The Canadian firm was built around the purchase in 1978 of a

Canadian firm Mowatt and Moore, originally established in 1920. Antibiotics are a major product category. Manufacturing facilities and offices are located in the Montreal area. In addition, the Bencard Allergy Service manufactures sterile allergy products in Weston, Ontario.

Boehringer Ingelheim (Canada) Ltd.

Boehringer Ingelheim (Canada) Ltd is a subsidiary of Boehringer Ingelheim of West Germany; the parent company was formed in 1885. The Canadian firm was established in 1972 in Montreal. Since 1978, its administrative offices, packaging plant and distribution centre have been located in Burlington, Ontario.

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Bristol Meyers Pharmaceutical Group

The Bristol Meyers Pharmaceutical Group is the pharmaceutical division of Bristol-Meyers company of the US. The Bristol-Meyers Group was formed in 1973 with the merging of Mead Johnson and Bristol Laboratories. Mead Johnson had been established in 1923 at Belleville, Ontario, and manufactured nutritional products. Bristol Laboratories had a sales office in Montreal from 1948. Bristol Laboratories had grown with a packaging operation in 1954 and a research and sterile facility in 1964, Westwood Pharmaceuticals was incorporated in 1967. With the creation of a joint company, a headquarters operation, manufacturing and packaging operation was established in Candiac, Quebec, and the nutritional products manufacturing was moved to Ottawa.

Burroughs Wellcome Inc.

The Canadian operation is a subsidiary of the Wellcome Foundation in the UK. Established in 1880 in Britain by two American pharmacists, the firm was very successful due to its tablet technology. Following the death of Silas Burroughs in 1896, Henry Wellcome became the sole owner and guided it to become a major international firm under the corporate structure of the Wellcome Foundation. A Canadian branch operation was established in 1906 in Montreal. Initially products were imported from Britain. Canadian manufacturing began in 1930. Several moves were made as the company grew and consolidated all the operations in LaSalle, Quebec. In 1983, a new plant was built in Kirkland (Montreal), Quebec, with a large manufacturing area of 19,700 square meters costing $24.5 million. It is noted for its state of the art injectibles production and large volume of syrups.

Ciba-Geigy Canada Inc.

Ciba and Geigy are old chemical (dyes) and pharmaceutical firms in Basle. Ciba began operating in Canada in 1922 and Geigy in 1945, both in Montreal. Ciba and Geigy

merged in 1971. They produced a full line of pharmaceuticals and were particularly successful in the field of psychotherapeutic products.

Connaught Laboratories

The Connaught Laboratories' research facility was initially owned by the University of Toronto. With the discovery of insulin, the licensing fees flowing in created a sizeable research fund to conduct research into vaccines and to produce insulin and immunization products. The Canada Development Corporation purchased the firm as part of Canada's attempt to have a seat at the table for pharmaceutical research and marketing. The firm was purchased by Merieux of France in 1989.

Cutter (Canada) Inc.

A.E. Cutter established a laboratory in a pharmacy in Fresno, California, in 1897 to produce vaccines and sera. A larger manufacturing facility with more products was built in 1906 and the firm moved to Berkley. This family-owned firm was purchased by Bayer AG of Germany. Canadian operations began in 1920 located in Calgary and eventually grew, with the establishment of a manufacturing facility for parenteral solutions and regional sales distribution centres.

Cyanamid Canada

Cyanamid was founded in 1907 to manufacture the world's first synthetic fertilizer, calcium cyanamide, from which the company took its name. In 1934, a Canadian subsidiary of American Cyanamid was formed. The pharmaceutical segment of the firm was Lederle Laboratories, originally founded in 1906 in Pearl River, New York, to produce diphtheria antitoxin and other antitoxins and sera. These products were made available in Canada as early as 1910, with a branch in Ottawa. In 1930, American Cyanamid purchased Lederle Laboratories and in 1946 the Lederle business in Canada became a division of Cyanamid Canada. A manufacturing plant was built in the Montreal area in 1952 with expansions and a relocation in 1976. The experience with biological products was the basis of the firm's early entry into antibiotics (Aureomycin). The product line expanded over the years and the firm was a major producer of pharmaceuticals in Canada.

Dow Pharmaceuticals.

Dow Pharmaceuticals is a division of Dow Chemical of Canada, which in turn is a division of Dow Chemical Company of Midland, Michigan. The pharmaceutical division began in 1879 when it was founded by E.B. Shuttleworth, the first Dean of the Ontario College of Pharmacy. Professor Shuttleworth led the company until 1888 when it was purchased by two chemists who changed the name to Smith and McAskill. It was

reorganized and incorporated as E.B. Shuttleworth Chemical Co. in 1895 with Professor Shuttleworth as president. Several relocations in Toronto occurred as a result of fires and the need for larger facilities. In 1957, it was purchased by Pitman-Moore company and three years later was purchased by Dow Chemical Company, becoming Dow Pharmaceuticals.

Eli Lilly and Company (Canada) Ltd.

Eli Lilly and Company of Indianapolis, Indiana, was founded in 1876 by Colonel Eli Lilly. The discovery of insulin in 1921 was a turning point for Lilly as the company offered to help Banting and Best in the production of insulin. Similarly they assisted Dr. Salk in the production of oral polio vaccine. Lilly (Canada) began in1938 with a sales and packaging operation in Toronto. In 1946, it relocated to a larger site and manufactured its first product completely formulated in Canada. A major plant expansion took place in 1977-78. Insulin production technology was shared with Connaught Laboratories of the University of Toronto, enabling them to produce the product for Canadian use.

Endo Laboratories

This company was first established in Canada in 1953 as Endo Drugs (Canada), with sales and marketing operation in Montreal. In 1968, the parent company, Endo Laboratories, was acquired by E.I. DuPont De Neimours. In 1974, the Canadian operation changed its name to Endo Laboratories. The product line has been progressively expanded over the years.

Fisons Corporation Ltd.

Fisons is a Canadian affiliate of Fisons Ltd of the United Kingdom. Canadian sales operation began in 1958, with a sales office in Toronto. The company expanded and consolidated divisions in 1961, 1966 and 1978. Facilities include a warehouse and laboratory.

Charles E. Frosst & Co.

This Canadian company was founded in 1899 by Charles E. Frosst in Montreal. The initial products were a variety of elixirs, syrups and solutions. In 1910, the company pharmacists developed an analgesic combination of acetylsalicylic acid, phenacetin, and caffeine. This was a very popular product and became even more popular when caffeine was added. The products were designated by numbers: 217, 222, 282, 292. In 1928, Frosst was the first firm to produce synthetic vitamin D in Canada. Research was conducted into radiopharmaceuticals, which were sold in Canada and the US. Further research was halted by a disastrous fire that destroyed the research facility and led to the purchase of the firm by Merck and Co. of the US in 1965. The firm was then known as

Merck Frosst until about 2010. The joint companies established a large research laboratory in Montreal in 1969.

Genentech Canada

Genentech Canada was formed in 1985 as a joint venture between Boehringer Ingelheim (Canada) and Genentech Inc. of California. It markets products developed by Genentech. The products are made using recombinant DNA technology, including human growth hormone, gamma interferon, and plasminogen activator.

Glaxo Canada Ltd.

Glaxo has its historical roots in England as Allen and Hanbury in 1715. The Canadian operation began in Niagara Falls in 1902, moved to Lindsay, Ontario, and then to the Toronto area in 1950. Until 1935, Glaxo Laboratories was a separate company from the parent firm. Allen and Hanbury was purchased by Glaxo in 1958, forming Glaxo Allenburys (Canada) Inc. When Glaxo purchased British Drug Houses (1968), a producer of galenicals and fine chemicals, the two firms merged in Canada forming Glaxo Canada Ltd. The firm produced penicillin during the war and then had a wide range of fine chemicals and pharmaceuticals including radio diagnostics, vitamin B12, cortisone, etc. In 1981, a major expansion of 85,000 sq. feet was added. This boosted production of oral solid dosage forms from 175 million to 250 million, some of which was for export. In 1989 Glaxo constructed a large plant at a cost of $100 million in Mississauga, Ontario. This production facility was designed to produce aerosols, tablets, and ointments. A strong supporter of pharmacy, Glaxo contributed $100,000 to help establish the College of Pharmacy at Memorial University.

Hoechst Canada Ltd.

Hoechst Canada is the Canadian division of Hoechst AG of Germany. It began in Canada in 1957, with facilities in Montreal. Several other divisions of Hoechst were consolidated in Montreal and a plant built on the outskirts of Montreal in 1971. In 1974, the firm moved to Toronto and changed its name to Hoechst Canada.

Hoffmann-LaRoche Ltd.

Hoffmann-LaRoche Ltd. is the Canadian subsidiary of F. Hoffmann-LaRoche &Co. AG of Switzerland. Canadian operations began in 1931 in Montreal as a sales office. Packaging was established in 1940 and in 1957 the firm moved to a facility in which manufacturing was begun. Expansions took place in 1960 and 1965 and finally a dedicated plant and offices were established in Vaudreuil, Quebec, in 1972. This facility was shut down as a result of compulsory licensing of pharmaceuticals in Canada.

ICI Pharmaceuticals

ICI Pharmaceuticals is the pharmaceutical division of Imperial Chemical Industry of the UK. Canadian operations began in 1977 in Toronto. Previously ICI products had been sold in Canada by Ayerst, McKenna and Harrison.

Mallinckrodt Canada Inc.

The Canadian operation that began in Montreal in 1913 is a subsidiary of Malickrodt of the US. It produces specialty chemicals for the food and health care industries. This includes medical diagnostic products, radiological contrast media, immunoassays, diagnostic test kits, and radioisotopes. A number of expansions of facilities and products took place with the Health Care division moving to Mississauga in 1966. Mallincrodt is particularly well known to pharmacists as they distributed chemicals used in compounding and many pharmacies have a row of identical Mallincrodt chemical bottles over the dispensing counter.

McNeil Laboratories (Canada) Inc.

McNeil Laboratories is a subsidiary of Johnson and Johnson (McNeil Division of Philadelphia). Johnson and Johnson began in 1886 pioneering in the manufacture of health products based on killing germs. It grew to a firm of 150 companies operating worldwide. McNeil products were first sold in Canada through an agent - VanZant - in 1958, then opened its own sales office. In 1959, McNeil Laboratories (US) was purchased by Johnson and Johnson. The firm operated a sales office in Toronto until 1963, when it relocated with a sister company Ortho Pharmaceuticals to Don Mills. In 1978, a larger plant was built just outside Toronto.

Merck Sharp and Dohme Canada Ltd.

The Canadian firm began in 1911 with Sharp and Dohme importing pharmaceuticals and biologicals from the US. Merck & Company was established in Canada in 1929 to provide pharmaceuticals and fine chemicals for laboratory use. The two firms merged in Canada in 1955, but continued with the same names until 1961 when the company became known as Merck Sharp and Dohme Canada. In 1965 the firm purchased Charles E. Frosst Inc. to form Merck Frosst.

William S. Merrell Company

The William S. Merrell Company is a subsidiary of Richardson-Merrell of the US, originally founded as Vick Chemical Company. Richardson Merrell was begun in 1905 by a pharmacist, Lunsford Richardson, a Greensboro, North Carolina, pharmacist. In 1938, it purchased the Wm. S. Merrell Company of Cincinnati, a firm that had

manufactured ethical drugs since 1828. Other acquisitions followed. Vick, including Merrell, moved to St. Thomas, Ontario.

Miles Canada

Established in Canada in 1937 as Miles Laboratories, this company was a subsidiary of Bayer AG of Western Germany.

Nordic Laboratories

Nordic was formed by a merger of several Quebec pharmaceutical firms. It was also partly owned by the federal government through the Canada Development Corporation. Sales tripled from 1980 to 1985, reaching $60 million in 1986. A major production plant was expanded in Laval (1986) and a new research site was build tin Kirkland, with 6,000 sq. ft. devoted to research. Became part of Aventis Pharmaceuticals

Norwich-Eaton Pharmaceuticals

A division of Norwich-Eaton of Norwich in the US, the company began manufacturing operations in Canada in 1944. It was a small firm that manufactured and distributed urinary tract antibacterials, topical antiseptics, nutritionals, antacids skeletal muscle relaxants and anti-diarrheals.

Organon Canada

Organon was founded in the Netherlands in 1923 and expanded operations to the US in 1938. A sales office was set up in Montreal soon after and imported finished and bulk goods from the US and Holland. Later, parenterals were manufactured and packaged by third-party manufacturers. The Montreal facility expanded over the years and in 1972, with the purchase of Penick company in West Hill, Ontario the firm established a manufacturing and packaging plant for all its products in West Hill.

Ortho Pharmaceutical (Canada) Ltd.

Ortho is a division of Johnson and Johnson. It is located in Don Mills, Ontario, a suburb of Toronto. The Canadian operation was established in 1941 in Montreal. Three years later the firm moved to Toronto and began manufacturing. In 1955, a plant was built, with a major expansion in 1969. Ortho is a major producer of oral contraceptives in Canada and has a contraceptive museum at its head office.

Pennwalt of Canada Ltd.

This firm is a subsidiary of Pennwalt Corporation of Rochester, New York, and a Canadian subsidiary was established in 1951 under the name of Strasenburgh. From 1969, following the amalgamation of the operations of Pennwalt, Wallace and Tiernan,

and their associated companies in Canada, the name was changed to Pennwalt. The firm markets both prescription drugs and nonprescription drugs.

Pentagone Laboratories

This firm is now owned by Knoll AG and Schering AG, both of Germany. Before its purchase in 1973, it began in Ville St. Michel in Quebec where it was founded by three pharmacists, Michel Graton, Claude Lafontaine, and Gerard Dufault. Much of the production was manufactured by third-party manufacturers.

Pfizer Canada

To manufacture fine chemicals, Pfizer was founded in Williamsburg (now Brooklyn) by Charles Pfizer and Charles Erhart. The company grew over time and the international division was founded in 1950. A Canadian office was opened in 1951 in Toronto then relocated to Montreal in the following year. Pfizer's first Canadian pharmaceutical plant was built in Arnprior, just outside Ottawa, in 1956 and renovated in 1977. The pharmaceutical side of Pfizer began as a result of its fermentation technology used to make citric acid, which was applied to the manufacture of antibiotics. Through acquisitions Pfizer has become one of the largest firms in the world.

Purdue Frederick Company (Canada) Ltd.

Purdue Frederick began in the US in 1892. The family name Purdue is the same family that was instrumental in the founding of Purdue University in Illinois. In 1956, Purdue Frederick Company (Canada) Ltd. was established in Montreal for sales and packaging. In 1958 the Canadian company became operationally separate and relocated to Toronto. A larger facility was acquired in 1964, with manufacturing and quality control departments. Additional facilities were added in 1975 and 1979.

Rhone-Poulenc Pharma Inc.

Rhone-Poulenc is a very large chemical company operating in many countries. The Canadian company was established in Montreal in 1920 to distribute the products of the French company, Poulenc Freres. It has acquired the firm Riker.

A.H. Robins Canada Inc.

This Canadian firm is a subsidiary of A.H. Robins Company of Richmond, Virginia. Albert Hartley Robins founded the company in 1866 in a small apothecary shop in Richmond, it grew slowly until it began to diversify in 1963. A.H. Robins was established in Canada in 1949 in Montreal and became a Canadian-incorporated company in 1952. It used third-party manufacturers In Canada until 1960 when it established its own manufacturing facility. Expansions were made in 1968 and 1974. It is now part of

Wyeth. It created the A.H. Robins Bowl of Hygeia Award for pharmacists who made a significant contribution to the community.

Rorer Canada Inc.

Jonathan T. Rorer operated a pharmacy in West Chester, Pennsylvania, in the middle of the 19th Century and this was then carried on by his son William H. Rorer, who was also a pharmacist. He became interested in pharmaceutical manufacturing and started his own company in 1910, a drug repackaging operation. By 1918, he was manufacturing his own products. His two sons, also pharmacists, took over the business in 1945 and oversaw the expansion of the firm. William H. Rorer (Canada) Ltd. Was incorporated in 1968 in Toronto. In 1980 the name was changed to Rorer Canada Inc. A major expansion in Bramalea at a cost of $3.5 million and 27,000 sq ft in 1987 produced a facility for laboratories, packaging, warehouse and offices. The firm produced a diverse line of pharmaceutical products specializing in gastro-intestinal, dermatological, and cardiovascular products. In 1989 Rorer purchased Wampole pharmaceuticals.

Roussel Canada Inc.

Roussel Canda is a wholly owned subsidiary of Roussel Laboratories Ltd. United Kingdom, which in turn is owned by Roussel Uclaf of France. The Canadian operation was founded in 1957 to market Roussel products in Quebec using the services of Anglo-French Laboratories in Montreal. The rest of Canada was serviced by Cow and Gate Ltd. These arrangements lasted until 1970 when the firm undertook sales, marketing, and packaging services. It later contracted out its manufacturing in Canada.

Sabex International (1980) Ltd.

Sabex International is a Canadian company that began in 1973 as an affiliation of 13 firms, the oldest established in Canada in 1923. The firm was reorganized in 1980. It was operated in the Montreal area. It was acquired by Aventis.

Sandoz Pharmaceuticals

Sandoz is a large Swiss firm with several divisions, one of which is pharmaceuticals. It began the distribution of pharmaceuticals in Canada through an agent in 1927. Sandoz Pharmaceuticals was established in Montreal in 1952. It was combined with Sandoz Chemical Works Ltd and built facilities in Dorval. In 1958, it partnered with Ciba to have Mount Royal Chemicals produce and package it products. The facilities of the pharmaceutical division were expanded in 1971, with increased Canadian manufacturing, some of it by Anca Laboratories. Anca was acquired in 1979. It is a major manufacturer of parenteral products in Canada.

R.P. Scherer (Canada)

This firm is a division of R.P. Scherer of Troy, Michigan. The company was founded in Detroit, Michigan, in 1933 by Robert P. Scherer following his invention of the rotary die encapsulation machine for manufacturing soft elastic gelatin capsules. In 1936, the firm established an operation in the John Wyeth building in Windsor, Ontario, under the name Gelatin Products Inc. Several moves and expansions took place so that by 1957 a new plant was established with additional manufacturing capacity in 1972 and 1978. The firm manufacturers soft gelatin products for the pharmaceutical industry as well as standard products, mostly nutritionals, for other firms.

Schering Canada Inc.

Originally established in Montreal in 1926 as a subsidiary of Schering AG of Germany, it was seized by the Canadian government during World War II and sold to Schering (USA) in 1943. Manufacturing began in Canada in 1939. Research and new products by the parent company required a relocation an expansion in Montreal in 1955. Further expansion and a relocation took place in 1968 and another expansion in 1976. It is now part of Merck Inc.

Searle Pharmaceuticals

Searle Pharmaceuticals is a division of G.D. Searle & Co of Canada, which is a subsidiary of G.D. Searle & Co of Chicago. Gideon Daniel Searle first established the company in 1888. The Canadian operation dates to 1951. Expansion of manufacturing required larger facilities in 1962, first in Brampton and then Oakville, Ontario. It was the first manufacturer and marketer of oral contraceptives.

Servier Canada Inc.

This firm is a wholly owned subsidiary of Les Laboratoires Servier of Nuilly-sur-Seine, France. This international firm established an operation in Canada in 1978 at Pointe Claire, Quebec. It produced a range of research-based pharmaceutical products.

Smith Kline and French Canada Ltd.

The parent company is Smith Kline and French Corporation of Philadelphia. The Canadian company began in 1950, with office and manufacturing facility in Montreal. In 1963, 30 acres of land was purchased in Senneville, just outside Montreal, for a research facility. The introduction of compulsory licensing in Canada resulted in the sale of the site and the end of the research program. The firm then relocated its manufacturing to Mississauga in 1979. It has since joined Glaxo. SKF was noted for its work on sustained-release preparations using spansules.

Squibb Canada Inc.

Squibb Canada is a wholly owned subsidiary of E.R. Squibb & Sons of New Jersey. The company was originally founded by Dr. E.R. Squibb during the American Civil War in order to provide quality pharmaceutical products. It specialized in the manufacture of ether for anesthesia. The Canadian operation began in 1925 in Toronto as a sales office and packaging plant. John A. Huston Company acted as Squibb's Canadian distributor until 1948 when Squibb established a plant in Quebec and a new sterile laboratory in 1952. A new major facility was built in 1952, with distribution centres across Canada. In 1974, the firm launched a new injectable line in Canada under the name Linson Pharmaceuticals. The name was changed to Squibb Canada Inc. in 1979.

Stiefel Laboratories (Canada) Ltd

This firm is an associate company of Stiefel Laboratories Inc., Coral Gables, Florida. Its historical origins go back to 1846 when the company began to manufacture soaps in Offenback-am-Main, Germany. Stiefel's products were introduced to the Canadian market in 1956 by Winley-Morris, a Montreal firm that held the agency for 20 years. In 1976 Stiefel Laboratories (Canada) was established in Montreal by Richard J. MacKay, a Canadian, in association with Herbert and Werner Stiefel, two descendants of the founder of the original company. Most of the firm's products are produced in Canada by contract manufacturers. The firm is owned 25% by Canadians. The product line consists of dermatologicals.

Syntex Inc.

The Canadian operation is a subsidiary of the Syntex Corporation of Palo Alto, California. Its historical roots go back to 1944 in Mexico where research into steroid compounds led to the production of progesterone-like compounds from cacti. This led to the production of oral contraceptives in 1960. A Canadian firm was established in 1962 in Montreal and with expansion relocated to Mississauga, Ontario, in 1980. In addition to manufacturing, a research facility was also built. The firm markets contraceptives, topical steroids, anti-arthritic drugs, and nutritional products. The parent company also markets veterinary drugs, dental instruments, diagnostic assay systems, beauty care products, fine chemicals and ophthalmic products.

The Upjohn Company of Canada

This firm is a subsidiary of the Upjohn Company of Kalamazoo, Michigan. It was founded in the US at the time of the Civil War. The products were first marketed in Canada through various agencies beginning in 1927. In 1933 the Upjohn Company of

Canada was formed with a sales office and warehouse in Toronto. A sales force of pharmacists was hired to market the products. In 1954, manufacturing began in Don Mills, Ontario. In 1979, the firm celebrated its 25th anniversary in the Don Mills facility. Upjohn is a major firm, with an extensive product line and world-wide marketing.

USV Canada Inc.

The Canadian company is owned by USV Pharmaceutical Corporation, which is part of Revlon Health Care Group, wholly owned by Revlon, Inc. USV International operates in many countries. Canadian operations began in 1953 in Montreal, Quebec, as Arlington Funk Laboratories. In 1967, it was purchased by Revlon and in the following year Arlington Funk Laboratories was renamed Arlington Laboratories, division of USV Pharmaceutical Corporation. In early 1979, the company's name was changed to USV Canada and operations were moved to Mississauga, Ontario.

Winthrop Laboratories

Winthrop Laboratories is a division of Sterling Drug Ltd of Aurora, Ontario, which is a wholly owned subsidiary of Sterling Drug of New York, a multinational firm. The company was first established in Canada in 1919 in Windsor, Ontario, as the Winthrop Chemical Company. Subsequently, as a result of the acquisition of Frederick Stearns and Company Ltd, it became known as Winthrop-Stearns. In 1958, the company moved its manufacturing and distribution facilities to Aurora, Ontario. Winthrop has allied divisions such as Sterwin Laboratories (veterinary products) and Breon-Winthrop Laboratories (hospital products).

Wyeth Ltd.

Wyeth Ltd is a subsidiary of American Home Products Corporation of New York. Wyeth was founded in Philadelphia in 1860 by two brothers - John and Frank Wyeth. Frank was a pharmacy graduate of the Philadelphia College of Pharmacy. The firm entered the Canadian marketplace in 1883 with a branch in Montreal. In 1932, the company was purchased by American Home Products Corporation and moved to Walkerville, Ontario, now the city of Windsor. The firm grew at this site with major expansions in 1954, 1973, and 1979. In 1980 over 90% of Wyeth's products distributed in Canada were made in Canada.