Cardiorespiratory symptoms of vitamin C deficiency: observations/records in the early literature

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Classical symptoms of scurvy, described in textbooks, consist of swelling of gums and poor healing of wounds, but scurvy has diverse other symptoms. This document collects early reports that are relevant when considering the potential effects of vitamin C deficiency on the cardiorespiratory system.

The following symptoms were recorded frequently in the early literature:
Dyspnea, in particular dyspnea on exertion.
Swelling and edema, in old terminology dropsy.
Irregular and weak pulse.
Such symptoms indicate cardiac and/or pulmonary sources for the symptoms.

The effects of vitamin C on the cardiorespiratory system may have relevance also currently. Meta-analyses have indicated that vitamin C supplementation can decrease the risk of atrial fibrillation in people with elevated risk [1], decrease the peak levels of cardiac enzymes during PCI and CABG [2], increase left-ventricular ejection fraction in people who have decreased levels [3], improve the endothelial function in patients with cardiovascular diseases [4], and decrease blood pressure [5]. In controlled trials vitamin C has also improved pulmonary function tests [6-8]. Severe vitamin C deficiency cannot, or at least should not [8b], be induced to humans currently because of ethical concerns, yet the early reports can indicate the potential cardiac effects of such a condition. Furthermore, severe vitamin C deficiency occurs nowadays even in the wealthy countries although it is infrequent and mostly among less well-to-do population groups.

Unfortunately, there are flaws in many reports of controlled trials [9-11], statistical analyses [12-17], and reviews [18,19] on vitamin C and the cardiac system. In addition, a Cochrane analysis of vitamin C and asthma was flawed [20,21], yet the editor-in-chief of the Cochrane Library was unwilling to correct the errors [22]. A statistical analysis of vitamin C and asthma also contained erroneous data [23].

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https://www.ncbi.nlm.nih.gov/pmc/articles/pmc4018579

8. https://doi.org/10.1186/1710-1492-10-58
https://www.ncbi.nlm.nih.gov/pmc/articles/pmc4363347

8b. https://doi.org/10.1038/s41430-022-01254-8
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12. https://doi.org/10.2146/ajhp160999

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Other recent books on scurvy

David I Harvie (2002) Limeys: The True Story of One Man's War against Ignorance, the Establishment and the Deadly Scurvy.
Book reviews:
https://www.ncbi.nlm.nih.gov/pmc/articles/pmc1124350
https://muse.jhu.edu/article/40931
https://muse.jhu.edu/article/172580
https://www.jstor.org/stable/44448080
https://www.captaincooksociety.com/remembering-cook/books/book-reviews/limeys-the-true-story-of-one-man-s-war-against-ignorance-the-establishment-and-the-deadly-scurvy-harvie-david-i-2002

Stephen R. Bown (2003) Scurvy How a Surgeon, a Mariner, and a Gentleman Solved the Greatest Medical Mystery of the Age of Sail.
https://www.stephenrbown.net/scurvy-description.php
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https://doi.org/10.1080/00822884.2023.2233764
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https://digital-commons.usnwc.edu/nwc-review/vol58/iss4/19
https://www.captaincooksociety.com/remembering-cook/books/book-reviews/scurvy-how-a-surgeon-a-mariner-and-a-gentleman-solved-the-greatest-medical-mystery-of-the-age-of-sail-bown-stephen-r-2003

Jonathan Lamb (2016) Scurvy: The Disease of Discovery.
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https://doi.org/10.23943/princeton/9780691182933.001.0001
Book reviews:
https://doi.org/10.1086/699347
https://doi.org/10.1093/shm/hkx086
https://doi.org/10.1177/0265691417747183q
https://doi.org/10.1017/S0007087417000954
https://doi.org/10.1080/1031461X.2018.1415609
https://muse.jhu.edu/article/749046
https://muse.jhu.edu/article/682384
https://slate.com/culture/2016/12/jonathan-lambs-history-of-scurvy-reviewed.html
https://worldhistoryconnected.press.uillinois.edu/14.3/br_ruediger.html
https://www.bsls.ac.uk/reviews/early-modern-and-enlightenment/jonathan-lamb-scurvy-the-disease-of-discovery
https://www.australianbookreview.com.au/abr-online/archive/2017/201-april-2017-no-390/3980-alan-atkinson-reviews-scurvy-the-disease-of-discovery-by-jonathan-lamb

https://doi.org/10.1503%2Fcmaj.160199

Hess AF. Scurvy: Past and Present (1920)

Alfred Fabian Hess may be the most important researcher on scurvy in the early part of the 20th century. There was extensive biochemical research which led to the identification of vitamin C, and to the Nobel prize for Albert Szent-Györgyi in 1937, yet Szent-Györgyi was not a committed long-term scurvy researcher.

Hess wrote a monograph about scurvy, published in 1920. This is the most informative monograph of the clinical medicine of scurvy available currently. Lind's monograph is important and he had more personal experience of scurvy. However, that text is limited by confused concepts of the origin and treatment, and therefore many parts of Lind's text has only historical interest. Carpenter's book discusses some aspects of scurvy symptoms but it is mainly focused on the history of scurvy and on the search for the treatment.

Portrait of Alfred Fabian Hess:
https://www.facebook.com/StrausHistoricalSociety/photos/a.172141832916264/2286596761470750

On the following pages are extracts/excerpt? of the monograph by Hess that are relevant about the effects of vitamin C deficiency on the cardiorespiratory system.

Hess AF. Scurvy: Past and Present (1920)
https://chla.library.cornell.edu search "Hess scurvy"
https://www.gutenberg.org/ebooks/40505
https://www.gutenberg.org/files/40505/40505-h/40505-h.htm
https://archive.org/details/b29823778/page/n4/mode/2up
https://openlibrary.org/books/OL6631267M
https://ia600505.us.archive.org/13/items/scurvypastpresen00hess/scurvypastpresen00hess_bw.pdf

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https://pubmed.ncbi.nlm.nih.gov/14368488
https://pubmed.ncbi.nlm.nih.gov/13814074
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https://doi.org/10.7326/0003-4819-10-4-558
https://doi.org/10.1001/archpedi.1934.01960100161022
https://siarchives.si.edu/collections/siris_arc_393647
https://www.jstor.org/stable/1660244
https://en.wikipedia.org/wiki/Alfred_Fabian_Hess

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https://doi.org/10.1038/107713d0
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https://doi.org/10.7326/0003-4819-98-3-431_2
https://doi.org/10.1056/NEJM192105121841908
https://www.ncbi.nlm.nih.gov/pmc/articles/pmc1353801

PREFACE

…

The World War has tended also to demand a renewed consideration of scurvy… Its incidence, however, was not limited to the military forces. Reports from England and the continental countries clearly indicate that scurvy prevailed among the civilian population during the past few years to a degree unknown in peace times. This was especially true of infants and children.

For the past seven years I have been engaged in an investigation of scurvy both in the laboratory and in the clinic, and have treated various aspects of the subject in a large number of articles published in various medical journals. In the course of these studies there has been ample opportunity for a comprehensive review of the widely-scattered literature. No treatise on scurvy has been published in English since the classical work of Lind in 1772. The time, therefore, seemed opportune to gather into one volume the recent advances in this field and to offer to the clinician, to the hygienist, and to the biological chemist a presentation of the existing status of this important nutritional disease.

…

ALFRED F. HESS.
New York,
August, 1920.

CHAPTER I: HISTORY OF SCURVY

p.1-4

It is difficult, as may be imagined, to define with precision the earliest description of scurvy, as the older references are so vague as to be open to individual interpretation… The Greek, Roman and Arabian writers do not seem to have been acquainted with scurvy. This is as we should expect, for fruits and vegetables grew in such plenty in these southern countries that scurvy must have been a disorder of rare occurrence.

…

An interesting early description of scurvy, and one which is quite convincing, is that of de Joinville, who accompanied the Crusaders in their invasion of Egypt under St. Lewis, about the middle of the thirteenth century. He refers to the lividity and spongy condition of the gums, and describes how “the barber surgeons were forced to cut away the dead flesh from

the gums to enable the people to masticate their food" he describes their debility, their tendency to faint, and the black spots on their legs…

It is probable that scurvy existed in the northern parts of Europe and Asia ever since they were settled by man. We should hardly expect to have records of this condition, in view of the low educational status of the people, their greatly restricted literature, and their lack of intercourse with the people in the southern countries. In the sixteenth century, with the development and spread of education, we begin to hear of scurvy from various sources. Claus Magnus [H1], in his "History of the Northern Nations," published in 1555 , described the disease which he tells us flourished among the soldiers in the camps and in the prisons. About this time Ronsseus, Echtius and Wierus wrote special treatises on this disease, and recommended many dietary measures which we recognize to-day as most efficacious. The number of monographs on this subject multiplied with great rapidity in the course of the next twenty-five or fifty years; none of them, however, added anything essential to our knowledge…

This period [1700s] is distinguished rather by the appearance of a great classic on Scurvy, the work of the English naval hygienist, Lind (1752). This book has intrinsic value to-day, and, at the time it appeared, served to crystallize the conception of scurvy, which had been stretched out of all proportions to include an ever-increasing conglomeration of clinical conditions. Scurvy had become the Alpha and Omega of professional routine, the catchword of the day, the asylum ignorantiæ of the practical man. Into this chaos, as Hirsch [H2] expresses it, "the first beams of light fell when Lind's classical work appeared."

[H1] Olaus Magnus (1555) Historia de gentibus septentrionalibus
https://en.wikipedia.org/wiki/A_Description_of_the_Northern_Peoples
http://runeberg.org/olmagnus
https://books.google.fi/books?id=O9lEAAAAcAAJ
https://www.avrosys.nu/prints/prints23-b-olausmagnus-intro.htm
See related:
https://doi.org/10.4000/belgeo.7677

H2. Hirsch, A.: Handbook of Geographical and Historical Pathology, London, 1885, New Sydenham Society. [Scurvy: pp.507-568]
https://archive.org/details/handbookgeograp03hirsgoog/page/507

p.10-11

Infantile Scurvy.—Glisson [H3], to whom we owe the first description of rickets, likewise was the first to recognize scurvy in infants. In his classic treatise on rickets, written in 1668, he writes as follows:

The scurvy complicated with this affect hath these signs: 1. They that labor under this affect do impatiently indure purgations; but they who are only affected with the Rachites do easily tolerate the same. 2. They are much offended with violent exercises, neither can they at all endure them. But although in this affect alone, there be a kind of slothfulness and aversation

from exercise, yet exercise doth not so manifestly, at least not altogether so manifestly hurt them, as when the scurvy is conjoyned with the Rachites. 3. Upon any concitated and vehement motion they draw not breath without much difficulty, they are vexed with diverse pains running through their joynts, and these they give warning of by theyr crying, the motion of the Pulse is frequent and unequal, and somethimes they are troubled with a Palpitation of the Heart, or threatened with a Lypothymie, which Affects are for the most part soon mitigated, or altogether appeased by laying them down to rest…

Glisson's description of scurvy was entirely lost sight of, overshadowed by his description of rickets, so that for over two hundred years no word of infantile scurvy is to be found either in the English or other literature. There is no doubt that from time to time cases must have occurred, but they were looked upon probably as rickets or as a manifestation of one of the hemorrhagic diseases.

H3. Glisson: Treatise on the Rickets, London, 1651.
https://wellcomecollection.org/works/qn24bpgf
https://quod.lib.umich.edu/e/eebo/A86032.0001.001

p.12

In 1883, Barlow [H4,H5] published his classical paper on this subject, the first to furnish anatomical proof that this disorder of infants presented the pathological changes characteristic of adult scurvy. Previous to this publication there had been but one autopsy report, that by Moeller, which had been incorrectly interpreted. The work of Barlow was accepted remarkably quickly in England and in America, but less promptly on the Continent. This was probably due to the fact that infantile scurvy was occurring far more frequently in these two countries, and that the subject was open therefore to more prompt investigation.

H4. Barlow, T.: (1) On Cases described as Acute Rickets, Med. Chir. Trans., 1883, LXVI, 159.
https://pubmed.ncbi.nlm.nih.gov/20896608
https://pubmed.ncbi.nlm.nih.gov/21031999 (reprint in 1935)

H5. Barlow, T.: (2) Infantile Scurvy and Its Relation to Rickets, Lancet, London, 1894, II, 1075.
https://doi.org/10.1016/S0140-6736(01)93995-9
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https://en.wikipedia.org/wiki/Sir_Thomas_Barlow,_1st_Baronet

p.21

That scurvy must have occurred extensively among the infants in Vienna may be gathered from the report of Erdheim [H6], who records 31 autopsies on infants under the interesting title of the “Barlow Heart.”

H6. Erdheim J. The heart in infantile scurvy [Ueber das Barlowherz; in German, translation available]. Wien Klin Wochenschr. 1918;31(49):1293-1295. https://doi.org/10.5281/zenodo.7756493

CHAPTER IV: PATHOLOGY

p.81-83

Physicians have had a general knowledge of the pathology of scurvy for a great many years. Lind [H7], in his “Treatise on the Scurvy,” published in 1772, included a chapter on “dissections” and a postscript on “Appearances on Dissections of Scorbutic Bodies,” based on a large, although indefinite, number of postmortem examinations… Tissues were being carefully studied by means of the microscope, and scurvy was subjected to this new method of investigation. As a result of intensive application of this technic, a lesion of the bones was identified and established as characteristic of scurvy. Study was focussed so exclusively on the bones, that for many years, indeed until very recently, the other organs of the body were neglected. This is true of the gross as well as of the microscopic anatomy. Protocol after protocol gives a hasty account of the appearance of the various organs, merely as a routine introduction to a careful and often minute study of the bones (Table 2). As the result of this myopic vision, enlargement of the heart, for example, which should have been noted many years ago, was, until recently, unobserved—indeed, the heart is but occasionally mentioned in the protocols.

H7. Lind. Part II: CHAPTER VII *Dissections* [see the next book]

p.83-84

Gross Pathology.—General Appearance.—The skin usually is pale, livid, and dotted with numerous petechiæ. These vary in size from the tiniest pin-points, barely recognizable to the naked eye, to ecchymoses of moderately large size. The most frequent site is the lower extremities...

Generally there is some œdema about the ankles, and in children a somewhat characteristic puffiness about the eyes. General anasarca also occurs, in some cases associated with renal involvement. Peculiar boggy, “tumor-like” masses of localized edema may be present, which were considered by the earlier writers (Lind) to be one of the typical lesions of this condition.

Hemorrhages.—Hemorrhage is such a striking manifestation that it is not surprising to find it was regarded by the older writers as the pathognomonic sign of scurvy. The bleeding may take place into almost any organ, and vary from small petechiæ to very extensive extravasations…

p.85

The blood surrounds the muscle fibres, which appear quite intact. The neighboring blood-vessels are congested and may contain thrombi, both venous and arterial. Such thrombi are found also in areas where extravasation has not taken place, and conversely, hemorrhages occur where no thrombi are demonstrable, so that a mutual causal relationship cannot be proved. Further evidence in regard to the mechanism of these extravasations is presented in the discussion of the minute anatomy. Brownish pigment, undoubtedly derived from the blood, is frequently found in the neighborhood of the hemorrhagic areas. New connective tissue also grows in these areas, so that in healing cases a marked formation of scar tissue will be found.

p.86-87

Anasarca.—This comprises the second characteristic lesion found in scurvy at necropsy and was referred to in the earliest records of the disease. In the account of his dissections Lind [H8] writes: “The breast, belly and several other parts of the body were filled with this water or serum,” mentioning also the pericardium and ventricles of the brain. He also noted that all the tissues seemed to contain an excessive amount of fluid, a condition which may be so striking that the muscles appear bathed in serum. In one of his first cases with postmortem verification, Barlow [H4,H5] described this appearance as follows: “The muscular walls of the thorax were pale yellow and watery, as though they had been bathed in serum.” In many cases this edema is most marked in the neighborhood of the hemorrhages, for example, in the muscles of the thigh when subperiosteal hemorrhage has taken place; less frequently it is produced by venous thrombosis.

Any or all of the serous cavities may be involved in this hydrops, the order of frequency being pericardium, pleuræ, peritoneum, and joint surfaces, especially the knee. The fluid is clear and straw-colored, or, in the event of secondary infection, becomes cloudy and fibrino-purulent. Later the exudate may become organized so that the entire cavity is filled with a solid mass, which binds the organs together and obliterates the cavity. The exudate may be blood-stained or apparently consist entirely of clotted blood.

H8. Lind. Part II: CHAPTER VII *Dissections*, cases N° 4, 6, 20

p.87-89

Heart.—In the protocols of most necropsies, the heart is passed over with scant mention. For example, Lind’s [H8] only statement in this regard is that “all those who died suddenly, without any visible cause of their death, had the auricles of their heart as big as one’s fist, and full of coagulated blood.” Barlow [H4,H5] accords it no attention, nor do most of the writers who immediately followed him. The first careful description of the heart is to be found in the excellent work of Schoedel and Nauwerk [H9], which contains the following record in regard to three of the five necropsies on infantile scurvy: (1) Pericardial fluid somewhat increased, both ventricles moderately dilated, the right somewhat hypertrophic. (2) The heart showed a hypertrophy of the right and left ventricles, as well as dilatation of

the right ventricle. (3) The right ventricle is dilated and slightly hypertrophied, the muscles pale and tough. There is no word of comment relative to these cardiac changes, which evidently were considered fortuitous. The same observation holds true in regard to a necropsy on an eight-year-old child reported by Ingier [H10,H11], which showed a moderate hypertrophy of the left ventricle. We look in vain, likewise, for information on the subject in the work on guinea-pig scurvy by Holst and Froelich [H12-H14], and that on scurvy in the monkey by Hart and Lessing [H15]. The first linking of cardiac enlargement with scurvy is found in a paper by Darling [H16], who described "right-sided hypertrophy and degenerative changes in the vagus and all its branches". Hess [H17] described and demonstrated by means of roentgenograms the enlarged heart in infantile scurvy. Recently Erdheim [H6], in an article entitled "Das Barlowherz," reported the occurrence of enlargement of the heart, especially of the right ventricle, in 21 out of 31 necropsies of infantile scurvy, and concluded that a direct ratio exists between the degree of enlargement and the intensity of the disorder. These reports gain added interest in view of the enlargement of the right heart so frequently encountered in beriberi, and described by Andrews in infants dying of this condition. In addition to the definite statement of Darling regarding adults, mention may be made of the observation of Aschoff and Koch [H18], that in two cases of uncomplicated scurvy there were fatty degeneration and dilatation of the heart. Fatty degeneration of the muscle is frequent, brown atrophy exceptional. Sato and Nambu [H19] also found hyperæmia and atrophy with increase of connective tissue between the muscle fibres.

The pericardial cavity contains almost invariably an increased quantity of fluid, which may be so great as to impede the heart's action. Adhesive pericarditis has been described. The cardiac valves are normal, unless previously damaged.

Lungs.—The lungs are almost always congested, but apart from this are remarkably free from abnormality. Smaller or larger hemorrhages are described occasionally, which are usually considered truly scorbutic; Andrews, however, found similar lesions in beriberi. In the necropsy of Stephen Mackenzie's case, described by Barlow [H2,H3], these small hemorrhages are stated to have resembled small red tubercles scattered throughout the lung. There may be pulmonary infarcts. Edema of the lungs is not uncommon, as we should expect, especially as a terminal condition. Pneumonia, lobular or lobar, is one of the most frequent complications and causes of death. Active tuberculosis is a not uncommon secondary manifestation.

Subserous hemorrhages are almost the rule; if infection supervenes, the pleuræ become thickened and covered with an exudate of pus and fibrin.

H9. Schoedel, J., and Nauwerk, C.: Untersuchungen ueber die Moeller-Barlow'sche, Krankheit, Jena, 1900.

H10. Ingier, A.: (1) Beitraege zur Kenntnis der Barlowschen Krankheit, Frankfurt. Ztschr. f. Path., 1913, XIV, 1. **TILAA ?**

H11. Ingier, A.: (2) A Study of Barlow's Disease Experimentally Produced in Fetal and Newborn Guinea-pigs, Jour. Exper. Med., 1915, XXI, 525.

https://doi.org/10.1084/jem.21.6.525
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H12. Holst, H., and Froelich, T.: (1) Experimental Studies Relating to Ship Beriberi and Scurvy, Jour. of Hyg., 1907, VII, 634.
https://doi.org/10.1017/s0022172400033623
https://www.ncbi.nlm.nih.gov/pmc/articles/pmc2236195

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H13. Holst, H., and Froelich, T.: (2) Ueber experimentellen Skorbut, Ztschr. f. Hyg. u. Infektionskrankh., 1912, LXXII, 1.
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H14. Holst, H., and Froelich, T.: (3) Scorbutus and its Prophylaxis, Norsk. Mag. f. Laegevidensk., 1916, LXXVII, 989.

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H16. Darling, S. T.: The Pathologic Affinities of Beriberi and Scurvy, Jour. Am. Med. Assn., 1914, LXIII, 1290.
https://doi.org/10.1001/jama.1914.02570150046011

H17. Hess, A. F.: (4) Subacute and Latent Infantile Scurvy, The Cardiorespiratory Syndrome (a New Sign), Jour. Am. Med. Assn., 1917, LXVIII, 235.
https://doi.org/10.1001/jama.1917.04270010235001

H18. Aschoff, L., and Koch, W.: Der Skorbut, Jena, 1919, Gustav Fischer.
https://openlibrary.org/books/OL25265482M

H19. Sato, T., and Nambu, K.: Zur Pathologie und Anatomie des Skorbuts, Virchow’s Arch., 1908, CXCIV, 151.
https://doi.org/10.1007/BF01998238

p.91

Liver.—The liver is frequently congested, as would be expected in view of the involvement of the right heart. Erdheim [H6] found congestion, however, in only nine among thirty-one necropsies, although enlargement of the heart was present twenty-one times. There may be

hemorrhages in the glandular tissue or under the peritoneum. “Cloudy” and fatty degenerations occur occasionally, and in some cases an early cirrhosis. Lind [H8] found abscess of the liver, and wrote that in a few instances “the matter or corruption was hardened, as it were, into a stone.”

MICROSCOPIC PATHOLOGY

p.97-100

The muscles also present a similar diverse picture of old and recent hemorrhages, pigment deposit and round-celled infiltration. Increase of connective tissue is usually found between the fibre bundles and in some cases where the hemorrhages are apparently of long standing, as evidenced by loss of contour of the red cells and pigmentation of the surrounding areas, this scar tissue formation is very marked. Changes in the muscle fibres themselves have not been encountered by all observers. Hayem [H20] describes widespread fatty degeneration and a deposit of pigment within the fibres, Leven [H21] a loss of sarcolemma, while Lasèque and Legroux [H22] found fatty changes which were equally marked in muscles showing no hemorrhage. On the other hand, Aschoff and Koch [H18], in their careful studies, did not find noteworthy fatty change of the fibres, but observed often that the fibres within the hemorrhagic areas seemed shrunken and were stained abnormally deep with eosin.

H20. Hayem, M. G.: Note sur l’Anatomie Pathologique du Scorbut, Gazette Méd. de Paris, 1871, XXVI, 126.

H21. Leven, M.: Une Épidémie de Scorbut observée a l’Hôpital Militaire d’Ivry pendant le Siège de Paris, 1871.

H22. Lasèque, Ch., and Legroux, A.: L’Épidémie de Scorbut dans les Prisons de la Seine et a l’Hôpital de la Pitié, Arch. Gén., 1871, II, 5, 680.
Biography:
https://en.wikipedia.org/wiki/Charles_Lasègue

Blood-vessels.—A similar difference of opinion obtains in regard to the changes in the walls of the blood-vessels, especially of those in hemorrhagic areas. This question is of particular interest because of its bearing on the problem of the mechanism involved in the escape of the blood. Since it has been demonstrated that neither the clotting time nor the viscosity of the blood is markedly changed in scurvy but that weakness of the vessel walls exists, as demonstrated by “the capillary resistance test,” it is natural that we should seek an explanation in the microscopic pathology of the vessels. So far no change has been found…

Hayem [H20] found fatty infiltration of the walls of the small veins and capillaries, and believed this to play an important rôle in the etiology of these bleedings. Lasèque and Legroux [H22] also found occasional fatty changes. Other authors have failed to demonstrate similar lesions, or have considered them due to postmortem change. Koch [H23] searched in

vain for “rents” in the vessel walls to account for the escape of blood. Hyaline degeneration has also been described, but is believed to result from secondary infections and not to be an intrinsic lesion of scurvy (Sato and Nambu, Aschoff and Koch).

Thrombosis of vessels is found both in the neighborhood of hemorrhage and elsewhere, the thrombi at times completely occluding the vessels and giving rise to typical wedge-shaped infarcts. The lung often shows areas of this kind.

Lungs.—Hemorrhages of various size occur in the tissue of the lung or in the air spaces. Hemorrhagic infarcts also have been described, and Sato and Nambu [H19] report hyaline degeneration of the blood-vessel walls. Secondary pneumonias, usually broncho-pneumonic in type, are of common occurrence, and in many epidemics constitute the prevailing cause of death. Tuberculous lesions are also frequently present, and are stated to assume fresh activity as the result of the nutritional disorder. Edema occurs frequently, the fluid in the acini often containing red blood-cells. Subpleural hemorrhages, thickening of the pleura, purulent or fibrinous pleurisy are common lesions.

Heart.—Although hypertrophy and dilatation of the heart have been noted by several observers, microscopic changes have rarely been recorded. Meyer [H24], and also Leven [H21], report fatty degeneration of the muscle fibres, which, however, was found by Aschoff and Koch [H18] in only one case. Sato and Nambu [H19] described an increase of connective tissue, and others anemia and pigmentation. Thickening of the pericardium and subserous hemorrhages also occur.

H23. Koch, J.: Untersuch. uber die Lokalisation d. Bakterien, etc., Zeitschr. f. Hyg., 1911, LXIX.
https://doi.org/10.1007/BF02216299

H24. Meyer, E.: Ueber Barlow’sche Krankheit, Arch. f. Kinderheilk, 1896, XX, 202.

CHAPTER V: EXPERIMENTAL SCURVY [Guinea pigs]

p.111

There is no mention whatsoever of scurvy in animals previous to 1895, when Theobald Smith [H25] wrote: “When guinea-pigs are fed with cereal (it has been observed for some years in this laboratory), with bran and oats mixed, without any grass, clover, or succulent vegetable, such as cabbage, a peculiar disease, chiefly recognizable by subcutaneous extravasations of blood, carries them off in from four to eight weeks.” Smith did not pursue the subject further.

H25. Smith, Th.: Bacilli in Swine Disease, U. S. Dept. Agric., Bureau Animal Industry, Ann. Rep. 1895–96, 172.
Biography:
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2634653

p.115-117

From time to time a doubt has been raised as to whether we should accept guinea-pig scurvy as the counterpart of human scurvy. This question can be answered only by comparing the disorder in the one species with that in the other—as to mode of production, pathology, symptomatology, means of cure and all other phenomena. Viewed from these standpoints it is found that in almost every respect the disorder is identical in man and in the guinea-pig. The outstanding distinction is the difference in the length of time elapsing before the development of symptoms. In the child or in the adult it takes about six months of the deficient diet before clinical symptoms are manifest and a diagnosis can be established; in the guinea-pig the disorder can be recognized two weeks after restricting the diet. In the one instance we seem to be dealing with a nutritional disorder which is chronic or at least subacute, and in the other with a markedly acute condition. This distinction is open, however, to certain qualifications. In the first place, we must consider the duration of life of the two species, the comparatively short span of the guinea-pig compared with that of man. It must be borne in mind, furthermore, that the guinea-pig is placed on a diet absolutely devoid of all antiscorbutic vitamine, whereas this rarely obtains in human beings. For example, the diet which is most markedly scorbutic for infants is the “malt soup” previously mentioned, but even this food contains an amount of the antiscorbutic factor which is not negligible. But after taking these differences into consideration, it is nevertheless evident that the guinea-pig is far more sensitive to scurvy than man. This does not indicate that the guinea-pig is an unsuitable experimental animal, any more than the fact that the pigeon is more susceptible to polyneuritis than man indicates that it is unsuited to investigations of beriberi. It merely prevents our carrying out delicate quantitative experiments, and cautions against drawing too finely-spun deductions. In all nutritional investigations it should never be forgotten that conclusions drawn from experiments on animals are merely provisional, and must await substantiation on man, and, furthermore, that where differences in reaction are noted, the clinical data should be accorded full consideration.

Pathogenesis of Guinea-pig Scurvy.—From a pathogenetic point of view guinea-pig scurvy and human scurvy show remarkable points in common. Any diet that leads to the development of scurvy in man likewise brings it about in the guinea-pig, and contrariwise, any food which cures the disorder has the same beneficent effect on both species. This similarity extends so far that, as will be shown in the chapter on antiscorbutics, the relative potency of the various foods is approximately the same for man and for the guinea-pig. The parallelism generally is striking. The dietary which has been commonly employed in experimental scurvy has been that first suggested by Holst and Froelich, namely, oats, hay and water.

p122-1

The Pathology.—The pathology of guinea-pig scurvy is essentially that of human scurvy…

On opening *the chest*, slight hemorrhages may be noted in the pericardium and in the visceral and costal pleuræ. The heart is frequently enlarged, and the pericardial sac contains

an excess of serum; the right ventricle, however, is not found disproportionately hypertrophied. Pneumonia is met with very frequently and constitutes a common terminal infection.

p.125

In view of the fact that many of the animals have taken very little food for some days previous to their death, it will be well to describe briefly the macroscopic picture of *simple starvation* in guinea-pigs. When guinea-pigs are given only water they live about one week; if orange juice is added to this water diet they succumb a little later to starvation. Under all these conditions the striking pathologic change—absent in scurvy—is edema. It is true that the limbs may show slight edema in scurvy, and that the pericardial and the pleural sacs, and even the peritoneal cavity, occasionally contain a small quantity of serum, but it is comparatively an insignificant amount. Moreover it is difficult to decide to what extent this edema is due to scurvy, and to what extent to starvation. In typical starvation, on the other hand, such as occurs on the limited diets enumerated above, we find marked subcutaneous edema, sometimes a true anasarca, and frequently also ascites. We are reminded of the “war edema” and its frequent association with starvation. Another distinction between the two conditions is the fact that the marrow in starvation is yellow and not red as in scurvy. In passing, it may be mentioned that the ascites was greater when orange juice had been given than where the animal received only water.

p.128

Microscopic Pathology.—Turning to the microscopic pathology, we find that the changes are similar to those described elsewhere in connection with human scurvy…

p.131-133

… All investigators have found a degeneration of the muscles, showing a loss of their striations, swelling of the fibres, and the presence of irregularly-distributed vacuoles and granules. The interstitial tissue frequently is permeated with edema, as we should expect from gross appearances. Holst and Froelich [H12] have reported a fatty degeneration of the heart muscle, as well as of the epithelium of the mucous membrane of the glands of the stomach and of the intestine. Hart and Lessing [H15], in their protocols of necropsies on monkeys, describe an interesting lesion associated with the degenerated muscle fibres—a collection of granules staining deep blue with hæmatoxylin and dissolving on the addition of acid. These granules, interpreted as being composed of calcium, were found in the muscles of the limbs, of the tongue, and in the heart. It is reasonable to attribute their formation to an absorption of bone throughout the body.

In the study by Jackson and Moore [H26] on experimental scurvy in guinea-pigs, the histology of the blood-vessels is carefully considered. “Marked thinning of the wall” was found and depicted; “the wall as a whole had partially melted away, leaving few traces.”

H26. Jackson, L., and Moore, J. J.: Studies of Experimental Scurvy in Guinea-pigs, Jour. Infect. Dis., 1916, XIX, 478.
https://doi.org/10.1093/infdis/19.3.478
https://www.jstor.org/stable/30080346

p.135-136

Symptoms.—Let us consider the symptomatology of guinea-pig scurvy. In the course of an observation of many hundreds of animals we have been struck by the striking uniformity of the signs and symptoms…

There is a variability in the sign which signalizes the onset of the disorder—sometimes it consists of a flattening of the weight curve, at others of an inordinate excitability of the animal, or frequently of a tender joint, generally a wrist. The joints almost invariably become tender early in the disease, causing the animal to wince and cry when it is examined. Accompanying this tenderness there is often slight swelling due to edema, or perhaps some hemorrhage, which alters the sharp, clean-cut contour of the joint. This edema may extend upward along the tendon sheaths. Soon the animal becomes lethargic rather than nervously active, and may look ill, as manifested by a roughness of its coat and its unnatural posture… hemorrhages into the muscles are noted, especially of the leg or of the thigh,

CHAPTER VII: SYMPTOMATOLOGY AND DIAGNOSIS

p.176-180

Adult Scurvy.—The earliest sign of scurvy is usually a change in the complexion of the individual. His color becomes sallow or muddy, an aspect difficult to describe, but one which is characteristic, and constitutes an important danger signal to the eye of the experienced physician. About the same time the patient loses his accustomed vigor, seemingly becomes indolent and complains of tiring quickly, and of breathlessness. He may experience fleeting pains in the joints and limbs, especially in the legs, symptoms which are frequently attributed to rheumatism. At this early stage the appetite may still be normal, there is usually no loss in weight, but merely a general malaise which is significant, although in no way distinctive. Very soon the gums become sore, bleed readily, and are found to be congested, spongy, and somewhat hemorrhagic at their edges. Absolute reliance must not, however, be placed on this sign for early diagnosis, as at times it does not appear until later. Careful examination at this stage will disclose petechial spots on the body, more especially on the legs, at the site of the hair follicles, or even larger ecchymoses, depending upon the hemorrhagic tendency of the individual, his exposure to bruising, the adequacy of his diet, and secondary infection. Less frequently bleeding from the nose occurs early, or the eyelid suddenly becomes swollen and purple, or the urine shows the presence of blood.

These signs progress steadily with a varying degree of rapidity. The complexion becomes more dingy and somewhat brownish, the weakness increases so that the slightest exertion causes breathlessness and palpitation, and the gums become spongy and even fungous. If there is infection of the gums and the teeth are carious, the breath is extremely foul—a sign

long associated with scurvy. Later the teeth become loose and may fall out, and the alveolar process undergoes necrosis. The surface hemorrhages increase in severity, large effusions appearing on the trunk, on the extremities, and less often beneath the mucous membrane of the mouth. A bloody diarrhœa may take the place of the constipation which is generally noted earlier in the disease. There are at this time hemorrhages into the muscles and deeper tissues, especially into the calves of the legs, giving rise to hard, brawny, tender swellings which have been termed “scurvy sclerosis.” This is sometimes the earliest sign noted by the patient and may puzzle the physician who has not met with it before. The swelling may be found in the popliteal space or at the site of the tendo Achilles, and result in lameness and contracture of the neighboring joint. Frequently there is slight edema of the ankles associated with a glossiness of the extensor surfaces of the legs. This infiltration differs from ordinary edema in being firm and not pitting on pressure. The skin is dry and rough, the follicles being unusually elevated;46 the hair likewise is dry and loses its lustre. Not infrequently subperiosteal hemorrhages occur, giving rise to exquisitely tender swellings, especially of the tibia or of the femur, or of the ramus of the lower jaw, as has been noted in connection with guinea-pig scurvy. If there are wounds or ulcers they assume a hemorrhagic aspect, the edges becoming bluish or livid and showing no tendency to heal; even scars which have existed for many years change in color and show an altered state of nutrition, and ulcers long healed break out afresh.

Nowadays, the disease usually does not reach this stage, and rarely progresses further. If, however, the patient remains untreated, he becomes progressively weaker and more lethargic; there is frequent palpitation, shortness of breath, and increasing loss of weight. The pains in the limbs render him helpless and an object of pity. Marked edema may be added to the picture as the result of starvation, so that the legs become swollen, and even the face becomes bloated. Hemorrhages into the skin as large as the palm of the hand appear on different parts of the body. The gums swell to such an extent that they overlap and may even hide the teeth and protrude from the mouth as foul fungoid growth. Death comes about in various ways. Frequently sudden and fatal syncope occurs, due to heart weakness or to the pouring out of fluid into the pleural or the pericardial cavities. Another frequent cause of death is secondary infection, resulting in pneumonia, which finally ends the suffering of the patient. The fatal outcome is thus described in the narrative of Lord Anson’s voyage [H27]:

Many of our people, though confined to their hammocks, ate and drank heartily, were cheerful, and talked with much seeming vigor, and in a loud, strong tone of voice; and yet, on their being the least moved, though it was only from one part of the ship to another, and that in their hammocks, they have immediately expired; and others, who have confided in their seeming strength, and have resolved to get out of their hammocks, have died before they could well reach the deck. And it was no uncommon thing for those who could do some kind of duty, and walk the deck, to drop down dead in an instant, on any endeavor to act with their utmost vigor; many of our people having perished in this manner during the course of this voyage.

The disease may develop and progress in various ways. It may remain latent for a long period and be cured by some accidental change of diet, or, as more frequently occurs, it runs a moderately acute course, and is promptly cured by means of antiscorbutics. In the days when scurvy was common and widespread it sometimes became chronic, developing into the “inveterate scurvy” of the older authors, which was notably resistant to treatment. Harvey

[H28], in his treatise published in 1685, states that “a mild scurvy may continue or be protracted to ten, twenty, or thirty years.”

H27. Anson, Lord: Walter and Robins, Voyage Round the World, London, 1848.
https://archive.org/details/voyageroundworld00walt
https://www.gutenberg.org/ebooks/16611
https://www.gutenberg.org/files/16611/16611-h/16611-h.htm
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See Lind’s PART III: CHAPTER I, year 1748
https://doi.org/10.2307/4053467
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https://www.publishersweekly.com/9780670891979
https://www.ncbi.nlm.nih.gov/pmc/articles/pmc9662994
https://archive.org/details/prizeofalloceans0000will_o5i8
https://en.wikipedia.org/wiki/George_Anson%27s_voyage_around_the_world
https://www.historyireland.com/an-island-of-cosmopolitan-culture-ansons-voyage-round-the-world-and-the-library-at-bowens-court-co-cork

H28. Harvey, G.: A New Discourse of the Smallpox and Malignant Fevers with an Exact Discovery of the Scurvy, London, 1685.
https://name.umdl.umich.edu/A43016.0001.001
https://wellcomecollection.org/works/ee8fvrhh

p. 181-182

The pulse is sometimes slow and feeble, having been recorded as low as 40 beats per minute, but more frequently is rapid, in the neighborhood of 140. It is, however, almost invariably unduly excited by emotion or by mild physical activity. Frequently there is a low type of fever, which has been termed “scorbutic fever,” but which probably should be regarded as a complication of the disease rather than as an intrinsic symptom.

The urine is apt to be scanty, becoming much more profuse following treatment. Perspiration is also retarded.

Pericarditis, hydrothorax, pleurisy with effusion, pneumonia, are common complications of severe forms of scurvy. Lind reports that the dominant complication varies in different epidemics; that on one cruise many cases of diarrhœa would occur and on another many pulmonary infections.

p.183-187

Infantile Scurvy.—The stereotyped picture of infantile scurvy and the one which this term commonly suggests, is that of the acute form of the disease. In *acute infantile scurvy* we have to do generally with a poorly-nourished, pale infant with a peculiarly alert and worried expression. As we approach its bed it whimpers or cries out in terror. Frequently its posture

is characteristic, as it lies quietly on its back with one thigh everted and flexed on the abdomen. Examination shows that one or even both thighs are swollen and exquisitely tender, or that there is merely tenderness, the baby shrieking at the slightest pressure upon the lower end of the femur. If teeth are present, the adjacent gums are red, swollen and bleed readily. This is the syndrome which the medical student is taught to carry away to guide him in his everyday practice. It is the acute, florid type, and presents a striking picture, but must not be regarded as the common form of the disorder. If we are to diagnose infantile scurvy early and not overlook its more subtle manifestations, the classic textbook description must be augmented by portrayals of types of the disorder which are less crude and more difficult to recognize—of "subacute" and of "latent" scurvy.

The commoner form, which we have termed "*subacute infantile scurvy*," comprises a large number of symptoms which are inconclusive individually, and frequently escape correct interpretation. The affected baby is usually in the second half of the first year of life, and does not gain in weight or gains but slightly for weeks. It may be fairly well nourished, but is pale or sallow, with perhaps slight edema of the upper eyelids. The mother or nurse complains that the child is irritable and peevish, and that the appetite is poor or capricious. The gums show a lividity or slight peridental hemorrhage, which on subsequent examination may be no longer visible, and may have consisted merely of a rim of crimson edging the borders of the upper gum, perhaps behind an upper incisor, as Still pointed out. On closer examination it may be observed that the papillæ of the tip of the tongue are markedly congested, and that a petechial spot is to be seen on its frenum, on the palpebral conjunctiva, or here and there on the surface of the body, more especially where there are erosions, eczema or other skin lesions. Attention may be called to tenderness of the lower thighs, which in some instances is definite, in others so ill-defined and fleeting that it is impossible to convince oneself of its significance or even reality. There may be slight edema over the crests of the tibia, of a kind which does not pit on pressure. The knee-jerks are almost always markedly exaggerated. The urine is diminished in volume but is generally normal or contains a trace of albumen and red and white blood-cells. The pulse is frequently rapid, and becomes markedly rapid and irregular on the slightest excitement. The respirations are also rapid (Fig. 15).

These symptoms do not constitute a rigid entity, but are subject to manifold variations…

An instance of subacute scurvy, which in many respects is typical, is the following:

I. F., girl, was seen when 3 months old… Accompanying this lack of gain in weight there were many of the other symptoms enumerated above; irritability, pallor, slight tenderness of the lower ends of the femora, albumin and a few red and white cells in the urine. The pulse- or heart-beat was frequently over 150, and the respiration 60 (Fig. 15). The diagnosis of subacute scurvy was substantiated by the prompt subsidence of all symptoms when orange juice was administered.

Infantile scurvy may be dormant for a long time. The diagnosis of latent scurvy is based mainly on the reaction to specific therapy, on the marked improvement when orange juice, tomato, potato or other antiscorbutic food is given. The symptoms themselves are suggestive, and do not enable an absolute diagnosis to be made.

… the history of a diet of heated milk, especially if the quantity was not large, considered in conjunction with the pallor and poor appetite, the increased knee-jerks, and perhaps a rapid pulse and respiration (the cardiorespiratory syndrome), has awakened suspicion. Orange juice or canned tomato, prescribed in such cases with a view to diagnosis as well as to treatment, frequently brings about a magic result.

p.188-189

When scurvy goes unrecognized or untreated for a long time, or the antiscorbutic content of the food is exceptionally small, or the patient unusually susceptible, the disorder may progress and resemble the advanced cases described in connection with the adult type of this disease. Happily such instances are rare. One of the most typical and vivid descriptions of *an extreme case* of infantile scurvy is that reported by Vincent [H29]:

The infant lay in its bed extremely apathetic and barely conscious. Its face was ashy gray in color, the respirations were extremely frequent, the pulse-rate was 144 per minute, and the temperature 103.2°. When touched it moaned feebly, and made no attempt at movement. The mouth was kept open, the lower jaw hanging away from the face. There was a complete absence of muscular tone, so that the infant appeared to be quite incapable of voluntary movement.

…

The baby was given large amounts of lemon juice and subcutaneous injections of salt solution and the necrosing surfaces of the gums were scraped and swabbed with boracic solution. By the third day the pulse was 100, the temperature 99.8°, the odor from the mouth scarcely noticeable, and the general condition distinctly improved. It continued to improve and to gain in weight and when seen at the end of the sixth week of treatment it was doing well and was quite happy.

H29. Vincent, R.: The Nutrition of the Infant, New York, 1904, Wm. Wood & Co.

p.193-194

As mentioned above, hemorrhages into the muscles or between the muscle planes are very common in adults, leading to hard swellings, the typical “scurvy sclerosis.” Such effusions occur much less frequently in infants, due probably to their lack of activity. In addition to these hemorrhages there are serous effusions of the muscles similar to those which are found in the pleural and pericardial cavities. These effusions are very striking at necropsy, when one incises the muscles—for example, the muscles of the thigh. During life they are frequently mistaken for subperiosteal hemorrhages.

Less frequently there are hemorrhages into the internal organs. These, however, play a comparatively insignificant rôle in the symptomatology of this disease. At postmortem examination we find numerous hemorrhages of the pleura, pericardium and peritoneum, which rarely produce symptoms during life… Hæmothorax and hæmopericardium occur…

p.195-197

…

A case of this kind is the following:

M. L., seven months old, was getting “Molkenadaptierte” milk, and in addition autolyzed yeast. On May 25th it developed nasal diphtheria, but soon afterward did well. On June 9th it was gaining, but its pulse was 160 and respirations 80. A few days later it developed marked eczema about the neck and to a less extent on the back and buttocks. The “capillary resistance test” was negative. Cardiographic tracings showed merely a simple tachycardia. A few days later petechial spots appeared at the site of the eczema. On June 17th orange juice was given. The appetite improved, the cardiorespiratory syndrome disappeared, and the child began to gain. The eczema also cleared up rapidly without any local treatment.

As is well known, *edema* constitutes a not infrequent symptom of adult scurvy. It has not, however, been accorded any place in the symptomatology of infantile scurvy. We do not refer to the edema in connection with subperiosteal hemorrhage or separation of the epiphyses of the long bones, but a mild and peculiar form which is seen early in the disease. It involves most regularly the upper eyelids, and the legs—especially the skin covering the lower part of the tibiæ. In the latter site it differs from edema as usually encountered, in that it does not pit on pressure; it is firm, tense, causing some glossiness of the overlying skin, which is rendered difficult to wrinkle or to pinch between the fingers. Not infrequently the skin is slightly reddened, a sign of interest, in view of a similar, although much more intense, hyperæmia seen in pellagra.

In addition to this very mild edema there may be marked swelling, resulting in what might be called, following the terminology of beriberi, “wet scurvy.” The legs, body and even the face may be swollen. This has been frequently described in adult scurvy, and occasionally in infantile scurvy. The first case of infantile scurvy described in America, that of Northrup [H30], had marked edema of the scrotum. Edema is frequently met with in “ship beriberi,” a disorder considered by some writers to be a combination of beriberi and scurvy.

The symptom leading to the diagnosis of scurvy most often is *tenderness* or swelling of one of the extremities, as the antecedent clinical signs, comprising latent scurvy, are generally overlooked. These manifestations involve usually the distal end of the thigh or thighs…

H30. Northrup, W. P.: Scorbutus in Infants, Arch. of Pediat., 1892, IX, 1.
https://babel.hathitrust.org/cgi/pt?id=uva.3470143072&seq=13

A related publication:
https://resource.nlm.nih.gov/101747078 (1894)
https://collections.nlm.nih.gov/catalog/nlm:nlmuid-101747078-bk

p.199-202

The cardiovascular system has been given but scant attention in connection with scurvy. Adults complain not infrequently of palpitation and pain over the pericardium, or rather of a

tightness or oppression in the chest. Little information is given regarding the size of the heart. Darling [H16] described enlargement of the heart, especially a right-sided hypertrophy, which he thought was pathognomonic of the Rand type of scurvy. The pulse is described in some cases as slow, and in others as rapid. In descriptions of infantile scurvy the entire subject is generally passed over without mention—for example, in the excellent report of the American Pediatric Society [H31] nothing whatsoever is stated regarding the heart's action or the pulse. Barlow [H4,H5] wrote: "There is nothing to note regarding the heart and lungs."

In a paper written a few years ago, it was pointed out by the author that there is frequently enlargement of the heart, and more especially of the right heart [H17]. This can be elicited at the bedside and has been substantiated in numerous cases by means of the Röntgen-ray, which demonstrates not only enlargement of the heart, but also a marked broadening at its base, at the site of the large vessels. These phenomena resemble closely the description of Reinhard in cases of beriberi.

Necropsy protocols usually are incomplete and unsatisfactory in their descriptions of the heart. The excellent monograph of Schoedel and Nauwerk [H9], however, which reports five careful necropsies, contains the following data regarding three:

1. Pericardial fluid somewhat increased, both ventricles moderately dilated, the right somewhat hypertrophic.

2. The heart showed a hypertrophy of the right and left ventricles, as well as dilatation of the right ventricle.

3. The right ventricle dilated and slightly hypertrophied, the muscles pale and tough.

In addition to this enlargement of the heart, or perhaps associated with it, there is a combination of signs which has been termed "*the cardiorespiratory syndrome*" (Hess [H17]). It will be noted in the above description of a case of subacute scurvy, that the pulse- or heart-beat was frequently over 150, and the respiration 60. These phenomena were noted in several instances before their significance and intimate relationship to scurvy were realized. The heart-beat not infrequently is found to be 200 per minute, and to be characterized by marked lability—increasing to an astonishing degree as the result of slight exertion or excitement. A mild febrile disturbance causing a rise of temperature to little more than 100° F. will send the pulse-rate up 30 beats. It must not be thought that this refers to severe cases; the babies we have in mind are similar to the one cited as an instance of subacute scurvy. Apparently they are not ill, but show merely some tenderness of the thighs, pallor, and the other minor signs described. The cardiographic tracings showed a simple tachycardia with an exceptionally tall T-wave in some tracings, such as is commonly seen in exophthalmic goitre (Fig. 22).

The rapidity of respirations is perhaps a more delicate indicator of this disturbance than the pulse and has been found to be markedly affected when the latter was merely slightly increased in rate. For example, in one instance the respirations were 64, 60 and 64 on three successive days, while the pulse was 124, 141 and 136; in other words, there was a 2:1 instead of the normal 4:1 pulse-respiration ratio. The accompanying chart illustrates the phenomenon in all its details better than a verbal description. There is one point in connection with it, to which especial attention should be called. This is a reaction evident at

a glance at the chart—the sharp drop in the pulse and in the respiratory rate when orange juice was given. It is the essence of the phenomenon; a therapeutic response which proves that the rapidity is scorbutic in nature.

The main involvement of the *respiratory system* in scurvy is the polypnœa just described in connection with the cardiorespiratory syndrome. There is no aphonia, a sign so typical of adult and of infantile beriberi, although at times the voice is abnormal and whining. The lungs frequently show some dullness posteriorly, which may be due to engorgement or to the pressure of the enlarged heart. Pneumonia is a frequent complication and edema a terminal event. Hydrothorax associated with hydropericardium is of frequent occurrence, and was noted in the early description of this disease in adults and in the first account of Barlow. These effusions rarely progress to what may be termed the clinical degree and under antiscorbutic treatment are rapidly absorbed.

It is commonly thought that scurvy does not involve *the nervous system*; that this is a feature which distinguishes it sharply from beriberi, another "deficiency disease." This view is incorrect, for the nervous system is probably affected in many cases of scurvy. The rapidity and lability of the pulse, combined with the rapid respirations, would seem to be due to a disturbance of the vagus mechanism…

H31. American Pediatric Society: Collective Investigation on Infantile Scurvy in North America, Arch. of Ped., 1898, XV, 481.
Related publications:
https://doi.org/10.1056/NEJM189806301382601
https://doi.org/10.1136/bmj.2.1967.750

p.203-206

In view of many of these symptoms, especially those involving the vagus, scurvy must be looked upon as a disorder which may seriously affect the nervous system. Furthermore, when we note the marked reaction brought about by the antiscorbutic vitamine—for example, the sharp fall in the rate of respirations and of pulse, as shown in Fig. 15, after giving orange juice, we must conclude that the antiscorbutic vitamine functions, at least indirectly as an antineuritic vitamine—that it must possess this character to allay the various nervous signs of this disorder.

The urinary system is frequently involved in the course of scurvy… Oliguria is a common symptom of both adult and infantile scurvy. Lind [H32] mentioned this symptom, and in this connection remarks on the beneficent effect of antiscorbutic treatment. Charpentier [H29] called attention to the fact that in a case of scurvy the urine decreased from 1250 g. to 800 g. The report of the American Pediatric Society [H31] mentions scanty urine in 9 cases and suppression of urine in one. This sign, however, was not emphasized until recently, when Gerstenberger [H33], and Hess and Unger [H??] drew attention to its frequent occurrence in infants. It has some diagnostic significance and should be borne in mind where a decreased excretion of urine is reported. A counterpart of this symptom is the sudden outpouring of urine frequently noted after antiscorbutic treatment has been instituted. This polyuria

accounts for the loss of weight or lack of gain which sometimes accompanies unmistakable general improvement, and which is difficult otherwise to understand (Fig. 23). I

H28. look for Lind

H29. Charpentier, P.: Étude sur le Scorbut, Paris, 1871, A. Delahaye.

H30. Gerstenberger, H. J.: Pathogenesis of Infantile Scurvy, an Hypothesis, Am. Jour. Med. Sci., 1918, CLV, 253.

H31. Hess, A. F., and Unger, L. J.: (9) Scorbutic Beading of the Ribs, Am. Jour. Dis. Child., 1920, XIX, 331.
https://doi.org/10.1001/archpedi.1920.01910230001001

p.209

Scurvy is associated with an alteration of both *the blood and the blood-vessels*. The characteristic pallor, which is one of the most common as well as earliest symptoms, is due in a large measure to the anemia…

p.212-213

The investigation was directed to a study of the integrity of the blood-vessels in order to account for the hemorrhages. To this end the “capillary resistance test” was devised. In the majority of cases this was found to be “positive” (the blood-vessels showing an increased permeability) and to become negative when antiscorbutics were given and the symptoms disappeared. This shows that the cellular structure of the vessels is altered in the course of scurvy, and indicates probably that this is an important cause of the hemorrhages. The edema of the face and ankles, the outflow of serum into the body cavities and into the muscles (Barlow) must be regarded as other evidences of the inadequacy of the vessel walls. The tendency of children with exudative diathesis to develop scurvy is perhaps still another manifestation of vascular weakness. This point of view has been strengthened recently by the pathological studies of Aschoff and Koch [H18], who regard scurvy as a nutritional disorder in which there is a lack of some colloidal substance needed for the normal structure of the vessels.

p.216

Fever.—Fever frequently accompanies scurvy. It is generally of a low grade, ranging between 100° and 101°, as may be seen in Fig. 15. There is a difference of opinion as to whether the rise of temperature should be considered as truly scorbutic in nature, as “scorbutic fever,” or regarded merely as a condition grafted upon the nutritional disturbance. A phenomenon which might seem to argue for its essential scorbutic character is the sharp subsidence on giving antiscorbutic food…

DIAGNOSIS

p.219

It has been our experience that medical students who were conversant with scurvy from a theoretical standpoint failed to diagnose a case presented to them in the clinic. Where diagnosis is uncertain, the most important aid is an exact knowledge of the previous diet, and observation of the reaction of the patient to antiscorbutic treatment.

p.221-222

We have thus far had in mind frank and outspoken cases of scurvy. When we come to consider latent or early cases, the diagnosis is more difficult and may have to be merely tentative. All that need be added, in view of the clinical picture sketched above, is that this condition should not be forgotten in treating adults who have malaise and indefinite “rheumatic” pains and, more particularly, in relation to infants who fail to gain, whose appetite is capricious, whose disposition has become fretful and who have developed the sallow scorbutic complexion.

p.224

The most important consideration in the diagnosis of scurvy is to keep in mind the heterogeneous character of its symptoms, and the manifold diseases with which it may be confused. Surgeons should be alert to this danger when about to perform operations for osteomyelitis or bone tumor. The mistakes occur because cases are infrequently seen and because the signs, being dependent largely upon hemorrhage, occur in such varied locations of the body. Where diagnosis cannot be made from the signs or symptoms, the most important aid is a thorough acquaintance with the previous diet of the individual and observation of his reaction to antiscorbutic treatment.

CHAPTER VIII: PROGNOSIS

p.227

In adults the heart may be weakened by scurvy, and death may result from cardiac failure. Cardiac disturbances occur also in infantile scurvy. This involvement might be expected, in view of the tachycardia (cardiorespiratory phenomenon) which is so frequent a symptom of infantile scurvy. The heart may be rapid for months or even for years after the disorder, and tachycardia may develop on the occasion of even a mild infectious disease. For example, a fever of 101°, due to a common coryza, may cause the heart-beat to rise to perhaps 180 a minute. Children so affected succumb readily to infection, especially to pneumonia, which may lead to sudden collapse followed by death.

CHAPTER IX: TREATMENT

p.236-237

Cure.—There is almost nothing in the realm of therapy which is so striking as a scorbutic patient’s prompt reaction to antiscorbutic treatment. It is all the more marvelous as the cure

is effected by means of foodstuffs with which we are accustomed to associate no specific virtue. A magic result is seen frequently within 24 or 48 hours. A baby which has had a poor appetite, has been irritable and exquisitely tender, suddenly regains its appetite, is no longer fretful, and can be handled without occasioning crying. Within a week, if the case is mild, all definite symptoms of scurvy may have disappeared, and soon thereafter the infant is thriving and apparently cured…

In most instances a gain of weight accompanies improvement. In not a few instances, however, there is a temporary loss or cessation of weight, due in part to an increased excretion of urine…

p.239-240

Non-dietetic Therapy.—There is little to be done for the patient in addition to the giving of sufficient antiscorbutic. No one has reported success with any drug…

The patient should be kept in bed, and exertion not allowed on account of the involvement of the heart, which has led to sudden collapse and death.

CHAPTER XI. RELATION OF SCURVY TO OTHER DISEASES

p.249-250

Although at first thought *beriberi* and scurvy would seem far apart from a clinical point of view, they have some important features in common. In both there is a tendency to a rapidity of the heart's action and a marked lability of the pulse, to an enlargement of the cardiac ventricles, to an involvement of the vagus, and to an exaggeration of the deep reflexes. It is unnecessary to describe these signs and symptoms in detail, as they have been fully considered under symptomatology. It has been recorded from time to time that under certain circumstances scurvy has developed in man where one should have expected beriberi, and *vice versa*. Darling [H16], who has had a large experience in this field, writes: "A deficient dietary in a tropical African negro mine laborer causes severe scurvy, in a Cape Colony African mine laborer, mild scurvy, and in some African negroes a diet that causes scurvy in one set of men causes neuritis in others." Possibly some minor differences in the dietary can explain this difference in reaction—for we do not know all the sources of the water-soluble vitamine, but such an experience deserves to be cited as it is not an isolated instance. It is all the more worthy of attention because it harmonizes to a certain extent with the everyday experience of animal investigation. As has been stated elsewhere, a diet of decorticated grain will lead to scurvy in the guinea-pig, to polyneuritis in the pigeon, and to a combination of these diseases in the hog! Results of this kind show that there must be a relationship between the etiologic factors of scurvy and of beriberi. It is unwise at present to attempt to define the relationship more precisely. The remarkable observation, first made by Fuerst, and since confirmed by numerous investigators, that seeds and legumes are devoid of antiscorbutic potency but acquire this power on sprouting, constitutes another link in the evidence of their kinship. Funk [H32,H33] has suggested that the antiscorbutic vitamine can be formed from the "antineuritic" vitamine, a theory which is very attractive but needs confirmation and experimental proof. It is quite evident that this change does not usually occur in animals, in

view of the specificity of the vitamines for their respective diseases—of the antiscorbutic for scurvy and the water-soluble for beriberi.

H32??. Funk, C.: (1) On the Chemical Nature of the Substance which Cures Polyneuritis in Birds, Jour. Physiol., 1911, XLIII, 395.

H33??. Funk, C.: (2) Die Vitamine, Wiesbaden, 1914, J. F. Bergman.
Related documents:
https://doi.org/10.1159/000319165
https://www.jstor.org/stable/45202920
https://pubmed.ncbi.nlm.nih.gov/1095967
https://pubmed.ncbi.nlm.nih.gov/4560436
https://pubmed.ncbi.nlm.nih.gov/13974893
https://pubmed.ncbi.nlm.nih.gov/23798048
https://www.researchgate.net/publication/46095638
https://en.wikipedia.org/wiki/Casimir_Funk

Lind J. A Treatise of the Scurvy in Three Parts (1753/1757/1772)

James Lind appears to be the most important researcher on scurvy in the early history, and perhaps over all times. He was working certain periods in ships where scurvy appeared and in Haslar hospital in which he treated large numbers of scurvy patients.

Lind wrote a monograph about scurvy, published in 1753 (1st ed), 1757 (2nd ed) and 1772 (3rd ed). In 1953, as a bicentenary volume, the 1st edition was reprinted with modern fonts (Edinburg at the University Press).

Portrait of James Lind:
https://en.wikipedia.org/wiki/James_Lind#/media/File:James_Lind_by_Chalmers.jpg
https://jameslindlibrary.org/wp-data/themes/jameslind/images/lind-portrait.jpg
https://www.rcpjournals.org/content/clinmedicine/19/1/22/F1.large.jpg

Hess' comments about Lind's treatise (the previous book, p.3-4)

> This period [of 1700s] is distinguished rather by the appearance of a great classic on Scurvy, the work of the English naval hygienist, Lind (1752). This book has intrinsic value to-day, and, at the time it appeared, served to crystallize the conception of scurvy, which had been stretched out of all proportions to include an ever-increasing conglomeration of clinical conditions. Scurvy had become the Alpha and Omega of professional routine, the catchword of the day, the asylum ignorantiæ of the practical man. Into this chaos, as Hirsch [H2] expresses it, "the first beams of light fell when Lind's classical work appeared."

Carpenter's comments about Lind's treatise (the third book, p.54-57)

> In 1748, Lind left the Navy, returned to Edinburgh, and was granted the Doctor of Medicine degree and a license to practice as a physician, and in 1750 was elected a Fellow of Edinburgh's Royal College of Physicians. At this time he set out to write a short paper on scurvy for the Society of Naval Surgeons, but it expanded into a 400-page book, which was published in Edinburgh in 1753 as *A Treatise of the Scurvy. Containing an inquiry into the Nature, Causes and Cure of that Disease. Together with a Critical and Chronological View of what has been published on the subject*. It is of interest that it was written in English rather than Latin.
>
> The treatise begins with a "critical history" of the subject, and has, as Part III (a kind of appendix to the book), a synopsis of each of the earlier publications on scurvy that Lind had been able to discover. This is impressive and scholarly work, and, wherever I have been able to compare his summary with the original, it appears objective and accurate. He made a thorough review of the claims of Echth and the other sixteenth-century writers that scurvy was known to Hippocrates and his successors (Pliny, Avicenna, etc.), and he argued that *stomakake* and *sceletyrbe* would not have been scurvy because

there was no mention of the spots that are so characteristic of the disease… Lind suggested that the ancients were not familiar with the disease because they had no reliable information about the northern countries where the conditions of existence had always been conducive to scurvy, nor did sailors in the early periods go for extended voyages far from land.

…

After reading Lind’s brilliant review of other people's ideas, which was so much ahead of its time, one turns eagerly to his own theory of the disease. But this is extremely difficult – even painful – to read, let alone summarize, and few have attempted it.

speculations nature, causes, fruits secondary, in current context, the symptoms and signs are still relevant

Age when scurvy was common, workplace where many cases were collected… fruits beneficial not specific but benefit consistent that the recorded symptoms were because of scurvy

However, there are several confusions and misstatements about Lind’s role in our understanding about the etiology of scurvy, see links on the next page.

On the following pages are extracts of Lind’s monograph that are relevant about the effects of vitamin C deficiency on the cardiorespiratory system.

Lind J. A Treatise of the Scurvy in Three Parts (1753/1757/1772)
https://doi.org/10.1017/CBO9781107256644

https://archive.org/details/b30507054 (1st ed 1753)
https://wellcomecollection.org/works/xc2t7736 (2nd ed 1757)
https://archive.org/details/treatiseonscurvy1772lind (3rd ed 1772)
https://babel.hathitrust.org/cgi/pt?id=ucm.5320216006 (3rd ed 1772)
https://openlibrary.org/books/OL24970496M (3rd ed 1772)
https://openlibrary.org/books/OL26752931M (3rd ed 1772)
Various paper versions are available through eg Amazon

Lind's Treatise on Scurvy (1953) Reprint of the first edition, with modern fonts.
Edinburgh University Press
Reviews of the 1953 version
https://doi.org/10.1113/expphysiol.1953.sp001028
https://doi.org/10.1001/jama.1953.03690150096035

Biographies and discussions of Lind's role in the research on scurvy
https://doi.org/10.1111/j.1753-4887.1983.tb07177.x
https://doi.org/10.1016/s0140-6736(04)17588-0
https://doi.org/10.1111/j.1753-4887.2009.00205.x

https://doi.org/10.1080/21533369.2002.9668317
https://www.jstor.org/stable/24618981
https://www.ncbi.nlm.nih.gov/pmc/articles/pmc2623040
https://www.ncbi.nlm.nih.gov/pmc/articles/pmc1296121

https://doi.org/10.1177/0141076813483090
https://doi.org/10.1258/jrsm.2012.12k089
https://doi.org/10.1258/jrsm.2012.12k090
https://doi.org/10.1177/014107680509801120
https://doi.org/10.1177/014107689709000527
https://doi.org/10.1177/014107689709000726
https://doi.org/10.1177/014107689709000926
https://doi.org/10.1177/014107680309601213

https://en.wikipedia.org/wiki/James_Lind
https://www.jameslindlibrary.org/lind-j-1753

https://www.cambridge.org/fi/academic/subjects/history/history-medicine/history-scurvy-and-vitamin-c

KATSO PROC NUTR SOC 1953

Certain old terms in Lind's text:

Asthma: In the 1700s, the term "asthma" referred to various kinds of dyspnoea and related symptoms, which had also non-pulmonary causes, e.g cardiac causes of breathlessness.

Derived from the Greek root, meaning "to pant heavily" or "gasp for breath"
https://pubmed.ncbi.nlm.nih.gov/15280175

Laborious respiration with lifting of the shoulders and wheezing
https://pubmed.ncbi.nlm.nih.gov/15778490

Heaviness of the chest… difficulty in breathing on a steep road…
https://pubmed.ncbi.nlm.nih.gov/3276885

Costiveness: Constipation

Dropsy: "The historical diagnosis of dropsy – which is now obsolete – indicated simply an abnormal accumulation of fluid; the word derives from the Greek hydrops (water). Alternative or supplementary terms included hydrothorax (fluid in the chest cavity), ascites (which still indicates excess free fluid in the abdominal cavity), anasarca (still used to describe generalized edema throughout the body)..."
https://doi.org/10.1017/CHOL9780521332866.101

"an ancient medical term used to indicate different conditions including chronic heart failure"
https://pubmed.ncbi.nlm.nih.gov/28789843

"some symptoms of edema in those called oidêma (swelling) and udrôps (dropsy) in the oldest treatises of the Corpus"
https://pubmed.ncbi.nlm.nih.gov/10213810

Flux: Diarrhea, marked by the frequent production of watery stools, may be confused with dysentery in historical accounts, but references to "bloody flux" refer to true dysentery.
https://doi.org/10.1017/CHOL9780521332866.102

"the flux (or dysenteries)"
https://www.ncbi.nlm.nih.gov/pmc/articles/pmc1008939

Orthopnœa: Sensation of breathlessness in the recumbent position, relieved by sitting or standing.
https://en.wiktionary.org/wiki/orthopnoea

Polypus: Cardiac thrombus usually found post-mortem
https://en.wiktionary.org/wiki/polypus

https://www.ncbi.nlm.nih.gov/pmc/articles/pmc1037031

Swoon: Faint
https://en.wiktionary.org/wiki/swoon

Pages refer to the 1953 bicentennial edition of Lind's Treatise (in parenthesis 3rd ed pp.)

ADVERTISEMENT to the 3rd ed (1772) [not in the 1st edition]

(p.iii-vi)

THIS Treatise now makes its appearance in a third edition, improved by the knowledge and experience acquired from an almost constant attendance for thirteen years, on patients afflicted with the scurvy.

Though the disease has of late raged with great mortality in different parts of the world, as will appear from the *Supplement*, yet perhaps, no spot whatever has exhibited more numerous or more distressing cases of it than *Haslar* hospital : I here frequently visited, during five years of the late war with *France* (from the year 1758 to 1763), three or four hundred scorbutic patients in a day ; every morning furnished me with original pictures of the disease, in all its various forms and stages, in patients brought from all quarters of the globe : on comparing these with accounts of authors, I found the disease to be precisely the same in every age, and in every country.

But the outward face of the disease did not alone engage my attention ; the dead were carefully inspected ; and every medicine, or method of cure, that could be suggested, was tried for the relief of the distressed. The result of these inquiries is now made public: in the *Postscript*, and a few other parts of this work, I have inserted the substance of four volumes of observations, daily and carefully made in the chambers of the sick.

…

What I have been more anxious about, than any theory, is to transmit to posterity a faithful register of all books and observations which have been published on this disease; together with the most effectual means hitherto discovered to check its progress, lessen its violence, and prevent its devastation.

I have, in the Postscript, put my last hand to a work, which in all probability I shall not further enlarge ; being perswaded I can carry my researches no further, without launching into a field of conjecture and uncertainty…

PREFACE

p.5-7 (3rd p.vii-xiv)

THE subject of the following sheets is of great importance to this nation ; the most powerful in her fleets, and the most flourishing in her commerce, of any in the world. Armies have been supposed to lose more of their men by sickness, than by the sword. But this observation has been much more verified in our fleets and squadrons ; where the scurvy alone, during the last war, proved a more destructive enemy, and cut off more valuable lives, than the united efforts of the French and Spanish arms…

It is now above 150 years since that great sea-officer, Sir Peter Hawkins [L1], in his observations made in a voyage to the South sea, remarked it to be the pestilence of that

element. He was able, in the course of twenty years, in which he had been employed at sea, to give an account of 10,000 mariners destroyed by it…

It was acknowledged, that the best descriptions of it are met with in the accounts of voyages : but it was regretted, that those were the productions only of seamen ; and that no physician conversant with this disease at sea, had undertaken to throw light upon the subject, and clear it from the obscurity under which it has lain in the works of physicians who practised only at land…

But as it is no easy matter to root out old prejudices, or to overturn opinions which have acquired an establishment by time, custom, and great authorities ; it became therefore requisite for this purpose, to exhibit a full and impartial view of what has hitherto been published on the scurvy ; and that in a chronological order, by which the sources of those mistakes may be detected. Indeed, before this subject could be set in a clear and proper light, it was necessary to remove a great deal of rubbish.

L1. Richard Hawkins (1622) Voyage into the South Sea, in the Year 1593.
https://www.gutenberg.org/ebooks/57502
https://www.gutenberg.org/files/57502/57502-h/57502-h.htm
https://doi.org/10.4324/9781315555058
https://www.routledge.com/The-Observations-of-Sir-Richard-Hawkins-Knt-in-his-Voyage-into-the-South/Bethune/p/book/9781409412670
Related documents:
https://doi.org/10.1111/j.1753-4887.1986.tb07575.x
https://en.wikipedia.org/wiki/Richard_Hawkins

Part I: CHAPTER I. ***A critical history of the different accounts of this disease***

p. 11-14 (3rd p.1-5)

IN the first accounts given us of this disease, by Ronsseus [L2], Echthius [L3], and Wierus [L4], it is surprising to find, not only an accurate description of it, but an enumeration of almost all the truly antiscorbutic medicines that are known to the world even at this day.

The first authors on the scurvy, Ronsseus and Echthius, though cotemporary, wrote separately, without having the benefit of seeing each others works.

… the putrid gums and swelled legs were the most certain and only characteristic signs of it [scurvy].

L2. PART III: CHAPTER II

L3. PART III: CHAPTER II, year 1541
https://doi.org/10.31952/amha.16.2.2
https://www.clinicalanatomy.com/mtd/858-did-andreas-vesalius-really-die-from-scurvy-1
https://www.clinicalanatomy.com/mtd/859-did-andreas-vesalius-really-die-from-scurvy-2
https://www.clinicalanatomy.com/mtd/860-did-andreas-vesalius-really-die-from-scurvy-3
https://www.clinicalanatomy.com/mtd/800-powerful-indications-that-vesalius-died-from-scurvy-4

L4. PART III: CHAPTER II, year 1567
https://en.wikipedia.org/wiki/Johann_Weyer

Part I: CHAPTER III. ***Of the distinction commonly made into a land and sea scurvy***

p. 52-54 (3rd p. 29-37)

THIS disease has been always most common at sea. It is well known there in the present age, by reason of the frequent voyages to the most distant parts of the world. The symptoms, though numerous, are yet observed to be regular and constant ; so that the most ignorant sailor, in the first long voyage, becomes well acquainted with it…

As to the pathognomonic signs of the disease… putrid gums, swelled legs, and spots, accompanying each other, and in their progress usually attended with rigid tendons in the ham, are observed in no other distemper. It is also peculiar to it, that persons thus afflicted, though otherwise apparently healthful, are upon the least motion, or exertion of strength, apt to faint, and do often suddenly drop down dead.

… the first just description published of this disorder in Europe, was in an acoount of it raging in besieged towns, bu the historian Olaus Magnus [H1].

p.59-60

It may be believed, that there are few people who have had the opportunities of reading more upon this subject than I have done ; and that there are few books or observations published upon the disease, that have not fallen under my inspection… I did not find two authors agree who founded their doctrine upon facts and observations. I observed, that ten different practitioners pronounced ten cases to be scorbutic, which, upon examination, did not bear the least resemblance or analogy to each other.

Part II: CHAPTER I. ***Mr Ives's journal***

p.107-111 (3rd p.89-96)

…

On the 8th day we left Gibraltar, growing daily worse in the scurvy. On the 10th day 50 scorbutic patients were on the sick-list… shortness of breath &c. … Scorbutic fluxes, scurvy with coughsm Scorbutic asthma…

… on the 20th of November, I gave to every scorbutic patient one China orange, and three apples [daily]

November 29. The scorbutic people in general mend much. Those whose limbs were contracted grew pliable ; their rotten gums became sounder ; shortness of breath, *&c*. better.

Part II: CHAPTER II. *The diagnostics, or signs* (*The diagnostics, or symptoms* in the 3rd ed)

p. 113-116 (3rd p. 98-129)

IN order to observe greater accuracy in the description of a disease attended with so many and various symptoms, these might have been properly enough ranged under three classes.

…

But, for the sake of greater perspicuity, I chuse rather to describe the symptoms in the order in which they generally appear, and as peculiar to the several stages of the disease ; and shall distinguish, as I go along, those which are more constant or essential, from the less frequent or adventitious.

The first indication of the approach of this disease, is generally a change of colour in the face, from the natural and usual look, to a pale and bloated complexion; with a listlessness to action, or an aversion to any sort of exercise. When we examine narrowly the lips, or the caruncles of the eye, where the blood vessels lie most exposed, they appear of a greenish cast. Mean while, the person eats and drinks heartily, and seems in perfect health ; except that his countenance and lazy inactive disposition, portend a future scurvy.

This change of colour in the face, although it does not always preceed the other symptoms, yet constantly attends them when advanced. Scorbutic people for the most part appear at first of a pale or yellowish hue, which becomes afterwards more darkish or livid.

Their former aversion to motion degenerates soon into an universal lassitude, with a stiffness and feebleness of their knees upon using exercise ; with which they are apt to be much fatigued, and upon that occasion subject to a breathlessness or panting. And this lassitude, with a breathlessness upon motion, are observed to be among the most constant concomitants of the distemper.

Their gums soon after become itchy, swell, and are apt to bleed upon the gentlest friction. Their breath is then offensive ; and upon looking into their mouth, the gums appear of an unusual livid redness, are soft and spungy, and become afterwards extremely putrid and fungous ; the pathognomonic sign of the disease. They are subject not only to a bleeding from the gums, but prone to fall into haemorrhages from other parts of the body.

Their skin at this time feels dry, as it does through the whole course of the malady. In many, especially if feverish, it is extremely rough ; in some it has an anserine appearance ; but most

frequently it is smooth and shining. And, when examined, it is found covered with several reddish, bluish, or rather black and livid spots, equal with the surface of the skin, resembling an extravasation under it, as it were from a bruise. These spots are of different sizes, from the bigness of a lentil to that of a handbreadth, and larger. But the last are more uncommon in the beginning of the distemper ; they being usually then but small, and of an irregular roundish figure. They are to be seen chiefly on the legs and thighs ; often on the arms, breast, and trunk of the body ; but more rarely on the head and face.

Many have a swelling of their legs ; which is first observed on their ancles towards the evening, and hardly to be seen next morning : but, after continuing a short time in this manner, it gradually advances up the leg, and the whole member becomes œdematous ; with this difference only in some, that it does not so easily yield to the finger, and preserves the impression of it longer afterwards than a true œdema.

These are the most constant and essential symptoms of this malady in the progress of its first stage. But a diversity is sometimes observed in the order of their appearance.

p.118-120

… the most frequent seat of their pain is in some part of the breast ; a tightness and oppression there, with stitches felt upon coughing, being usual symptoms in this disease… they are always exasperated by motion of any sort…

I observed a considerable difference in the genius of the disease in the two cruises *ann.* 1746 and 1747. In the latter, when fevers from cold of the pleuritic and peripneumonic sort prevailed, it tended chiefly to affect the breast with a tightness, oppression, and a hard bound cough, by which a very viscid phlegm was with great difficulty brought up. The fits of coughing were not constant, but extremely fatiguing ; and this was a universal complaint.

…

John Hearn was our patient in both cruises… He has been afflicted with the scurvy for some time past. It first appeared with sore spungy gums, pain and œdematous swellings of his legs, weakness, *&c*. J. Hearn complains of a lassitude and stiffness of his limbs complains of a lassitude and stiffness of his limbs… his chief complaint is a troublesome fatiguing cough. And this last was what afflicted him most during the whole cruise.

I believe indeed it will universally be found, that, in the progress of this distress, the breast is always more or less affected…

p.123-124

ln the second stage of this disease, they most commonly lose the use of their limbs… when long confined from exercise, to a proneness to faint upon the least motion of the body ; which are the most peculiar, constant, and essential symptoms of this stage.

Some have their legs monstrously swelled, and covered with one or more large livid spots, or ecchymoses ; others have hard swellings there in different places, extremely painful ; and others I have seen, without any swelling, have the calf of the leg quite indurated.

They are apt, upon being moved, or exposed to the fresh air, suddenly to expire. This happened to one of our people, when in the boat, going to be landed at Plymouth hospital. It was remarkable he had made shift to get there without any assistance, while many others were obliged to be carried out upon their beds. He had a deep scorbutical colour in his face, with complaints in his breast. He panted for about half a minute, then expired.

Scorbutic people are at all times, but more especially in this stage, subject to profuse haemorrhages from different parts of the body ; as from the nose, gums, intestines, lungs, &c.

p.126-128

It is not unusual at this time, for such persons as have had ulcers formerly healed up, to have them break out afresh : while in others the skin of their swelled legs often bursts, particularly where soft, painful, livid swellings, have been first observed : and these degenerate into such crude, bloody, fungous ulcers, as formerly described.

The fatal termination of this disease in a dropsy is very usual, dropsies of the breast and belly are most frequent… [3rd ed p. 113; not in 1st ed]

Towards the close of this malady, the breast is most commonly affected with a violent and uneasy straitness and oppression, and an extreme dyspnœa ; accompanied sometimes with a pain under the sternum, but more frequently in either of the sides : while others, without any complaint of pain, have their respiration become quickly contracted and laborious, ending in sudden, and often unexpected death.

Many more symptoms might be here added that at times have been observed, especially towards the close of this most virulent disease. And we shall have no occasion to be surprised, even at the most extraordinary which have been related by authors, when we come, in its proper place, to view the true state of the body at this period, with the high degree of putrefaction in the blood, the other humours, and viscera.

I shall conclude this chapter, after giving a case somewhat more out of the common road, with an account of some scurvies in Scotland.

Lieutenant John A – of marines, aged 40, was formerly extremely healthy, though much at sea ; where he had seldom or never eat of salt provisions, officers tables being generally well provided with better fare. He had lately returned from some Channel cruises to the westward ; where, as usual, he had not eat of any thing salt, having a natural aversion to such food. One day, to his great surprise, he observed on about the middle of one of his legs a considerable bunching up from over the tibia ; and taking down his stocking, found a bluish insensible swelling. Next morning it was increased to the size of a large walnut ; and in two

or three days the skin broke, and it became a genuine scorbutic ulcer, with the liver-like fungus. After which began also other symptoms ; change of colour, tightness in the breast, rotten gums, and, what was very threatening to his life, an obstinate constipation of the bowels, attended with intolerable gripings.

p.128-130

Letter from Dr James Grainger, surgeon to Lt-Gen. Pultney's regiment

I have extracted from my notes the following brief description of the scurvy, which prevailed *ann*. 1751-2, among the six companies of our regiment quartered at Fort-William.

I had then an opportunity of seeing it in no less than near 100 patients ; and must ingenuously own, it was there I learned my first lesson upon the disease.

My predecessor had not informed me, that this was a disorder of that garrison ; it was a subject of which I had read much, but knew little ; so that the first I treated, had well nigh fallen a martyr to improper prescription. The pains this soldier complained of, appeared to me rheumatic…

…

The scurvy now began to spread, and I profited by my former inattention.

Its first appearances were, *lassitudo*, breathlessness upon the least quickness of motion, and a taste in the mouth peculiarly disagreeable : which were soon followed by rotten, spungy, painful gums, bleeding from the slightest touch ; fœtid breath ; pains always of their thighs, frequently of their legs, sometimes of their loins, seldom of their arms. All these parts were sometimes discoloured with purple *maculæ*, which, as the malady increased, grew black and broad. The anterior parts of the legs and thighs chiefly suffered… their faces grew strangely sallow, their teeth loosened, palate and fauces ulcerated, asthma increased ; they fell away, slept little, old ulcers broke out again, cried out when turned a-bed, and sometimes fainted upon motion of their body.

Extract of a letter received from Dr. Huxham, *late physician in* Plymouth. [3rd p.128-129]

IN answer to your question, whether we meet with many truly scorbutic cases in *Devonshire* and *Cornwall*, amongst those who constantly live at land, I assure you we meet with very many patients of that kind… In these places the scurvy is as it were *endemic* from the lower degrees of it, *viz.* pustular eruptions, itching spungy gums, sallow complexion, lassitude and inactivity, weak pulse, black and blue spots up and down the arms, legs, thighs, *&c*. a foul greasy urine loaded greatly with salinosulphureous salts, to its greatest degree of virulence, accompanied with fungous, livid, bleeding gums, horribly stinking breath, a sallow bloated countenance, vast dejection of spirits and faintings, a swelled belly, gripes, the bloody flux, profuse hæmorrhages from various parts, a difficulty of breathing, especially upon the least motion, very-large black, blue, yellow spots, swellings, contractions, and stiffness of the lower limbs, and sordid, spungy, livid ulcers on the legs, *&c*. with a load on the breast, and an anxiety scarce to he expressed.

Part II: CHAPTER III. *The prognostics*

p. 133-136 (3rd p. 129-138)

Persons who have been weakened by other proceeding distempers, such as fevers or fluxes ; or by tedious confinement and cures, as those who have undergone a salivation, are of all others most subject to this disease. Intermitting fevers in a particular manner dispose the constitution to it.

Those who have formerly been afflicted with it, are much more liable to it, in parallel circumstances, than others.

Different

… when confined to bed, or prevented from using exercise, by swelling of the legs, weakness, or from other causes, the evil, where no green vegetables or fruits can be procured, infallibly increases ; and when it is advanced to what I have called the *second stage*, is not to be cured without them.

The symptoms related to occur in the last stage, are of all others the most dangerous ; *viz.* oppression on the breast, obstinate costiveness, stitches in the side [sharp pains in the side; 3rd], and frequent faintings ; but especially great difficulty of breathing.

Their dropping down dead upon an exertion of their strength, or change of air, is not easily foretold ; though it generally happens after a tedious confinement in a foul air.

…

3rd p.136-137

On the 21 *June*, 1760, *John Macgottin* was landed at *Haslar*, from the *Richmond* frigate, who had laboured under the scurvy above 12 months …a gnawing pain in his ankle. That joint grew so extremely weak, that he compared himself to a person, who after a long journey on foo, could not stand or walk. His legs swelled much towards evening. Other scorbutic signs appeared afterwards, especially a boil upon his right knee…

This poor man, upon the least motion of his body, even in bed, fell into long and dangerous fits of fainting, attended with violent sweats, which hung upon him in large drops, warm at first, then turning cold and clammy… He had also a cough, and the scorbutic pain of the breast, in its usual seat. His face was bloated, and swelled.

Part II: CHAPTER V. *The cure of the disease, and its symptoms*

p.185-186 (3rd p.239-245)

When the legs are swelled and œdematous…

But if the legs are much swelled, stiff, and painful…

If such swellings are not removed soon after…

p.188

There remain two symptoms of this disease, which are, of all others, the most obstinate to remove, even though the patient enjoys the benefit of the purest air, with the most proper antiscorbutic food and medicines. These are, the scorbutic dysentery in some ; and in others, a hard bound cough, accompanied with dyspnœa, pain and disorder in the breast. This last often ends in a consumption : while the former, or flux, is very troublesome to stop, and sometimes also proves fatal.

p.190

For scorbutic pectoral disorders…

Besides the consumptive disposition now mentioned, a dropsical habit is now and then contracted ; or, what is more frequent, the legs remain swelled, œdematous, and ulcerated…

p.196-198

… oppression on the breast…

… the breast was much affected…

… faintishness, dyspnœa…

Part II: CHAPTER VII. *Dissections*

p.227-231 (3rd p.239-245)

THE appearances in scorbutic dead bodies, are here distinguished under different numbers, for the convenience of making proper references to them in the following chapter.

No. 1 contains the observations made by Lord Anson's [H23] surgeons upon the blood of their patients, and upon the dissection of dead bodies, in the several stages of this distemper at sea.
No. 2 a dissection made upon one of Jaques Cartier's crew [L5].
No. 3 to 21 inclusive, is Mr Poupart's [L6] account of many, and very accurate dissections of scorbutic bodies, in the hospital of St Lewis at Paris, in the year 1699.2 It will admit of no doubt, that this last was a true scurvy, as it proceeded from the same causes, *viz*. long want, improper food, grief, melancholy, cold, &c. ; and the symptoms were entirely alike with those in Lord Anson's crew ; such as gums monstrously putrid, swelled legs, livid blue spots and hardness on the body, contracted limbs, the scorbutic *deliquium*, often ending in the most sudden and unexpected death, fluxes and haemorrhages of all sorts, &c.

L5. See summary in: PART III: CHAPTER I. and in Carpenter p.8-9

L6. François Poupart (1708) A relation of some strange and wonderful effects of the scurvey, which happened at Paris in the Year 1699. By Mr. Poupart. Taken from the memoirs of the History of the Academy of Sciences.
Philosophical Transactions of the Royal Society of London
https://doi.org/10.1098/rstl.1708.0035

N° 1. In dissected bodies, the blood in the veins was so entirely broken, that, by cutting any considerable branch, you might empty the part to which it belonged of its black and yellow liquor ; and when found extravasated, it was all of the same kind…

N° 2. The heart was found white and putrid ; its cavities were quite full of corrupted blood. The lungs were blackish and putrid ; more than a quart of reddish water was found in the thorax.

N° 3. All those who had any difficulty of breathing, or their breasts stuffed or stopped up, had there a quantity of serosity ; and we found more or less of it according as they were oppressed.

N° 4. The breast, belly, and several other parts of the body, were filled with this lymph or serum…

N° 5. We have seen some whose breast was so oppressed, that they died all of a sudden. In the mean time, we found no serosity, neither in their breasts nor in their lungs. But the pericardium was entirely fastened to the lungs ; and the lungs were glued to the pleura and diaphragm. All the parts were so mixed and blended with each other, that they made up but one mass or lump, so confounded that one could scarce distinguish one from another. As the lungs were squeezed together in the midst of this mass, they were deprived of their motion, and the sick person was choked for want of breath.

N° 6. All they who died suddenly, without any visible cause of their death, had the auricles of their heart as big as one’s fist, and full of coagulated blood.

N° 7. We have seen several, who without pain dropped down dead. They had no apparent sickness ; only their gums were ulcerated, without any spots or hardness on their skin : yet we found their muscles were gangrened, and stuffed with a black corrupted blood ; and upon handling them, they fell to pieces.

…

N° 11. We also found their muscles swelled and hard. This was occasioned by blood fixed in the body of the muscles, which were sometimes so full of it, that their legs remained bent, without being able to extend or stretch them out.

…

N° 14. Some old persons had such large bleedings from the nose and mouth, that they died of them. The coats of the vessels were corroded and eat through by the sharp and corrosive humour.

…

N° 20. In scorbutic people the glands of the mesentery are generally obstructed and swelled. Some of these were found partly corrupted and imposthumated. In the liver of some few, the matter or corruption was hardened, and, as it were, petrified…

Other dissections in Lind’s texts:

PART III: CHAPTER II: 1736, 1750 M. Gmelin

PART III: CHAPTER II: 1764 L. Rouppe

PART II: CHAPTER VIII. ***The nature of the symptoms, deduced and explained from the foregoing theory and dissections***

p.232-234 (3rd p.245-256)

THE symptom most commonly preceeding the others in this disease, is a preternatural change of colour in the face…

But in the case of scorbutic people, it is somewhat singular, and peculiar to them, that though when at rest they find themselves quite well ; yet, upon the least exercise, they are subject, at first, to a panting and breathlessness ; which, as the disease increases, degenerates into a proneness to faint ; and, lastly, in the height of the malady, upon using exercise, or an exertion of their strength, or upon being exposed to a sudden change of air, they are apt to drop down dead.

p.135

When the body is at rest, the circulation is languid and slow: the blood then, in a small quantity, glides gently through the lungs, notwithstanding the obstruction in them. But when, upon using exercise, or an exertion of strength, the velocity of the blood is accelerated, and a much greater quantity, *viz*. that which, when at rest, was almost stagnating in the veins, is at once returned into the right cavities of the heart, and from thence into the lungs ; the weakened and obstructed vessels of the lungs not being able so quickly to transmit so great a quantity, the blood is necessarily accumulated in the *sinus venosus*, right auricle and ventricle of the heart : which causes a breathlessness and panting ; that is, an effort is made by all the powers subservient to respiration, to dilate the breast fuller and more frequently, for the passage of this increased quantity of blood.

… the passage of the blood through the lungs must still be more straitened. Hence, upon the least motion of the body, by which the circulation is quickened, and a greater quantity of blood sent at once into the heart, the heart becomes in such cases not able to overcome the resistance it meets with in forcing the blood through the lungs, as well as the weakened unelastic arteries. Whence, as before observed, the blood being accumulated, and stagnating as it were, in the cavities of the heart, there must follow an almost entire stoppage of the circulation for some time, a pause and cessation of the vital motions for a little ; that is, the patient must faint away, till, by the exertion of the vital principle, and the heart being evacuated by the person’s lying at rest, the circulation is again quickened, and he recovers.

Lastly, It appears by the weakness and feebleness of the pulse, and many other symptoms in this disease, as likewise from the known effect of putrefaction on animal bodies, by which the fibres are always rendered softer and tenderer, that the whole system of solids is in the most relaxed and weakened condition. Even the heart itself was found putrid, (N° 2), whose force to circulate the blood is not indefinite, more than its cavities, which can contain only a proportioned quantity. The first is certainly here greatly impaired ; while the latter, or its cavities, were found preternaturally weakened and dilated, (N° 6). In this state, such people are apt to drop down dead upon an exertion of their strength, or from exercise, but especially upon being exposed to a sudden change of air ; that is, by removing them at once from the warm and moist air in the hold of a ship, into a colder, drier, and purer air. For the effect of

this is, to constringe the whole external habit of the body, and to drive the blood at once with great force from thence towards the heart ; at which time the velocity, as well as quantity of it, is increased in the internal parts. So that the heart is not able to overcome the resistance it meets with in the weak and unsound lungs, (whose vessels are also straitened by the contact of such fresh air) ; nor in the arteries, which will be in proportion to the quantity of blood with which they remain distended. But the weak unelastic arterial system is not here able to contract and propel the blood in their canals. On the contrary, the cutaneous vessels being thus constringed by the external air, the blood may perhaps have, as it were for an instant, a retrograde motion towards the heart, which this debilitated muscle (N° 2) cannot overcome. Hence such people drop down dead suddenly, without any other visible cause of their death found upon dissection, (N° 6), than the weakened auricles of their heart aneurismatic, and distended with blood. They are observed to have a panting or breathlessness for about half a minute before they expire.

In Lord Anson's [H23] crew it was remarked, that a straitness of the breast, with an obstinate costiveness, was one of the most dangerous and fatal symptoms.

PART III: CHAPTER I. ***Passages in ancient authors, supposed to refer to the scurvy ; together with the first accounts of it***

p.249-261 (3rd p.283-302)

THIS distemper, barbarously in the Latin denominated *scorbutus*, is said to derive its appelation from *schorbect* in the Danish language ; or the old Dutch word *scorbeck* : both which signify a tearing or ulcers of the mouth. Most authors have deduced the term from the Saxon word *schorbok*, a griping or tearing of the belly ; which is by no means so usual a symptom of this disease ; though, from a mistake in the etymology of the name, it has been accounted so by these authors. The word seems to me most naturally to be made out from *scorb* in the Sclavonic language, which signifies a disease ; this being the endemic evil in Russia, and those northern countries, from whence we borrowed the name.

… we find, that as soon as arts and sciences began to be cultivated among those northern nations, (about the beginning of the sixteenth century, a period remarkable for the advancement of learning over all Europe), this disease is mentioned by their historians and other authors. We could not have expected it sooner from their physicians, if we reflect upon their extreme ignorance, and the little esteem this science was held in by them.

In like manner, no sooner were long voyages performed to distant parts of the world, by the great improvement of navigation, and by the discovery of the Indies, which happened much about the same period of time, but the seamen were afflicted with it ; as appears by the voyage of Vasco de Gama, who first found out a passage by the Cape of Good Hope to the East Indies, in the year 1497 ; above a hundred of his men, out of the number of a hundred and sixty, dying in this distemper. In the relation of which voyage, the first account of this disease at sea is to be met with.

The second voyage of James Cartier to Newfoundland, by the grand bay up the river of Canada, ann. 1535.

In the month of December, we understood that the pestilence was come upon the people of Stadacona ; and in such sort, that before we knew of it, above fifty of them died. Whereupon we charged them neither to come near our forts, nor about our ships. Notwithstanding which, the said unknown sickness began to spread itself amongst us, after the strangest sort that ever was either heard of or seen ; insomuch that some did lose all their strength, and could not stand upon their feet ; then did their legs swell, their sinews shrunk, and became as black as a coal. Others had also their skin spotted with spots of blood, of a purple colour. It ascended up their ancles, knees, thighs, shoulders, arms and neck. Their mouth became stinking ; their gums so rotten, that all the flesh came away, even to the roots of their teeth ; which last did also almost all fall out. This infection spread so about the middle of February, that of a hundred and ten people, there were not ten whole ; so that one could not help the other ; a most horrible and pitiful case ! Eight were already dead ; and more than fifty sick, seemingly past all hopes of recovery. This malady being unknown to us, the body of one of our men was opened, to see if by any means possible the occasion of it might be discovered, and the rest of us preserved. But in such sort did the calamity increase, that there were not now above three sound men left. Twenty-five of our best men died ; and all the rest were so ill,

that we thought they would never recover again : when it pleased God to cast his pitiful eye upon us, and send us the knowledge of a remedy for our health and recovery.

Our Captain considering the deplorable condition of his people, one day went out of the fort, and walking upon the ice, he saw a troop of people coming from Stadacona. Among those was Domagaia, who not above ten or twelve days before laboured under this disease ; having his knees swelled as big as a child’s head of two years old, his sinews shrunk, his teeth spoiled, and his gums rotten and stinking. The Captain, upon seeing him now whole and sound, was thereat marvellous glad, hoping to know of him how he had cured himself. He acquainted him, that he had taken the juice of the leaves of a certain tree, a singular remedy in this disease. The tree in their language is called *ameda* or *hanneda* ; by a decoction of the bark and leaves of which, they were all perfectly recovered in a short time.

[sinew: tendon]

PART III: CHAPTER II *Bibliotheca scorbutica : or, A chronological view of what has hitherto been published on the scurvy*

[Lind reviews dozens of earlier reports of scurvy, but only those that report symptoms relevant to the current document are extracted here]

[Lind's PREFACE]

The *Bibliotheca scorbutica*, or the collection of authors on the scurvy, is placed at the latter end of the book, as proper to be consulted in the dictionary-way.

In the third part, where I have given an abridgment of what has been written upon the subject by the most celebrated medical authors, and others, I have always endeavoured to express their sentiments with as much clearness and conciseness as I could. I have indeed through the whole aimed at perspicuity rather than elegance of diction, as most proper in a book of science. To know a disease, and to cure it, being the two things most essential to be learned ; I have therefore transcribed the symptoms and cure of the scurvy from those authors, where they do not entirely copy from each other.

p.262-348 (3rd ed 302-494)

A.D. 1541
Joan. Echthii de scorbuto, vel scorbutica passione, epitome.

He proposes it as a question, Whether the blood here may not be corrupted, without the spleen or any other of the viscera being affected ? but is inclined to think the spleen often is. He assigns as causes of this disease, gross unwholsome food, of salt, dried, or putrid flesh and fish, pork, spoiled bread, stinking water, &c. He distinguishes the symptoms into two classes. The first contains such as appear at the beginning, and are common to it with other diseases ; the second, the succeeding and more certain signs of the malady. Under the first, he comprehends a heaviness of the body, with a spontaneous lassitude, generally most sensibly felt after exercise ; a tightness of the breast, and a weakness of the legs ; an itching, redness, and pain of the gums ; a change of colour in the face to a darkish hue : and observes, that where all these concur, we may foretel an approaching scurvy.

But the more immediate and certain signs he enumerates under the second class, viz. a foetid breath, a spungy swelling of the gums, which are apt to bleed, with a loosening of the teeth ; an eruption of leaden-coloured, purple, or livid spots, on the legs ; or of somewhat broader speckled or dark-coloured maculae, sometimes on the face, at other times on the legs. As the disease advances, the patients lose the use of their legs, and are subject to a difficulty of breathing, particularly when moved, or when they sit erect ; at which times they are apt to faint : but upon being laid down again, they recover, and breathe freely ; nay, when lying, they affirm that nothing ails them. But as they cannot always thus continue without some motion, they are subject to these perpetual swoons. The appetite is seldom bad ; on the contrary, they generally have a good one. There is sometimes observed an aggravation of the

symptoms ; with some on the fourth or fifth day, in others on the third. Some few have it every day, but without any fever : others become feverish. Preceeding fevers may terminate critically, as it were, in the scurvy : and with such scurvies whole families and monasteries are together infected ; which generally end either in a deadly dysentery, or, at other times, in a sudden and mortal faint. During the course of this disease, some are apt to be very costive ; while others have a continual diarrhoea. Sometimes their spotted legs swell so monstrously, as to resemble the elephantiasis of the Arabians ; while others have them so extenuated, that the bones seem only covered with skin. The spots of some separate into black and duskish scales, like the *morphœa* and leprosy of the Greeks ; while in others they remain soft, smooth, and shining ; and the impression of the finger continues for some time upon the part. In those who die, the spots sometimes disappear ; at other times they break out afresh. Lastly, There have been observed varicose swellings of the veins, as in those under the tongue, and of the lower lip.

He afterwards delivers the indications of cure, without giving us any remedies. **And it may not be amiss to remark, that this is the first description now extant of the scurvy by a physician.**

1564 RONSSEUS

1567

Jo. Wieri medicarum observationum hactenus incognitarum lib. I. *de scorbuto.*

He transcribes all the symptoms out of Echthius at great length, with the following additions. The weakness in the legs felt upon the approach of the disease, is attended with a stiffness there, and a small pain. The flesh of the gums is often destroyed to the roots of the teeth. Smaller spots, resembling blood sprinkled upon the part, (or flea-bites, but larger), appear on the legs, thighs, and on the whole body ; but the very large, livid, and purple spots, chiefly on the legs. Sometimes this livid colour will shew itself in the fauces of those who are near death. In the progress of the disease, the tendons of the legs become stiff and contracted. Some are seized with a slow erratic fever. After ardent malignant fevers, and double tertians, ill cured, he has known the scurvy to follow ; upon which a malignant quartan has ensued. This still left the scurvy behind it ; which was at last cured by the proper method. When the legs are greatly swelled, they are sometimes altogether of a livid colour. The pulse, as in a quartan fever, varies : so that at different times, and according to the state of the disease, it is small, hard, quick, and weak. The urine is reddish, turbid, thick, and feculent, like new red wine, resembling that which is usual in the fit of a quartan when sweating ; and of a bad smell…

1569

DROPSY

1593
Scorbuti historia proposita in publicum; a Solomone Alberto, &c.

by giving diuretics if it tends to the kidneys ; having particularly remarked, that, by a flow of urine, the disorders of the breast in this disease were most effectually relieved…

1595
Petri Foresti observationum et curationum medicinalium lib. 20. *obs.* 11. *de scorbuto malo cognoscendo et curando ; obs.* 12. *ibid, de quinque ægris a scorbuto curatis.*

The patient was troubled with a great difficulty of breathing, had lost the use of his limbs ; his left knee, and whole leg, being swelled, scirrhous, spotted, and so stiff, that he could not walk, or even move himself…

Forestus, who has had great practice in this disease, says, the pathognomonic signs of it are, a straitness of the præcordia ; weakness and pain of the legs ; redness, pain, and itching in the gums ; with an alteration of colour in the face. However, in the beginning it is not so easily known ; being sometimes slow in its progress, and having the above symptoms, together with a lassitude after exercise, common to it with other diseases. But where all such signs appear together, he thinks it the beginning of the distemper, or at least there is some certainty of an approaching scurvy…

In particular, after the remarkable proneness to swoon in the height of the malady, he adds, that he has known several drop down dead instantly…

1600
Hieronymi Reusneri diexodicarum exercitationum liber de scorbuto.

The pulse is low, weak, slow, and inordinate

1604
De morbo scorbuto liber; cum observationibus quibusdam, brevique et succincta cujusque curationis indicatione. Auctore Severino Eugaleno.

And the IV. is a difficulty of breathing ; known to be scorbutic, 1*st*, By the part affected ; which is under the diaphragm, at the orifice of the stomach, 2*dly*, By the complaint. It is a great and uneasy straitness and oppression upon the præcordia, not easily expressed. 3*dly*, By its remission and intermission ; though sometimes it is almost continual. 4*thly*, By its having none of the symptoms which usually follow disorders of the breast, *viz.*, cough, pain, orthopnœa, *&c.* …

XI. Fainting-fits. XII. Pains of the legs. XVI. The bastard pleurisy ; discovered in a girl to be scorbutic, by the smallness and inequality of the pulse. XIX. Weakness of the legs upon walking. XXXI. The dropsy …The difficulty of breathing is at all times greater, even in the beginning ; with extreme anxiety under the diaphragm. XXXII. The encysted dropsy. Before

this is fixed in any particular place, it causes a momentaneous swelling as it were, in different parts of the body ; which most commonly happens upon change from a finer to a thicker air, or to those who use gross food ; otherwise the legs swell first, then the whole body is covered with a hard and unequal swelling, and with various indolent tubercles, *&c*…

[In PART I CHAPTER I, Lind extensively criticizes Eugalenus for inappropriate extension of the definition for scurvy]

1608
Felicis Plateri praxeos medica lib. 3. *cap.* 4. *de defadatione.* Under which title, he treats of the *lues venerea, scorbutica,* and *elephantica.*

The sweat of scorbutic persons is foetid ; their urine red and turbid ; their pulse feeble

may end in… dropsy

1609
Matthcei Martini de scorbuto commentatio.

… the smallness and inequality of the pulse…

1624
Dan. Sennerti tractatus de scorbuto. Ejusdem practices medicines lib. 3. *pars.* 5.

difficulty of breathing, and tightness of the breast… an asthma… palpitations of the heart… dropsy…

1645
Consilium medicæ facultatis Hafniensis de scorbuto.

It attacks the patient in various shapes, according to his habit and constitution, or other diseases with which it may be complicated.

difficulty of breathing ; swelling, putrefaction, and bleeding of the gums ; loose teeth ; a weakness, swelling, and stiffness of the legs ; spots, and the like.

Although the malady may not easily be discovered in the beginning, by reason of its appearing under the form of other diseases ; as also from its unexpected and slow attacks, (so that, in countries in which it is endemic, we are to suspect anomalous diseases not yielding to the usual remedies, especially if the patient is of a melancholy disposition, to be scorbutic) ; yet when the distemper is violent, it is easily known. It is usually preceded by a lassitude of the whole body, weakness of the legs, breathlessness upon walking.

When farther advanced, the difficulty of breathing is so great, that the patient cannot walk or move himself, but he falls into a swoon ; of which he recovers when laid in bed.

the legs swell, and grow stiff, so that the patients cannot walk…

The pulse is variable ; sometimes weak, at other times strong, when the patient seems very weak ; and now and then it is altogether obscure. This evil is easily removed by proper remedies in the beginning ; but when advanced, it is not so easy to prevent relapses. Where proper diet and medicines are neglected, health is seldom restored. It commonly ends in a dropsy or atrophy. A difficulty of breathing, and black spots on the legs, are dangerous symptoms…

1667
Thoma Willis tractatus de scorbuto.

He observes, that no single description or definition of this distemper can be given ; and, consequently, that the best method of describing it, is according to the different parts affected of the body ; in all which it produces manifold symptoms.

The breast is affected with pains in different parts of its membranes, chiefly on the sternum, where they are very violent, acute, and darting ; frequent asthma's ; difficult and unequal respiration ; straitness of the breast ; violent cough ; inordinate pulse ; palpitation of the heart ; frequent faintings, and the continual dread of them.

… cardialgia…

In the limbs, or even over the whole body, there are wandering pains, often very acute, and becoming worse at night ; a spontaneous lassitude ; wasting of the flesh ; lumbago, a weakness of the other joints ; spots of various colours on the skin ; tumours, tubercles, and often cacoethic ulcers ; a stupor or stinging pain about the muscles ; a sense of cold as it were in the parts ; contractions and *subsultus* of the tendons. Besides these, scorbutic people are subject to irregular effervescencies of the blood, erratic fevers, and profuse haemorrhages.

He concludes this long detail with observing, that these are the most common and usual symptoms of the scurvy, sometimes more, sometimes fewer, of this or that kind, afflicting the diseased : but besides what have been already mentioned, there occur in it more uncommon and prodigious appearances.

Biography:
https://en.wikipedia.org/wiki/Thomas_Willis

1672
De scorbuto liber singularis ; auctore Gualtero Charleton.

… cardialgia… the symptoms are, straitness of the breast, palpitation of the heart, and faintings ; numbness and lassitude of the body… palpitations of the heart ; a sudden stoppage of the pulse, attended with great anxiety, ending in a faint, with a cold sweat.

1675
The disease of London ; or, A new discovery of the scurvy. By Gideon Harvey. [H24]

swelling and ulcers of the legs

1685
Thomæ Sydenham opera universa.

The author has no where treated expressly of this disease, but in a posthumous work ascribed to him…

… scurvy is said to be accompanied with, 1. spontaneous lassitude ; 2. heaviness ; 3. difficulty of breathing, especially after exercise ; 4. rottenness of the gums ; 5. foetid breath ; 6. frequent bleeding at the nose ; 7. difficulty of walking ; 8. a swelling sometimes, at other times a wasting of the legs ; on which spots always appear, that are either livid, or of a leaden, yellow, or purple colour ; 9. a sallow complexion.

… dropsy…

Biography:
https://en.wikipedia.org/wiki/Thomas_Sydenham

1696
Archibaldi Pitcarnii element, medicines physico-mathematic. lib. 2. *cap.* 23. *de scorbuto.*

… an unusual lassitude… an unequal pulse… faintings, fluxes, or a difficulty of breathing, afflict the patient…

1708
Hermanni Boerhaave aphorismi de cognoscendis et curandis morbis. Aph. 1148. *&c. de scorbuto.*

Sect. 1. An unusual laziness ; an inclination to rest ; a spontaneous lassitude ; a general heaviness ; pain of all the muscles as after too great a fatigue, particularly in the legs and loins ; an extreme difficulty in walking, especially up or down a steep place ; in the morning, upon awaking, the limbs and muscles feel as if wearied and bruised.
Sect. 2. A difficulty of breathing, panting, and almost suffocation, upon every little motion ; a swelling of the legs, often disappearing, and an inability to move them, from their weight…
Sect. 4. …faintings ; and an oppression upon the *præcordia*, often suddenly mortal ; a dropsy…

1732, 1734
An account of the scurvy at Wiburg. Communicated by Dr Abraham Nitzsch to Dr Schulze. *Commerc. literar. Norimb. ann*. 1734, p. 162.

I observed the appearances of the disease were not the same in all ; but different in individuals…

Those who were of a lax habit, laboured under an œdematous swelling of the legs, (rarely of the abdomen), yielding easily to the impression of the finger, but often becoming harder upon the continuance of the malady… swelling of the legs, universal lassitude…Several were distressed with a great difficulty of breathing, moist cough, a vertigo, and faintings, most commonly when in an erect posture ; the latter often proved fatal to those who had been long afflicted.

… the spasmodic asthma… calf of the leg and scrotum, when there appeared a tense watery swelling upon these parts…

1734
Parerga medica conscripta a Damiano Sinopeo.

In Cronstadt … the scurvy is an endemic and common disease.

The symptoms are, a putrid swelling of the gums, lassitude, and a remarkable pain and weakness of the legs ; swelling of the feet and knees ; contraction of the tendons ; a cachectic, and, as it were, anasarcous habit of body, with a dark yellowish hue ; costiveness, and a thick lateritious urine. After those appearances, ensue pain, and even contractions of the upper extremities ; livid spots of different sizes ; pains in the shoulders, and small of the back. These latter prove very violent in such as are tainted with the venereal poison. Few die of this distemper ; for the most part only those who have become consumptive or dropsical.

1737, 1720
Jo. Geo. Henrici Krameri dissertatio epistolica de scorbuto.
The case of the Imperial troops in Hungary; transmitted to the college of physicians at Vienna, by the author.

The muscles of the legs, thighs, and even cheeks, become greatly swelled, and hard, nay, altogether indurated. But those swellings, as also the large ecchymoses, never suppurate. The pulse is quick, small, and hard…

The difficulty of breathing is so great, that the patients not only faint away upon the slightest motion of the body ; but frequently, when walking about, drop down suddenly dead. They generally complain excessively of this dyspnœa, a few days before death, though they have neither cough nor spitting. All the species of dropsies, and œdematous swellings on the body, accompany the advanced stages of this calamity ; in so much that, by lying with the head in a declining posture, the face in half an hour becomes so swelled, that the person cannot open his eyes. Such swellings often disappear and return.

… Orthopnœa, dropsy…

Scorbutic people…Their death is for the most part tranquil, if you except their laborious breathing.

1739

Frederici Hoffmanni medicinæ rationalis systematicæ tom 4. *part* 5. *cap.* 1. *de scorbuto, ejusque vera indole.*

After a preceding scorbutic dyspnœa, the patient is very apt to fall into a dropsy…

1747

Theoretisch practische abhandlung des scharboctes, wie sich derselbige vornemlich bey denen kayserlich Ruszischen armeen an verschiedenen orten geaussert and gezeiget hat, &c. :

or, A theoretical and practical treatise of the scurvy, as it has appeared chiefly in the Imperial Russian armies, together with a circumstantial description of its causes, means of prevention, and cure. By Abraham Nitzsch.

There is a general lassitude. The thighs and legs feel heavy ; and a remarkable weakness is perceived in the knees. At the same time the gums begin to swell and corrupt. The preternatural colour of the face afterwards increases, the legs begin to be painful, the cheeks and bones swell, the gums become monstrously rotten, the body more feeble, and a difficulty of breathing ensues upon using of exercise. The knees and joints are also contracted. Finally, the appetite gradually decays, the body becomes constipated…

… the quickness of the pulse, being always increased…

… an universal pale swelling covers the body ; which becomes of a yellowish colour… the thighs and arms are prodigiously swelled and indurated… an anasarca is induced ; when within the substance of the lungs, an asthma, upon which a true *hydrops pectoris* ensues ; when in the lower belly, an *ascites per infiltrationem*… It also produces a spasmodic suffocative asthma.

These are the chief kinds of the slow scurvy, which occurred in the Russian armies, and fell under the author’s observation.

The principal reason why…such a considerable number were attacked by the scurvy, and brought into the hospital…was, the excessive fatigues they underwent through the whole winter…

1748

A voyage round the world, in the years 1740, 41, 42, 43, 44, by George Anson, Esq. ; now Lord Anson, commander in chief of a squadron of his Majesty’s ships, sent upon an expedition to the South seas. Compiled from his papers and materials, by Richard Walter, M.A. &c.

[Anson’s voyage is such interesting that this section is copied as full; see links H23]

Soon after our passing straits Le Maire, the scurvy began to make its appearance amongst us : and our long continuance at sea, the fatigue we underwent, and the various disappointments we met with, had occasioned its spreading to such a degree, that, at the latter end of April, there were but few on board who were not in some degree afflicted with it ; and in that month no less than forty-three died of it on board the *Centurion*. But tho' we thought, that the distemper had then risen to an extraordinary height ; and were willing to hope, that as we advanced to the northward, its malignity would abate : yet we found, on the contrary, that, in the month of May, we lost near double that number. And as we did not get to land till the middle of June, the mortality went on increasing ; so that, after the loss of above 200 men, we could not at last muster more than six foremast men in a watch, capable of duty.

This disease, so frequently attending all long voyages, and so particularly destructive to us, is surely the most singular and unaccountable of any that affects the human body. Its symptoms are unconstant and innumerable, and its progress and effects extremely irregular : for scarcely any two persons have the same complaints ; and where there hath been found some conformity in the symptoms, the order of their appearance has been totally different. However, though it frequently puts on the form of many other diseases, and is therefore not to be described by any exclusive and infallible criterions ; yet there are some symptoms which are more general than the rest, and occurring the oftenest, deserve a more particular enumeration. These common appearances are, large discoloured spots dispersed over the whole surface of the body ; swelled legs ; putrid gums ; and, above all, an extraordinary lassitude of the whole body, especially after any exercise, however inconsiderable : and this lassitude at last degenerates into a proneness to swoon, on the least exertion of strength, or even on the least motion. This disease is likewise usually attended with a strange dejection of spirits ; and with shiverings, tremblings, and a disposition to be seized with the most dreadful terrors, on the slightest accident. Indeed it was most remarkable, in all our reiterated experience of this malady, that whatever discouraged our people, or at any time damped their hopes, never failed to add new vigour to the distemper : for it usually killed those who were in the last stages of it, and confined those to their hammocks who were before capable of some kind of duty. So that it seemed, as if alacrity of mind, and sanguine thoughts, were no contemptible preservatives from its fatal malignity.

But it is not easy to complete the long roll of the various concomitants of this disease. For it often produced putrid fevers, pleurisies, the jaundice, and violent rheumatic pains. And sometimes it occasioned an obstinate costiveness ; which was generally attended with a difficulty of breathing ; and this was esteemed the most deadly of all the scorbutic symptoms. At other times the whole body, but more especially the legs, were subject to ulcers of the worst kind, attended with rotten bones, and such a luxuriancy of fungous flesh as yielded to no remedy. But a most extraordinary circumstance, and what would be scarcely credible upon any single evidence, is, that the scars of wounds which had been for many years healed, were forced open again by this virulent distemper. Of this there was a remarkable instance in one of the invalids on board the *Centurion*, who had been wounded above fifty years before at the battle of the Boyne : for though he was cured soon after, and had continued well for a great number of years past ; yet, on his being attacked by the scurvy, his wounds, in the progress of his disease, broke out afresh, and appeared as if they had never been healed. Nay, what is still more astonishing, the callous of a broken bone,

which had been compleatly formed for a long time, was found to be hereby dissolved ; and the fracture seemed as if it had never been consolidated. Indeed, the effects of this disease were in almost every instance wonderful. For many of our people, though confined to their hammocks, appeared to have no inconsiderable share of health ; for they eat and drank heartily, were chearful, and talked with much seeming vigour, and with a loud strong tone of voice ; and yet on their being the least moved, tho' it was only from one part of the ship to the other, and that in their hammocks, they have immediately expired. And others, who have confided in their seeming strength, and have resolved to get out of their hammocks, have died before they could well reach the deck. And it was no uncommon thing for those who could do some kind of duty, and walk the deck, to drop down dead in an instant, on any endeavours to act with their utmost vigour ; many of our people having perished in this manner, during the course of this voyage.

Upon arriving at the island of Juan Fernandes, 167 sick persons were put on shore, besides at least a dozen who died in the boats, on their being exposed to the fresh air. The extreme weakness of the sick may be collected from the numbers who died after they got on shore : for it had generally been found, that the land, and the refreshments it produces, very soon recover most stages of the sea-scurvy ; yet it was near twenty days after their landing, before the mortality was tolerably ceased : and for the first ten or twelve days, they buried rarely less than six each day ; and many of those who survived, recovered by very slow and insensible degrees. Indeed those who were well enough, at their first getting on shore, to creep out of their tents, and crawl about, were soon relieved, and recovered their health and strength in a very short time ; but in the rest, the disease seemed to have acquired a degree of inveteracy altogether without example.

It was very remarkable what happened to the *Gloucester*, which, like the other ships in that squadron, had suffered the most unparallelled hardships, and buried three fourths of her crew in this disease ; that, upon landing the remainder of her sick, less than eighty in number, very few of them died. Whether it was, (as the ingenious author observes), that the farthest advanced in the distemper were already dead, or the greens and fresh provisions sent on board them when plying off that island, had prepared those who remained for a speedy recovery ; their sick, however, in general, got much sooner well than the *Centurion*' s crew.

The havock which this dreadful calamity made in those ships, was truly surprising. The *Centurion*, from her leaving England, when at this island, had buried 292 men, and had but 214 remaining of her complement. The *Gloucester*, out of a smaller complement, buried the same number, and had only 82 alive. This dreadful mortality had fallen severer on the invalids and marines than on the sailors : for on board the *Centurion*, out of fifty invalids, and seventy-nine marines, there remained only four invalids, including officers, and eleven marines ; and on board the *Gloucester*, every invalid died, and only two marines escaped out of forty-eight.

In less, however, than seven weeks after leaving the coast of Mexico, having continued in perfect health for a considerable time before, this fatal disease broke out again amongst them. Upon which occasion, the ingenious author makes the following remarks.

Some amongst us were willing to believe, that in this warm climate the violence of the disease, and its fatality, might be in some degree mitigated. But the ravage of the distemper

at that time convinced them of the falsity of this speculation ; as it likewise exploded other opinions about the cause and nature of this disease. For it has been generally presumed, that plenty of water, and of fresh provisions, are effectual preventives of this malady. But it happened in the present case, we had a considerable stock of fresh provisions on board, being the hogs and fowls taken at Paita. We besides, almost daily, caught abundance of bonito's, dolphins, and albicores : and the unsettled season having proved extremely rainy, supplied us with plenty of water ; so that each man had five pints plenty of water, and fresh provisions distributed among the sick, and the whole crew often fed upon fish ; yet neither were the sick hereby relieved, nor the progress and advancement of the disease retarded. It has likewise been believed by many, that keeping the ship clean and airy betwixt decks, might prevent, or at least mitigate the scurvy ; yet we observed, during the latter part of our run, that, though we kept all our ports open, and took uncommon pains in sweetening and cleansing the ships ; yet neither the progress, nor the virulence of the disease were thereby sensibly abated. The surgeon at this time having declared, that all his measures were totally ineffectual for the relief of his patients, it was resolved to try the effects of Ward's drop and pill ; and one, or both of them, at different times, were given to persons in every stage of the distemper. Out of the number who took them, one, soon after swallowing the pill, was seized with a violent bleeding at the nose. He was before given over by the surgeon, and lay almost at the point of death ; but he immediately found himself much better, and continued to recover, though slowly, till we arrived on shore near a fortnight after. A few others were relieved for some days. But the disease returned again with as much virulence as ever ; though neither did these, nor the rest who received no benefit, appear to be reduced to a worse condition than they would have been if they had taken nothing. The most remarkable property of these medicines in almost every one that took them, was, that they operated in proportion to the vigour of the patient. So that those who were within two or three days of dying, were scarcely affected ; and as the patient was differently advanced in the disease, the operation was either a gentle perspiration, an easy vomit, or a moderate purge. But if they were taken by one in full strength, they then produced all the before mentioned effects with considerable violence ; which sometimes continued for six or eight hours together with little intermission. Upon their arrival at Tinian, they soon began to feel the salutary influence of the land : for though they had buried in two days before twenty-one men, yet they did not lose above ten more from the day after they were landed ; and reaped so much benefit from the fruits of the island, particularly those of the acid kind, that in a week's time there were but few of them who were not so far recovered as to be able to move about without help.

1748

A voyage to Hudson's-bay, by the *Dobbs* galley, and California, in the years 1746 and 1747, for discovering a north-west passage. By Henry Ellis

Our men, when first seized with it, began to droop, to grow heavy, listless, and at length indolent, to the last degree : a tightness in the chest, pains in the breast, and a great difficulty in breathing followed ; then ensued livid spots upon the thighs, swelled legs, contraction of the limbs, putrid gums, teeth loose, a coagulation of blood upon and near the back-bone, with countenances bloated and sallow ; these symptoms continually increasing, till at length death carried them off, either by a flux or a dropsy.

[The following are from the 3rd ed p.453-494 and were not included in the 1st ed]

1736, 1750.
Or a journal of voyages made by order of the court of Russia *into* Ramavatzin, *by the coast of* Siberia *&c. By* M. Gmelin.

The disease began by pains afflicting those parts of the body which were formerly subject to ulcers or other complaints. The appetite was a little diminished; after which followed a weakness of the body, accompanied with an extraordinary lethargic indolence. The legs became swelled, and were covered with blueish spots. The patients sneezed with difficulty, and then piercing pains were felt in the back. The teeth were all loose; the breath was fœtid. Towards the close of the disease a dropsy came on, accompanied with a violent thirst. A dry cough and costiveness were symptoms common to all, insomuch that many remained constipated for two or three weeks ; the strongest purgatives were of no effect ; and in this condition one died after another.

With regard to the case of the lieutenant, it is said, that towards the end of the disease, it was remarked, he had a violent fever, an asthma, an insensibility over the whole body, and an hiccough, under which he expired.

Upon opening the body… The right lobe of the lungs was covered with a viscid humour ; the throat and *aspera arteria* were inflamed ; the heart and the great artery were distended with a blackish blood…

1755
A treatise on the scurvy. Designed chiefly for the use of the British *navy. By* Charles Bisset.

Chap. 1. *Of the progress and different species of the scurvy.*

The forms the scurvy now assumes are divided into five classes.

The first is, when an *anasarca* is the most prevalent symptom: this does not often occur.

In the second species, the *anasarca* is almost wholly confined to the legs and feet : little elevated pustles about the bigness of a small pin-head at the roots of the hairs of the legs, are most conspicuous in this species and the third.

In the third the legs are swelled and hard, chiefly at the calves, and sometimes they are greatly indurated without much swelling. The muscles of the thighs are often rigid and painful…

The fourth species is distinguished by a dry emaciated habit and legs, excruciating bone-achs, frequently most violent in the middle and forepart of the legs…

The fifth species, the most malignant and fatal, is commonly preceded by a continued or remitting fever, and sometimes the second and third species degenerate into it, especially if supervened by any degree or species of fever. Besides the usual symptoms of a bloated complexion and oedematous legs… Two cases occurred wherein the diuresis was much impaired, with thick turbid urine…

Chap. 4. *Of the method of curing the scurvy, particularly at sea and in desert places.*

… in the treatment of the first we must chiefly regard the dropsy: for the cure of which he furnishes us with great variety of all such medicines as have been recommended in dropsical cases. He has observed good effects in scorbutic swellings and spots…

Sweet oranges will be best tor this purpose in stiff and painful swellings, indurations, *&c.*

1761

Tractatus de scorbuto, Joannis A Bona.

He observes in his dedication, that no *Italian* author had before him treated expresly on the scurvy, so far as he knew.

The symptoms were a lassitude, spots of various colours, bleeding swelled gums, loose teeth, acrimonious spittle, pain and contraction of the knees, a weak feeble pulse, *&c.*

1764

Ludovici Rouppe, *M. D. de morbis navigantium liber, sect.* 2. *cap.* 2. *de scorbuto.*

… if life be so long preserved, the hardness of the legs is converted into a soft swelling…

The dropsy and a mortification are the last and deadly symptoms of the distemper.

In the first dead body mentioned to have been opened (which was of a person who died at the island *Curacoa* of a *yellow* fever and scurvy) we find nothing remarkable; but that about three pounds of a yellow or reddish water was contained in the belly, the liver was hard and very large, but upon cutting, it appeared of the natural colour. The gall bladder was replete with a yellow gall.

The 2nd dissection was of a soldier, who after having suffered uncommon distress from the scurvy, which gradually passing through its three different stages terminated in a dropsy, was at length suffocated by it. The cellular membrane under the skin and between the muscles of the belly, was turgid with water. Three or four pints of yellow water were found betwixt those muscles and the *peritonæum*, and a like quantity in the cavity of the belly. The *omentum* was consumed. In the breast were some ounces of water. The lungs were of a red or livid colour, hard to the touch; and their blood vessels full of black blood. They were encrusted over with a fleshy substance half an inch thick, of a red colour like to that of the liver, and sunk in salt-water. The heart was large, and of a white colour ; its right *ventricle* and *sinus* being distended with black coagulated blood, and with a yellow *polypous* substance. On the left side of it there was no blood, but a *polypous* substance extended into the artery.

Much the same appearances were observed in another person, who had been afflicted with almost all the symptoms of the scurvy. His legs had for three months been as hard as a piece of wood, until about ten days before his death, when they began to swell, his appetite and senses continuing entire to the last. He expired with his body surprisingly contracted.

A yellow transparent gelatinous substance was found between the several abdo*

minal muscles, and spread upon the peritoneus as alfo a like fubftance (but not fo

tough) in the cavity of the belly. The fpleen

was hard large and white; the liver white

and enlarged.

… The lungs and heart were in the same state as in the former dissection…

A man who had been afflicted with the scurvy for a whole winter died at Naples. His knees were greatly swelled, and a crackling noise had been perceived in the joint when moved. Above ten pounds of a turbid water having a disagreeable cadaverous stench was found in his belly. The liver and spleen were quite corrupted. The *mesentery* was full of knots, the lungs hard. The heart contained, besides some coagulated blood, a *polypous* substance…

In a man who died of hunger and the scurvy, the *omentum* was corrupted, the liver hard and enlarged, the gall-bladder full of a black greenish bile, the *mesentery* spotted with black and red blotches, the lungs were in a sound state, but the right *ventricle* of the heart contained black coagulated blood, and somewhat of a *polypous concretion* as in the former persons…

In others, who had died of the scurvy, he found pretty much the fame appearances, *viz.* the lungs hard, its vessels turgid with black blood ; in the right *ventricle* of the heart, the blood was coagulated and a *polypous* substance extended into the large blood-vessels. In those who died dropsical, the bowels for the most part were corrupted, and as it were *water-soaked* ; the gall bladder was full of a green or black bile, and the *mesenteric* glands obstructed.

1768

Libellus de natura, causa, curationeque scorbuti. Auctore Nathaniele Hulme, *M. D. To which is annexed a proposal for preventing the scurvy in the* British *navy.*

…

In a voyage to *India*… scorbutic asthma.

… an acute pain of the breast…

The scorbutic asthma is to be removed by the juice of oranges or of lemons…

Scorbutic pains and swellings…

POSTRIPT to the 3rd ed (1772) [for the revised ed. not in the 1st ed]

SECTION I: ***Appearances on dissection of scorbutic bodies.***

p.495-496

SINCE the second edition of the preceding Treatise was published, I have had an opportunity of inspecting a number of the bodies of such as died of the scurvy in *Haslar* hospital. Outwardly several of them had the appearance of being much wasted and extenuated, but a few were still plump and corpulent, having the *tela cellulosa* sufficiently distended, and no apparent consumption of the body.

…

The greatest signs of putrefaction were commonly observed in the limbs, especially in the legs and thighs, which are most frequently the seats of the disease.

Of those parts an accurate dissection cannot indeed be well performed, by reason of the fleshy or muscular fibres being extremely lax and tender. What also greatly obstructs the operator, is the large quantity of congealed blood, which presents itself, not only where no stains, or mark of it can be perceived on the surface of the body, and where no hardness of the flesh can be felt, but even in limbs greatly emaciated. The quantity of this effused stagnating blood was sometimes amazing : we have opened bodies in which almost a fourth part of this vital fluid had escaped its vessels.

p.499

In the cavities of the breast there was commonly confined a quantity of *serum* or water, especially in the left side. A dropsy in that side, as like-wise of the *pericardium*, being frequent occurrences.

This water was apt to whiten and shrivel the hands of the person who dissected the body ; and in some instances where the skin of his hands was broke, it irritated and *festered* the wound. A dropsy in the substance of the lungs was remarked in a few, and in most strong adhesions of the lungs to the *pleura* : which last are usually met with in dead bodies.

p.500-501

Water was sometimes lodged in the cavity of the belly, even when there was no apparent swelling of it ; but not so frequently as in the breast. The water in both cavities was of a similar nature…

In a word, the true scorbutic state, in an advanced stage of the disease, seems to consist in numerous effusions of blood into most parts of the body, superficial as well as internal, particularly into the gums and legs. This is frequently, though not always, accompanied with a dropsical indisposition, which appear chiefly in the legs and breast.

When there is no disorder in the breast, swelling of the belly or legs, the patient may be supposed to labour under extravasations of the blood only; but when the legs are soft and

swelled, the water which is there seated in the cellular membrane is apt to be occasionally conveyed elsewhere, particularly into the breast. I have observed some patients to be tolerably free from complaints in their chests, while their legs continued swelled : and on the contrary to become afflicted with *asthmatic* complaints, attended with acute pains in the side, when by a horizontal posture, or by their lying in bed, the swelling of the limbs subsided. And a few, upon the disappearance of large watery swellings of their legs, were suffocated by the removal of the water into their breast.

But it must be remembered, as I said before, that a dropsical disposition does not always accompany this disease. In some cases the legs do not swell at all, but continue, through the whole course of the disease, hard, painful, and discoloured; when there is no water, and but little blood effused in them, they are for the most part greatly emaciated.

p.502

The acute pain in the breast, so frequent in this disease, is most commonly felt on the left side, about an hand-breadth above the pit of the stomach, at the articulation of the ribs with the breast-bone. I have often observed, at that place, swellings of the *cartilages*.

Sudden death is often occasioned by the rupture of a blood vessel, and a subsequent discharge of the blood into one of the large cavities of the body. I have remarked this to happen in the breast; and once observed coagulated blood swimming in the liquor of the *pericardium*, or membrane inverting the heart, however it most frequently occurs in the belly…

In patients, whose deaths were unexpected and sudden, and where no effusion of blood could be perceived in any cavity of the body ; the heart was commonly much distended with blood : the *auricles* and *ventricles* of both sides were filled, but those on the right to the greatest degree.

p.503

In one man, who suddenly dropped down dead, while walking in the fields ; there was a large *polypus* which filled entirely the right ventricle of the heart, and sent forth two branches, one into the *pulmonary* artery, another through the right *auricle* into the *vena cava*. But I am apt to think those *polypous* appearances, so commonly found in the heart of those who die of the scurvy, are formed after death. And, indeed, it is impossible to conceive, that the branch of a *polypus* should run in a living person from the heart into the *vena cava*, it being contrary to the well known course of the circulation of the blood. In the same person, a few clots of blood were found in the cavity of the breast.

The doctrine of *polypous* concretions in the heart, during life, is upon the whole very exceptionable, and the fatal consequences said to arise from thence are often merely imaginary. That these concretions are most probably formed after death, appears from their being generally found in the right *ventricle*, seldom in the left ventricle of the heart, the former of which after death is generally distended with blood, the latter seldom contains any.

SECTION II: ***Effects of the scurvy on other diseases.***

p.504-505

I have remarked among some thousand patients in *Haslar* hospital, that such as were scorbutic, were not liable to be seized with fevers and that even an infection from a fever was long resisted by a scorbutic habit of body. To illustrate this remark, I must observe, that patients in an advanced state of the scurvy have often a quick and low pulse, and at times a considerable degree of heat on the skin…

… Much about this period of the disorder, it is usual for a few to be suddenly attacked with the scorbutic pain in the breast, a difficulty of breathing, and cough.

This I conjectured might be owing to the water being suddenly, and in too great a quantity removed from the *cellular membrane* of the legs, into the cavity of the chest. I have examined the cases of several thousand scorbutic patients, who had been sent from different ships, in order to find, whether any other fever was commonly attendant on the scurvy, than what has been already mentioned.

SECTION III: ***State of the blood and secretions in the scurvy.***

p.515

Now, in several scorbutic habits, there is a manifest redundancy of *water,* stagnating in the body ; by reason not only of the weakness of the solids, or of the constitution, but also from a diminution of the watery secretions.

SECTION V: ***The cure.***

p.521

But what I have found highly to improve the antiscorbutic virtues of the juice, was an addition of wine and sugar… such draughts ought always to be administered : they frequently prove greatly *diuretic*, and will sometimes occasion profuse sweats.

[Case reports]

p.523-526

George Young, ten days after a fever, was seized with the scurvy in his legs. They became extremely painful and swelled towards the evening… He was extremely weak, had a cough… he eat two apples every day, and had broth with greens for three weeks, mending but slowly till ordered fresh lemons, then he recovered apace.

Reeves was long ill of a fever and flux, by which he was greatly reduced. He complained of intolerable pains in his legs, accompanied with spots and a large swelling. After taking lemon juice in wine, for some days, he was seized with a severe fit of shivering, upon which he fell into a violent and profuse sweat, which removed the *anasarca* and scurvy entirely.

But in a few days he relapsed into the flux, upon which his *anasarcous* swellings returned, these continuing after the scurvy had entirely left him.

[A] lady, during a tedious recovery after her delivery in child-bed, was seized with universal and severe pains, particularly in the back, legs, and thighs; she had frequent bleedings at the nose, and her gums were so painful, that she could not chew any solid food ; she became at length so low and feeble, to be seized with a great difficulty of breathing, and a disposition to faint away upon the least exertion of her strength… The nature of her disorder being quite obvious, I discontinued all her former medicines, and by the same acid and vinous draughts, as in the former case, this lady, from a dangerous condition, was restored to a perfect state of health.

p.528

But the most frequent concomitants of the scurvy, and which require our particular attention, are, dropsical swellings in almost every part of the body ; these are often very difficult to remove, and sometimes prove fatal.

Weak, aged, and scorbutic persons, are subject to a cough, swellings of their legs, and sometimes even of the face, all which I judge to proceed from *serum* extravasated in those parts.

… when a considerable quantity of water is accumulated in the breast, it will sometimes, without any other cause, give rise to a violent and incessant cough, attended with a constant spitting of gross phlegm, of which I have seen several instances, and sometimes it produces so great a difficulty of breathing, that the patient cannot lie on bed, but must sleep in an erect posture. The *peripneumonia notha*, which so often puts an end to the life of old men, sometimes proceeds from this cause. In several young persons, who have died consumptive, the lungs seem to have been chiefly injured by being steeped or macerated in the water contained in the breast ; and in others, the waste of substance in the lungs, it is not improbable, may be owing to their peculiar structure ; for as in a general decay of the body, some parts seem to suffer more than others, so, next to the *omentum*, the lungs are often found to be the organ which corrupts, and is consumed soonest.

Œdematous swellings of the legs, accompanying these disorders of the breast, are the surest signs of water being in that cavity. This water may sometimes have no communication with that of the legs, or any part of the body, but it is certainly more frequently the case, in weak scorbutic persons, that water in the legs is received from, and returned again into the cavities of the breast and belly, as I have formerly observed.

It must be owned, that the passages for such water, from those cavities into the legs, are unknown to us ; but they are no more so, than the passages for it into the intestines or kidneys, from which sometimes, by slight irritations of those parts, or from other causes, it is plentifully discharged.

There is no doubt, but in some scorbutic patients, there is also water even in the joints of the knees. For those scorbutic patients, whose legs were much swelled and *œdematous*, we prescribed daily a pint of strong beer, medicated with the most powerful *antiscorbutic* herbs.

When the difficulty of breathing was great, and attended with violent fits of coughing at night, we gave at bed-time the salt of tartar, joined with an opiate, in sufficient quantity to procure rest, and to promote a plentiful flow of urine.

But, if notwithstanding those remedies, the water increases so much as to impede respiration, and both legs are affected with a soft swelling, which retains the impression of the finger for a considerable time…

… dropsy of the breast…

SECTION VI: ***Further observations on the cure. Conclusion.***

p.533

THE scurvy admits not only of various and very opposite methods of cure, but is also often relieved by the most simple means. There are few chronic diseases so painful, and attended with such a variety of alarming symptoms, in which the transitions from life to death, or from sickness to health are so unexpected and sudden ; a removal of the cause often produces an almost immediate effect on the disease.

Carpenter KJ. The History of Scurvy and Vitamin C (1986)

Kenneth J Carpenter's book "The History of Scurvy and Vitamin C" was published in 1986. Currently it is the most authoritative monograph on scurvy, and about the search for the substance the deficiency of which causes scurvy. However, the descriptions of symptoms of scurvy are rather brief yet worth collecting. On the following pages are extracts/excerpt? that are relevant about the effects of vitamin C deficiency on the cardiorespiratory system.

https://www.cambridge.org/fi/academic/subjects/history/history-medicine/history-scurvy-and-vitamin-c

https://archive.org/details/historyofscurvyv0000carp

Book reviews
https://doi.org/10.1086/354301
https://doi.org/10.1038/324177a0
https://doi.org/10.1086/ahr/92.4.927
https://doi.org/10.1093/jn/117.3.599
https://doi.org/10.3138/cbmh.4.2.198
https://doi.org/10.1093/jhmas/42.3.386
https://doi.org/10.1002/ajpa.1330770314
https://doi.org/10.1017/S0007087400024602
https://doi.org/10.1177/027046769001000241
https://doi.org/10.1016/0191-6599(88)90148-9

https://www.ncbi.nlm.nih.gov/pmc/articles/pmc1139720
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https://www.ncbi.nlm.nih.gov/pmc/articles/pmc2589114
https://www.ncbi.nlm.nih.gov/pmc/articles/pmc5379445

p.1-2 **Portuguese and Spanish expeditions**

From 1440 on, Portuguese sailors had been exploring the west coast of Africa, getting successively farther south, and finally rounding its southern Cape in 1487. Ten years later, Vasco da Gama led an expedition designed to go by this route all the way to the Indies. The fleet of four ships, with a total of about 140 people on board, left Lisbon on July 9. By January 24 of the new year 1498, they had rounded the Cape and reached a river mouth on the southeast coast of Africa. They spent a month there cleaning the ship hulls and refitting a mast. Da Gama notes that "many of our men fell ill here, their feet and hands swelling, and their gums growing over their teeth so that they could not eat." They ran up the eastern coast, and on April 6, while beached at night, two boats manned by Moorish traders approached, one laden with fine oranges "better than those of Portugal." Two of the moors remained on board, accompanying them that day to Mombasa. "In front of the city there lay numerous vessels all dressed in flags… Anxious not to be outdone we even surpassed their show, for we wanted in nothing but men, even the few we had being very ill." By April 12, "it pleased God in his mercy that… all our sick recovered their health for the air of this place is very good."

On the return journey across the Arabian Sea, they were hindered by "frequent calms and foul winds," and were twelve weeks at sea (October to December, 1498). The sailors "again suffered from their gums; their legs also swelled, and other parts of the body, and these swellings spread until the sufferer died without exhibiting symptoms of any other disease." As on the previous occasion, thirty men died, and only seven or eight were fit enough to navigate each ship.

In another two weeks there would have been no men at all to navigate the ships… all bonds of discipline had gone … we addressed vows and petitions to the Saints… it pleased God in his mercy to send us a wind which, in the course of six days, carried us within sight of land… at this we rejoiced as we … hoped to recover our health there as we had done once before… On Monday, the 7th of January we again cast anchor off Mitindy… the Captain-Major sent a man on shore to bring off a supply of oranges which were much desired by our sick.

There is no further description of sickness in the later part of the voyage, just a comment, as they rounded the Cape of Good Hope, that "those who had come so far were in good health and quite robust." But they were no more than half of the original complement. What can we conclude from this record? First, it seems that the sickness they encountered had been quite outside their previous experience; nor do they relate it to anything they had read. It would also seem that, by the time of its second appearance, the crew were convinced that the oranges that they had eaten on the earlier occasion were powerful curatives, because they were specifically asking for them. On each occasion apparently, the sickness appeared only after they had been ten weeks at sea.

p.3

After the return of da Gama, the Portuguese rapidly organized further expeditions… In 1579, Thomas Stevens, who was a passenger on one of the regular voyages from Lisbon to Goa wrote home:

… by reason of the long navigation, and want of food and water, they fall into sundry diseases, their gums wax great, and swell, and they are fain to cut them away, their legs swell, and all the body becometh sore, and so benumbed, that they can not stir hand nor foot, and so they die for weakness, other fall into fluxes and agues, and die thereby…

p.5

In 1602, Father Antonio de la Ascension, a would-be missionary of the Order of Barefoot Carmelites, was the diarist in an expedition from the south of Mexico exploring the coast of what is now Baja California and the State of California. Even though they had repeatedly been ashore and bartered for provisions with curious Indians, both officers and men began to suffer from disabling sickness. He said that it was the same illness that attacked

every year those who sail from the Philippines to New Spain [Mexico] and come in sight of the neighborhood of Cape Mendocino or in that latitude. It is this which causes the death of almost all those who die on that route, there being years when hardly a person is left on the ships to manage the sails…

The first symptom they notice is a pain in the whole body which makes it so sensitive to touch… the legs and the thighs become so straight and stiff with them that they cannot be extended or drawn up a degree more than the state in which they were when attached… The sensitiveness of the bodies of these sick people is so great that… the best aid which can be rendered them is not even to touch the bedclothes… the upper and lower gums of the mouth in the inside of the mouth and outside the teeth, become swollen to such a size that neither the teeth nor the molars can be brought together. The teeth become so loose and without support that they move while moving the head… With this they cannot eat anything but food in liquid form or drinks… they come to be so weakened in this condition that their natural vigor fails them, and they die all of a sudden, while talking.

p.8 **The French and English in North America**

A second expedition, under Jacques Cartier, left in 1534 with the aim of trying to find a route that would lead them across the continent, beginning with a navigation into the St. Lawrence estuary… late September, it was too late to return home; they were faced with wintering where they were, and built a stockade on an island in the river bed. From mid-November until mid-April 1536, their ships were frozen in:

… some-lost all their strength, their legs became swollen and inflamed…

some lost all their strength, their legs became swollen and inflamed, while the sinews contracted and turned as black as coal. In other cases the legs were found blotched with purple-coloured blood. Then the disease would mount to the hips, thighs, shoulders, arms

and neck. And all had their mouths so tainted, that the gums rotted away down to the roots of the teeth, which nearly all fell out.

There died Phillip Rougemont, aged some twenty-two years, a native of Amboise. And because the disease was a strange one, the Captain had the body opened to see if anything could be found out about it, and the rest, if possible, cured. And it was discovered that his heart was completely white and shrivelled up, with more than a jugful of red date-coloured water about it… his lungs were very black and gangrened; and all his blood has collected over his heart, for when the body was opened, a large quantity of dark, tainted blood issued from above the heart.

… As soon as they had drunk it [juice of leaves of *Annedda* in the local language], they felt better which must clearly be ascribed to miraculous causes; for after drinking it two or three times, they recovered health and strength and were cured of all the diseases they had ever had.

p.14 **British experience at sea**

Thomas Candish (or Cavendish) led another circumnavigation, setting out in 1586… John Davis's ship, the *Dainty*, got through the Straits only to be driven back, and the crew rested on the Argentine coast; the narrator went on: “In this place we found a herbe called scurvygrass, which we fried with eggs, using train oil instead of butter. This herbe did so purge the blood, that it took away all kinds of swellings, of which many died, and restored us all to perfect health of body, so that we were in as good a case as when we came first out of England.”

After crossing the Equator,

the men began to fall sick of a monstrous disease: for in their ankles it began to swell, from thence in two days it would be in their breasts, so that they could not draw their breath, and then fell into their cods, and their cods and yardes did swell most grievously and most dreadfully to behold, so that they could neither stand, lie, nor go. Whereupon divers grew raging mad, and some died in most loathsome and furious pain… To be short, all our men died except sixteen of which there were but five able to move.

[train oil: obtained by boiling the carcasses of seals and skimming it off]
[cod: testicle in Old English]
[yarde: penis in Old English]

p.15

Sir Richard Hawkins [L1] led another expedition in 1593. He had been a leader in the fight against the Armada, and both his father and grandfather had been famous sea captains. Twenty years after his return, he published his “observations” on the voyage; this is an elder's book of advice rather more than a detailed record of the voyage.… “The signs to know this disease in the beginning are divers: … by denting of the flesh of the legs with a

mans finger, the pit remaining without filling up in a good space. Others show it with their laziness: others complain of the crick of the back, etc."

Hawkins then considered the diseases at some length: "The signs to know this disease in the beginning are divers: by the swelling of the gums, by denting of the flesh of the legs with a mans finger, the pit remaining without filling up in a good space. Others show it with their laziness: others complain of the crick of the back, etc., all which are, for the most part, certain tokens of infection."

p.29-30 **The writings of learned men**

As we have already seen, the English sea captain Sir Richard Hawkins said in the 1590s that in his twenty years at sea he could give account of 10,000 men consumed with scurvy, and added that he "wished some learned man would write of it, for it is the plague of the sea."

It was only a minority of the early expeditions that carried a surgeon, and he would naturally have been a lowly member of his profession (or otherwise he could have obtained better employment), He was therefore unlikely to write a treatise on the subject or to find a publisher if he did. Surgeons were also considered inferior to physicians…

The physicians, of course, were less likely to encounter cases of scurvy. Nevertheless, there had already been some "learned writing" at the time of Richard Hawkins's appeal. In 1541, John Echth [L3], a Dutch physician practicing in Cologne had sent a short treatise to a colleague for his consideration, though it was published only after his death in 1556. It was written in Latin, the international language of educated Europeans, and even the author's name was given as Johannus Echthius. It was intended to be an "epitome" or summary of the subject. He called the disease "scorbutus" and explained that he had Latinized the Danish word *Scorbuck*, which had been taken over by German-speaking people. (Modern scholars, in turn, have traced the word back through the earlier Scandinavian forms of *skjoerbug* and *skörbjugg* to the old Icelandic *skyrbjûgr*, which is believed to signify "cut (or ulcerated) swellings." As seen already in Chapter 1, even in English, early forms of the word were scarby and scorby.)

p.36-39

John Woodall [C1], the Surgeon-General of the British East India Company, in relation to his emphasis on provisioning their ships with juice from oranges, lemons, or limes… as so many others had done, he remarked on how some could be swollen as with a dropsy and others have their legs withered and apparently dried up… "The use of the juice of lemons is a precious medicine and well tried".

[Records by John Hall, who was married with the daughter of William Shakespeare]

The following is an example of a relatively straightforward case [of scurvy] (probably in 1622):

Mrs. Mary Talbot… troubled with the Scurvy… her Pulse was small and unequal

Hall's own wife Susanna, who would then have been forty-seven years old. She

was troubled with the Scurvy, accompanied with Pain of the Loins, Corruption of the Gums, Stinking Breath, Melancholy, Wind, Cardiac Passion [disorder causing distress], Laziness, difficulty of breathing…

C1. John Woodall (1617) The Surgeon's Mate
https://archive.org/details/surgionsmateortr00wood
https://en.wikipedia.org/wiki/John_Woodall

p.46-47 **Scurvy in the British Navy**

Anson's voyage 1740-1744 [See links at H14]

Anson's voyage makes an extraordinary story, which is readily available to the modern reader. It is famous, on the one hand, for the tenacity and courage of its commander and, on the other, for the extraordinary losses from sickness. Three of the ships were no longer with him in the Pacific. Of the remainder, which started with over 1,000 men, only 145 returned, and the great majority of the rest died of scurvy.

… many of our people, though confined to their hammocks, ate and drank heartily and were cheerful, yet having resolved to get out of their hammock, died before they could well reach the deck. It was also no uncommon thing for those who were able to walk the deck, to drop down in an instant on any endeavours to act with their utmost vigor.

Pascoe Thomas, the schoolmaster on the *Centurion*, wrote after his return:

… the most active, stirring persons are oftenest seized with this disease; and the continuation of their labour only helps to kill them the sooner.

p.110-112 **Scurvy in California, 1848-50** [the Gold Rush]

… adults on crutches and children so crippled from scurvy that they could not move a limb.

One miner wrote: "I was again dreaming of fortune and success, when my hopes were blasted by an attack of a terrible scourge that wrought destruction through the northem mines during the winter of 1848/9 … land scurvy… many persons were rendered unable to walk by swellings of the lower limbs, and severe pains in them… I noticed its first attack upon myself by swelling and bleeding of the gums, followed by a swelling of both legs below the knee; and I was laid up in my tent."

p.113-118 **The Crimean War, 1854-6**

In the British Army, ominous signs had begun to appear as early as August.

During the ensuing winter 1,600 were admitted to hospital with the disease. However, the official *Medical and Surgical History* of the war states that

Before the more specific signs appeared, the patient was apathetic… and dull aching pains in the ankles and feet were complained of… There was shortage of breath on slight exertion.

p.119-122 **The American Civil War, 1861-5**

As the disease advanced the body became swollen, the face bloated.

Dr. Foltz, the surgeon who described the [scurvy] epidemic in this Fleet, was himself on the *Potomac*'s sister ship, the *Raritan*, which fared even worse: "More than two hundred cases of scurvy were under treatment… The more vigorous and active men's habits, in the same ratio were their liabilities to the attack, and the violence of the disease." … "Where the disease was far advanced, the respiratory system was much involved."

The Surgeon of the Twenty-eighth Massachusetts Regiment, for example, reported "the usual marks of the disease… painful swelling of the muscles, languor, nostalgia"

Dr. Letterman, who described, in a later report, what he had found:

scurvy had made its appearance… it is not to be dreaded merely by the numbers it sends upon the reports of the sick… The causes which give rise to it undermine the strength, depress the spirits, take away the energy, courage, and elasticity of those who do not report themselves sick, and who yet are not well… Their energy, their powers of endurance, and their willingness to undergo hardship are in a great degree gone, and they know not why. In this way it had affected the fighting powers of the army.

p.151-154 **The Arctic and Antarctic expeditions**

Scott set off again with Shackleton and Wilson… all three were definitely scorbutic, and Shackleton, who had been the strongest and hardest working of them all, was breathless and coughing up blood.

Lieutenant Edward Evans… By the end of January, Evans had "a stiffness at the back of the legs behind the knees," then they turned "swollen, bruised and green."

p.156-160 **Infantile scurvy**; Barlow's disease

In January 1877, Dr. Cheadle [C2], a leading London pediatrician most famous for his studies on rickets… child of sixteen months … extremely swollen gums, spongy and bleeding with an offensive smell; his legs were swollen and extremely tender to the touch.

Francis Glisson, the Cambridge Professor whose classic book on infantile rickets was published in 1650, also said: "The scurvy" … "pains running through their joynts" on any

kind of movement, and sometimes “palpitations of the heart… soon mitigated by laying them down to rest.”

C2. Cheadle WB. Clinical Lecture ON THREE CASES OF SCURVY SUPERVENING ON RICKETS IN YOUNG CHILDREN. Lancet 1878
https://doi.org/10.1016/S0140-6736(02)43922-0
https://www.ncbi.nlm.nih.gov/pmc/articles/pmc1975437

The Sheffield Experiment (1944-1946)
https://doi.org/10.1093/ije/dyl020
https://www.ncbi.nlm.nih.gov/pmc/articles/pmc2125893

https://en.wikipedia.org/wiki/Sorby_Research_Institute
https://www.sheffield.ac.uk/library/special/sorbyres

VITAMIN-C requirement of human adults; experimental study of vitamin-C deprivation in man. Lancet. 1948
https://doi.org/10.1016/S0140-6736(48)90572-8

p.853-854

Some important abnormalities were observed in single cases… Another was taken ill in July, 1945, nineteen hours after heavy physical exercise. He had severe pain in the lower sternal region, and he became dyspnoeic and cyanosed. The pulse was rapid and the blood-pressure low. The clinical picture was that of an acute cardiac emergency. He was immediately admitted to hospital and dosed with vitamin C. The lower sternal pain, which at first had increased in intensity, passed off after nine hours. The electrocardiogram showed high ST levels in leads I and II. A radiogram of the chest showed no abnormality. Eighteen days later another deprived volunteer complained of a sudden constrictive pain in the chest. Physical examination revealed a systolic murmur which had not been heard before, and the electrocardiogram showed a partial heart-block, the P-R interval being 0.28 sec. Before the experiment the electrocardiogram had been normal with a P-R interval of 0-20 sec. It was thought necessary to treat this volunteer immediately with large doses of vitamin C. The chest pain and the systolic murmur disappeared within, twenty-four hours, but during the following months the P-R interval showed variable periods between 0-20 and 0-28 sec., depending on posture, breathing, administration of drugs, and other factors. These subsequent electrocardiographic observations raised the question whether the heart-block in this case had any connexion with the deficient diet, especially in view of recent observations on Service personnel (see Manning and Stewart 1945, Hall et al. 1942, Holmes and Weill 1945).

…

A modification of the “agility” test (Frankau 1943) … was used to measure objectively the incidence of fatigue in the volunteers… in the totally deprived group there appeared first a variability, and later a small but significant increase, in the time taken to perform the test. Both these observations indicate increased fatigue. On the pulse-rate the effect of the “all-out” effort demanded by the agility test was to cause a rise followed by a fall in the 3 min. immediately after the test, both of which were significantly greater in the group receiving 70 mg. than in the groups receiving 10 mg. or none.

…

Three of the ten volunteers who developed scurvy on the unsupplemented diet were lost for trials with graded doses, because sudden emergencies demanded their immediate treatment

with large doses of the vitamin. Two of these three, as already mentioned, were dosed because they had signs of acute cardiac complications. A third had shortness of breath and pain in the chest in May, 1945. Radiography revealed spondylitis and a paravertebral abscess, and spinal tuberculosis was diagnosed. A review of earlier radiograms indicated that this man's spine was not healthy at the beginning of the experiment. At the time when he developed symptoms his skin and gums showed the most advanced scorbutic changes seen in the volunteers. In view of his serious state he was at once given a large dose of vitamin C. The three volunteers dosed with large amounts showed striking improvement within a few days.

Krebs HA. The Sheffield Experiment on the Vitamin C Requirement of Human Adults. Proceedings of the Nutrition Society 1953
https://doi.org/10.1079/PNS19530054

p.239-240

Some important abnormalities were observed in single cases… Another was taken ill 4 weeks later, 19 h after heavy physical exercise. He had severe pain in the lower sternal region, and became dyspnoeic and cyanosed. The pulse was rapid and the blood pressure low. The clinical picture was that of an acute cardiac emergency. He was immediately admitted to hospital and dosed with vitamin C. The lower sternal pain, which at first had increased in intensity, passed off after 9 h. The electrocardiogram showed high ST levels in leads I and II. A radiogram of the chest showed no abnormality. Eighteen days later another deprived volunteer complained of a sudden constrictive pain in the chest. Physical examination revealed a systolic murmur which had not been heard before, and the electrocardiogram showed a partial heart-block, the P-R interval being 0.32 sec. Before the experiment the electrocardiogram had been normal with a P-R interval of 0.20 sec. It was thought necessary to treat this volunteer immediately with large doses of vitamin C. The chest pain and the systolic murmur disappeared within 24 h, but during the following months the P-R interval showed variable periods between 0.13 and 0.32 sec. depending on posture, breathing, administration of drugs, and other factors.

The pathological process underlying this cardiac emergency is bound to remain uncertain. The older records of scurvy contain many references to sudden death. Lind (1757, p. 137) writes:

Persons that appear to be but slightly scorbutic, are apt to be suddenly and unexpectedly seized with some of its worse symptoms. Their dropping down dead upon an exertion of their strength, or change of air, is not easily foretold'. As these incidents occur at a stage when multiple skin petechiae are the main clinical manifestation of scurvy, and when general fitness still appears to be fairly good, it is not improbable that a haemorrhage at a critical point of the conducting system of the heart forms the basis of the cardiac syndrome.

…

When the Committee decided on account of the cardiac incidents to shorten the period of deprivation in certain cases the volunteers let it be known as their wish that considerations for their personal safety should not stand in the way of pursuing the object of the trial. Fortunately they suffered only temporary disabilities. No permanent harm was done.

VITAMIN C requirement of human adults. Spec Rep Ser Med Res Counc (G B). 1953;280:1-179. PMID: 13119061.

F. Case Histories
https://doi.org/10.5281/zenodo.7661782

p.80-81

Milburn

Past history. Scarlet fever 1935.

Period of depletíon. 13.11.44: start of deficient diet; …

20.7.45: (250 days' depletion) at 8 a.m. agility test; on same day B.P. 104/72; at 5 a.m. next day severe pain in lower sternal region, gradually becoming worse; when seen at 9 a.m., was sitting up, breathing with difficulty and in great pain; pulse rapid; at 10.30 a.m. in great distress and appearing critically ill; grey face, breathing slow, deep and painful; pulse 85; temperature 99.2: B.P. 80/40; heart sounds not easily audible because of dyspnoea; no distention of cervical veins; given morphia and removed to hospital in an ambulance. As it seemed likely that the condition was the result of vitamin C deficiency, an intravenous injection of 1 g. vitamin C was given with 6 g. vitamin C by mouth at 11.20 a.m. Oxygen also was administered. Within 3 hours the patient was feeling considerably better and made an uninterrupted recovery.

A radiograph of the chest on 23.7.45 showed the heart to be normal in position and size. 2.8.45: skin lesions almost gone; brown pigmented spots left on sites of follicular haemorrhages; gums normal. 22.8.45: received 100 mg. vitamin C daily for the next 9 days. 4.10.45: resumed basal diet and received 20 mg. vitamin C daily. 31.10.45: slight acne on back;folliculitis of beard atea, arms and front of thighs near wounds. This condition remained substantially unchanged until the end of the experiment.

Summary. The diagnosis of clinical scurvy became definite on 19.6.45, the 219th day of the period of depletion, through the occurrence of haemorrhages into the hair follicles of the forearms and lower limbs. Nine days later a haemorrhage behind the top right upper molar was observed and 28 days later haemorrhages of the interdental papillae. Acne, present at the start of the experiment in a mild form, grew worse as the period of depletion lengthened and became very profuse. On 21.7.45 a sudden acute illness occurred presenting the clinical picture of acute cardiac emergency. After a dose of 6 g. vitamin C there was recovery within a few hours.

While no definite statement about the cause of the cardiac attack can be made it is not improbable that it was due to a scorbutic haemorrhage.

p.87

Another

Past history. Scarlet fever in childhood. Took part in vitamin A trial, deprived of vitamin A from 27.7.42 to 24.5.44.

Period of depletion. 13.11.44: start of deficient diet; …

7.8.45: (269 days' depletion) woke up during the night with a constrictive pain in the chest which was intensified by deep breathing; looked ill but was not in severe pain; temperature was normal; pulse rate 72; blood pressure 90/60; respiration 18; systolic murmur detected on physical examination; electrocardiogram normal before the experiment with a P-R interval of 0.20 seconds, now showing a P-R interval of 0.32; transferred to hospital and given 3.6 g. vitamin C, the dose being repeated daily for 3 weeks; within 24 hours disappearance of systolic murmur and pain in chest.

…

Summary. Unequivocal signs of scurvy did not develop. After 270 days of the deficient diet the volunteer had an attack of pain in his chest, which was associated-with a systolic murmur and a prolonged P-R interval of 0.33 seconds. The P-R interval subsequently varied with posture, respiration and other factors, but remained, in general, chronically prolonged. Whether the cardiac symptoms can be attributed to vitamin C depletion remains uncertain.

p.84-85

Williams, D.

Past history. No previous illnesses. Experimentally infected with benign tertian malaria 2.4.44, prophylactically treated with small doses of "Mepacrine." Took part in vitamin A experiment, deprived of vitamin A from 27.7.42 to 30.1.44.

Period of depletion. 13.11.44: start of deficient diet. …

5.5.45: (174 days' depletion) acne spread to front of chest and to buttocks; follicular haemorrhages on thighs and legs; petechiae on medial aspect of knees as well as on dorsum of foot; interdental papillae more swollen, tender and haemorrhagic; pain in chest and shortness of breath first reported. 17.5.45: (186 days' depletion) numerous follicular and petechial haemorrhages, some on legs confluent (Plate III, C); scars of wound purplish; routine X-ray of chest revealing a paravertebral abscess and an erosion of the upper border of the body of the 8th dorsal vertebra, interpreted as an active tuberculous lesion. The patient was at once admitted to hospital, placed on a normal diet and given large doses of vitamin C. On review, the X-ray films of the chest taken in November 1944 and March 1945 both showed a slight shadow suggesting the existence already, at those times, of a paravertebral abscess. They were originally overlooked because the films, and the attention of the radiologists, had not been focussed on the spine. The onset of the tuberculous process thus preceded the development of scurvy or of clinical malaria.

Dosing. 17.5.45: 100 mg. vitamin C five times a day. 23.5.45: (7 days' dosing) total dose so far about 3 g. vitamin C; skin smoother; haemorrhages on arms gone, and follicles of legs no longer keratotic, congested or haemorrhagic (Plate III, D); wound scar nearly normal in colour.26.5.45: (10 days' dosing) acue no longer red, rapidly disappearing; legs and gums normal.

…

Summary. A diagnosis of scurvy could definitely be made on 24.4.45 (163 days' depletion) on the grounds of the numerous perifollicular haemorrhages of the thighs and legs and petechial haemorrhages on the foot. The period was the shortest in which any volunteer developed definite scurvy, and it may perhaps be related to the accompanying tuberculosis and malaria. … On 17.5.45 routine radiography of the chest disclosed tuberculosis of the spine, probably present at the start of the experiment. After administration of about 3 g. vitamin C at the rate of 0.5 g. a day, all scorbutic lesions showed complete regression within l0 days. The tuberculous process healed under conservative hospital treatment. Although the process probably began before the deficient diet started it is likely that its development was precipitated by the deprivation.

Crandon's self-experimentation (1940)

Crandon JH. Experimental Human Scurvy. N Engl J Med 1940;223:353-369.
https://doi.org/10.1056/NEJM194009052231001

[In the classic vitamin C deficiency trial, John Crandon exposed himself to vitamin C deprivation for six months. The sections that are informative on the cardiovascular system are extracted here.]

p.358

Fatigue

From the beginning of the third month of the diet there developed a feeling of fatigue which became progressively more marked. Measurement of this weakness was at first attempted by an ergograph. The number of contractions at the rate of one per second, made by the right hand against a standard resistance, showed only a slight drop during the period of vitamin C deficiency, falling from 59 at the outset to 42 at the end of the experiment. A week after institution of the ascorbic acid therapy, while the subject was still on the diet, the number of contractions increased slightly to 49, a rise which can hardly be considered significant.

At the end of the six months a fatigue test was carried out of the Fatigue Laboratory of Harvard University (Table 1). In order to determine the extent to which the capacity for work was reduced and to learn something about the mechanisms involved, the subject performed two grades of work on a motor-driven treadmill (walking and running). After ten days, during which the subject received vitamin C intravenously but remained on the deficient diet, the experiment was repeated. A control test was made seven weeks after the normal diet had been, resumed. The data of Robinson covering the same age group were used for comparison.

p. 360

Blood pressure

The blood pressure remained at a constant level of 120 systolic, 70 diastolic, until immediately following the fourth episode of blood loss on the one hundred and fifty-fifth day of the diet, when it fell to 90/60. During the next week the systolic pressure rose to 98, but it never exceeded this level until the ascorbic acid was started, when it promptly rose.

p. 362

Effect of Vitamin C Therapy

Within twenty-four hours after the administration of the vitamin a subjective improvement was noted, there being a marked alleviation of weakness and languor. This improvement seemed to progress during the next four or five days.

...

the blood pressure, which had been somewhat below the subject's normal since the last episode of acute blood loss, almost immediately began to rise after the vitamin C had been given.

p. 365-366

Fatigue

The belief that scurvy is characterized by languor and incapacity for work is well borne out by this experiment. Subjectively, weakness was first noticed at about the end of the third month, becoming progressive as time went on. Although no marked change could be found in the muscular activity of the forearm as measured by an ergograph, both for a single contraction and for contractions each second to exhaustion, the results when the subject ran on a treadmill were striking. Although a considerable part of his inability to run over 16 seconds must be attributed to factors other than vitamin C deficiency, he was able to run 66 seconds following the parenteral administration of ascorbic acid while on the same diet, even though the hemoglobin was 13 per cent lower. Of interest, also, is the fact that the heart rate fell more rapidly during the recovery period following the administration of the vitamin. Moreover, it will be noted that the blood lactate curve was definitely abnormal in the scorbutic state.

Blood Pressure

Of possible significance was the fall in blood pressure which occurred and persisted after the last episode of acute blood loss (one hundred and fifty-fifth day), since it resumed to normal after the administration of vitamin C

The Iowa City Studies (1971)

Hodges RE, Hood J, Canham JE, Sauberlich HE, Baker EM. Clinical manifestations of ascorbic acid deficiency in man. Am J Clin Nutr. 1971
https://doi.org/10.1093/ajcn/24.4.432

Table 2: two participants had “dyspnea on exertion” during vitamin C deprivation.

p. 436

Edema was noted in three of the men, but in two of them there was only minimal pretibial pitting on pressure or some slight puffiness of the feet. Beginning on the 88th day of deprivation there was a rapid increase in weight followed by swelling of the legs in the third man (H), who had the most severe degree of scurvy. Repletion with 4 mg ascorbic acid day was commenced 4 days later on day 105 (see Table 5). Oliguria followed and his urinary output dropped to 340 ml/day on day 109. His intake of ascorbic acid was then increased to 6.5 mg/day on day 111 and after a brief initial increase in edema, he had a profound diuresis with complete disappearance of edema by day 133.

Abboud FM, Hood J, Hodges RE, Mayer HE. Autonomic reflexes and vascular reactivity in experimental scurvy in man. J Clin Invest. 1970
https://doi.org/10.1172/jci106239
https://www.ncbi.nlm.nih.gov/pmc/articles/pmc322472

Abstract

During ascorbic acid deficiency, four subjects had reduced responsiveness of resistance vessels of the forearm to lower body negative pressure as compared to the responsiveness observed after vitamin repletion… The results suggest that the decreased vascular responsiveness to intra-arterial norepinephrine and tyramine and to lower body negative pressure during ascorbic acid deficiency is caused by a defect in the ability of resistance vessels to constrict in response to adrenergic stimuli.

Holst: Experimental Studies Relating to “Ship-beri-beri” and Scurvy

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2236198

[see also H9-H11]

AMONG the diseases which have of late attracted the attention of the official medical authorities of Norway, so-called *ship-beri-beri* takes a prominent place. The symptoms of this disease consist, in the great majority of cases, in weakness and a prominent dropsy of the lower limbs, extending often to other parts of the body. There also exists shortness of breath and other symptoms of a weak heart, causing often sudden deaths from acute paralysis of the heart. But as Nocht in Hamburg and the *Norwegian Ship-beri-beri Committee* have shown, symptoms of neuritis of the limbs are comparatively rare. For instance, Nocht was only able to ascertain *neuritis* in cases from four of his thirty-four beri-beri-ships; and though the investigations of the Committee extended to fifty-seven affected ships, the neuritis was only found in men from four of them. Considering that neuritis is the essential symptom of the beri-beri of tropical countries and Japan, and that dropsy, though present, as a rule is not prominent in cases of this disease, it seems, therefore, rather doubtful whether ship-beri-beri is identical with tropical beri-beri. This doubt, first emphasized by Bullmore and Nocht, is strengthened by the fact that the great majority of patients suffering from the ordinary, *i.e.* dropsical ship-disease, recover as soon as they are able to change their food, which is not the case with the disease of the tropics and Japan. The subject of this and the following articles will be limited to experiments relating to the dependence of the ship-disease on food, the etiology of tropical beri-beri being outside the field of these investigations.

The recovery of patients suffering from ship-beri-beri is due to *fresh food*. This fact has chiefly been emphasized by Nocht, while the report of the Norwegian Committee contains many corresponding observations. No doubt, some cases do not appear to agree with this observation, which fact, perhaps, favours the idea that “ship-beri-beri” occasionally comprehends more than one disease. This idea may possibly also be supported by the occurrence of cases of neuritis. But in the great majority of cases the effect of fresh animal food, such as eggs or meat, but above all of fresh green vegetables or potatoes, is very marked. For instance, Nocht (*l.c.*) has pointed out that the symptoms regularly disappear within 8-14 days after the patients get fresh food: even after 4-5 days many patients feel able to resume their work.

That ship-beri-beri is very closely connected with food, is further evident from the fact, that the disease appears almost solely on board sailing-ships on long voyages. On account of this fact, first observed by Dr Stian Erichsen in Norway, Nocht has introduced the name " beriberi of sailing-vessels." Cases very seldom appear on board steamers on the samne waters. It seems natural to explain this difference by the fact that on long voyages sailing-ships take considerable time before they reach a port where they are able to get fresh provisions, whereas this is not the case with steamers.

Apart from the sore gums and haemorrhages in the skin and muscles, which Nocht observed in cases from twelve of his thirty-four ships, but which the Norwegian Committee could not find, it therefore seems probable, that *ship-beri-beri is, in accordance with the opinion of Nocht, a food disease, showing a marked congruence with scurvy.*

That the malady is a form of scurvy (Nocht) or related to it (Nocht and the Norwegian Committee), is also supported by the fact, quoted by Nocht, that cases of dropsy without haemorrhages or sore gums often occur during epideinics of manifest scurvy. For instance, Nocht quotes authors relating a considerable number of cases of this kind in the epidemic of scurvy, during the siege of Paris in 1870-71. He has further stated, that such cases often occur during epidemics of scurvy in Russia. I may add that many dropsical cases without sore gums and hemorrhag,es were also observed during the Crimean war where scurvy was very prevalent'. (Some of these Crimean cases were connected with anaesthesia of the feet and looked like “acrodynie” or beri-beri; but as they were sometimes associated with a local gangrene of the feet or with distinct symptoms of scurvy, the opinion prevailed that they were due to the cold of the winter in addition to latent or manifest scurvy.) It may further be mentioned, that many cases of dropsy without sore gums, *&c*. occur every year besides manifest scurvy on board the French vessels fishing for 5-6 months on the banks of Newfoundland. Finally I may add, that during the first part of the 19th century not only scurvy, but also dropsy without sore gums and haemorrhages was very common in European and American prisons. For instance, besides typhoid fever and consumption, this “prison dropsy” (*Wassersucht der Gefangnisse*) is stated, in 1847, to have been the most prevalent cause of death in 41 prisons in England, France and North America. In 1857 it caused one half of the deaths in a prison in Breslau; and if it were not that nothing is said about the occurrence of neuritis, some reports from those days recall the descriptions of the Asiatic beri-beri-prisons of our own time.

Proceeding to the question as to *which* faults in diet may be the essential causes of ship-beri-beri, Nocht limits himself to expressing the opinion, that it must be left to the future to decide whether the disease is due to some special sort of starvation or to an intoxication by fermenting food or another poison, or to an autointoxication. The question is more positively answered by Bullmore (*l.c.*), who, basing his opinion on the fact that the disease mostly appears on board ships in the tropics, has started the idea, that the malady is due to an intoxication through all sorts of food, including tinned foods, becoming tainted in consequence of the hot climate. This idea has also been adopted by the Norwegian Committee, which also founds its opinion on the corresponding theory as to the etiology of scurvy. According to the Committee the principal cause of the disease is tainted tinned meat and fish, since Stian Erichsen (*l.c.*) has shown, that the disease did not become prevalent on board Norwegian ships, before tinned meat and fish were largely introduced in their dietary. As to scurvy, this theory will be discussed in the following paper. As for ship-beri-beri Bullmore does not base his opinion on direct observations of food on board beri-beri-vessels. And though the Committee mentions seven crews who got bad provisions and were attacked by the malady, in none of these cases was it evident that the cause was damaged tinned articles of food. In some of these cases, indeed, the tainted aliment consisted in potatoes; but they were thrown overboard, and the disease did not break out before from 4-6 weeks afterwards. On the other side, the report of the Committee contains evidences of six crews being attacked in spite of the food being proved to be of good or even excellent quality. Finally it may be added, that the medical inspector of the Medical Government Board of Norway, Dr Geirsvold, Christiania, has examined a great number of boxes of tinned meat and fish from six beri-beri-ships. He examined them microscopically and made aerobic as well as anaerobic cultures of their contents; but none of the boxes showed any sign of being tainted. On the contrary, all boxes were sterile except one containing a small number of an

aerobic bacillus, which had not been able to develop under the anaerobic conditions inside the tin.

Comrie JD. Scurvy in North Russia. Edinb Med J. 1920;24(4):207–15. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5294660

The heart was always feeble, and in a considerable number of cases functional murmurs were audible. In cases where a P?st-mortem examination was performed, the cardiac muscle showed a striking degree of brown atrophy with great reduction ln size of the ventricles. This and the large effusions sometimes found in the pleural cavities constitute the great risk for severe cases of scurvy, in which sudden death is very liable to occur. The blood-vessels in sections which were examined by Captain Stevenson showed no obvious changes.

Comrie JD. Scurvy. Trans Med Chir Soc Edinb. 1921;34:59-68. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5403999

The heart was always feeble, and in a considerable number of cases functional murmurs were audible. In cases where a post-mortem examination was performed, the cardiac muscle showed a striking degree of brown atrophy with great reduction in size of the ventricles. This and the large effusions sometimes found in the pleural cavities constitute the great risk for severe cases of scurvy, in which sudden death is very liable to occur. The blood-vessels in sections which were examined by Captain Stevenson showed no obvious changes.

Shattuck GC. Scurvy with Reference Especially to Adults. Trans Am Climatol Clin Assoc. 1928;44:165-79. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2262271

Weakness, dyspnea on exertion, edema of the ankles, anorexia and other minor digestive disorders were common symptoms, generally antedating the disabling lesions.

Richard WJ, Mackinnon WD. Scurvy among Adults in Glasgow. Glasgow Med J. 1920;94(6):336-343. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5925903/

In a few instances there was breathlessness and vertigo after exertion.

… in all the cases, patches of purplish discoloration of the skin with deep swelling, which felt brawny and elastic to the touch. In most of the cases these brawny patches were present over the calves of the legs, extending in a few to the popliteal region, aud even up the posterior aspect of the thigh. These swellings on the calves and in the popliteal spaces were so tense that they caused flexion of the legs in two of the cases. Commonly there was swelling and discoloration on both sides of the tendo-Achillis extending below and behind the malleoli, and even on to the dorsum of the foot on the outer side. There was also, frequently, considerable oedema round the ankle-joints.

In all the cases the heart sounds were weak, and a soft systolic murmur over the aortic area was heard.

Finley FG. Scurvy. Can Med Assoc J. 1920;10(3):274-5.
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1523810

About six months ago he noticed swelling of the gums and feet. Three weeks ago he began to feel weak in the legs.

There is a soft systolic murmur at the apex of the heart, regarded as functional

Boyd TC. Scurvy.-A Short Note. Ind Med Gaz. 1917;52(2):41-42.
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5176569

Swelling of legs several recruits

Case 1.- Recruit R. C. T-, age 27, service 1 year, was admitted to hospital on the 29th September, 1916, complaining of pain and swelling of the right calf… Large extravasation into right calf which was swollen and tense and very tender, also complained of pains in ankles and shoulder- joints,was dull and lethargic, and had slightly exaggerated knee-jerks.

Case 2. - Recruit M. G., age 2o, service 8 months and 12 days, was admitted on the 23rd September, 1916, complaining of swelling and pain in both calves… large extravasations into right and left calf, which were tender and painful

Case 3. - Recruit M. S., age 19, service 9 months and 12 days, was admitted on the 5th August, 1916, complaining of pain and swelling in left calf and in both ankles… left calf swollen and painful, leg and thigh muscles very flabby, dull, and lethargic, knee-jerks slightly exaggerated

Case 4. - Recruit R. B. A., age 28, service 7 months and 12 days, was admitted on the 2oth August, 1916, for pain and swelling of the right ankle… faint systolic murmur over mitral area, right ankle swollen and puffy, history of pain in joints, mentally dull, knee-jerks exaggerated. Shortly after admission he developed a large extravasa tion into right calf.

Case 5.?Recruit S. T., age 18, service 8 months and 12 days, was admitted on the 29th August, 1916, with swelling of both calves, he is sallow and anaemic, gums pale but not spongy, tongue flabby and coated, nothing in lungs, abdomen or urine abnormal, both calves swollen and painful, no history of syphilis, malaria, or dysentery, no previous flying pains. After being in hospital for 47 days without showing any improvement he suddenly developed severe pain in the upper abdomen with a weak and rapid pulse, without any previous history of gastric or other abdominal trouble; an enema was ordered and strychnine given after which the pain became less severe, but the pulse did not improve but got gradually worse until death took place eight hours afterwards. A hurried P. M. was held, and it was found that the pericardium was full of fluid and the heart layer coated with fibrin, white clot in left ventricle and the whole organ fatty and flabby, no other lesion was found except a small haemorrhage on the ant surface of the stomach near the lesser curvature.

Knowles R. Acute Scurvy. Ind Med Gaz. 1910;45(2):56-57. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5140509

In view of the great difficulty of treating acute scurvy in a station such as Aden, where fresh vegetables are almost unknown, the following particulars of a case may be of interest. Mahamad Ali, age 20, S. and T. Corps follow- er, was admitted to hospital on the 22nd October 1909. He had previously been attending as an out-patient for some 8 or 9 months. The patient was extremely debilitated : there were sub-periosteal effusions over both tibiaa; the legs being swollen and tender: both knee- joints were hot, swollen and painful on movement : haemorrhages under the periosteum of both sides of the mandible,causing the cheeks to appear swollen. There had been epistaxis and some bleeding from the gums, which were swollen and spongy. The breath was very foul. The tongue was slightly swollen and furred, shewing de- pressions opposite to three lower carious molars. The cardiac dulness was subnormal. The apical sounds were clear, but of weak timbre and short. The pulse was markedly irregular : and by holding the patient's arm above his head it could at times be made to disappear.

Joulal H, Yousfi J, Benjilali L, Zahlane M, Essaadouni L. Haemorrhagic Pericardial Effusion as the Presenting Symptom of Scurvy. Eur J Case Rep Intern Med. 2023;10(9):004026. http://www.ncbi.nlm.nih.gov/pmc/articles/pmc10482132

A 56-year-old woman presented with a 2-week history of worsening chest pain and dyspnoea, with no significant medical history. Upon admission, the patient exhibited tachycardia, tachypnoea, low blood pressure, elevated jugular venous pressure, muffled heart sounds and multiple petechiae on her lower limbs. An ultrasound revealed a large pericardial effusion, and an emergency pericardiocentesis was performed

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