



ADVENTURES IN DIET

PART III

BY VILHJALMUR STEFANSSON

SCURVY has been the great enemy of explorers. When Magellan sailed around the world four hundred years ago many of his crew died from it and most of the others were at times so weakened that they could barely handle the ships. When Scott's party of four went to the South Pole twenty-three years ago their strength was sapped by scurvy; they were unable to maintain their travel schedule and died. Nor has scurvy been the nemesis of explorers only. Twenty years ago the British Army in the Near East was seriously handicapped, and last October an American doctor reported a hundred Ethiopian soldiers per day dying of scurvy. The disease worked havoc during the Alaska and Yukon gold rushes following 1896. Scores of miners died and hundreds suffered.

Medical profession and laity equally believed for more than a hundred years that they knew exactly how to prevent and cure the disease, yet the method always failed on severe test.

The premise from which the doctors started was that vegetables, particularly fruits, prevent and cure scurvy. Since diet consists of animals and plants, the statement came to take the form that scurvy is caused by meat and cured by vegetables. Finally the doctors standardized on lime juice as the best of preventatives and cures. They named it a sure cure, a specific. Law-makers followed the doctors. It is on

the statute books of many countries that on long voyages the crews are to be supplied with lime juice and induced or compelled to take it.

Obtained from officers of the Royal Canadian Mounted Police, and from sourdoughs, I have in my diaries and notes many a case of suffering and death caused by scurvy in the Alaska and Yukon gold rushes. The miner generally began to sicken toward the end of winter. He had been living on beans and bacon, on biscuits, rice, oatmeal, sugar, dried fruits and dried vegetables. When he recognized his trouble as scurvy he made such efforts as were possible to get the things which he believed would cure him. Apparently the miners had the strongest faith in raw potatoes. These had to be brought from afar, and there are heroic tales of men who struggled through the wilderness to succor a comrade with a few pounds of them. There were similar beliefs in the virtues of onions and some other vegetables. Curiously, there was either no belief in those vegetables which were obtainable, or else there was a belief that they should be treated in a way which, we now understand, destroys their value. For instance, a man might have been cured, or at least helped, with a salad of leaves or the green bark of trees. What the miners did with the pine needles and willow bark was to cook them for hours and

drink the tea. If they had fresh meat they boiled it to shreds and drank the broth. Death frequently occurred in two to four months from the recognized onset of the disease.

Ignoring the decimation of armies, and the burden of this disease in many walks of civil life through past ages, we turn to the explorers, the class most widely publicized as suffering from and dying of scurvy.

It is usual to rank James Cook of a hundred and fifty years ago with the foremost explorers of all time. Part of his fame may be attributed to his having discovered how to prevent and cure scurvy. Medical books name him as pioneer in the field, saying that we owe to him the conquest of a dread disease. For he demonstrated that with vegetables (again, particularly fruits) scurvy could be prevented on the longest voyages. By statement or inference these books assert that from this developed the knowledge according to which we extract and bottle the juice of the lime, stock ships with it, prevent and cure scurvy.

As above intimated, however, the good physicians, with their faith in lime juice as a specific, overlooked its constant failure upon severe test.

How stoutly the faith was kept is shown by the British polar expedition of Sir George Nares. When he returned to England in 1876 after a year and a half, he reported much illness from scurvy, some deaths, and a partial failure of his program as a result. In his view fresh meat could have saved his men. But the doctors, as we shall see when we consider how they later advised Scott, soon forgot whatever impression was made by Nares. They seem to have squared themselves with the old doctrines by a series of assumptions; that the lime juice on the Nares expedition might have been deficient in acid content; that some of the victims did not take as much of it as

needed; and that perhaps it was too much to expect of even the marvelous juice to cope with all the things which tended to bring on scurvy—absence of sunlight, bad ventilation, lack of amusement and exercise, insufficient cleanliness.

Particularly because the Nares medical court of inquiry had closed on a note of cleanliness and "modern sanitation," you would think the medical world might have felt a severe jolt when they read how Nansen and Johansen had wintered in the Franz Josef Islands (now Nansen Land) in 1895-96. They had lived in a hut of stones and walrus leather. The ventilation was bad, to conserve fuel; the fire smoked, so that the air was additionally bad; there was not a ray of daylight for months; during this time they practically hibernated, seldom going outdoors at all and taking as little exercise as appears humanly possible. Yet their health was perfect all winter and they came out of their hibernation in as good physical condition as any men ever did out of any kind of Arctic wintering. Their food had been the lean and the fat of walrus.

Tens, if not hundreds, of thousands of scientists in medicine and the related branches must have seen this account, for Nansen's books were best-sellers in practically every language and newspapers were full of the story. Yet the effect was negligible. The doctors and dietitians still continued to pontificate on meat producing scurvy and on the contributory bad effects of what they called insufficiency of ventilation, cleanliness, sunlight, and exercise. They still prescribed lime juice and put their whole dependence on it and other vegetable products.

Excuses for lime juice have persisted to our day. It was, for instance, demonstrated with triumph recently that the meaning of "lime" had

changed during the last hundred years, explaining the claim that it worked better in the eighteenth than in the nineteenth century—then the juice was made from lemons called limes; now it is made from limes called limes.

The antiscorbutic value of lemons may be far greater than that of limes per ounce, but that does not go to the root of the matter. For proof of this consider how Nansen's experience was re-enforced and interpreted by four expeditions during two decades, two of them commanded by Robert Falcon Scott, one by Ernest Henry Shackleton, one by me.

II

Scott, in 1900, sought the most orthodox scientific counsel when outfitting his first expedition. He followed advice by carrying lime juice and by picking up quantities of fruits and other vegetable things as he passed New Zealand on his way to the Antarctic. He saw to it that the diet was "wholesome," that the men took exercise, that they bathed and had plenty of fresh air. Yet scurvy broke out and the subsequently famous Shackleton was crippled by it on a journey. They were pulling their own sledges at the time, so they must have had enough exercise. There was plenty of light with the sun beating on them, and there was plenty of fresh air. To believers in the catchwords and slogans of their day, to believers in the virtues of lime juice, the onset of the scurvy was a baffling mystery.

That it was Shackleton's scurvy which most interfered with the success of the first Scott expedition was particularly unfortunate, if you think of the jealousies it aroused, the enmities it caused. Scurvy, as diseases go, is really one of the cleanest and least obnoxious; but in English the name of it is a term of opprobrium—"a scurvy fellow," "a scurvy trick." Shackleton

may have smarted as much under that word-association as he did under the charge that his weakness had been Scott's main handicap. The passion to clear his name, in every sense, drove him to the organization of an expedition which many in Britain considered unethical—a subordinate, with indecent haste and insistence, crowding forward to eclipse his commander.

The crucial element in the first Shackleton expedition, to the students of scurvy, is the fact that Shackleton was an Elizabethan throwback in the time of Edward VII. He was a Hawkins or a Drake, a buccaneer in spirit and method. He talked louder and more than is good form in modern England. He approached near to brag and swagger. He caused frictions, aroused and fanned jealousies, and won the breathless admiration of youngsters who would have followed Dampier and Frobisher with equal enthusiasm in their piracies and in their explorations.

The organization, and the rest of the first Shackleton expedition, went with a hurrah. They were as careless as Scott had been careful; they did not have Scott's type of backing, scientific or financial. They arrived helter-skelter on the shores of the Antarctic Continent, pitched camp, and discovered that they did not have nearly enough food for the winter, nor had they taken such painstaking care as Scott to provide themselves with fruits and other antiscorbutics in New Zealand. Compared with Scott's, their routine was slipshod as to cleanliness, exercise, and several of the ordinary hygienic prescriptions.

What signifies is that Scott's men, with unlimited quantities of jams and marmalades, cereals and fruits, grains, curries, and potted meats, had been little inclined to add seals and penguins to their dietary. With Shackleton it was neither wisdom nor the

acceptance of good advice but dire necessity which drove to such use of penguin and seal that Dr. Alister Forbes Mackay, physician from Edinburgh, who was a member of that Shackleton expedition and later physician of my ship the *Karluik*, told me he estimated half the food during their stay in the Antarctic was fresh meat.

In spite of the lack of care (indeed, as we now see it, because of that lack), Shackleton had better average health than Scott. There was never a sign of scurvy; every man retained his full strength; and they accomplished that spring what most authorities still consider the greatest physical achievement ever made in the southern polar regions. With men dragging the sledges a considerable part of the way, they got to latitude $88^{\circ} 23' S.$, practically within sight of the Pole.

Scott began his second venture as he had begun the first, by asking the medical profession of Britain for protection from scurvy and by receiving from them once more the good old advice about lime juice, fruits, and the rest. In winter quarters he again placed reliance on that advice and on constant medical supervision, on a planned and carefully varied diet, on numerous scientific tests to determine the condition of the men, on exercise, fresh air, sanitation in all its standard forms. The men lived on the foods of the United Kingdom, supplemented by the fruit and garden produce of New Zealand. Because they had so much which they were used to, they ate little of what they had never learned to like, the penguins and seals.

Once more they started their sledge travel after a winter of sanitation. The results had previously been disappointing; now they were tragic. While scurvy did not prevent them from reaching the South Pole, it began to weaken them on the return and progressed so rapidly that the growing

weakness prevented them, if only by ten miles, from being able to get back to the final provision depot.

Those who have ignored the scurvy have sometimes claimed that if Scott had reached the depot he would have been able to reach the base camp eventually. This becomes more than doubtful when you realize that the progressive decrease of vigor, both mental and bodily, was not going to be helped by even the largest meals, if those meals were of food lacking anti-scorbutic value.

The story of Scott and his companions, especially through the last few weeks, is among the noblest in any language; through it they became national heroes and world heroes. But in the speech of their countrymen (though not in many another European tongue), scurvy sounds unclean. It appeared necessary to Scott's surviving comrades, and to those in Britain who knew the truth, to take care that the tabooed word should not sully a glorious deed.

To suppress the association of a disease with the beauty and heroism of Scott's death may have been worth while at the time; but it can scarcely be deplored by anyone—and must be praised by scientists—that Commander Edward R. G. R. Evans, now Admiral, Scott's second-in-command, after a time gave out the scurvy information, including the statement that he himself had been ill.

It is irrational, at least now that emotions have calmed, to blame Scott. No one was to blame, for they all acted according to the light of their day. If anybody was to blame it was primarily those who gave medical advice to the expedition before it sailed; secondarily, it was the chief medical officer, rather than the commanding officer, of the expedition.

It seems strange, now, that a comparison of the Scott and Shackleton

experiences did not fully enlighten the doctors on the true inwardness of scurvy; but of course part of the explanation is that the Scott medical information was suppressed. Therefore, it remained for my own expeditions to demonstrate, so far as polar expeditions are concerned, and for the Russell Sage experiments to call to the attention of the medical profession, the most practical and only simple way of curing scurvy. For no matter how good the juice of limes (or lemons), it is difficult to carry, it deteriorates, and you may lose it, as by a shipwreck. The thing to do is to find your anti-scorbutics where you are, pick them up as you go.

On my third expedition it happened, as circumstantially related in a book called *The Friendly Arctic*, that three men came down with scurvy through disobeying the instructions of the commander and living without his knowledge for two or three months chiefly on European foods when they were supposed to be living chiefly on meat.

It seems to take from one to three months for even a bad diet to produce recognizable scurvy, but thereafter developments are rapid through the next few weeks. In the case of my men it was about three weeks (as they later thought) after they noticed the trouble, and about ten days after they complained of it to me, when one of them was so weak we had to carry him on a sledge, while the other was barely able to stagger along, holding on behind. By then every joint pained, their gums were as soft as "American" cheese, their teeth so loose that they came out with almost the gentlest of pulls.

We were 60 or 80 miles from land on drifting sea ice when the trouble started, and we hastened ashore to get a stable camp for the invalids. It would have been no fun, with sick men on your hands, if the site of your

camp started disintegrating under pressure and tumbling about.

We reached an island (about 900 miles north of the Arctic Circle) the coast of which was known although the interior had never been explored. We traveled a few miles inland, established a camp, hunted caribou (there were two of us well, out of four) and began the all-meat cure. Fuel was pretty scarce, so we cooked only one meal a day; besides, I thought raw food might work better. We cooked the breakfast in a lot of water. The patients finished the boiled meat while it was hot and kept the broth to drink during the rest of the day. For their other meals they ate slightly frozen raw meat, with normal digestion and good appetite. We divided up the caribou in ordinary Eskimo style, so the dogs got organs and entrails, hams, shoulders, and tenderloin, while the invalids and we hunters got heads, briskets, ribs, pelvis, and the marrow from the bones.

On this diet all pain disappeared from every joint within four days and the gloom was replaced by optimism. Inside of a week both men said that they had no realization of being ill as long as they lay still in bed. In two weeks they were able to begin traveling, at first riding on the sledges and walking alternately. At the end of a month they felt as if they had never been ill. No signs of the scurvy remained except that the gums, which had receded from the teeth, only partly regained their position.

By comparing notes later with Dr. Alfred Hess, the leading New York authority on scurvy, I found that when I was getting these results with a diet from which all vegetable elements were absent, he was getting the same results in the same length of time through a diet where the main reliance was upon grated raw vegetables and fruits and upon fresh fruit juices.

There is no doubt, as the quantitative studies have shown, that the percentage of Vitamin C, the scurvy-preventing factor, is higher in certain vegetable elements than in any meats. But it is equally true that the human body needs only such a tiny bit of Vitamin C that if you have some fresh meat in your diet every day, and don't overcook it, there will be enough C from that source alone to prevent scurvy. If you live exclusively on meat you get from it enough vitamins not only to prevent scurvy but, as said in a previous article, to prevent all other deficiency diseases.

Closing the subject of vitamins in relation to long expeditions, we had better emphasize that there has recently been such progress in the extraction, concentration, and storage of Vitamin C that it is now possible to carry with you enough to last several years and of such quality that it will not deteriorate to the point of uselessness. But why carry coals to Newcastle? If you are in the tropics, pick a fruit or eat a green; if you are at sea, throw a line outboard and catch a fish; if you are in the Antarctic, use seals and penguins; if in the Arctic, hunt polar bears and seals, caribou and the rest of the numerous game. True enough, if you make a journey inland into the Antarctic Continent or toward the center of Greenland, where there is no game because the land is permanently snow-covered, you have to carry food with you. In that case you might as well take lemon juice. It is one of the most portable sources and they know now how to make and pack it so that its qualities as well as quantities will last you.

III

A bulletin conspicuous in the subways co-operated some time ago with the New York Commissioner of Health by displaying this notice:

"FOR SOUND TEETH
BALANCED DIET with
VEGETABLES : FRUIT : MILK
BRUSH TEETH
VISIT DENTIST REGULARLY
—Shirley W. Wynne, M.D.,
Commissioner of Health"

During the same time the ether was full and the magazine pages were crowded with advertising which told you that mouth chemistry is altered by a paste, a powder, or a gargle so as to prevent decay, that a clean tooth never decays, that a special kind of toothbrush reaches all the crevices, that a particular brand of fruit, milk, or bread is rich in elements for tooth health. There were toothbrush drills in the schools. Mothers throughout the land were scolding, coaxing, and bribing to get children to use the preparations, eat the foods, and follow the rules that insured perfect oral hygiene.

Meantime there appeared a statement from Dr. Adelbert Fernald, Curator of the Museum of the Dental School, Harvard University, that he had been collecting mouth casts of living Americans, from the most northerly Eskimos south to Yucatan. The best teeth and the healthiest mouths were found among people who never drank milk since they had ceased to be suckling babes and who never in their lives tasted any of the other things recommended for sound teeth by the New York Commissioner of Health. These people, Eskimos, never use tooth paste, tooth powder, tooth brushes, mouth wash, or gargle. They never take any pains to cleanse their teeth or mouths. They do not visit their dentist twice a year or even once in a lifetime. Their food is exclusively meat. Meat, be it noted, was not mentioned in the advertisement issued by Dr. Wynne.

Teeth superior on the average to those of the presidents of our largest tooth-paste companies are found in the world to-day, and have existed during

past ages, among people who violate every precept of current dentifrice advertising. Not all of them have lived exclusively on meat; but so far as an extensive correspondence with authorities has yet been able to show me, a complete absence of tooth decay from entire communities has never existed in the past, and does not exist now, except among people in whose diet meat is either exclusive or heavily predominant.

Our Bellevue experiments threw a light on tooth decay, but the key to the situation lies more in the broad science of anthropology. I now give, by sample and by summary, things personally known to me from anthropological field work:

My first anthropological commission was from the Peabody Museum of Harvard University when they sent John W. Hastings and me to Iceland in 1905. We found in one place a medieval graveyard that was being cut away by the sea. Skulls were rolling about in the water at high tide; at low tide we gathered them and picked up scattered teeth here and there. As wind and water shifted the sands we found more and more teeth until there was a handful. Later we got permission to excavate the cemetery, and eventually we brought with us to Harvard a miscellaneous lot of bones which included 80 skulls and, as said, a great many loose teeth.

The collection has been studied by dentists and physical anthropologists without the discovery of a single cavity in even one tooth.

The skulls in the Hastings-Stefansson collection represent persons of ordinary Icelandic blood. There were no aborigines in that island when the Irish discovered it some time before 700 A.D. When the Norsemen got there in 860 they found no people except the Irish. It is now variously estimated that in origin the

Icelanders are from 10 per cent to 30 per cent Irish, 40 per cent to 60 per cent Norwegian, the remainder, perhaps 10 per cent, from Scotland, England, Sweden, and Denmark.

None of the peoples whose blood went into the Icelandic stock are racially immune to tooth decay, nor are the modern Icelanders. Then why were the Icelanders of the Middle Ages immune?

An analysis of the various factors makes it pretty clear that their food protected the teeth of the medieval Icelanders. The chief elements were fish, mutton, milk, and milk products. There was a certain amount of beef and there may have been a little horse flesh, particularly in the earliest period of the graveyard. Cereals were little imported and might be used for beer rather than porridge. Bread was negligible and so were all other elements from the vegetable kingdom, native or imported.

My mother, who was born on the north coast of Iceland, remembered from the middle of the nineteenth century a period when bread still was as rare as caviar is in New York to-day—she tasted bread only three or four times a year and then only small pieces when she went with her mother visiting. So far as bread existed at her own house, it was used as a treat for visiting children. The diet was still substantially that of the Middle Ages, though the use of porridge was increasing. She did not remember hearing of toothache in her early youth but did remember accounts of it as a painful rarity about the time when she left for America in 1876. Soon after arrival in the United States (Wisconsin, Minnesota, Dakota) and in Canada (Nova Scotia, Manitoba) the Icelandic colonists became thoroughly familiar with the ravages of caries. They probably had teeth as bad as those of the average American long before 1900.

There is then at least one case of a north-European people whose immunity from caries (to judge from the Hastings-Stefansson collection and common report) approached 100 per cent for a thousand years, down to approximately the time of the American Civil War. The diet was mainly from the animal kingdom. Now that it has become, both in America and Iceland, approximately the same as the average for the United States or Europe, Icelandic teeth show a high percentage of decay.

I began to learn about another formerly toothacheless people when I joined the Mackenzie River Eskimos in 1906. Some of them had been eating European foods in considerable amount since 1889, and toothache and tooth decay were appearing, but only in the mouths of those who affected the new foods secured from the Yankee whalers. The Mackenzie people agreed that toothache and cavities had been unknown in the childhood of those then approaching middle age, while there were many of all ages still untouched, the ones who kept mainly or wholly to the Eskimo diet. Here, and in many other places, this is somewhere between 98 per cent and 100 per cent from animal sources. There are districts, like parts of Labrador and of western and southwestern Alaska, where even before the coming of Europeans there was considerable use of native vegetables. Probably, however, the vegetable element nowhere furnished as much as 5 per cent of the average yearly caloric intake of the primitive Eskimos, even in southwestern Alaska.

Dr. Ales Hrdlicka, Curator of Anthropology in the National Museum, Washington, writes me that he knows of no case of tooth decay among Eskimos of the present or past who were uninfluenced by European habits. Dr. S. G. Ritchie, of Dalhousie

University, wrote after studying the skeletal collection gathered by Mr. Diamond Jenness on my third expedition: "In all the teeth examined there is not the slightest trace of caries."

I brought about 100 skulls of Eskimos, who had died before Europeans came in, to the American Museum of Natural History, New York. These have been examined by many students, but no sign of tooth decay has yet been discovered.

Dr. M. A. Pleasure examined at the American Museum of Natural History 283 skulls said to be Eskimo of pre-European date. He found a small cavity in one tooth; but when the records were checked it turned out that the collector, Rev. J. W. Chapman of the Episcopal Board of Missions, who now lives in New York City, had sent that skull to the Museum as one of an Athabasca Indian, not of an Eskimo.

The slate is, therefore, clean to date. Not a sign of tooth decay has yet been discovered among that one of all peoples which most completely avoids the foods, the precepts, and the practices favored for dental health by the New York Commissioner of Health, the average dentist, the toothbrush drillmasters of the schools, and the dentifrice publicists.

IV

When addressing conventions and societies of medical men, I usually state the oral hygiene case somewhat as above, though in more detail. If there is rebuttal from the floor, it invariably takes the form of contending that the tooth health of primitive people is due to their chewing a lot, and to their eating coarse food. The advantage of that argument to the dentist, whose best efforts have failed to save your teeth, is obvious. It gives him an excuse. He can from the doctrine make a case that not all your care, even when supported by his skill

and science, can preserve teeth in a generation of soft foods that give no exercise to the teeth and no friction to the gums.

But it is deplorably hard to square anthropology with this comfortable excuse of the dentist. Among the best teeth of a mixed-diet world are those of a few South Sea Islanders who as yet largely keep to their native diets. Similar or better tooth condition is described, for instance, from the Hawaiian Islands by the earliest visitors. But can you think of a case less fortunate for the chewing-and-coarse-food advocates? The animal food of these people was chiefly fish, and fish is soft to the teeth, whether boiled or raw. Among the chief vegetable elements was poi, a kind of soup or paste. Then they used sweet potatoes.

It would be difficult to find a New Yorker or Parisian who does not chew more, and use coarser food, than the South Sea Islanders did on the native diets which gave them in at least some cases 97 per cent freedom from caries, a record no block on Park Avenue can approach.

Nor do Eskimos chew much, as compared with us. So far as their meat is raw it can be chewed like a raw oyster—slips down similarly. When perfectly fresh meat is cooked, two main causes determine toughness: the age of the beast and the manner of cooking. The chief food animal of inland Eskimos is the caribou. A young caribou is as fleet as a heifer; an old one is as slow as a cow. Therefore the wolves get the clumsy old which drop behind when the band flees, and the Eskimos seldom have a chance to secure an animal that is more than three or four. Such young caribou are not tough, no matter how cooked.

I do not know a corresponding logical demonstration for seals, but I can testify from helping to eat thousands that their meat is never tough—at least

not in comparison with the beefsteaks you sometimes get in New York chop-houses.

Then there are Eskimos who live practically exclusively on fish. As said, you can't chew them when they are raw; there is not much chewing when they are eaten boiled. The only condition under which fish become tough, or rather hard, is when they are dried. Some Eskimos use dried fish; others do not.

There is for separated districts a wide difference in the amount of Eskimo chewing, but no one has reported that the health of the teeth is better among the heavier chewers. How could it be when as yet no caries has been found either among the lightest or heaviest masticators?

It is used as a second line of defense by the mastication advocates that even if Eskimos perhaps don't chew their food so very much they do chew skins a great deal. Their chewing of leather is far less than you might believe from what has been said by a particular kind of writer and pictured in certain movies. In any case, skin chewing is mainly by the women, and it is not easy to bring under the conditions of modern scientific thought the idea that the wife's chewing preserves her husband's teeth.

Once at a talk to a medical group I encountered a further argument. Is it not true that Eskimo men use the teeth a great deal in their crafts? Do they not bite wood, ivory, or metal to hold, pull out, twist, and so on? The best I could think of was to agree that Eskimos pull nails with their teeth, and to follow by suggesting that it is more likely they bite nails because they have good teeth than that they have good teeth because they bite nails.

There are several reasons why the teeth of many Eskimos wear down rapidly. They usually meet edge to edge, where ours frequently overlap,

and that tends to cause wear. Some Eskimos wind-dry fish or meat, sand gets in, and to an extent makes them like sandpaper. Both sexes, but especially men, use their teeth for biting on hard materials. Both sexes, but especially the women, use their teeth for softening skins. A wearing toward the pulp may, therefore, take place in early middle life. What then happens is stated by Dr. Ritchie (whom we have already quoted) with relation to the Coronation Gulf Eskimos:

"Coincident with this extreme wear of the teeth the dental pulps have taken on their original function with conspicuous success. Sufficient new dentine of fine quality has been formed to obliterate the pulp chambers and in some cases even the root canals of the teeth. This new growth of tissue is found in every case where access to the pulp chambers has been threatened. There has therefore been no destruction of the pulps through infection and consequently alveolar abscesses are apparently unknown."

Total absence of caries from those who live wholly on meat is then definite. Cessation of decay when you transfer from a mixed to a meat diet happens usually, perhaps always. The rest of the picture is not so clear.

Caries has been found in the teeth of mummies in Egypt, Peru, and in our own Southwest. These ancient peoples were mixed-diet eaters, depending in considerable part on cereals. Their teeth were better than ours, though not so good as those of the Eskimos. If you want a dental law, you can approximate it by saying that the most primitive people usually have the best teeth. You can add that in some cases a highly vegetarian people, while not attaining the 100 per cent perfection of meat eaters, do, nevertheless, have very good teeth as compared with ours.

It is contended by the Hawaiian Sugar Planters Association Health Research Project that the shift from good to execrable teeth among the mixed-diet Polynesians there has been due to a change from the native taro and yams to cereals. I have seen no comment of theirs upon the (I should think) great increase of sugar consumption that has been synchronic with the deterioration of Hawaiian teeth.

On the view that diet is the greatest factor in saving teeth, the anthropologists have been getting support from experiments conducted by institutions and by scattered students. Some dentists are here contributing nobly to a research, and to a campaign of education, that seems bound to deplete their income. My probing has not revealed thus far corresponding unselfishness among the dentifrice manufacturers.

A serious mouth disease, next after caries, is pyorrhœa. He who runs cannot read the marks so readily on human skeletons; but it seems at least probable that the medieval Icelanders, the Eskimos, and others who have left teeth free from cavities, were also free from, or at least not severely afflicted by, pyorrhœa. Similarly, the modern investigators have found Eskimos who are still living on their native foods to have an unusually good average condition of general oral health, therewith absence of pyorrhœa.

One of the things we noticed in the general well-being of our New York year on meat and similar years in the Arctic was the absence of headaches. I used to have them frequently before going north and have them occasionally whenever I am on a mixed diet. The whys and wherefores are not clear, and what we say on this point is more tentative than any other part of this statement.

It was noticed in the X-ray pictures during our New York meat year that we had far less gas in the intestinal

tract when on meat than when on a mixed diet—practically no gas. The work of Dr. John C. Torrey showed that neither did digestion and elimination produce those offensive smells which are found in vegetarianism and on a mixed diet. But whether the freedom from a certain kind of intestinal food decomposition was what led to the freedom from headache is no more than a working hypothesis.

The prevention of headache by abstaining from vegetables has been recorded in books. An outstanding case is that of Francis Parkman, the historian, who suffered with headaches all his life except, as he states, during one period when he was living with an Indian tribe chiefly or exclusively on meat. This testimony, though by an eminent man widely read, and though a fair sample of the testimony of meat eaters, commanded little attention from the physicians. It should be said in their defense, however, that Parkman himself does not proclaim the experience as a triumphant discovery. He rather puts it the other way about, that in spite of being compelled to live on meat, he was free from the headaches that plagued him the rest of his days.

Professor Raymond Pearl, nearly twenty years ago, while he was at the Maine Agricultural Experiment Station, proved that chickens know more than professors about what is good for chickens to eat. Now several experiments appear in a good way to establish that children, if given complete freedom to choose among foods undisguised by sauces and artificial flavors, will select better for their own health and strength than the mother or the child specialist. One of the things frequently noticed about these children is that they eat large quantities of a single item which they happen to like. Our living for years on a single item which we liked was from

that point of view no more than carrying forward a childhood tendency.

V

More than twenty-five years have passed since the completion of my first twelve months on meat and more than six years since the completion in New York of my sixth full meat year. All the rest of my life I have been a heavy meat eater, and I am now fifty-six. That should be long enough to bring out the effects. Dr. Clarence W. Lieb will report in the *American Journal of Gastroenterology* that I still run well above my age average on those points where meat has been supposed to cause deterioration. The same is the verdict of my own feelings. Rheumatism, for instance, has yet to give me its first twinge.

The broadest conclusion to be drawn from our comfort, enjoyment, and long-range well-being on meat is that the human body is a sounder and more competent job than we usually give it credit for. Apparently you can be healthy on meat without vegetables, on vegetables without meat, or on a mixed diet.

Two stories summarize one of the most interesting sides of the case, the dental. In 1903 I heard the Dean of the dental school of the University of Pennsylvania say in a lecture that he thought dentists to that year had done more harm than good, but would thereafter be doing more good than harm. In 1928, when I told this to Dr. Percy Howe, Director of the Forsyth Dental Infirmary for Children, he said he thought the good Dean had been premature by at least twenty years. As I understand Dr. Howe, much good was done in particular cases by dentists long ago, but it is only within the past ten years or so that the average for good has overbalanced the harm by any very heavy proportion.

While meat eaters seem to average well in health, we must in our conclusion draw a caution from the most complete modern example of them, the Eskimos of Coronation Gulf. Mr. Diamond Jenness, now chief anthropologist for the Canadian Government at Ottawa, concluded from his experience in the Gulf, when he was anthropologist on my third expedition, that the two chief causes of death were accidents and old age. This puts in a different form my saying that these survivors of the stone age were the healthiest people I have ever lived among. I would say the community, from infancy to old age, may have had on the average the health of an equal number of men about twenty, say college students.

The danger is that you may reason from this good health to a great longevity. But meat eaters do not appear to live long. So far as we can tell, the Eskimos, before the white men upset their physiological as well as their economic balance, lived on the average at least ten years less than we. Now their lives average still shorter; but that is partly from communicated diseases.

It has been said in a previous article that I found the exclusive meat diet in New York to be stimulating—I felt energetic and optimistic both winter

and summer. Perhaps it may be considered that meat is, over all, a stimulating diet, in the sense that metabolic processes are speeded up. You are then living at a faster rate, which means you would grow up rapidly and get old soon. This is perhaps confirmed by that early maturing of Eskimo women which I have heretofore supposed to be mainly due to their almost complete protection from chill—they live in warm dwellings and dress warmly so that the body is seldom under stress to maintain by physiological processes a temperature balance. It may be that meat as a speeder-up of metabolism explains in part both that Eskimo women are sometimes grandmothers before the age of twenty-three, and that they usually seem as old at sixty as our women do at eighty.

So you could live on meat if you wanted to; but there is no driving reason why you should. Moreover, vegetables are fundamentally economical. You can get several times more food value from an acre of corn than from the pigs that ate the corn.

The thing to do then, probably, is to go on as you have been doing, but adding to your mental equipment, if it be a novelty, the idea that several at least of the disadvantages of a meat diet are compensated for by advantages.