Vitamin C, a survey of scurvy

In Shakespeare's time scurvy was a long way from being regarded as a disease of malnutrition. Like some unexplained symptoms today, it was thought to have been caused by melancholy. Indeed, the word was used to mean "sorry, worthless, contemptible" some 29 times in his plays. Shakespeare's daughter Susanna married the Stratford physician John Hall. When she was 47 she was treated by him for scurvy, the symptoms being "corruption of the gums, stinking breath, melancholy and cardiac passion". She was cured in 10 days with a potion of white wine, coral, ivory, watercress and scurvy grass. Plants featured in the remedy, but what seems logical to us today had not back then been reversed to look for a cause of the disease.

Scurvy grass or *Cochlearia officinalis* is a group of 30 or so cabbage-related plants with spoon shaped leaves and small white flowers with four petals. It often grows in coastal areas and salt marshes, where its high salt tolerance allows it to thrive. The leaves are rich in vitamin C and sailors would seek it out after long voyages. Interestingly scurvy grass has recently found a niche on roadsides where it can grow despite the salty runoff after winter gritting.

It has been calculated that in the 300 years to 1800, some 2 million sailors died of scurvy, placing it as one of the earliest occupational hazards. It was not until World War I that it became recognised as a deficiency disease, although citrus and fresh/pickled greens had been known to remedy the condition from about 1750. The administration of lime juice became compulsory in the British Navy from 1795 and British sailors were famously known as 'limeys'.

It was widely believed that Captain Scott and his tent-mates died from scurvy but Ranulph Fiennes questions this in his 2003 biography. On 15th January 1912, five men reached the South Pole (three weeks after Amundsen's party), hauling sledges with rations rigorously calculated only for four – an impulse of Scott's to take an extra man. Edgar 'Taff' Evans died a month later on the journey back, collapsing in the snow. He had been on a surveying expedition for seven weeks before the departure of the polar party so on less nutritious rations. He declined 'lightly boiled pony meat', a good source of vitamin C, and Scott wrote in his diary that a cut in Evans' hand was not healing. Vitamin C is now known to help in the healing of wounds and fractures.

Fiennes admits that it's likely that Evans died from scurvy. A month after his death, the remaining four pitched their tent just 11 miles short of One-Ton-Depot. Oates went outside into the blizzard, with that saddest of understatements 'I may be some time' and Scott, Wilson and Bowers died a few days later from hypothermia and starvation.

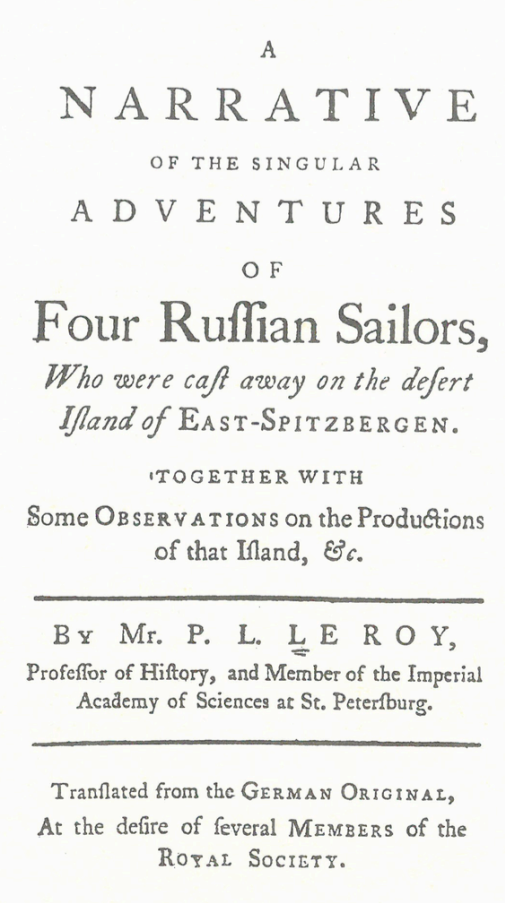
Nutritionist Kenneth Carpenter counters this, stating that Scott's notes showed that he thought food contamination was the cause of scurvy. The expedition was provisioned on pemmican and ships' biscuit with no lime juice. Fresh meat (seal, penguin etc.) was had only on the initiative of the sailors, and meat from the ponies killed by the polar party was given only to the dogs.

Scott's diary states that he had the medic Wilson hand out opium to each man a few days before the end. With the return of the sun six months later, the death tent and three bodies were found. The surgeon Atkinson reported on the tragedy and scurvy was not mentioned as a cause of death. But to do so would have been to admit to poor preparation.

A lesser-known but more remarkable scurvy story is told by David Roberts in *Shipwrecked on Top of the World*. He sets out to verify an account of four Russian walrus hunters stranded on one of the Svalbard islands when separated from their fleet in the 1740s (title page below). Amazingly, three of the four survive the six-year ordeal. The fourth – the indolent Verigin – succumbs to illness before the end of the first winter but lasts, bedridden and in agony, almost until the rescue.

They manage to fashion two spears from driftwood and flotsam nails. The four used these to kill a polar bear and, after enjoying the meat, extracted its tendons to make bowstrings to fit a bow made from a fir-root. With these weapons, they managed to survive on reindeer and fox meat until their rescue in 1749, when they were spotted by another walrus-hunting party and taken back to Archangel.

At that time, groups had been overwintering in the archipelago for many decades to protect the assets of trading enterprises such as the Noordsche Company and the Muscovy Company. The latter



A

NARRATIVE

OF THE SINGULAR

ADVENTURES

OF

Four Ruſſian Sailors,

Who were caſt away on the deſert Iſland of EAST-SPITZBERGEN.

TOGETHER WITH

Some OBSERVATIONS on the Productions of that Iſland, *&c.*

By Mr. P. L. LE ROY,

Profeſſor of Hiſtory, and Member of the Imperial Academy of Sciences at St. Peterſburg.

Tranſlated from the GERMAN ORIGINAL, At the deſire of ſeveral MEMBERS of the ROYAL SOCIETY.

hired a group of London criminals sentenced to hang and offered them a pardon if they wintered in the Company's Arctic settlement! As the sun disappeared from mid October, the men got cold feet and told their warders they would rather hang than face such a winter. They were shipped home, their sentence happily commuted.

Contemporary ideas on scurvy prevention centred on eating raw meat and blood still warm from the kill, exercise, and eating scurvy grass, again raw. Survival tales were often pious, if not puritanical in tone and saw industriousness as next to godliness, with excessive sleep certain to induce scurvy. Russian sailors engaged in knot-tying vigils, trying to postpone sleep and protect against the disease.

Nutrition expert Kenneth Carpenter points out that the chroniclers were confusing effect with cause: fatigue is one of the first symptoms of scurvy, not a character flaw that predisposes to it! So the supposedly lazy Verigin was actually first to succumb to the disease, although the three survivors do state that he refused to drink reindeer blood.

Roberts holds that although Verigin's decline was due to scurvy, his death was the result a second condition because vitamin C is water soluble, lost from the body in less than a month. And of course also destroyed by cooking, pickling etc. When Roberts travels to Edgeoya to look for the sailors' hut he tastes scurvy grass for himself, noting that it actually tastes like a vitamin C tablet!

Over the centuries hundreds of thousands fell victim to the disease. For example, Carpenter describes the ravages of scurvy in a fleet of seven ships, charged with capturing a Spanish treasure galleon in the bizarrely-named Battle of Jenkin's Ear 1740–48 (a tangent you must investigate for yourself, dear reader!).

The fleet set sail in August 1740, over a thousand men in total, including 520 on *Centurion*, their flagship. By the time they reached Brazil, sailors were already dying in scores, and when they rounded Cape Horn in April the fleet had streamlined to just four ships.

The *Centurion's* chaplain, one Richard Walter, chronicles the slow decline of the crew and publishes it as *A Voyage Round the World by George Anson, Esq* (below) in 1748. Anson was captain of the fleet and it was due to his extraordinary persistence that the treasure galleon was eventually captured.

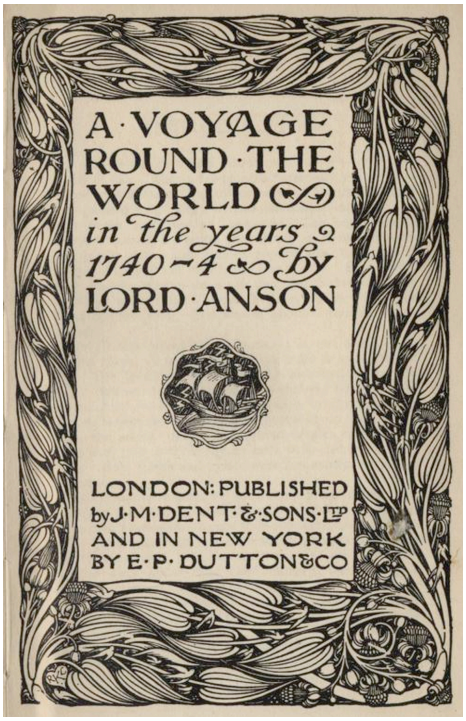
The sailors' accounts read like a scene from *Pirates of the Caribbean*. Walter describes how the sickness caused old scars to weep and bleed again. He notes – curiously – that those sailors "confined to their hammocks … were cheerful" in the face of the disease while those who attempted to get up would "drop down in an instant on any endeavours to act with their utmost vigour". In scurvy, it seems that inactivity is a survival mechanism and exercise hastens decline.

Over the next few weeks, four or five men were lost to scurvy each day and the *Centurion* had just 72 healthy sailors left by the time of their rendez-vous with the *Gloucester* on the island of Juan Fernandez. There, they found fruit and vegetables in abundance "for the cure of scorbutick disorders". Walters quoted a lieutenant:

> I could plainly observe that there is a certain *Je ne sais quoi* in the frame of the human system that cannot be renewed … without the assistance of certain earthly particles, or in plain English, the land is man's proper element, and vegetables and fruit his only physic

In September 1741 the two ships left the island and, by April the following year, scurvy had reappeared. The few survivors were transferred to the *Centurion*, which in August 1742 landed on

the Mariana Islands where they found “the only treasure which we then wanted … lemons and oranges”. Amazingly, they later managed to capture the treasure galleon even though its crew outnumbered their own by three to one (it seems that the Spaniards were less tenacious than the scurvy!). Just 145 from the thousand who left England survived the four-year journey.



Shortly after the return, Edinburgh naval surgeon James Lind was working on a ship in the English Channel on which the crew was suffering from scurvy. To find the most effective treatment he took six pairs of sailors and maintained them for 14 days on a diet that varied only in terms of the remedy under test: mustard & garlic paste, cider, vinegar, sea water, vitriol (sulphuric acid), oranges & lemons (you can see an acid theme going on here – Lind thought the disease was due to putrefaction from blocked perspiration). This was one of the first controlled trials in medicine.

The pair given oranges and lemons improved dramatically after just six days, followed by the cider pair. The experiment was the foundation of Lind’s career, but his fixation with the blocked perspiration theory meant that scurvy was still not recognised as a deficiency disease. His 1779 recommendation that officers add their unwanted citrus peel to spirits given to their men is another legacy! Ice and a slice with your gin?

Scurvy ravaged prospectors in the California gold rush. For some, disease remained latent during the crossing of the Atlantic, and they were struck down the moment activity levels increased on leaving the ship. Travelling by rail or steamer to outposts in the mid-West, the hopefuls then faced an 1800-mile wagon journey across the Rockies. Standard provisions were flour, crackers, salted beef and pork. Some families took pickles and vinegar as preventives, as well as foraging wild onions, greens and berries from along the trail. There are no records of exact numbers lost to scurvy/malnutrition, but diarists recall seeing children and adults on crutches left to die by the trail. Citrus plantations were soon established in California to support the growing population.

During World War I Dr Harriette Chick’s team in London tested the relative potencies of different anti-scorbutics on guinea-pigs, finding lemon juice the most potent, at four times the strength of lime juice. In 1932 Hungarian scientist Albert Szent-Gyorgyi published the formula for vitamin C in *Nature*, having spent several years isolating it from offal, paprika and lemons.

Harvard surgeon John Crandon deprived himself of vitamin C for 26 weeks and noted delayed wound healing, swollen hair follicles and fatigue. These findings were mirrored in an experiment on conscientious objectors in Sheffield during World War II. Two of the volunteers continued for 38 weeks without any vitamin C intake and experienced cardiac events thought to be the result of haemorrhage so the experiment was stopped. Recovery was, fortunately, instantaneous on injection of the vitamin.

With U-boat patrols in the Atlantic, homegrown food was encouraged, especially the potato in all its presentations: “Enjoy them all, including chips, Remembering that spuds don’t come in ships!” went the ditty. In the radio show *Home Front*, it was suggested that they should be cooked “in their jackets” to retain the vitamin C.

In the 1970s US scientist Linus Pauling published a number of books making semi-miraculous claims for vitamin C in large doses, namely that it would cure the common cold and also cancer. Trials were undertaken to investigate vitamin C treatment for colds and although it did not reduce the incidence of colds, it did lessen their duration by about 30%.

Vitamin C was ineffective in treating end-stage cancer but its value as an “oxygen scavenger” of free radicals, beneficial in cancer prevention, emerged around this time. Free radicals are charged (therefore unstable) particles that arise as a result of energy production, pollution, stress and sun-damage. They are thought to be one of the mechanisms involved in ageing and can oxidise LDL

cholesterol to 'harden' the arteries. But the jury is still out on the safety and efficacy of mega doses of vitamin C. Dietary intake, together with foods containing the other antioxidant vitamins (A and E) should keep you away from A&E!

Returning to the humble but pesky common cold, recent evidence shows that runners are one group who *will* benefit from supplements. In five trials totalling almost 600 very active participants (runners, skiers and military), vitamin C supplements were found to reduce the risk of succumbing to a cold by 50%. This echoes the exercise fallacy theme noted by Carpenter in his survey of historical scurvy accounts. Laziness is not a character flaw that somehow invites scurvy, but a survival adaptation.

Most cases of scurvy these days are of so-called widower scurvy, that is men over 65 who eat limited fruit and veg. Carpenter concludes that this group is protected if they cook potatoes regularly, but if they substitute bread or pasta, this protection is lost. Fortunately even the humble chip is an effective prophylactic!

Brought back from the New World by Drake and Raleigh in the late 16th century, the potato was regarded with suspicion and used as animal fodder until about 1800. Before then, bread was Britain's staple carb, dependent on a wheat crop prone to failure and a labour-intensive preparation. During the food shortages brought about by the war against the French in the 1790s, the government began to promote the potato, with editorials and recipes in *The Times*. It has been argued that the potato's high yield per acre and convenience to cook (no oven needed) fuelled the population growth of the Industrial Revolution.

Sources (for those disinclined to fresh blood): citrus, kiwis, red berries & black currants, peppers & chilli peppers, cabbage, beetroot, sweet potato, broccoli, sprouts, spinach and onions.

While potatoes don't contain a high concentration, as a staple food they remain a reliable source of the vitamin for many, even though 50% is lost in cooking.

Dry seeds and grains lack the vitamin, but when they are sprouted it begins to synthesise (Dr Koettlitz grew mustard and cress on Scott's 1901 expedition)

Important for building healthy connective tissue, bones and teeth, vitamin C also helps with the absorption of iron (conversely, tea reduces iron absorption). Lack of it causes bleeding gums, poor healing, nosebleeds, lowered resistance to infection – the syndrome that we now know as scurvy.

Sales of oranges have allegedly dropped by 30% over the last five years because we no longer have time to eat them! This and the rise of the saucepan-ready carbs rice and pasta over the time-consuming but vitamin-C-rich spud are putting scurvy back on the horizon in much the same way as modern habits are causing an increase in cases of rickets.

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Full text of *A Voyage Round the World by George Anson, Esq* available at: http://www.gutenberg.org/ebooks/47130