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Malaria in the 18th and 19th centuries in Ontario

The year was 1793. Invitations for a gala ball had been extended by the Lieutenant Governor of Upper Canada and Mrs. Simcoe. The evening for gaiety arrived but the usual sparkle was missing. Mrs. Simcoe, ill with malaria, was unable to attend. Speculation suggests that the Governor, too, was not immune: as Mrs. Jarvis, the wife of William Jarvis, the Provincial Secretary, wrote, "his health is much impaired and his eyes are as yellow as saffron and he is peevish beyond description". Others succumbed to the disease in the decades to follow as it spread across the southern part of the province bringing misery to hundreds.

Malaria arrived in America in the 16th century and became especially prevalent in the warmer parts of the country. It spread northward and as late as 1880 it occurred in epidemic proportions in Massachusetts.

Significant events in 1783 included the arrival of the first refugees to Canada: people loyal to the British Crown who fled northward following the American War of Independence. Fifty thousand or more arrived in the years that followed. Many, encouraged by Governor Simcoe, settled in the newly-formed Upper Canada. Uninvited "guests", the minute parasites that cause malaria, presumably accompanied some of these loyalists. No one, of course, was aware of these "hitch hikers", for the cause of the disease was unknown. That would not be recognized until 1880 and further seventeen years would elapse before Ross would report transmission by mosquitoes.
People were unaware of the cause, the mode of transmission or the vector, *Anopheles quadrimaculatus* (which, incidently, is still present), and the disease soon obtained a foothold. It spread to the native population too, facilitated perhaps by the movement of loyalist Six Nation Indians that Captain Joseph Brant brought to the region around Brantford. This is in contrast to the situation reported by MacTaggart along the Rideau canal where he said, "The Indians are never troubled with anything of the sort". Increased immigration from Britain compounded the situation in some localities, by increasing the density of population. Possibly among the British troops garrisoned in Canada were some who had served previously in endemic areas such as India or the West Indies and were carrying the parasites. Some, indeed, may have caught the disease in Britain, for, as MacArthur noted, "as late as the 1870's the garrison of Tilbury fort was changed every six months, because of the prevalence of ague thereabouts". Conceivably, too, some civilian immigrants were carriers: as late as 1850-60 up to 30% of the patients treated in certain hospitals in England were cases of ague.

The disease became established near lakes St. Clair, Erie and Ontario, along the lower Grand river, and in the vicinity of the Rideau canal. Doctor MacKinnon of Stratford wrote in 1873:

the great malaria district of western Ontario is but a fraction of a larger malarial district extending beyond the waters separating Ontario from the State of Michigan. It includes the whole of Lambton, Kent and Essex with portions of adjoining counties, including a strip running along the Huron shore to Bayfield.

Doctor J. G. Bray wrote in the Ontario Board of Health Report for 1883 that "it is the source of most of the sickness in Chatham and vicinity". The shaking ague, prevalent in the county of Kent 20-30 years previously, was in 1883 almost unknown. Drainage was believed to have had a modifying influence, although the disease which was confined then to a few localities was now widespread.
Newark (the older name for present day Niagara on the Lake) was an early focus of infection. Mrs. Jarvis writing from there in 1793 to her father in England implored him to bring plenty of "bark" to Canada as the children were all ill with the fever. The "bark" was that from the Cinchona tree of Peru which, in the 17th century, had been found to be effective against malaria. Quinine, the active ingredient, was not isolated however until 1820 by Pelletier and Conventon in France and its structure was not determined until 1907 by Rabe. Perkin tried to synthesize it in 1856 but almost 100 years elapsed before Woodward completed this difficult task in 1944. Others, too, referred to the disease at Newark. Wild, 1790, noted "there is not a single house without a case of ague and in some the whole family is ill". Rochefoucault, a guest of Governor Simcoe in 1795, remarked "The place is pleasant but very unhealthy, the inhabitants being affected two thirds of the year with fever or ague". Fifty years later the disease was declining. A doctor Melville believed it was due to long time settlement. Leaking from the Welland canal leading to putrefaction was held responsible for its continued presence in nearby St. Catherines.

Lord Selkirk in his dairy November 20, 1803 described the unhealthy position of the blockhouse at York surrounded by a 1000 acre marsh at the mouth of the Don River. Mulvany, too, wrote The early days of York were in constant struggle with malaria disease. But as the population increased (by 1832 it was 5500) the hygienic condition steadily improved. Swamps were drained, and became first meadows, then the sites of city streets; ravines such as those once made impassable chasms of Yonge and Queen streets were bridged over and filled up. The city, as if by hygienic instinct, began to move away from the fetid Don banks to the north and west.

In 1803 Lord Selkirk received permission to establish a settlement believed to be strategically placed, at Baldoon near Lake St. Clair. Settlers arriving in September 1804 lived in tents and "soon began to sicken with malaria". Five years later the population was healthy.
A malignant form of the disease appeared between 1839 and 1847 from Brantford southward. Recent arrivals were especially susceptible and rather discouraged, "since who would occupy land", Harvey said, "where in spring or fall, to be ill was the rule to be well was the exception".

The Moodies, soon after arrival in Canada in 1832 asked a friend, Tom Wilson, who had arrived earlier, "What are you doing here?" He replied, "Shaking every day with ague". Whole families were down with the ague or fever in 1847", said Anne Langton, "and perhaps no one to look after them but a neighbour, a mile away, herself in a state of ague".

As late as the 1880's sudden outbreaks occurred around Coboconk and around Madoc. That at the former was attributed to accumulation of sawdust from the recently established sawmills. At Madoc flooding by the newly erected dams was believed responsible. An epidemic near Perth in 1820 was so severe that few were healthy enough to look after those who were ill and an outbreak in 1847 interfered with the harvest.

Few of today's travellers on the beautiful Rideau canal realize that Colonel By's problems in building it were compounded by illness and death among his men due to malaria. John MacTaggart, Clerk of Works for Colonel By stated, "The malaria in this dreadful place [referring to Cranberry marsh] was the chief cause, in my opinion for putting a stop to progress of the public works in the warm weather of 1828; hundreds of labourers and mechanics were laid down with sickness, many of whom never rose again". Conditions were similar at Jones' Falls and Kingston Mills where he said, "no one was able to carry a draught of water to a friend; doctors and all were laid down together". Clearly he was referring to malaria as he described the typical signs and symptoms of chills, fever, chattering teeth, aching bones, profuse sweating and other characteristics of the disease.
Reference was made above to the possible arrival of malaria in Upper Canada by way of loyalists and soldiers. Proof is difficult, if not impossible, to obtain without authentic records of the first cases. The history of the Rideau Canal provides circumstantial evidence for both sources. In the early 1790's the loyalist Stephen Burritt arrived at the Rideau river, built a raft and floated down the river to a favoured spot, which to this day bears his name, Burritt's Rapids. He cleared some forest, built a log house and settled down with his wife. Soon both were stricken with ague. So severe, the record states, that they lay helpless for three days without fire or food. Indians passing by, seeing no activity, went inside, ministered to their needs and saved their lives. The kind attention was not forgotten. The Burritt home from that time forward was always open to Indian travellers. The possibility of a carrier of malaria among the Royal Engineers building the canal is suggested by the name of the lock at Poonamalie, so named by one of the officers. Most probably this name was given because the officer had previously had experience in the Indian sub-continent.

Beliefs concerning the cause of malaria were many although bad air was held responsible by most. The disease, in places, according to MacCulloch 1827, was believed to be almost inevitable, "Who can hide himself from the universal atmosphere, or refuse to breathe the wide air, though conscious that every inspiration is a draught of poison?" Various reasons were advanced for this. Putrefaction appealed to many, especially in centres where outbreaks of intermittent fever occurred, or increased, following the building of dams with the accompanying drowning of land behind the dams. It was not realized that the damned water provided ideal breeding sites for mosquitoes. Some believed the disease was associated in some way with the type of underlying rock.

Some treatments used at the time are of interest. Mrs. Simcoe was persuaded that drinking an infusion made with the buds of sassafras
cured the symptoms of ague. Wild\textsuperscript{25} advised "as a precaution against ague, we took, fasting in the morning, a glass of brandy into which is infused a teaspoon of Peruvian bark. This is deemed to be a certain preventive. You take that and avoid the evening dew". The latter precaution, of course, although unknown at the time, would minimize exposure to the twilight feeding \textit{Anopheles} mosquitoes. Plants with a bitter taste, dogwood, poplar, and cherry, were often chosen in the mistaken belief that the bitterness of the bark was effective. Blood letting was an accepted remedy by some.\textsuperscript{26} Some treatments seem nowadays quite bizarre. John Wesley suggested\textsuperscript{27} "...a purge one day and next bleeding in the beginning of a fit, or apply to each wrist a plaster of treacle and soot". Others resorted to superstition. Rochefoucault wrote:\textsuperscript{28}

The poorer classes of inhabitants dread their [physicians] advice in intermittent fevers, because they always prescribe bark; and the poor people instead of following their advice, have recourse to a sort of magic charm, in which confidence is placed in this country. If seized with the ague they go into the forest, search a branch of the elm or sassafras, of the last year’s growth, fasten to this branch without breaking it off the tree, a thread, which must be quite new, tie as many knots as they think they will have "spells" of the fever, and then return perfectly convinced that they shall have no more fits than they have bound themselves to sustain by the number of knots they have tied. The first discoverers of this arcana used to make so few knots that the ague would frequently disappoint their hopes, but they who at present practise this superstition tie so many, that the febrile condition is generally carried off before the number of fits comes up to that of the knots.

Psychological remedies were proposed also. Notes of the late Doctor Richard Stanbury, taken at lectures in 1863–64 at Dr. Rolph’s Upper Canada Medical School specify, in addition to quinine, emetics, and purgatives, "you may frighten a man out of ague. News good and bad may affect the paroxysm or putting back a clock will provide like effect. Thereby showing the nerves have a very important part in the disease".
Cinchona bark, and later quinine which was derived from it, were used increasingly. The Countess of Chinchon, wife of the Viceroy of Peru, had found in the seventeenth century that a tea prepared from the bark of a certain tree was effective against malaria and in 1640 took supplies of it to Spain. (Recently Coatney et al have questioned whether she was treated with the bark). Later in the century Jesuit priests shipped bark to Rome where it became known as Jesuits' bark. It is an interesting example of the discovery of a remedy for a disease centuries before etiology of that disease was known. "Quinine sulphate has replaced other remedies", wrote John Galt in "The Canadas". Cayenne pepper was still considered useful. Indians also recognized the value of quinine. Bull quotes Dr. Adamson that "some of the affected Indians would terrify the doctor's family by slipping into his home and helping themselves to the remedy for this fever". This is understandable, as MacTaggart has noted, for the drug was expensive and "poor people are at a loss to procure it".

Lack of knowledge of the cause of the disease ruled out any effective eradication campaign; nevertheless by 1850 malaria was disappearing in Ontario. Lack of knowledge about vital statistics, the extent of the use of quinine, and the amount of draining and clearing of land permit only speculative reasons for the disappearance. These and other factors together with improved socio-economic conditions were likely responsible. Quinine, which was expensive initially, became cheaper and more readily available and was obviously used prophylactically by some; Osler wrote, "I retain lively recollections of the buzzing ears of my boyhood from the large doses of quinine administered to us in the spring and autumn". The brighter, more tightly constructed, houses that were built to replace the early log houses were less accessible and less suitable as resting sites for mosquitoes than the early dwellings with their chinks and crevices. Expansion of agriculture, with increased number of farm animals and buildings to house them, provided alternative sources for blood meals and resting sites for mosquitoes thus reducing
the probability that they would feed on man. Certainly the disappearance of the disease coincided with cutting of forests and the cultivation of the land. Some believed this was beneficial to health, others contended that clearing the trees allowed winds to carry the disease. An Ontario Agricultural Commission in 1880 was shocked by the disappearance of trees.

The lives of men and women were affected in many ways by malaria. For example, Robert Gourlay arrived from England in 1817 and planned an early return, but at Queenston, "he was laid up for two months with the fever..." Consequently he remained in Canada, became embroiled in political controversy, "crossed swords" with the famous Dr. Strachan and was prosecuted and acquitted for seditious libel. However under another law relating to residency he was found guilty and ordered to leave the province. If he did not do so the death penalty could be imposed, "without benefit of clergy". If he had returned early to England he would have avoided involvement with the law.

Some believe the boundary line between United States and Canada might have been different were it not for malaria. Following the war of 1812 the Americans appointed General Porter and the British, John Ogilvy, to determine, "The middle line of international waters which was the boundary line agreed upon" in the treaty of 1783. While working on the St. Clair flats in 1819 both men contracted malaria "from the miasmic air of the lowlands" and the strong-willed Ogilvy died.

Most entries about malaria must be placed on the debt side of the ledger although it led to a few worthwhile developments. Belief in its cosmic origin and its association with bad air led to the keeping of weather records in the United States and in 1870 the United States Weather Bureau was established.

Some in Canada in 1873 despaired that the cause would ever be found: one physician wrote, "As yet the subject is imperfectly under-
stood, and the probability is it will always remain so". Others were persevering however in the search for the cause. First credit goes to Alphonse Laveran, then a relatively unknown physician with the French army in Algeria. In 1880 he saw minute organisms in blood cells of soldiers dying from malaria. Convinced that these were the cause he presented his observations to the Academy of Medicine in Paris. Skepticism, even hostility of senior scientists, failed to daunt him. Supported by Pasteur and others he pressed on. His discovery finally received world acclaim and in 1907 he was awarded the Nobel prize. Enthusiasm over the discovery reached Canada, too; at the opening of the biology building at the University of Toronto in 1889 two of the invited-lectures were on malaria. The mode of transmission was still unknown. Intensive investigations by British, French and Italian scientists followed. Lancisi had previously, in 1717, implied a relationship between malaria and mosquitoes. A century or more later people living near undrained marshes in Wales believed ague was acquired from mosquitoes associated with the marshes. The idea was not taken seriously until Manson showed that mosquitoes were hosts to filarid worms and Smith and Kilborne discovered the role of ticks in the spread of Texas fever to cattle. Ross, encouraged by Manson, began intensive work in India and in 1897 he optimistically penned his now famous lines.

This day designing God
Hath put into my hand
A wondrous thing. And God
Be praised. At His command,

I have found thy secret deeds
Oh million murdering Death.

I know that this little thing
A million men will save -
Oh death where is they sting?
Thy victory oh grave?

Other discoveries followed rapidly. Bignami, Bastianelli and
Grassi (1898) showed that the parasite developed in certain Anopheles mosquitoes. 46

A Canadian, W. G. MacCallum, played a significant role in unravelling the life cycle of the parasite. MacCallum, born in 1874 near Dunnville, graduated in classics in 1894 from the University of Toronto. Attracted perhaps by Osler, he studied medicine at Johns Hopkins University, graduating at the head of his class in 1897. He remained there until 1909. From 1909–1917 he was professor of pathology at Columbia University. Then an opportunity arose for him to return to Johns Hopkins where he remained until retirement; he died in 1944. It was my privilege to meet and talk to him in 1936. He had been absorbed in pathology for years, but recalled with interest his contribution to parasitology. It happened in 1897 while vacationing near his family home. Like many physicians of that period he was interested in natural history. Examining the blood of birds he noticed in a sample from a crow that the cells were infected with a species of Haemoproteus, an organism with similarities to that causing malaria. While observing a fresh sample of blood he noticed the process of exflagellation. Laveran had seen it too but the significance was unknown and was warmly debated. MacCallum wrote 47

I decided...to observe carefully in the same field a granular form and a hyaline form [of the parasite] from the time of extrusion from the corpuscle to the beginning of the motile stage and having found such a field, the following picture presented itself: The two forms lay at some distance from one another separated by the plasma and a few corpuscles. The granular form happened to escape from the corpuscle first and lay perfectly quiet beside the free nucleus and the shadow of the corpuscle. Soon the hyaline body, becoming greatly agitated, burst from the corpuscle and threw out active flagella, which beat about for a few moments and finally tore themselves loose. Then came the acme of the process. One of the four flagella passed out of the field, but the remaining three proceeded directly toward the granulated form, lying quietly across the field, and surrounded it, wriggling about actively. One of the flagella concentrating its protoplasm at one end, dashed into the granular sphere, which seemed to put out a process to meet it, and buried its head, finally wriggling its whole body
into the organism, which became perfectly round. The remaining flagella, seeking to repeat the process, were evidently repulsed, and soon became inactive and degenerate. Have we not here a sexual process...? This is the process...which I am confident will be found to occur in the case of malaria parasites.

A short time later MacCallum established the truth of his conviction by observing the same phenomenon in the parasites causing aestivo-autumnal fever in man. MacCallum presented his findings to the British Association for the Advancement of Science, meeting August 24, 1897 at Toronto. His observations assured him a permanent place in the annals of parasitology.

Transmission of malaria ceased in the last century in Canada, but, surprisingly perhaps, many cases have been seen in recent years. This is the result of more Canadians travelling to tropical lands and also immigration of infected persons from endemic areas. Fortunately expansion of knowledge, public health practices, and fewer breeding sites for the mosquito vector assure us that the endemic situation of the early 19th century is unlikely to return.

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NOTES


10. Wild, Issac (1779). Travels through the states of North America and the provinces of Upper Canada and Lower Canada during the years 1795, 1796, 1797. London, as quoted by Glazebrook op. cit. p. 72.


29. Coatney, et. al. op. cit. p. 11.


32. MacTaggart op. cit. p. 18 Vol II.


34. Bray op. cit. p. 306.


37. Ibid. p. 87.

38. Ibid. p. 85-89.


41. Coatney et. al. op. cit. p. 11.


