On this McCollum² wrote:

"Osborne and Mendel observed calculi of calcium phosphate in the urinary tract in 91 [read 81] animals among 857 necropsies; 43 per cent. of these had not had a satisfactory supply of vitamin A. In McCollum and Simmonds's experience calculi have occurred so frequently in animals whose diets contained an abundance of this factor, but were faulty in other respects, that it would seem to be the results of general debility rather than lowered vitality brought about by specific cause."

The contradiction in the observations of the experimenters led me to control the records of the rats of the laboratory of the Netherlands Institute of Nutrition. I have examined 886 rats, piebalds and albinos, of which 405 were males and 481 females. Among them are 241 rats (see

Diet.	Number of Rats.	Cases of Calculosis	Other Lesions.		
			Haemat-uria.	Cylind-ruria.	Xeroph-thalmia.
Adequate vitamin A ...	211 (108 ♂ 133 ♀)	0	0	0	0
Deficient vitamin A ...	645 (297 ♂ 343 ♀)	130 ♂ 67 ♀	46	12	92

table) which certainly never suffered from vitamin A deficiency. Their diet consisted in wholemeal bread, raw milk, butter or cod-liver oil, raw carrots or cabbage, and, now and then, some cheese and spinach or lettuce. In none of these 241 rats (108 males and 133 females) were calculi found. Hence the conclusion does not seem too bold that in healthy, adequately fed rats calculi do not appear, or are at any rate rare.

Among the other 645 animals (297 males and 348 females) 197 cases of calculosis were found—namely, in 130 males and 67 females. These rats had been fed on an A-deficient diet. Among them were some that were fed on a rickets-producing diet. That all these rats suffered from vitamin A deficiency was shown by clinical examination. They grew little, and the mortality among them was great. In a number of those I examined the oestral cycle was disturbed. There were also many cases of xerophthalmia. That this eye disease did not occur still more frequently must be attributed to the short life of many rats. The search for calculi was made with care. In all cases the pelvis, the ureters, and the bladder were examined, and, to make quite sure, the bladders which were apparently without calculi were also investigated microscopically. In this way it was possible on several occasions to find concretions invisible to the naked eye. X-ray photographs were taken of many of the rats.

That calculi are more frequent in males than in females has its natural explanation, already given in the Hippocratic book *De Aere Locis et Aquis*—namely, that the urethra of females is short and wide.

Most of the calculi consisted of calcium phosphate or of a mixture of calcium phosphate and calcium oxalate. Calcium oxalate concretions occurred in rats on McCollum's rickets-promoting diet. A number of rats suffered from haematuria. However, this did not occur so often as might have been expected, considering the frequency of the calculosis. Though probably caused by the lack of vitamin A, it is yet of less frequent occurrence than calculosis, and is not directly connected with it, for in many cases of haematuria there were no calculi, while in many cases of calculi in the bladder there was no blood in the urine.

Contrary to all expectations, obvious cystitis was rare. As a rule the urine was clear and its reaction to litmus was acid. In most cases of calculosis, on microscopic investigation the mucous membrane proved to be normal and the surface layer of the epithelium intact.

Calculi may soon appear in case of vitamin A deficiency; the production of calculi in three or four weeks proved to be very common. Several times I found formations in the urine, in shape resembling casts; they were straight or bent crystalline cylinders of calcium phosphate or oxalate. This discovery led me to examine the kidneys, and I found that, in vitamin A deficiency, lime deposits in the tubules are frequent, not to say constant. These lime deposits are found throughout the kidney, especially

in the tubules, but never in the glomeruli. According to the shape of the tubules, they are straight, bent, or sinuous.

Altogether I examined 254 rats with regard to their kidneys; 76 had had a satisfactory supply of vitamin A, and 178 had suffered from vitamin A deficiency. Of the 76 rats, 10 had lime deposits in their kidneys, but these deposits were very small in number, one, or at most two, to a section. Hence I believe that with healthy, adequately fed rats lime deposits of any size in the kidneys may be said to be exceptional. On the other hand, calcium deposits in the tubules were almost constant in the rats suffering from deficiency of vitamin A; of 178 rats deposits were found in 158 (87 per cent.), whereas there was a frequency of calculi in the bladder of only 35.4 per cent.

As a control I first extirpated one of the kidneys from a number of rats on an ordinary diet, and then withheld vitamin A from their food. I then, after some time, killed those which had not already died from the consequences of the operation or some other cause. In 14 rats which died within three to fifteen days after the operation there were no lime deposits in the extirpated kidney nor in the other one; 9 other rats fed in the same way also had no lime deposits in the extirpated kidney, but in 7 of them, after more than twenty days of vitamin A deficiency, I found deposits in the remaining kidney. These lime deposits form quickly; in one case of deficiency in vitamin A they had been formed in thirteen days.

From what has been said above it may be concluded that in rats there is without doubt a connexion between deficiency in vitamin A and the formation of phosphatic calculi.

It is known that absence of the fat-soluble vitamin from the food causes typical changes in the epithelium of the mucous membranes—for example, keratinization; witness the xerophthalmia and the lengthening of that stage of the oestral cycle characterized by the horny cells. Probably such a morbid change of epithelial cells of the tubules gives the impulse to the deposition of lime, which deposition, once liberated, grows to larger concretions in the bladder.

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EFFECT OF EARLY INDUSTRIALISM ON THE HEALTH OF THE COMMUNITY.*

BY

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THE popular view is that the effect of industrialism on the health of the community was necessarily bad, but the fact is that the population of Great Britain grew at an unprecedented rate during the period 1760-1860. To account for this, an increase in the birth rate was postulated; there is, however, no evidence for this, and definite evidence for a decrease of the death rate. An estimate of the death rate for England and Wales in the middle of the eighteenth century shows that, on a rough average, it was 35 per 1,000. In the year 1815 it had been reduced to about 20 per 1,000. In the middle of the eighteenth century the death rate in London and other large towns was 50 per 1,000, while in 1815 the death rate in London was about 30 per 1,000. These figures give very little support for the contention that economic advance was at the expense of health. The main part of the population in the middle of the eighteenth century were living in comparatively isolated rural communities, in which the death rate is usually very high. It is not primarily a hot climate which is responsible for diseases like plague, but the lack of hygiene, along with the uncertainty of food supply. Plagues were frequent in mediaeval Europe, and scurvy certainly and rickets probably were present. The towns were without the most elementary sanitation, overcrowding was rife, and the water

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supply was poor. From the fifteenth century onwards society was passing gradually from the agricultural to the industrial stage. The growth of trade led to the growth of towns, and owing to the widening of the area from which food supplies could be drawn these became more secure. Improvements were possible with production for market rather than for subsistence, and large quantities of green vegetables were grown. All these things tended to decrease scurvy and rickets and to increase general resistance to disease. Commerce introduced tea and sugar to the national diet; tea probably helped to reduce the consumption of alcohol somewhat, and sugar was decidedly beneficial. Malaria was reduced by the draining of the marshes, undertaken for agricultural reasons, and in the towns there was better scavenging and a better water supply. The provision of hospitals and dispensaries during the eighteenth century also made a vast difference. The latter half of that century saw the beginning of preventive medicine, first in military and naval hygiene, and in this connexion the names of Pringle and Lind should be remembered; later it was extended to the civilian population by Percival and Ferriar of Manchester and Currie of Liverpool. All these men, except Percival, were Scotsmen, and all received part at least of their training in Edinburgh. It was Lind who first laid down the rules for combating typhus. The first experiments among civilians were carried out in Chester, and then the Manchester Board of Health was established in 1795, and the Manchester House of Recovery was founded in 1797. Probably the campaign against typhus was aided by the introduction of cheap cotton clothing and of the iron bedstead, and the reform of the gaols also did something to wipe out the breeding places of typhus.

There was a campaign against small-pox even before Jenner, but the most outstanding improvement was the greater attention to infant and child welfare throughout the whole of western Europe. In the middle of the eighteenth century of those born in London about 75 per cent. died before attaining the age of 5 years. In 1825 the proportion had fallen to 30 per cent. This was mainly due to the better food supply, coupled with the application of elementary rules of cleanliness, fresh air, and rational methods of feeding and clothing. The establishment of maternity hospitals and of lying-in hospitals was very important, because by them knowledge was spread among the masses of the people. In London an extraordinary number of maternity hospitals was established, and there was actually a baby clinic in London in 1815, although it was not so called; in the British Museum there exists a pamphlet given to poor mothers, telling them how to treat their babies. At the British Lying-in Hospital in London during the ten years ending 1758, for every 1,000 deliveries 24 mothers and 66 infants died. In the ten years ending 1798, for every 1,000 deliveries 3.5 mothers and 13 infants died. In 1781 figures were published in the midwifery reports for the Westminster General Dispensary, and for the poor people who were attended in their own homes the maternal mortality rate was only 3.7 per 1,000. From these figures it seems that the end of the eighteenth century had a better record in relation to its knowledge in this matter than we have at the present day. Before 1780 the death rate in nearly all towns exceeded the birth rate. So long as this was true, real urbanization was impossible. But by 1820 the birth rate in most English towns exceeded the death rate, and the towns had improved more than the country. At the end of the nineteenth century, when the study of economic history began, the death rate of the mid-nineteenth century appeared to be appalling, but it was not realized that the figures for that time showed an enormous decrease compared with those of earlier times. The mistake lay in comparing the figures with those for the years that followed, instead of with those for previous years.

The earlier stages of the industrial movement were probably not so bad as they are thought to be, but the increasing urbanization from 1825 onwards was a growing factor of difficulty from the point of view of public health. It may be asked whether this advance in hygiene can be correlated with economic advance, or was it just an accident that when economic advance began hygiene im-

proved? Both movements were essentially parts of one great movement towards a higher civilization. Is it an accident that in India and China agricultural and industrial methods have remained unchanged and at the same time preventive medicine also? The first fruit of the new control of nature by medicine has been the growth of population.

Memoranda:

MEDICAL, SURGICAL, OBSTETRICAL.

PREGNANCY UNINTERRUPTED BY SEVERE BURNS AND DOUBLE AMPUTATION.

THE following case seems worthy of record, since the continuation of normal pregnancy in spite of a serious accident followed by grave complications is of some interest.

A woman, aged 21, was admitted to the Royal Sussex County Hospital, Brighton, in the autumn of 1923 following an accident. The motor-cycle combination in which she was a passenger ran head on into a charabanc and the petrol tank of the cycle ignited, severely burning both occupants. The driver died of his burns just after admission, his body being in the typical pugilistic attitude. On admission, one and a half hours after the accident, the condition of the woman was good. Her pulse was about 70, she had no pain, and was able to give information about the accident to the police. She had, however, sustained burns involving the whole surface area of both legs, from the level of the great trochanter down to the soles of the feet, the only parts escaping being a narrow band above each knee, where the garters protected the skin, and the sole of each foot, protected by the shoes. The skin was charred down to the muscles. There was also a compound fracture of the left leg above the ankle. The legs were wrapped in picric acid dressings and kept moistened constantly. The patient was given a gum saline with adrenaline intravenously; 4 pints were administered in the first two hours, and 6 pints of saline were absorbed by the rectum in the following twelve hours. In this way about 16 pints of fluids were retained in the first thirty-six hours. She continued restless, and suffered from insomnia. To relieve the restlessness and induce sleep 1/2 grain of morphine hydrochloride was given hypodermically at intervals of two hours, but repeated doses failed to relieve the insomnia, as also did trivallin, given by the mouth, or rectal ether, the latter being returned. In all, she had an average of 6 grains of morphine a day for five days, but the only effects were slight drowsiness and pin-point pupils.

Her general condition kept constant in this period—that is, the pulse about 120 and temperature up to 100°. The legs were left undisturbed and kept moistened with picric acid, but on the fifth day secondary haemorrhage set in, and under intravenous ether both legs were removed at the level of the great trochanter. Under the anaesthetic she was found to be three months pregnant.

She recovered from the operation with little or no shock, and apart from a local osteomyelitis in the amputation stumps, and pyrexia for six weeks, her general condition improved. Some four months later a secondary operation was performed on the stumps and the bare bone was covered.

One month before labour she had typical facial erysipelas, but recovered. The pregnancy was unaffected by this sequence of events, and some six months after the accident she was delivered of a healthy child. At the time of the accident the patient was expected to succumb from the effects of her burns, but neither this nor the shock of a double amputation had any effect on the course of the pregnancy.

I am indebted to Mr. A. G. Bate, surgeon to the Royal Sussex County Hospital, for permission to publish the case.

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FOREIGN BODY REMOVED FROM THE EAR.

THE case described by Dr. C. J. L. Wells in the *BRITISH MEDICAL JOURNAL* of October 8th (p. 637) of a foreign body removed from the ear after thirty-three years reminds me of one seen some years ago.

A woman, aged 40, complained of slight earache in the right ear. She said that she had never previously had any pain, but that she had always been completely deaf in the right ear, so much so that as a schoolgirl she had always had a special seat at the front of the class, and could only hear at the left side.

I removed a large plug of cotton-wool embedded in wax. The membrane was perfectly normal, and at once the patient was able to hear a watch held about thirty inches away.

It must be very unusual for such an amount of deafness to be put up with for so many years without any attempt being made to find out the cause.

London, W.I.

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