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# Scurvy at York

## *A Dread Affliction Lingered at the Bay*

By JODY F. DECKER

**A**s winter approached, the men of the Hudson's Bay Company at York Factory knew that the danger of scurvy loomed ahead, especially if there was a failure in procuring "country provisions" over the months ahead. If enough fresh venison, ducks, partridges, rabbits, grouse, ptarmigan, and fish were obtained, the threat of this dreaded disease was diminished. Despite efforts by the Company, scurvy was never eradicated from York Factory, and, in fact, it mysteriously reappeared at that post with a vengeance in the middle of the nineteenth century at a time when the disease was relatively well understood and easily controlled.

Other HBC posts reported only isolated outbreaks of the disease. The explanations for this enigma at York are complex, but the rich diversity of the HBC records permits some solutions to this puzzle. These records include: the daily post journals, the sole surviving medical journals for the years 1846-1852, the provision books which contain the daily food record of standard rations and the amounts of imported and locally obtained food, and the invoice books of shipments and volumes to York. From these records, the incidence of scurvy at York Factory and its possible causes can be examined.

Unlike most animals, humans do not synthesize Vitamin C in their bodies; they are dependent on food as the source of the vitamin. This vitamin is essential in the human body for wound healing, production of collagen which aids in strengthening bones, teeth, skin, blood-vessel walls, and other body parts, and for resistance against infections. Depletion of Vitamin C results in scurvy. To prevent the disease, a daily minimum requirement of approximately 10 milligrams of Vitamin C is necessary, while 30 milligrams is recommended

as the level sufficient to replace the amount of ascorbic acid metabolized daily.

The following vivid description of scurvy by Joseph Colen, the Chief Factor at York Factory in April of 1789, graphically illustrates how ravaging the disease could be:

The scurvy rages with violence and some Men are so Bad it is with difficulty they are removed from their beds — Scarcely one person at this place but is tainted with this disorder — and It is almost impossible to describe the Malady that rages amongst us which is attended with a kind of putrifaction the Teeth loosen Gums swell, A quantity of loose dark flesh is cut off daily from the afflicted before they can take any kind of Subsistence. The Patients legs swell which are much discoloured they are disabled and contracted in their limbs as to render them objects of comisseration. Their breath is so offensive as to be almost unbearable; and a lowness of spirits attends the whole afflicted . . .

The signs and symptoms that Colen described were those of advanced scurvy. The onset of this disease was however, insidious. The first symptoms were preceded by a period of vague complaints — general lassitude, weakness, irritability, and weight loss. The HBC men were well aware of the first symptoms; swelling of the arms and legs, bruises on the lower extremities, and wounds that would not heal. They were terrified of the progression of the disease. Weakened blood vessels ultimately led to bleeding into the joints, which became heated, painful, swollen, and debilitated. The limbs eventually contracted and the sufferer was unable to walk — sometimes permanently. The gums became swollen and spongy, and bled easily. Soon the teeth



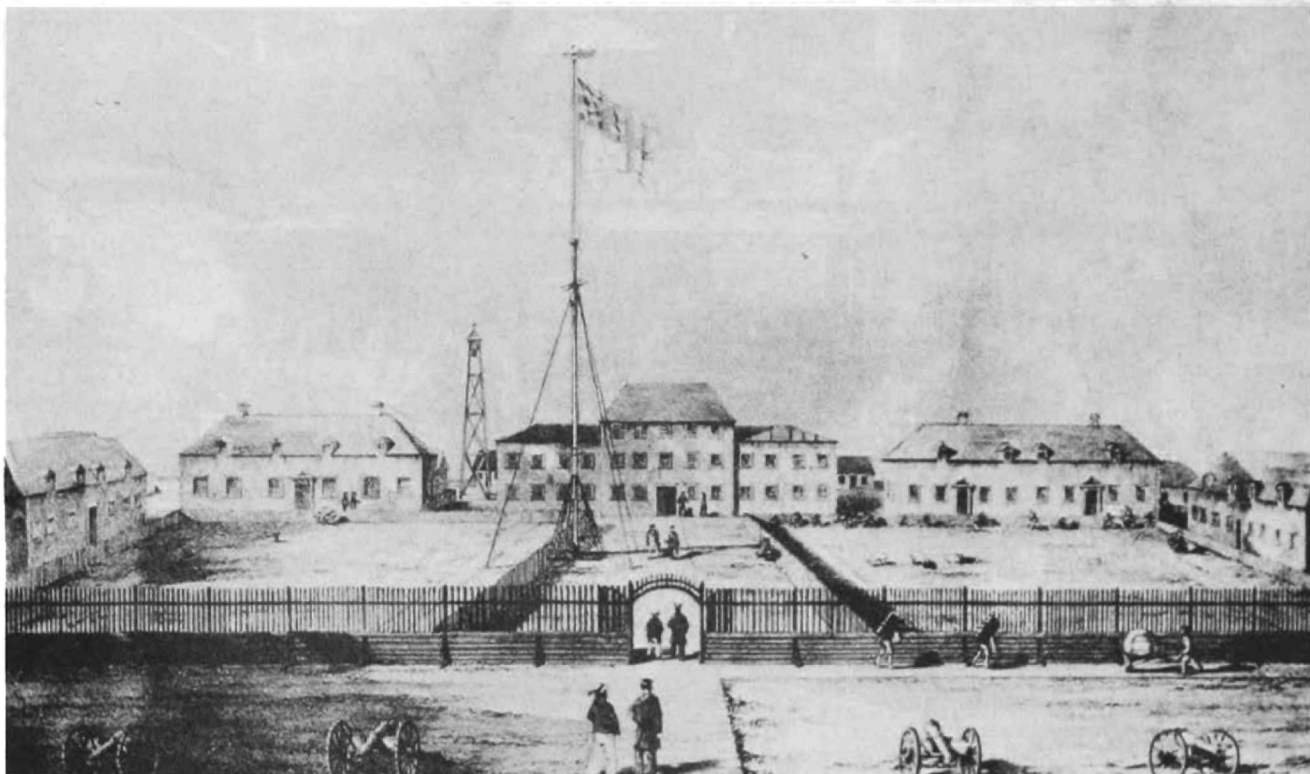
*A Victorian print of activities in an English factory that bottled lime juice.*

loosened and fell out. Unable to eat, and without antiscorbutics, the victim inevitably died. Because a lack of Vitamin C leads to a failure of the body to synthesize collagen, death occurred most often from the bursting of a major blood vessel. Fevers, infections, and stress, combined to deplete tissue stores of the vitamin, and likely hastened the victim's end.

Although scurvy had been first described at the time of the Crusades in the thirteenth century, it was not until the early twentieth century that the cause of the disease was clearly recognized as a dietary deficiency. The therapeutic value of citrus fruits as a cure for the disease had been recognized for centuries before this time, however, but even after James Lind's famous therapeutic tests in 1753 in which he demonstrated the efficacy of curing scurvy with citrus juice, it took another 40 years before the Royal Navy adopted his suggestions. By the beginning of the nineteenth century, citrus juice was being used universally as a preventive for scurvy, but subsequent unexplained outbreaks of the disease, especially in the second half of that century, diverted scientists of the time away from the notion of scurvy as a deficiency disease, toward other explanations such as chemical imbalances. These unexplained outbreaks were partially due to a confusion over limes and lemons. As early as 1845, it had been suggested to the British Admiralty that the British West Indian lime could be used as an antiscorbutic

in place of the Mediterranean lemon, and over the next decade this substitution began. Lime juice is now known to have, at best, one-half of the Vitamin C content of lemon or orange juice. The changeover of citrus fruits was a good marketing strategy for the British, but the therapeutic value of the substitution was unknown at the time. Adding to the complexity of this issue is the fact that orange, lime, and lemon juice were indiscriminately referred to as "lime juice" by the Royal Navy. This fact is substantiated in the case of York Factory where the medical records at that post only indicated issuances of "lime" juice, whereas the provision books for that post indicate both lime and orange juice were regularly sent over from Britain. It would never have occurred to the HBC men that the more acidic lime would actually be a less potent antiscorbutic than the lemon or the orange.

In light of contemporary findings, the therapeutic value of the citrus juices in the nineteenth century must be regarded with some skepticism, as Vitamin C is very easily destroyed by a variety of factors such as temperature, humidity, storage, and handling. Modern analysis has shown that 100 grams (approximately equal to a small, filled wine glass) of fresh lemon or orange juice contains approximately 45-50 milligrams of ascorbic acid, whereas fresh lime juice contains only one-half that amount. As well, different varieties of a citrus fruit such as an orange contained varying



*York Factory was a substantial establishment in the 1840s and 50s and yet scurvy mysteriously persisted. This depiction, thought to be based on a sketch made by Chief Trader Alexander Hunter Murray, shows the HBC trading and supply centre as it was in 1853.*

amounts of ascorbic acid. In order to maximize the vitamin content, all fruits had to be picked at maturity and in the best physical condition. If they were picked before maturity, or badly bruised, the vitamin content was lowered. The technique used in the preparation of the citrus concentrate was critical. Vitamin C is inactivated with pickling, salting, curing, fermenting, heating, prolonged exposure to air and sunlight, exposure to an alkaline solution such as baking soda in food, and exposure to metals such as copper or brass, and, to a lesser extent, iron.

James Lind's original recommendations for prevention of scurvy from his 1753 therapeutic tests, specifically called for the evaporation of the citrus juice in a clean, well-glazed, open earthen vessel for several hours. The process he advocated of boiling and evaporating citrus fruits in order to concentrate their volumes would have resulted in the loss of at least one-half the original Vitamin C content. This being the case, if 5 pounds of lemons were boiled down to 3 ounces according to Lind's method, then the resultant concentrate would have contained approximately 260 milligrams of Vitamin C. Lime juice would have contained one-half that amount. In either case, the usual administered dosage of 3-4 ounces of juice per day, would have delivered, by itself, well over the daily recommended requirement of Vitamin C. The records give no indication whether or not the juices were concentrated.

It is known, from the lists of trading goods, that copper pots were sent over from Europe and were probably used by the cooks. If the concentrating process was done in a copper pot, or if the juice had been decanted and then pumped from container to container in copper tubing (which is thought to have been the case), the vitamin content would have been negligible. Subsequent storage of the juice would have resulted in further loss of the vitamin through time. Potatoes, for instance, stored at lower temperatures will lose one-half their Vitamin C content over a period of 6 months. Generally, the rate of loss of ascorbic acid through time is dependent on temperature fluctuations and relative humidity, and is therefore difficult to measure.

Since its inception in 1670, the HBC had shown concern about scurvy, and had sent over English provisions such as salted meat, dry goods, grains, and seeds for gardening to supplement the "country provisions". Lime juice was sent to the Bay as early as 1684, potatoes were being harvested at York in the 1770s, and vegetables such as radishes, turnips, and lettuce were grown with limited success in what one of the traders referred to as a "small spot of ground called, by courtesy, a garden". When scurvy appeared at the Factory, the men were issued "fresh provisions", and anywhere from 3-4 ounces to a wine glass of lime juice, 3-4 times per day, depending on the surgeon on duty at the time.

The ascorbic acid content of the foods eaten at York varied considerably. One twenty gallon cask of orange juice and one 60 gallon cask of lime juice were shipped over most years from Britain to York. They were the best known and most highly valued antiscorbutics in the nineteenth century. Leafy green vegetables, cabbage, and fruits such as cranberries, wild gooseberries, and particularly black currants, which contained approximately 210 milligrams/100 grams, were also rich in Vitamin C. Spruce beer, an antiscorbutic decoction made from the green leaf buds of fir trees, had been the mainstay at the HBC posts since their inception, but its effectiveness depended on the freshness of the buds and on how long they were boiled. Meat, in a raw or lightly cooked state, contained enough of the vitamin to ward off scurvy. Potatoes, baked, and to a lesser extent boiled, eaten as a daily staple, would also have protected the men from scurvy. Other foods eaten by the HBC men, such as sauerkraut, fresh onions, and turnips, also contained moderate amounts of Vitamin C. (10, 15, and 35 milligrams/100 grams respectively). Foods they consumed which contained essentially none of the vitamin included sugar, molasses, bread, rice, vinegar, coffee, potable soup (dried animal entrails), cheese, oatmeal, salted meat, butter, well-cooked fish or meat, all mature dry seeds such as wheat or corn, and legumes such as peas and beans. The highly valued "fresh provisions" of fish, fowl, and meat contained little or no ascorbic acid. Whitefish and ptarmigan contained approximately 6 milligrams/100 grams of ascorbic acid, but caribou, deer, and rabbit were devoid of the vitamin.

It was only after the Treaty of Utrecht in 1713 when the Bay and its environs were returned to the British, that York became a pre-eminent trading post along the Bay. When the HBC began to establish posts inland in the Western interior in 1774, York Factory became the primary supply depot, where goods came in from Europe, were sent to Europe, or were manufactured right at the post. After the amalgamation of the North West Company and the Hudson's Bay Company in 1821, York Factory became the headquarters for the vast Northern Department. Consequently, the post always had a relatively larger complement of men than most of the other HBC posts. The usual number of around 50 officers and men would increase over the summer months when the Indians came to the post to trade and the fur brigades returned with their goods from the interior. The annual arrival of the boat from Europe in late August or early September brought in a new complement of HBC servants and officers, who waited at York until they were able to take up their new assignments inland. An additional seasonal influx of people occurred with the establishment of an agricultural settlement at Red River in 1812. Settlers bound for that colony (280 people between 1812 and 1815),



Portrait of the Scottish physician James Lind (1716-94) holding his celebrated "Treatise of the Scurvy".

arrived via York Factory. In 1848, British army pensioners were brought over with their families to defend the colony, and York's usual complement swelled to a record 1,000 people in the first part of August. Supplying food for this busy post, as well as assuring that one year's emergency rations remained on hand, put a constant drain on provisions. An already over-taxed provision stock, combined with seasonal shortages of "country provisions", could spell disaster for the post, and both HBC men and their families, as well as the natives who worked for the Company, would suffer.

Robert Ballantyne, an HBC fur trader posted at York Factory in 1843, described that post as "a monstrous blot on a swampy spot, with a partial view of the frozen sea". Mosquitoes and flies in the summer and intense cold in the winter "render the country unbearable", and the growing season was too short for grain and most vegetables. The immense swamp around the post was alive with ducks and geese in the spring and fall, and ptarmigan in the winter. The tree line had receded miles inland from this swamp due to the relentless demand for firewood and timber. It was into these woods that the traders sent the Indian women and children to gather cranberries, wild gooseberries, and wild red and black currants "for the Scorbutics which is the ease with most of us", as Humphrey Martin wrote in 1783. Either as a preserve or mixed in



with pemmican, fresh berries were recognized by the men as an integral ingredient in their diets. By the middle of the eighteenth century, the area around York Factory had not only been depleted of trees, but also of valuable furs. By the 1820s, winter food shortages had become common, and there was an increasing dependence on fish, fowl, and small game. In mild winters when the hunters were unable to track animals, or in seasons when small game, especially rabbits, were in the downswing of their rhythmic cycles, or had been depopulated from disease, over-trapping, or climatic influences, the necessary supply of "country provisions" dwindled, and the threat of scurvy escalated.

Two men died of scurvy in 1784 at York as an indirect result of the smallpox epidemic that struck that post in 1782-3. The epidemic had carried off many of the native men hired as hunters by the HBC. A shortage of hunters to procure "country provisions", combined with a shortage of partridges, contributed to the serious outbreak of scurvy that year. Such was the case as well in 1788-89 when there was almost a total disappearance of partridges and rabbits and the men were forced to live on salted provisions. This violent outbreak of scurvy, in large part due to a complete failure of "country provisions", affected both natives and traders well into July of that year. The sole cause was thought to be "the putrid unsound state of the salted provisions from England" upon which the men had relied for their survival. Joseph Colen reported that this outbreak was so serious that one of his officers acquired scurvy — "the first and only instance I have seen of an officer being afflicted", and the only instance reported in the post journals in subsequent years at York Factory. The officers' diets usually consisted of fresh foods and very little salted geese or meat, and oatmeal, whereas the labouring servants depended heavily on those prepared foods, which were, of course, devoid of Vitamin C. The "country provisions" which were in short supply during these years of scurvy outbreaks, were also almost entirely devoid of Vitamin C.

During the first third of the nineteenth century the number of yearly cases of scurvy declined considerably. The British navy had by now adopted Lind's recommendation of citrus fruits as antiscorbutics, and casks of orange and lime were regularly sent over from Europe. If scurvy appeared, as it did in the winter of 1835, then the men's regular weekly rations were changed to "only two days salt provisions, the remainder being fish, partridges, rabbits, grain, and spruce beer". Daily tablespoons (approximately 46 milligrams of Vitamin C if it was concentrated lemon juice) of a citrus juice were also part of the standard rations. In one month on this "fresh diet with the usual remedies", all symptoms of scurvy had disappeared. The following year, Hargrave, the Chief Factor at York, boasted that "even the slightest symptom of scurvy

have not yet shewn themselves", and defended the fact that salt provisions "could scarcely be the principal cause of the disease at this Place as the present Rations, consist of a large portion of that food as usual, say 3 days in the week". He was partially wrong, as salted meat contained almost no Vitamin C. But the post journal of 1836 gave no indication of any food shortages and three days of salted provisions would not be deleterious when enough fresh meat and fowl were available.

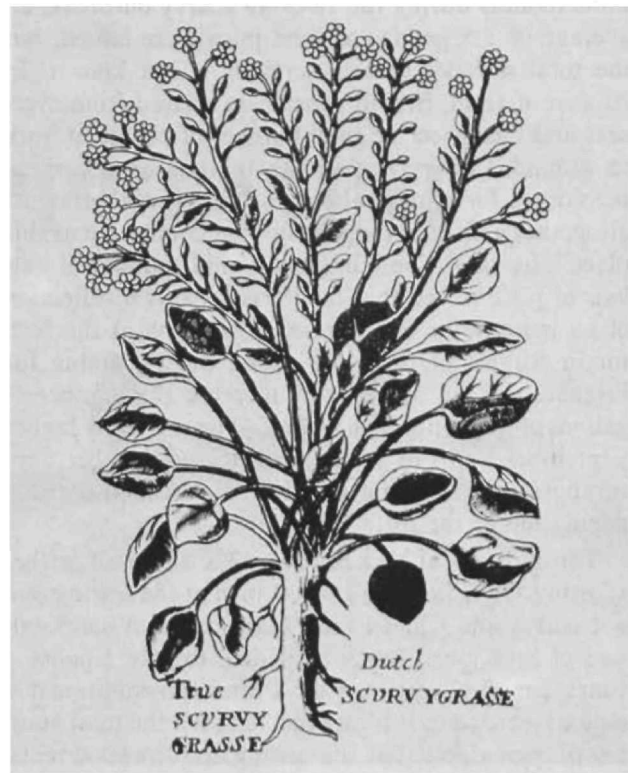
Again in 1841, deer and rabbits were scarce, and by March of that year scurvy made its expected appearance at York. Generally in the 1840s, the annual number of cases of scurvy amounted to the "usual 8-10", as Dr. Smellie of York had written in his medical journal of 1849. He was puzzled that year because York had had the biggest outbreak of scurvy on record at that post. It had lasted the entire 12 months of the year, and "scarcely one individual of the labouring servants in the establishment has been exempted", although there is no indication from the records that anyone had died. He questioned why scurvy broke out that particular year, and why it was in general so prevalent at York Factory since the diet, the climate, and the habits of the people were the same at Severn and Churchill where they had had only rare cases of scurvy. He added that there had been "a deficiency of fresh provisions and a total want of cranberries" last season, and that cranberries were the only vegetable preserve in the men's rations. But surely the difference between fresh provisions and salted provisions as a prophylactic against scurvy is of little consequence, he said, when antiscorbutics such as lime juice could be obtained. He concluded that the likely contributing factors for this epidemic were a concomitant outbreak of scurvy in 1848 in Britain, and the fact that there was "excessive indulgence in tea by the servants". Again, despite the overall havoc this scurvy outbreak caused at York, not one of the officers was reportedly affected with this disease of the labouring classes.

Explanations for the 1848-49 outbreak of scurvy at York were beyond Dr. Smellie's knowledge of the disease at that time. He was correct regarding the importance of the loss of cranberries. Usually, 10-20 bushels were collected each year, and in 1849 the HBC men were unable to "procure a single gallon". What Dr. Smellie did not realize, was that the total failure of the potato crop that particular year was just as serious a loss. Kenneth Carpenter, in his book *The History of Scurvy and Vitamin C*, maintained that potatoes, eaten regularly each day as a cheap staple food, in large part kept the population of Northern Europe free from scurvy before 1800. He also argued that the outbreak of scurvy in 1848 in Britain that Dr. Smellie thought might be related to the outbreak at York, was due to the Great Potato Famine in Britain,

Ireland, France, and Belgium from 1845-48. The loss of cranberries, potatoes, and a shortage of small game animals, all contributed to the outbreak at York in 1848-49. There was however, an additional factor which may have contributed to this outbreak; the mid-nineteenth century changeover from lemon to lime juice, which, according to Carpenter, had universal repercussions.

For centuries, scurvy had been the curse of sailors, soldiers, and adventurers around the world, all of whom depended on stored provisions for prolonged periods of time. Not until the first half of the nineteenth century was the value of lemon juice as an antiscorbutic universally recognized, and the subsequent incidence of scurvy dramatically decreased. It was unthinkable that the disease could ever become the killer it had been, but in the mid-nineteenth century the power of the disease was again realized. Thousands died in the California and Klondike gold rushes, and in the Crimean War of 1854-56. Once again, the effectiveness of citrus juices were questioned and those people who were faced with an unexplainable resurgence of scurvy, such as Dr. Smellie at York Factory in 1849, began grasping for causes — too much tea-drinking he thought, or a link to an outbreak in Britain.

The post journals from other Hudson Bay posts such as Churchill, and inland posts such as Cumberland and Edmonton, rarely mention the presence of scurvy in the eighteenth or nineteenth centuries at those establishments. The likely explanation for this is that in contrast to the Canadian Shield area around York, which was hunted out of larger game by the turn of the nineteenth century, the parkland and grassland areas inland from the Bay had a much greater abundance and diversity of food resources, and shortages of “country provisions” at the inland posts were relatively rare. In the case of Churchill, less than 8 men had to live off the land around that post, and cranberries were very abundant there. The outbreaks of scurvy at York Factory before the middle of the nineteenth century were blamed by the factors at York on the shortage of “country provisions”. Unless this wild meat was eaten in great quantities and in a raw or lightly cooked state, which is not known, it would contribute at best, only a few milligrams of Vitamin C. The fact that there was a greater dependence on fish and fowl during this time was actually advantageous. Both whitefish, which was always abundant, and ptarmigan, contained 6 milligrams of Vitamin C, whereas most wild meat, (with the exception of the liver), like English salted provisions, contained almost no Vitamin C. Scurvy was always worse in the spring months when supplies of fresh fruit and vegetables were low, and old potatoes stored since the fall had lost most of their vitamin value. Consequently, it was probably a combination of small amounts of Vitamin C in fish and



The title page of the English edition of Moellenbrok's seventeenth-century book on the virtues of scurvy grass and his illustration of the plant.

fowl, along with citrus juices and spruce beer, which cured most scurvy outbreaks before the mid-nineteenth century.

When the Royal Navy ordered daily rations of lime juice for their sailors in 1793, they did not adhere to Lind's original recommendation of boiling the fruit to a syrup. The casks of orange and lime juice sent to York were therefore not likely concentrated. The sole surviving medical journals for the years 1846-1852, give us more insight into the efficacy of citrus juices given out at York, and the number of men affected. From the provision books for the same years as the available medical journals, it was possible to compute the number of gallons of lime juice issued to the servants, per month, at York Factory. There is no mention in any of these sources that women, children, or officers contracted scurvy during this time. The lists of servants in the Northern Department in 1851-52, indicate that 44 men were stationed at York Factory. This number would remain relatively constant during the winter months, but would fluctuate in the summer and early fall when the brigades returned from inland. Dr. Smellie said that out of the 40-plus men wintering at York, he usually had 8-10 cases of scurvy per year. With the exception of 1848-49, there would have been approximately 1.5 gallons per month of lime juice issued to these 8-10 servants from October to May. For the

same months during the 1848-49 scurvy outbreak, an average of 3.5 gallons of lime juice were issued, but the total number of sick servants is not known. In August of 1848, British pensioners arrived from overseas and increased the total number of people at York to around 1,000. Dr. Smellie treated one of these pensioners for scurvy, although "the disease presents altogether a different type from that contracted at this place", he said. The relatively higher number of gallons of juice issued that month was likely a reflection of an increase in the overseas population at the fort, for in August of the other years, the in-coming fur brigades did not appreciably increase the number of gallons of lime juice being issued. The relatively higher September totals in 1848, as compared to other Septembers, can also be attributed to the increased population at the fort.

The outbreak at York in 1848-49 is worthy of further scrutiny. On 6 January 1849, 4 men at the sawing tent got scurvy and Chief Factor Hargrave sent out 3 gallons of lime juice, "each individual to take 1 ounce 4 times per day". Fifteen days later, an additional 2 gallons were sent. It is impossible to tell the total number of men affected at the sawing and firewood tents, but the medical journals indicate that between this outbreak in January until the end of August when Dr. Smellie was replaced by Dr. Wills, a total of 20 new cases of scurvy were treated. Out of these 20 new cases, 9 cases were treated at least twice. It is impossible to determine if lime juice was taken every day by those men who were repeats, but it is evident that all else being equal, the lime juice was not curative in almost half of the total cases. Scurvy did not reappear again until December of 1849. Dr. Wills' treatment consisted of a wine glass of lime juice 3 times per day, which had almost the same value as Dr. Smellie's dose of 3-4 ounces, 3 times per day. Unfortunately, the medical journals are non-existent from 1852 onward, and it is only possible to speculate that during the years 1852-54, when greater than average amounts of lime juice were being issued all year around, that the juice itself was ineffective.

The effectiveness of the citrus juices issued during the 1848-49 outbreak may have been reduced for a variety of reasons. The substitution of lime for lemon juice may have taken place by that time, but it is impossible to know as both Dr. Smellie and Dr. Wills referred to their antiscorbutic as simply "lime juice". Not only may the "lime" juice at York have contained less Vitamin C than it had in the past, but its potency may also have been reduced in the preparation technique employed, and from prolonged storage. The invoice books indicate that the citrus juices were placed on board HBC ships bound for Hudson Bay in late May or early June. The ships arrived 3-4 months later at the Bay. The juices would customarily be stored in

the provision sheds until they were needed, which meant a year or more could have elapsed from the time when they were originally prepared for shipment in Britain to when they were used at the post. Despite their knowledge of antiscorbutic remedies, all the cards were stacked against the HBC men in the 1848-49 outbreak of scurvy. Their usual remedies either failed completely, or had reduced value, their normal dietary routine had been altered, and many of the men contracted an influenza-like disease prevalent at York at that time. The disease may have been an added stressor for many individuals who may have depleted normal body stores of Vitamin C.

For the sawers, wood cutters and other labouring servants posted at York Factory, the disease was an omnipresent occupational hazard. Very few deaths occurred and on only rare occasions did the disease totally cripple the day-to-day operations at the post. Here, as in other areas of the world, the incidence of scurvy had decreased considerably in the first half of the nineteenth century. If the normal dietary routine of the trader was not broken and fresh food was available, then normal body reserves of Vitamin C would have prevented scurvy. In lean years when scurvy did occur, it was usually curtailed with spruce beer, citrus juice, and a fresher diet. The efficacy of these remedies for each episode of scurvy depended on how each remedy was prepared and ingested, and on individual body stores of the vitamin in the liver. This may account for the fact that some traders seemed immune to the disorder in spite of the fact that all their co-workers had succumbed. Those traders who had acquired liver damage from too much alcohol consumption, were much more prone to scurvy than teetotallers. With such an overall failure of fresh provisions as had occurred in 1848-49, it was very likely that additional nutritional deficiencies would also have arisen at the same time and presented a confusing array of signs and symptoms, as in the case of the British pensioners whom Dr. Smellie said had a "different type of scurvy". The classic signs and symptoms of scurvy may have been masked or augmented by other malnutrition disorders.

How mysterious and frightening this disease must have seemed to them at this time and at this place, particularly when a cure had been found, but had subsequently failed. Scurvy had made a dramatic impact on the outcome of history, both before and after appropriate remedies were adopted. ♦

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