idea had formerly been held about sick persons and Sydenham was one of the first to combat it.

The new ideas had a mass of ignorance and prejudice to overcome, even among the well to do, but they slowly gained ground and through the channels of the maternity hospitals, the trained midwives and, most of all, the dispensaries, even penetrated to some degree to the homes of the poor. In 1816 a baby clinic (though not of course so called) was actually established in London. The Universal Dispensary for Sick Children, founded in that year, had as one of its objects the spread of the knowledge of infant and child management among the poor. Bound up with its report is a copy of the pamphlet distributed to poor mothers. This pamphlet advocated breast feeding, cleanliness, bathing, loose clothing and fresh air. The mother was warned against quack medicines and told to avoid night feeding. There was another pamphlet on the management of young children with advice upon similar lines.[10]

All contemporary authorities give the better care of infants as one cause of the diminution of the death rate, another was the better treatment and partial prevention of infantile diseases, particularly smallpox. Together all these improvements resulted in a reduction of infantile mortality which has only been equalled in the 20th century.[11] Dr. Lettsom wrote in 1774, "In the nurture and management of infants, as well as in the treatment of lying-in women, the reformation hath equalled that of the small pox; by these two circumstances alone, incredible numbers are rescued from the grave".[12]

CHAPTER XII

Rickets and Scurvy

"For if Rome decreed the Civic Crown to him who saved the life of a single citizen, what wreaths are due to that Man who having himself saved many perpetuates . . . the means by which Britain . . . may preserve numbers of her intrepid sons". (Sir John Pringle. Discourse on occasion of presentation of Copley medal to Captain Cook, 1776.)

It has been suggested in the previous chapter that a considerable part of the credit for the reduction of the infantile death rate must be given to the medical profession. But by no means all the credit was due to the doctors, a good deal must be ascribed to the general advance of society and in particular to the advance of agriculture. Undoubtedly a great deal of the infant and child mortality was due to malnutrition, sometimes causing direct specific disease, sometimes only leading to an impaired vitality. In this connection the histories of rickets and scurvy are important, not only in themselves, but as indicators of the general condition of the food supply of the population.

Rickets is a disease of malnutrition in childhood which shows itself in the lack of proper calcification of the bones. For a very long period it has been recognised as a dietic disease and many factors have been suspected in the past, such as a lack of lime in the water, too early or too late weaning and so on. Modern research has lately revealed a close correlation between rickets and the absence of fat-soluble vitamin A, which vitamin is present in most animal fat, and, in smaller quantities, in some vegetables. Butter and milk are particularly rich in it. But it is not believed that the absence of vitamin A is the sole determining factor in rickets. Obviously bone cannot be formed without calcium and phosphorus and a deficiency of either of these or a lack of balance between the two may lead to rickets.

It happens that several food-stuffs rich in vitamin A are often also rich in calcium so that a deficiency in these two factors may be closely associated. Recent research has also shown that sunlight is an important factor and that plentiful sunlight may counteract, at any rate to some extent, the deficiency of other anti-rachitic factors. Finally, Dr. Mellanby believes that cereals have a definite anti-calcification effect on growth and that in this respect oatmeal is the worst and white flour and rice the best. Calcification is an extremely complex physiological process which has by no means been completely elucidated; but it seems probable that there is more than one possible cause for rickets and that the worst cases are often due to a combination of causes.

Rickets was first ascribed by Glisson in a treatise published in 1650 which is famous as the first medical treatise on modern lines written by an Englishman. Glisson says that he first observed the disease "about thirty years since in the Counties of Dorset and Somerset" and ... "later in London, Oxford and Cambridge in almost all the Southern and Western parts of England" but that it was very rarely seen in the north. Glisson believed the disease to be a new one but there can be no doubt that it had existed long before his time but had not been recognised as a specific disease. Rickets seems to have been very prevalent in London in the 17th and early 18th centuries but to have decreased rapidly during the second half of the 18th century. The writer J. H. alleges that Charles I had rickets and that as a child he was so sickly that he "could neither go nor speak till 7 years old and altho' the said Prince outgrew and conquered the weakness . . . yet he carried somewhat remarkable both in his Mouth and Knees to the Block and Scaffold. . . . He ever walked in a riding Posture; and besides most of the Courtiers, and Wealthier sort of Citizens were accustomed to walk both to Church and Exchange in Boots, as being ashamed to expose their Crooked, Ricketty Legs".[1]

Bateman writing in 1819 says that rickets, once "a most prevailing and mortal disease" . . . "although occasionally occurring at present, among the children of the poor, has no longer a place in the bills of mortality, as a cause of death;

it is said to have originated in the West of England about the year 1540; but is first noticed in the Bills of London in the year 1624, when the total number of deaths, under this head, were only 14. It appears, however, to have increased rapidly, but irregularly; for, in 1649, the deaths from rickets amounted to 190;—in 1650 to 260;—in the following year to 329;—and in 1660, 521 persons died of the disease; at the commencement of the 18th century (A.D. 1700) the mortality from this disorder was 393; and it has since been on the decrease, as we find the number of deaths in the year 1750 to be only 21, and at the end of the century (1799) the deaths from 'evil and rickets' conjoined do not exceed 7".[2] He adds that the disease originated, increased and declined under no observable change of circumstances with which it could be connected. The origin and increase were probably a mere matter of nomenclature and diagnosis but that cannot be the case with the decline. After Glisson's treatise no moderately competent doctor could mistake a well marked case and the decrease in rickets was remarked upon by all medical writers on the history of disease. Blane says "there is no doubt . . . of the great decrease of it in common with other complaints of children". Black in 1781 refers to the decline of rickets and ascribes it to "more maternal attention to the rearing and suckling of children".[3]

Does modern knowledge throw any light on the problem? It is significant that the period of the decline in rickets is also the period of advance in agriculture, particularly in the breeding and feeding of cattle and the production of root crops and winter feed for cattle which made fresh meat and butter and also milk available all the year round. It was also a period of extensive market gardening which meant more vegetables, many of which contain not only vitamin A but calcium salts. It is notorious that the animals bred during the 18th century agricultural revival were very fat; many of the famous breeds have been abandoned because modern palates do not like the coarse fat meat. But their 18th century popularity may have been due to a natural craving on the part of people who had been starved of proper fat. We may safely associate the decrease of rickets with the better and more varied diet that

became available after the revolution in agricultural methods, and the lighter houses and wider streets in towns may also have been a factor. It is possible also that in London the decrease may have been associated with the extinction of malaria and in support of this view Sydenham may be quoted; he says, " except in those years where autumnal intermittents are paramount true rickets rarely occur ". It may further be noted that Glisson's observations all refer to low lying, marshy districts.

The death rate from rickets was probably never high nor, on the other hand, can we imagine that rickets was quite as rare a disease at the beginning of the 19th century as contemporary writers supposed. Mild cases would escape diagnosis with the then available methods and many cases probably never came under the eye of a doctor at all. Even to-day the apparent incidence of rickets cannot be accepted at its face value, an apparently high incidence may only mean a very well organized medical service. But the evidence is fairly conclusive that very acute rickets decreased almost to the point of disappearance during the period under discussion,[4] and we can be certain, in the light of modern knowledge, that mild rickets decreased *pari passu*. For every child that died of rickets there would have been numbers who survived with every degree of deformity and ill health and numbers more, who apparently had never had rickets, who yet suffered from ill-defined delicacy. Modern research has shown that if the anti-rachitic factors are absent during pregnancy and lactation the maternal organism attempts to supply them at its own expense, thus leading to ill health and ultimately to disease in the mother. The conditions which produced acute rickets, therefore, were probably a factor in maternal mortality. But rickets certainly added to maternal mortality in another way, for one of the results of suffering from it in childhood is contracted pelvis. Before the improvement of obstetrics in the 18th century this malformation must have meant almost certain death both for mother and child. 17th and 18th century writers on midwifery in discussing cases of difficult delivery often mention that the patient had suffered from rickets in her youth.[5]

Modern medical science distinguishes between true rickets and " scurvy rickets ". Scurvy, which does not normally occur in adults in modern times, does sometimes occur in babies which have been fed on dried milk extracts. Scurvy is also a deficiency disease due to the absence of certain essential factors from the diet. Recent scientific research has established the fact that these accessory food factors, which have been christened vitamin C, are to be found in varying quantities in most raw vegetables and fruits and are destroyed, in varying degrees, by cooking and preservation processes. They are also found in small quantities in fresh meat but are destroyed in preserved meat. The exact nature and functions of these vitamins have yet to be elucidated.[6]

Scurvy is now thought of as a disease peculiar to seamen but a knowledge of its cause at once suggests that it must frequently have occurred on land before the modern developments in agriculture and transport. This is borne out by historical records of the 16th and 17th centuries in which scurvy is frequently mentioned. Hentzner [7] in his travels in the time of Elizabeth observes that " the English are often molested by scurvy " and it is noteworthy that in England the art of gardening was particularly backward. Chameau [8] writing in 1683 says " that scurvy in a particular manner is endemic with the English ". However, scurvy also occurred very frequently elsewhere.

The writer J. H.[9] who published what he called a supplement to Graunt's work says, " Scorbute . . . hath invaded all the Populous Cities along the Sea Coast of Germany, Holland and England ". He is not absolutely reliable, as he thought, not unnaturally, that scurvy and rickets were different forms of the same disease. But he mentions a bad epidemic in Paris in 1652, due to the blockade, and a further one in 1670, which were probably true scurvy; indeed the latter epidemic is mentioned in the records of l'Hôpital Saint-Louis and is said not to have ceased until 1690. A new epidemic occurred in Paris in 1709, " par suite de la rigueur de l'hiver et de la misère qu'il occasionna ".[10] J. H. quotes the famous French physician Patin as saying " we do not meet with the Disease among the Rich Burgers, but only amongst the Poor People, which Wretches

mostly drink bad Waters." It is curious after this to read in Smollett that the French doctors of his day seemed to think that scurvy was a purely English disease. Perhaps the 17th century confusion between scurvy and rickets had survived, for rickets was always known on the Continent as the English disease, for no better reason than that an Englishman first described it. Smollett, who was himself a doctor, says that the French doctors " often confound the symptoms of it " (scurvy) " with those of venereal distemper ".[11] Pringle states that scurvy was endemic in the Baltic provinces in the late 18th century owing to a winter diet of salt meat and no vegetables.[12]

In Northern Europe it is not easy to obtain an adequate supply of fruit and green vegetables, especially during the winter months. Until the 17th century the art of gardening remained extremely backward, indeed some authorities believe that there was retrogression in the 14th and 15th centuries, at any rate in England. This retrogression, if it actually took place, may have been associated with the upheaval caused by the Black Death and also with the decay and final destruction of monasticism, since monks and nuns have always found in gardening a solace for the loss of many earthly pleasures. During this period, too, England became predominantly pastoral and gardening is seldom highly developed in a pastoral community. The women, who are the gardeners in all primitive communities, are perhaps too occupied with dairy work to undertake it. In the latter 16th century a revival in gardening began, which revival was continued during the 17th century. Wealthy persons began to take a pride in their gardens and to introduce new plants from abroad. In England the revival was much influenced by the example of Holland. This movement, however, only affected the well to do ; the poor, especially in towns, would probably have had a very inadequate supply of vegetables even in summer and would have been without in the winter, when, moreover, only salted meat would have been obtainable. But by the end of the 18th century a great change had occurred. The agricultural revolution had made fresh meat available all the year round and market gardening had so developed, especially round London, that vegetables were obtainable even

by the poor. In 1758 Tucker wrote, " the price of green vegetables is prodigiously sunk to what it was in former times, and I much question whether any town of note in Scotland can now vie with the common markets of London in that respect. Certain it is that . . . about 100 years ago a cabbage would have cost threepence in London which at present may be bought for a halfpenny. . . . The common articles of pease and beans, sallads, onions, carrots, parsnips and turnips are considerably cheaper than ever they were known to be in former times, tho' the rent of garden grounds and the wages of journeymen gardeners are a great deal higher."[13] The introduction of the potato as a common article of diet was also important from the point of view of the extinction of scurvy. The potato is not rich in the anti-scorbutic factor but it does possess it and if eaten in sufficient quantities is protective. It has the great advantage of keeping and therefore being obtainable and relatively cheap in the winter and early spring when other vegetables are very dear. Its importance is proved by the fact that local outbreaks of scurvy among the poor followed failures of the potato crop in the 19th century and even, under war conditions, in 1917.[14] The use of the potato was increasing rapidly during the 18th century and as early as 1758 a writer speaks of it as " that great help of the poor ".[15]

Owing to this improved dietary, scurvy ceased to be a cause of death among the civilian population though doubtless mild cases occurred in times of scarcity. Lind stated in 1753 that scurvy was still found among the land population, though not in an extreme form. Blane says that a considerable number of deaths were ascribed to scurvy in the London Bills of Mortality of the 17th century, seldom under 50, often as high as 90 ; he adds, " we know from the description which Willis has given us that a disease having the genuine characters of sea scurvy did prevail in London in that age though now entirely extinct ".[16] Bateman was doubtful if scurvy was ever very prevalent in London, he believed that consumption was often confused with it, but the balance of evidence is strongly against this view. It is possible that some of the rickets of the 17th and early 18th centuries was really infantile scurvy. This disease can occur

even in breast fed babies if the mother's diet is very deficient in anti-scorbutic factors.

Scurvy often appears in acute form in beleaguered cities or among armies imperfectly provisioned, either from necessity or from mismanagement. Several thousand Saxons died of it at the siege of Thorn in 1703, Howard found it prevalent in the military hospitals in Russia in 1790.[17] In more recent times scurvy has often been a menace to armies either on account of military contingencies or through the ignorance of commanders. There was much suffering from this disease during the American Civil War owing to the use of dried vegetables instead of fresh ones. During the late war a severe outbreak of scurvy among the Indian troops at the siege of Kut was an important factor in the final surrender. The white troops were saved by a large ration of fresh horse flesh.[18]

The reduction of scurvy on land was due to the advance in agriculture, but its conquest at sea can be ascribed to administrative action based on medical knowledge. Scurvy only became a specifically sea disease with the long voyages of modern times; the first account of the disease at sea is that of Vasco da Gama who lost by it 100 men out of 150. In the first voyage of the East India Company the four ships carried a total complement of 480 men and, when the ships were three days beyond the line, the scurvy was so bad that the merchants had to do duty as common sailors and before the Cape was reached 105 men were dead.[19] Sir Richard Hawkins said that in 20 years' life at sea he could give an account of 10,000 mariners who had been consumed by scurvy. The disease continued to be a heavy drain on the manhood of the maritime nations during the 18th century, especially in war time when vessels were kept at sea for long periods. In 1747, 1,200 men of Admiral Martin's fleet were disabled by scurvy and John Huxham of Devon (a pupil of Boerhaave) recommended that they should be put upon a vegetable diet. Lind states in 1754 that more men died of scurvy in the preceding naval war than were killed in action with the French and Spanish. The fleet was on several occasions prevented from putting to sea owing to this disease. In the ship in which Lind voyaged in

1746, 80 men out of 350 were prostrated by it and when Lord Anson circumnavigated the globe one of his vessels lost 292 men out of 506 and the other, 292 out of 374.

At first it was thought that sea scurvy was a different disease from land scurvy and that it was due to sea air and damp. Some authorities held it to be infectious, rather naturally, since whole crews would be affected at once. Lind, writing in 1753, declared land and sea scurvy to be one and the same disease and that therefore it was not due to sea air nor was it infectious since officers practically never contracted it. He found the true cause in the diet of the common sailor which consisted of salt meat and biscuit and said that the disease could not only be cured but prevented by the provision of fresh fruit and vegetables. He recommended the use of lemon juice as being very effectual and easy to carry on ship-board. Lind was not the discoverer of the anti-scorbutic properties of fruit and vegetables in general and oranges and lemons in particular. Nature gives to the victim of scurvy an intense longing for fruit and vegetables, Lind himself noted that scorbutic patients ate the oranges and lemons given to them with greediness. The almost magical effect of anti-scorbutics upon the patients could not fail to be noticed by the most ignorant and unobservant. This common knowledge was accepted by the more broadminded physicians, though others continued to advocate useless remedies. Mead, not a very original thinker, writing in 1702 thought scurvy was due to bad air, yet he stated it could be cured by fruit and vegetables, especially oranges, lemons and pomegranates. As early as 1720 Kramer, chief surgeon of the Austrian army in Hungary, after having been faced with an outbreak of scurvy in which thousands perished and in which the remedies dispatched by the Vienna College of Physicians were useless, commented in his Medicina Castrensis as follows—"The scurvy is the most loathsome disease in nature: for which no cure is to be found in your medicine chest, no, not in the best furnished apothecary's shop. Pharmacy gives no relief, surgery as little. Beware of bleeding: shun mercury as a poison: you may rub the gums, you may grease the rigid tendons in the knee, to little purpose. But if you can get green vegetables, if you can prepare a sufficient

quantity of fresh, noble, anti-scorbutic juices, if you have oranges, lemons or citrons; or their pulp and juice preserved with whey in cask, so that you can make a lemonade, or rather give to the quantity of three or four ounces of their juice in whey, you will, without other assistance cure this dreadful evil." Bachstrom writing in 1734 said, "From want of proper attention to the history of scurvy, its causes have been generally, though wrongfully, supposed to be, cold in northern climates, sea air, the use of salt meats, etc., whereas this evil is solely owing to a total abstinence from fresh vegetable food and greens, which is alone the true primary cause of the disease. And where persons, either from neglect or necessity, do refrain for a considerable time from eating the fresh fruits of the earth and greens no age, no climate or soil are exempted from its attack. Other secondary causes may likewise concur: but recent vegetables are found alone effectual to preserve the body from this malady and most speedily to cure it, even in a few days, when the case is not rendered desperate by the patients being dropsical or consumptive."

Lind was acquainted with the works of both these above writers, indeed the above quotations are taken from his book. But he was no mere copyist, he had studied the disease at first hand in his capacity of navy surgeon and in 1747 had carried out a rough experiment upon twelve scurvy patients from which he had concluded that, among the various available remedies recommended by different authorities, lemons and oranges were the only satisfactory anti-scorbutics. Lind published his results in 1757 in his famous Essay on the Health of Seamen. Its importance in respect to scurvy lies in its clear and convincing exposition and the stress laid upon *prevention* rather than cure. Ships' crews should be given fresh meat and vegetables whenever possible and during long voyages a regular ration of lemon juice should be consumed daily. Lind's ideas upon naval hygiene were given a great advertisement by the experiences of Captain Cook. In a voyage of discovery ending in 1771 this famous explorer lost 30 men out of a complement of 85, mainly from scurvy. This proportion was not considered heavy at the time. Cook then became acquainted with the new

methods of preventing scurvy and of general naval hygiene and applied them in his next voyage of exploration. This lasted 3½ years and was an extremely hard voyage, yet the expedition enjoyed entire freedom from scurvy and, out of a complement of 118 men, lost only one man by disease, which man is stated to have been consumptive when he embarked. Curiously enough Cook was no believer in lemon or orange juice and pinned his faith to malt, sugar and sauerkraut. Modern science only confirms his faith in regard to the first. Pringle thought that Cook's poor opinion of lemon juice was due to his having had experience of juice which had been improperly prepared. Cook, however, was careful to touch land and to obtain fresh provisions whenever possible and he carried portable soup by means of which he rendered unaccustomed green food palatable. Captain King who wrote the account of Cook's third voyage, during which Cook was killed, stated that scurvy was avoided "by availing ourselves of every substitute our situation at various times afforded. These frequently consisting of articles which our people had not been used to consider as food for men, and being sometimes exceedingly nauseous, it required the joint aid of persuasion, authority, and example, to conquer their prejudices and disgusts". Cook also exercised persuasion, authority and example in inculcating scrupulous cleanliness both of the person and of sleeping quarters and also careful ventilation of the latter. He in fact, instituted that almost fanatical cleanliness which we associate with a well managed ship and which alone renders healthy conditions possible in a crowded and confined space. If it be considered what the condition of ships must have been before these reforms, the appalling death rate among sailors is easily explained.

Cook's achievement in the matter of health during his second voyage caused a considerable stir. He was invited to read a paper explaining his methods before the Royal Society and later the Society bestowed upon him the Copley medal, upon the occasion of the presentation of which Sir John Pringle, the President, delivered a laudatory address.[20] The new ideas, however, spread slowly; it was not until 1795 that the Admiralty,

owing to the efforts of Sir Gilbert Blane, ordered the provision of lemon juice upon every ship and the issue of a lemon juice ration when at sea. This ration was served with sugar, also believed to be anti-scorbutic and mixed with the rum ration in order to ensure its being taken. The effect of correct precautions against scurvy was magical. Blane states that in 1779 the Channel fleet after a cruise of 10 weeks put on shore 2,400 men ill of scurvy. In 1800 the Channel fleet kept the sea off Brest for four months without one ship being in port and when they did return to port there were only 16 subjects for hospital. He adds, "If the mortality during the 20 years of the revolutionary war had been equal to what it was in 1779, the whole stock of seamen would have been exhausted." It is recorded that in 1797 Earl Spencer visited Haslar and wished to see a case of scurvy and there was not one in the hospital. Writing in 1813 Blane was able to say that scurvy "is now nearly as rare at sea as it is on land".

Though the Admiralty order was not issued until 1795 many commanders undoubtedly anticipated it. Blane effected a great improvement in the health of Rodney's fleet in 1779, especially in regard to scurvy, and his tract for officers of the fleet upon the health of seamen must have been read by many. Lind's much greater work went into several editions and must have been read by many young navy surgeons and officers. The new movement was much helped by the new school of navy officers which was growing up. In the old days when the mercantile and navy services were not differentiated, the fighting officers were army officers detailed for the purpose, with soldiers acting under them, and the navigating officers were the ordinary mercantile captains, rough men who had generally served before the mast. As a royal navy gradually evolved the officers continued at first to be of a similar class, brave and skilful men no doubt, but like the early master manufacturers, hardened by their own early experiences, and unlikely to be amenable to new ideas. Cook, it is true, had risen from the ranks but he was in every way an exceptional man. During the 18th century the navy gradually became a profession for gentlemen and its officers began to be largely recruited from the families of the

smaller squirearchy and the clergy. They came, in fact, from homes where paternal care for the poor, even if a stern paternal care, was part of the everyday work of life, and they were sufficiently educated to realize the importance of the health of seamen from a military point of view. During the latter part of the century the navy was engaged in a stern conflict which gave scope to talent and ensured that, on the whole, the officers were men of elasticity of mind. Above all there was the influence of Nelson. Nelson was the darling of the fleet, not only because of his personal daring and his success in war but because he cared for the well being of the ordinary sailor. No officer could hope for his approval who did not follow him in this in the letter, if not in the spirit. Nelson took a great pride in the health of his crews. He writes after the pursuit of Villeneuve's fleet to the West Indies, "We have lost neither officer nor man by sickness since we left the Mediterranean" (a period of ten weeks, total numbers about 7,000); the "French and Spanish landed a thousand sick at Martinique and buried full that number during their stay". Collingwood writes, "I have not let go an anchor for 15 months, and on the first day of the year had not a sick list in the ship—not one man".[21] This perfection of naval hygiene must have been no small factor in victory, for the man-of-war's man was a highly skilled person not easily replaced, moreover good health among fighting men enormously increases their military value. The honour of this great administrative achievement rests with Nelson and his band of devoted commanders, but they built upon the knowledge supplied by the doctors; and the name of Lind, which is almost forgotten, surely deserves to be enshrined in honourable memory with that of Nelson.