

WHY DENTAL CARIES WITH MODERN CIVILIZATIONS?

XI. NEW LIGHT ON LOSS OF IMMUNITY TO SOME DEGENERATIVE PROCESSES INCLUDING DENTAL CARIES

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IN THE preceding four installments we have considered primarily immunity and loss of immunity to dental caries as represented in the Eskimos and Indians. This has been expressed as physical perfection of the teeth on the one hand, and their solution by carious processes on the other. The diets have been reported in terms of foods eaten. In this communication the foods will be considered in terms of their chemical and activator content. I have called attention to the splendid development of the dental arches and to the relatively normal position of all teeth including the third molars as well as to normal interrelationship between the two arches, as a constant condition found among the people with highest immunity to dental caries. It is important that it be clearly understood that the reverse of this expression is not true; namely, that normal development of the arches with relatively perfect teeth does not of necessity imply continued immunity to dental caries since even those with a high degree of anatomic perfection of development readily become victims of tooth decay by loss of their immunity when they abandon their native protective foods in favor of modern foods in sufficient quantity. I have called attention to the fact that there was practically no marked irregularity of the teeth found among the most primitive Eskimos and Indians. I shall now present data dealing with the effect of our modern foods on facial and dental development.

Persons were frequently encountered among the more primitive groups who had spent a few months or a year or two in some community on the "outside," as they call it, where they were in contact with modern foods for the time of their sojourn, which may have been from a few months to a few years. These were found to be without active tooth decay at the time of examination but with distinct evidence that at some time they had lost their immunity and caries had become active. On inquiry we would always find that these persons had left the environment and foods that had previously established

and maintained their high immunity, and that the serious injury that we found had occurred some time in the past. From the history, the condition could be clearly related to the period when they were away from the defensive native foods. Their arches would, of course, still be regular except as extractions or loss of crowns would permit movement of the teeth and the establishment of faulty interrelations. Their perfect faces and normal development indicated that they had had normal nutrition both prenatal and postnatal, and during the period of development of the face and jaws. When, however, we found ourselves in a community that had been in contact with foods of modern civilization since before the persons being examined were born we found routinely evidences of disturbance in physical development. It is of interest that this occurred in precisely the same expressions among the Indians as among the Eskimos. It therefore was not related to ancestry nor to the type of primitive foods that had been abandoned inasmuch as the foods were entirely different for these two races. The primitive Eskimos live almost entirely on the animal life of the sea and the primitive Indians of the interior, in the groups studied, on the animal life of the land.

In general these developmental defects may be classified as lack of development forward of either the middle third of the face or the lower third of the face or both or a lateral narrowing of one or both the upper or lower dental arches. These would result in an apparent protrusion or retrusion and in the jumbling of the teeth in the arches in which various teeth would be crowded out of their proper alinement. Associated with this lack of development in the middle third of the face there would practically always be a narrowing of the nostrils with a more or less marked interference with breathing, often resulting in typical mouth breathing and evidence of lack of normal chest development and normal lung expansion. A typical illustration is seen in Fig. 1 in which the lower anterior teeth will be seen to be well forward of the upper anterior teeth. In the

less severe expression of this type there would be a tendency to an end-to-end bite on the centrals with the laterals going inside the arch with a consequent contraction between the cuspids and lack of prominence of the upper lip and a depression and narrowness at the base of the nose with an absence of normal width of the middle third of the face owing to the lack of normal cuspid prominence. The cuspids may appear to be too prominent but only because of the depression of the bicuspids and incisors. A typical case is shown in Fig. 2.

Irregularities of the teeth and dental arches have been explained by many and varied theories; for example, the premature loss of deciduous teeth. A common explanation has been the intermingling of races in which the large teeth of one race have been inherited and the small jaws of another race with the result that there is insufficient room in the arch for the teeth. It is important to note that these conditions were found just as constantly and typically among the pure blood Eskimos and the pure blood Indians as among the mixed bloods of these races with whites. It is also of interest that the whites living in the same community and on the same type of modern diet had comparable conditions as shown in Fig. 3.

The problem of the impacted lower third molars is a common one in our modern civilizations but it was not found among the more primitive Indians or Eskimos living on their native foods but did occur with regularity when the individuals of these races were on modern foods during the period of their growth. This was often found to be associated with either lack of development in the middle or lower third of the face or both. A considerable percentage of the developmental disturbances had their expression in the lack of development in the lower third of the face with the chin receded. A typical case will be seen in Fig. 4 in which the lower anterior teeth are so far posterior to the uppers as probably to be in contact with the soft tissues. The deformity that was most frequently



Top—left to right—Fig. 1—This is a typical illustration of the incomplete development of the middle third of the face with constriction of the nostrils and nares. The chin appears to be too prominently, it is, however, relatively normal.

Fig. 2—Incomplete development of the premaxillary and maxillary bones produces a typical tendency to an end-to-end bite as seen in the case of the upper centrals with the lower incisors. The laterals erupt inside the arch. There is a narrowing between the bicuspsids.

Fig. 3—This white boy is a son of a mining engineer. He was born in Alaska and reared largely on imported foods of white men. He is a typical mouth breather. Note the lack of development of the nose and middle third of the face.

Bottom—left—Fig. 4—In some cases the nutritional deficiency disturbs chiefly the development forward of the mandible as shown in this figure giving the effect of protruding upper incisors.

Fig. 5—Tuberculous glands are often the first expression. With proper care and adequate nutrition many of these patients could be saved. This boy is typical of hundreds.

Fig. 6—Skeletal involvements are common manifestations of nutritional deficiencies with development of arthritic processes. This boy will probably soon be bedridden.

seen, however, involved the lack of development of both the lower and middle thirds of the face often resulting in marked irregularity of the teeth in both arches.

As serious as these developmental factors are because of their production of deformity and the interference with normal breathing and mastication we have another important ob-

servation that I believe is an entirely new contribution to our knowledge and one that has grown out of these special investigations. In my discussion of the conditions in the Outer Hebrides and the Isle of Bardsey in the August, 1933, number of *THE DENTAL DIGEST*, I presented data illustrating the marked difference in facial development of two typical

groups. I used a picture of a group of children from the Isle of Harris whose diet had been limited almost entirely to the native foods, chiefly sea foods and oat products, and whose facial development was fine and regular. All were normal nose breathers. In contrast with this I showed a family of four children whom I photographed on the Isle of

Bardsey, all living on modern foods. All were mouth breathers and all had marked lack of development of the middle third of the face as well as having active dental caries. I also reported that on that island the death rate for tuberculosis had been so great that it became necessary a few years ago to repopulate the island by moving a number of families there for residence. I also reported that the incidence of dental caries among that group was high; namely, 27.6 out of every one hundred teeth examined had been attacked by tooth decay, while in the control group on the Isle of Harris living on native foods the incidence of caries was negligible; namely, only one tooth in each one hundred teeth examined.

In the seventh installment (February, 1934, the DENTAL DIGEST) of this series, in discussing the modernized Indians of the Six Nations Reservation in Ontario I used as an illustration a girl of 12 in bed in the government hospital whose teeth showed marked irregularity and active tooth decay. This girl was suffering from pulmonary tuberculosis. In installment 4 concerning the Outer Hebrides, I reported the rapidly increasing incidence of tuberculosis among the younger generations necessitating a special wing for women under 30 years of age which had recently been added to the tuberculosis sanatorium at Stornoway. In my investigations among the Indians of the Pacific coast I referred to a large number of homes in which one of the children was either sick with tuberculosis or in which a death had occurred from tuberculosis. This condition has also occurred among the modernized Eskimos. It is common knowledge that tuberculosis is one of the important causes of premature death among the modernized Indians and Eskimos. Among the theories that have been presented and perhaps the one most frequently accepted is that the ancestors of these people had not been exposed to tuberculosis and consequently they had not built up an immunity to be transmitted as an inherited defense against this disease to which their children have been exposed as part of their contact with modern civilization; hence this new generation has had an exposure factor that is different from that of their ancestors, which is all that was needed since their defense was by inheritance low. This argument becomes particularly forceful in view of the report from pathologists that practically all the lungs of adults that have not died from pulmonary tuberculosis show calcified tubercles as an evidence of an early active infection and an efficient healing process. As I have in-

vestigated young people who are developing active tuberculosis in various countries where immunity to dental caries has been lost with the present generation, I made a critical study to note the relationship between any physical defects from nutritional deficiencies and their loss of immunity to tuberculosis. I have been impressed with the frequency with which this break has been found to be related to a lack of normal development of either the middle or lower third of the face or both, involving one or both dental arches with irregularity of the teeth.

In the government hospital at Juneau there were twenty Eskimos and Indian boys and girls reported to be under 21 years of age who were bedridden with pulmonary tuberculosis. Every one of these boys and girls had marked evidence of nutritional disturbance in early childhood which in the light of accumulating data involves both prenatal and postnatal nutrition with the chief deficiency usually occurring in the first five years of life. It is particularly important to note that the first or deciduous teeth may be in normal relation and the permanent teeth erupt badly out of alignment. Unfortunately, the light in the hospitals was not adequate for making excellent snapshot exposures of the bedridden patients.

The condition of narrowing of the upper arches due to a lack of normal development of the premaxillary and maxillary bones results in the narrowing of the air passages which greatly restricts free ventilation.

Does our boasting civilization which is so ignorantly but so thoroughly accomplishing the extermination of the American primitives know how to produce as good bodies and maintain as good health and as high a resistance to disease as do the primitive Indians of the isolated interior? Unfortunately, the cost of modernization to the primitives is not limited to the pulmonary form of tuberculosis. In the communities in contact with modern civilization the children were often found with suppurating tuberculous glands of the neck which for them was the beginning of almost certain progressive decline and ultimate death as the disease extended throughout the system. Large numbers of these children had incomplete development of the dental arches, with dental caries and irregularity of the teeth. A typical case is seen in Fig. 5.

I found an Indian in one of the older modernized coast towns who said he had not fed himself for forty years. He, as others who were described in previous installments was

bedridden because of arthritis. No animals taken from the wilds and placed in cages could suffer more intensely from enforced confinement than these boys and girls of the echoing mountains and multicolored valleys with their great stretches of timber and beckoning streams. One can never forget the pathetic appeal for help of these boys and girls who are progressively becoming crippled and who seem to sense their doom like the young arthritic patient shown in Fig. 6.

Some may be tempted to say that since the native foods were amply rich in material for making healthy bodies and repairing them people who could not get anything else deserved little credit for special knowledge. Over against this we have the important factor to keep in mind that they had no food that we do not have, relatively speaking, and that we have many good foods that they do not have; yet they accomplished what we have failed to achieve.

The people of the high isolated Alpine valleys whom I studied in 1931 and 1932 lived largely on entire rye and dairy products yet with these they built their superb physiques with almost complete freedom from dental caries. In the Outer Hebrides the more primitive groups could not get either of these foods and indeed could get little else than oats for oatcake and oatmeal porridge and fish and other animal life of the sea. The more primitive Eskimos that we studied in 1933 could not get either oats or rye nor any other cereal or dairy products. They had little food except animals of the sea. In the interior, inside the Rocky Mountain Divide little marine food was available and the splendid physiques of the Indians were built on foods consisting almost entirely of wild game. None of these four groups had any appreciable quantity of vegetables or fruits. The last two groups had practically none at all, except that the Eskimos and Indians occasionally had a small quantity of cranberries and some bark and roots which would be a small part of the menu.

Since each of these limited menus has been competent to build splendid physiques and establish and maintain a high immunity to dental caries we are deeply concerned to know the chemical content of each. An important part of these field investigations has accordingly been the collecting of samples of the various foods eaten, and the shipping of them to my laboratory for chemical analysis.

We are now concerned to study critically the nutrition of the Indians of the interior with their excellent physiques and freedom from disease

TABLE 1.—*The Distribution of Activators and Minerals in a Typical Menu of Primitive Indians.*

Calories	Food	Fat	Calcium	Phos- phorus	Iron	Magnesi- um	Copper	Iodine
		Soluble Activators						
2500	Flesh of Wild Game	++	0.58	4.16	0.13	0.35	0.0033	0.000014
400	Glands and Organs	++++	0.10	1.49	0.025	0.066	0.0189	0.0000087
100	Vegetables, Barks & Roots	+	1.62	0.96	0.031	0.266	0.0032	0.0000013
3000		+++	2.30	6.61	0.186	0.682	0.0254	0.0000240

TABLE 2.—*The Distribution of Activators and Minerals in a Typical Menu of Primitive Eskimos.*

Calories	Food	Fat	Calcium	Phos- phorus	Iron	Magnesi- um	Copper	Iodine
		Soluble Activators						
1700	Salmon	+++	1.24	2.68	0.048	0.710	0.022	0.000072
200	Seal Oil	++++						0.000015
100	Plants, Roots	+	0.49	1.40	0.035	0.26	0.002	0.000016
500	Sea Animals	++	0.36	1.02	0.014	0.21	0.0065	0.000021
500	Caribou	++	0.05	0.60	0.003	0.093	0.0007	0.000007
3000		+++	2.14	5.70	0.100*	1.273	0.0312	0.000131

TABLE 3.—*Mineral Distribution in a Typical Menu of Modernized Indians and Eskimos.*

Calories	Food	Fat	Calcium	Phos- phorus	Iron	Magnesi- um	Copper	Iodine
		Soluble Activators						
1200	Bannock Bread	—	0.13	0.42	0.003	0.09	0.0144	0.00000006
1200	Sugar, Jam, Syrup	—	0.15	0.24	0.06		0.0009	0.0000006
1100	Chocolate, Coffee	—	0.02	0.07	0.0004			
300	Meat	++	0.03	0.33	0.0027	0.032	0.0004	0.0000016
100	Vegetables	+	0.06	0.08	0.001	0.022	0.0010	0.0000005
100	Vegetable Fats	—						
3000		+	0.39	1.14	0.0671	0.144	0.0167	0.00000276
% Reduction: Indians	90+		83	83	64	76	34	88
% Reduction: Eskimos	90+		82	80	30	87	47	98

and high immunity to dental caries for comparison with those of the same tribe or bands who have been in contact with modern civilization and who are breaking physically. The food of the former was found to consist almost entirely of wild game but this does not mean what we moderns would understand by a meat diet. In the ninth installment (April, 1934, the DENTAL DIGEST) in discussing this group I referred to their conception of what was necessary to life as requiring each person to eat some of each part of the animal. This did not, of course, include indigestible structures, such as hide, hair, hoofs, horns, or bones, but did require that the marrow be taken from bones and that even the walls of the intestine or stomach after having been thoroughly cleaned should be utilized for foods as well as the tissues of every organ and gland of the body of the animal. I was told by different Indians that even when plenty of moose were available the livers of small fur animals were utilized for food. It must be kept in mind that these people are living a vigorous outdoor life in a country where they are subjected to intense cold in the winter.

A white trapper with whom I talked told me that by following the methods of living of these Indians he was able to sleep out in the open,

night after night, for weeks with no other shelter than his furs and blankets and the evergreen trees with the weather far below zero. He did this without catching cold or suffering from cold. It follows that the very nature of their life requires that these primitives be hearty eaters in order that they may obtain adequate calories to supply heat and to provide the energy for their long tramps on their trap-lines. This physical activity on the part of all required a daily intake of foods which consisted of various parts of the animal prepared in different ways generally cooked either on spits before the open fire or in kettles as stews. The average amount eaten as I would judge from the sample servings, would be from 5 to 7 pounds per day per individual adult. These Indians were conscious that certain of their foods were much better than others. While they liked the flavor of the caribou several Indians informed me that they could travel farther and do more work on a moose diet than on caribou.

These living conditions of the Indians, as studied in the interior, which subjected them to severe exposures and vigorous activity would require as with the Eskimos a specially liberal supply of fuel for maintaining the warmth of the body. This for the adults would amount to from 3000 to

4000 calories per day. On the basis of the minimum of 3000 their daily intake would probably be about as follows: muscle tissue and fat, 2500 calories; glands and organs, 400 calories; and barks and roots, 100. The minerals of these would be distributed as shown in Table 1 and would total: calcium, 2.30 Gm.; phosphorus, 6.61 Gm.; iron, 0.186 Gm.; magnesium, 0.682 Gm.; copper, 0.0254 Gm.; iodine, 0.000024 Gm. The total weight of this food would be 4.8 pounds per day or 2176 Gm.

The activating substances essential for the utilization of the minerals are stored in various animal organs and tissues for periods of special need. The Indian knows where these special life-giving substances are to be found and he like the wild carnivorous animal is wise in food selection. He accordingly selects the liver, brain, kidneys, glands. Part of every day's food for the Indians includes eating some of these special tissues. The parents provide these for the children and teach them their special values.

Similarly the native foods of the more primitive Eskimos consisted, as I have reported, almost entirely of the tissues of animal life of the sea. But this is not quite what would be likely to be understood from this simple statement by our modern civilization which limits the use of animal tissues largely to muscles, whether fish, beef, or mutton. Like the Indians of the interior who live on the animal life of the land the Eskimos eat not only the muscle part of fish and other forms of aquatic life but the livers and hearts and in many cases the edible parts of the head; also the milt and roe when these are present as is the case when the fish are running toward their spawning grounds which is the time the principal harvesting is done. While it is true that some Eskimos occasionally get moose or more frequently caribou for a part of the year, these are not often available for the Eskimos living along the Bering Sea. The severity of their weather requires that they provide their bodies with large quantities of fuel for the production of heat. The adult Eskimos will accordingly probably average as calories intake from 2800 to 3500 and for the growing children from 2500 to 3000. This would be provided largely by the stored smoked dried red salmon. This salmon is dipped in seal oil as it is eaten. Both of these products are high in fat-soluble vitamins. The seal oil is one of the richest available sources, for the sample that I brought proved to be several times as high as ordinary cod liver oil. I have allowed 200 calories to be supplied by this product which would be about 1 ounce. Small quantities of

parts of several plants are used when available. One of these is a bulbous root which grows on the tundra and which is gathered and cached by the wild mice. The Eskimos appropriate this food. They also use at certain times of the year stems or roots of certain plants, particularly the growing parts. For these vegetable products I have allowed 100 calories per day. The flesh of walrus, seal, caribou, moose, sea cow, and occasionally whale should be a regular part of the menu according to the season. The proportion of the first and last items; namely, the red salmon and the seal, walrus, moose, caribou, and sea cows, would vary with the seasons. Probably a fair average of calories for the salmon used daily would be 1700, and for the seal, walrus, moose, and caribou meat 1000 calories. This total of 3000 calories per day would provide 2.14 Gm. of calcium, 5.7 Gm. of phosphorus, 0.1 Gm. of iron, 1.27 Gm. of magnesium, 0.0312 Gm. of copper, and 0.000131 Gm. of iodine. The total weight of the food would be 5.07 pounds or 2295 Gm. A detailed distribution of these minerals is shown in Table 2. These quantities would establish a high factor of safety. Since, however, the salmon, seal oil, and fats of sea animals are rich in fat-soluble activators this menu would have a remarkably high factor of safety, because with such liberal quantities of the fat-soluble activators a larger proportion of the total minerals present would become available for use by the body.

The foods of commerce that displaced the native foods of the primitive Indians and Eskimos consisted of those foods that can be transported in concentrated form and that have keeping qualities; also, low first cost and palatability. The fact that these foods have to be transported long distances and over difficult routes greatly increases their value by the time they reach the consumer and since they are exchanged in large part for furs the prices at the outside market value have little to do with the prices on the inside.

I inquired routinely where modern foods were available what exchanges were usually made. I found that the principal articles of food are white flour, sugar, jams, syrups, canned fruits, canned vegetables, polished rice, tea, salt, chocolate, and vegetable fats. By far the largest quantities of imported foods that were used by Indians and the Eskimos were white flour and sugar. I was surprised to find the relative proportions of the various foods used. At nearly all Posts and Exchange Stores the Indians and Eskimos were taking in trade as much sugar as white flour.

In a few places half again as much sugar as white flour, and in one Post the manager told me that the Indians of that vicinity were taking 250 pounds of sugar with 100 pounds of white flour in exchange for their furs. When I inquired how they could use this quantity of sugar he informed me that they sweetened their tea until it was like syrup and that they found they did not get hungry when they drank a great deal of this sweetened tea. In some districts they used in addition considerable quantities of polished rice. In both the Indian and Eskimo communities the white flour was used largely for making "bannock" which is a baking powder bread, stirred up and put on the fire in a skillet and is prepared and cooked in a few minutes. When it is haked part way through from one side it is thrown into the air, caught in the pan the other side down, and the baking continued. They do not have any native milk, and, except for the salt that is added, it is a flour and water product. The bread is snow white and was to be seen in many of the homes where the Indians and Eskimos were using largely modern foods. In some communities they eat this bannock with corn syrup. Owing to the weight of the canned vegetables they are expensive and accordingly not liberally used. The proportion of native foods that are still eaten is influenced by the distance from the hunting grounds and the nearness to the Post. There was much evidence that what formerly was cheerfully accepted as routine work readily became disagreeable when they found they could get their hunger satisfied without the exertion of stalking the game and carrying it to camp. This is not always pure laziness but is influenced by the desire to be like the white men they have seen who do not need to work at such physically tiring duties as carrying heavy loads of game or, among the Eskimos, making a sea journey in all kinds of weather in search of animal life of the sea. Naturally the people tend to congregate in the vicinity of the Post or Exchanges. This of necessity increases the ratio of human beings to the wild game of that vicinity and this progressively increases the distance that must be traveled to get to the game country.

For both the Eskimos and Indians who have displaced a considerable portion of their native foods with the foods of modern civilization since they are living under the same exposure of cold, we will estimate their mineral intake on the same basis of calories notwithstanding the fact that with the decreased exertion necessary for stalking and carrying their

wild game or their sea foods they would actually have less demand for energy as supplied from the foods. The principal displacing food that they obtain from modern civilization is white flour and next to this in energy production is the sugar, syrup, and jams. In some instances, however, the energy produced by the foods containing sugar would be higher than that from the white flour products. They would still continue to use some meat although in greatly reduced quantity. In some instances they purchase vegetable fats of commerce. On a basis of 3000 calories this modernized Eskimo or Indian diet would supply the quantities of minerals shown in Table 3; namely, 0.39 Gm. of calcium; 1.14 Gm. of phosphorus; 0.067 Gm. of iron; 0.14 Gm. of magnesium; 0.0167 Gm. of copper; and 0.0000276 Gm. of iodine. The total weight of the food would be 2.72 pounds or 1225.5 Gm. This modernized diet is exceedingly low in fat-soluble vitamins, their being practically none in white flour, sugar, syrup, jams, chocolates, coffee, and vegetables. Since their muscle meat, glands, and other organs of animals of the land for the Indians, and of the sea for the Eskimos, would be reduced approximately to one-tenth, this would decrease the total fat-soluble activators per day to a quantity below the minimum bodily requirements of even an adult. This will make it impossible for them to utilize properly even the small amount of minerals that are present in the foods ingested besides being insufficient to maintain the functioning of various organs and tissues of the body. It is at this point that their greatest injury occurs. Even if they could utilize all the minerals that are available the intake for those on the modern foods is reduced as shown in Table 3 to less than one fifth of that in the original diets for several of the minerals. This means tragedy especially for growing child life and motherhood because of their greater demands.

Since these modernized Eskimos and Indians do not have a large variety of foods such as are available for people of most modernized communities the urgency that their problems shall be met is even greater than the needs of the white races. These two races have been developed through thousands of years of adaptation to their environment and its limited available native foods. The rigorous climate makes necessary a more efficient and highly reinforced nutrition than that of the more temperate climates. It will probably be a physical impossibility to maintain

healthy Eskimos and Indians in those northern climates or in any climate on foods that are so poor in minerals and vitamins as those being made available to them.

It will, accordingly, be imperative if these races are to be conserved that the transportation of foods that are low in minerals and vitamins shall not be made available to them. This could readily be accomplished by requiring that entire wheat, preferably unground, shall take the place of white flour. The wheat can be cooked whole and made into various food products without difficulty. This, however, is not essential since the wheat can readily be ground into coarse or fine flour as required at the Hudson Bay Posts or Exchanges. It will not be satisfactory to have the wheat shipped in as entire wheat flour since the embryo or germ of the wheat will rapidly become oxidized or rancid and this food product will have lost much of its intrinsic virtue. Whole wheat flour will also become wormy. Similarly, sugar which contains practically no minerals, also jams, marmalades, and syrups should be either prohibited from reaching these people or at least sold only in very small quantities. Canned meats and canned fish will provide minerals though they are much lower in the natural activators than the fresh or dried and smoked products.

It will be a matter of importance that sources for supplying a liberal quantity of the native foods from the sea for those near the coast and from the land for those in the interior, far

away from easy access to the source of marine foods, shall be maintained. Since it is impossible in the northern climates for vegetables to be produced in large quantities for use in a fresh state the year round, those people cannot readily be adapted to a diet that would be competent to protect and maintain the people of any race in the temperate zones. It will doubtless be essential to provide reinforcement as fat-soluble activators or vitamins for these people in proportion as they depart from their native food sources for these essential products. This cannot readily be done with dairy products since cattle cannot be maintained in so rigorous a climate. Imported fish oils should accordingly be available as an important reinforcement for groups both near the coast and in the interior. A logical procedure for the coast Indians and Eskimos would be to provide unrestricted fishing facilities on certain and sufficient of the rivers where their right to life would be recognized as taking precedence.

The more direct application of these important new truths to the needs of our modern civilizations not only for the control of tooth decay but for establishing a similar defense to other degenerative processes involves the modification of the modern diets to make them equivalent in their supply of minerals and activators and other chemicals to those foods that have built and are maintaining the splendid Eskimo and Indian races. The principles are the same as those demonstrated to obtain in the studies

made in countries of Europe and reported in the DENTAL DIGEST from March to August inclusive, 1933. In the August number of that series detailed practical application was made to the modern diets with clinical data illustrating the ease with which these principles could be successfully applied to the needs of modern civilizations. Readers are referred to that review since space does not permit an extended application here.

New light has been thrown on the origin of facial deformities and dental irregularities as well as on defects of physical development in other parts of the body; also on some factors involved in the lowering of immunity to infections, such as tuberculosis and arthritis. These emphasize the urgent need for governmental supervision, if necessary, of the nutrition in child life and motherhood in all lands.

The report on the chemical analyses of the samples of saliva obtained from the Eskimos and Indians in various stages of modernization cannot be included here for lack of space.

A critical discussion and detailed application of these various factors are being provided in a textbook under the title THE ETIOLOGY AND CONTROL OF DENTAL CARIES AND ASSOCIATED DEGENERATIONS. This publication has been delayed by the industrial depression.

These field studies among primitive peoples are being extended to the Polynesians and Melanesians of the South Sea Islands.