

# BLOOD GROUPS OF THE ANAKTUVUK ESKIMOS, ALASKA

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At the invitation of Dr. Kaare Rodahl, Director of Research, Arctic Aeromedical Laboratory, Ladd Air Force Base, Fairbanks, Alaska, a blood group study of the Eskimos living at Anaktuvuk Pass was undertaken. Between December 17 and 24, 1955 a total of 43 members of this small village were typed for presence of the antigens of the A, A<sub>i</sub>, B, O system, the MN system and for three antigens of the Rhesus system: Rh<sub>0</sub> (D), Rh' (C), and Rh'' (E). A description of the sample, in terms of genealogical relationships and birth places, was collected. Subsequent to the typing of the bloods in the village the gene frequency ratios were computed, analyses of the inheritance inside families was made and, lastly, the frequencies were compared with those of other Eskimo groups. Mr. W. O. Tilman and Airman R. Spencer provided indispensable assistance.

## OBJECTIVES OF THIS STUDY

The primary objectives of this study were:

1—Performance of agglutination tests on all available Anaktuvuk Eskimos and computation of the gene frequency ratios from the numbers of persons reacting with the various sera.

2—Description of the sample by means of genealogies and birth-place.

3—Examination of those questions for which this blood group information is pertinent. Such questions are:

- (a) Are these people Eskimo or Indian?
- (b) Is there evidence of Indian or European admixture?
- (c) Have these people drawn their genes from coastal Eskimos or preceding groups of inland Eskimos?
- (d) In what ways do their genetic composition affect the validity of biological comparisons with other groups?

Since the inheritance of the blood group genes is precisely known, the estimates of intra-group and inter-group variability based upon their distribution with in-groups and between-groups provide the most accurate base for the kinds of questions listed above.

## LOCATION AND DESCRIPTION OF THE ANAKTUVUK BREEDING ISOLATE

The Anaktuvuk Eskimos live in a village at the south end of Anaktuvuk Pass (151° 40' west longitude; 68° 10' north latitude, approximately 2250' altitude), some 87 miles north of Bettles, and 252 miles southeast of Point Barrow. Anaktuvuk Pass lies in the Brooks Range mountains of northern Alaska and constitutes one of

the important passes through which the caribou migrate from the interior to the north slope draining into the Beaufort Sea. Anaktuvuk is a cartographic corruption of the Eskimo term "anaqtuavik," which means literally: anaq/feces, tua/having many, vik places of. Though this village was founded as recently as 1951, it now has nine permanent houses and a post office, and can, therefore, be considered a stable Arctic Eskimo village. The members of this village constitute a breeding isolate in that they are biologically self-sustaining and exchange genes more frequently among themselves than with other Eskimos. To what extent this condition has obtained in the past is an important historical question. Since we are concerned with the human biology of this group of people, we shall refer to it as an isolate, indicating that it is a segment of a larger breeding population.

Outlying camps are still used for summer hunting in the traditional fashion of all Eskimo and Aleut villages. Two families were spending the entire winter at a camp, Tuluak (raven), some sixteen miles to the north of Anaktuvuk. Whether or not the people at Tuluak habitually live at that place, as long as their mates are drawn from Anaktuvuk they will be, genetically, a division of the Anaktuvuk isolate. For biological considerations it will be necessary in all future studies to assess the membership of the Tuluak camp and all similar camps. If it should be found that the membership does not rotate but depends upon continuation of existing family lines now living there, then it must be considered a sub-isolate.

Along with other Eskimos who lived in various parts of the interior of Alaska, including the Alaska Peninsula, the term Nunatagmiut (people from the interior) has applied to the Anaktuvuk people by coastal Eskimos. This term is sometimes contracted to Nunamiut, though in this form it ceases to have as much meaning. The point to be emphasized here is that the application of this term to the various interior Eskimos must not be taken to imply a genetic homogeneity among them, nor does it imply any long time genetic continuity for any one of these groups. There does not appear to be any over-all entity of "inland Eskimos"; wherever a group of Eskimos lived interior to their coastal relatives they were referred to by the coastal group as people from the interior. In each case they had their own name for themselves and spoke the same dialect or a close variant of the adjacent coastal group. Thus, it is important for comparative studies that the exact affiliation of each group be determined and that they not be pooled into one series. Different groups may be pooled if they were actively exchanging genes, as in the case of the diverse groups represented in this new isolate.

The Anaktuvuk isolate is composed of at least two interior bands, plus a number of individuals from both the interior and the coast. The number of bands fluctuated as they merged with each other or moved to the coast. Consequently, the number referred to by different observers depends on the time with which they were concerned. The component Anaktuvuk bands have variously been referred to as the Tulugarmiut and the Ki'lirmiut, or the Killik of Anaktuvuk Pass

(Bergsland, 1956; Solecki, 1950). According to one Anaktuvuk Eskimo the present village was formed of two groups. One consisting of four men, and their families, who moved from Chandler to Tuluak to Anaktuvuk. The two families wintering at Tuluak in 1955 were members of this group. The other group consisted of six men and their families who moved in from Killik. However, this informant was referring only to the groups at the most recent points of departure leading to their present location. These were not genetic or linguistic units of long standing.

The census of the summer of 1955 lists seventy-eight living persons (45 males, 33 females) and twenty-four different birthplaces. Geographically these places range from Barter Island and the headwaters of the Firth River to the drainage area of Kotzebue Sound, including such places as Demarcation Point, Cross Island, Chandler Lake, Tuluak Lake, Anaktuvuk Pass, Killik River, Colville River, Kobuk River, Noatak River and Barrow. In order to size the largest numbers came from the Colville River, 14; Anaktuvuk, 13; Killik River, 11; Chandler Lake, 5; and Barrow, 5.

In view of the fact that many of these people had been living on the coast following the depopulation of the north slope around the turn of the century, it is important to see where the older people came from. If we note only the husband and wife of each of the fifteen families listed in the census, the resulting sample of older persons, including two deceased wives who bore children, is drawn from fifteen places but none from Tuluak Lake or Anaktuvuk. Seven come from the Colville River, four from Barrow, three each from the Killik River, Sheenjih River, Demarcation Point, and the remaining ten were each born in a separate place.

It is possible to refine this even further. Only seven lineages are present, utilizing the males. It is not possible to determine precisely to what extent these seven may be related to each other. We may assume that they are sufficiently unrelated to avoid duplication in counting their genes. Their dates of birth and birthplaces are: 1—1882, Noatak River; 2—1885, Wild River; 3—1904, Barrow; 4—1880?, Killik River; 5—1900, Killik River; 6—1893, Turning River; 7—1900, Killik River. Fortunately we have the blood types of five of these founding fathers and, therefore, know that all the major types are represented: three A, one B and one O.

With reference to their wives, the man from the Noatak River married a woman born on the Colville in 1896. The man from Turning River married a woman born at Chandler Lake in approximately 1898. The man from Barrow first married a woman from Killik, and after her death married a woman born in 1919 near Barrow, a daughter of the man from Wild River. One of the men from Killik married a woman born on the Turner River and another man from Killik married a woman born in 1919 at Demarcation Point.

We may epitomize the foregoing data by noting that the membership of this isolate is diverse in origin, that none of the original or older members came from either Tuluak Lake or Anaktuvuk and that there

is a relatively large component of persons who were born somewhere in the interior of Alaska, but whose parentage cannot be assumed to be exclusively interior. In addition to the component from the interior there is a large proportion born in coastal villages and from places in regular and direct contact with coastal villages.

#### DESCRIPTION OF THE SAMPLE BLOOD TYPED

The 43 persons tested consist of 26 males and 17 females. The males range in age from less than one year to over 74, with a mean age of 25. The females range in age from 2 to 45 with a mean age of 22. It is not without interest that the oldest woman is 45, whereas the four persons above this age are all men.

Four generations are represented with 4 men in the oldest generation, 10 males and 10 females in the second, 11 males and 6 females in the third, and 1 male and 1 female in the fourth generation. The actual degree of relatedness is increased by the marriage of one man, listed with the first generation on the basis of age only, to two daughters of two men of the first generation. Genetically, his children and grandchildren are grandchildren and great-grandchildren of the first generation on their mother's side. His second wife had also had a previous marriage. Consequently we are able to deduce the genotypes of two additional persons who are now deceased or living on the coast. The family line to which this second wife belongs is of especial importance because it has contributed all the B genes to this isolate. There is one other person, in addition to the older man from Barrow, who has come from the outside and married into the second generation living here. This is a female of type A whose parents lived at Beechey Point on the north coast, some 174 miles from Anaktuvuk.

The twenty brothers and sisters of the second generation are the offspring of four men of the oldest generation. The seventeen brothers and sisters of the third generation are the offspring of nine matings of members of the second generation. All the persons in the sample are comprehended under five family names.

#### TECHNIQUE OF TESTS

Specimens of blood, consisting of a few drops, were taken from the ear into a Wasserman tube containing 2 cc. of physiological saline. Tests using anti-A and anti-B were performed in well slides using this 3-5% suspension. These specimens reacting with anti-A were then tested with anti-A<sub>1</sub>.

For the MN and Rh tests the cells were washed. Tests with anti-M and anti-N sera were performed in well slides, those with anti-Rh<sub>0</sub> (D), anti-Rh' (C), and anti-Rh'' (E) were carried out in blood group tubes with one hour incubation at 37.5° C. Tests with anti-Hr' (e) were performed only on well slides.

All negative and weak reactions were examined under the low power of a microscope. As an added check thirty of the Rh' (C) and Rh'' (E) tests were repeated. As a check on the A<sub>1</sub> reactions a

specially prepared serum provided by Dr. Margery P. Gray, Memorial Affairs Division, USAAF, was used on fifteen blood specimens. All other sera were supplied by Dr. A. S. Wiener.

#### The A B O Groups

The first point of major interest is the low percentage of group O persons, and the low frequency of the gene *r* for this blood type. The second point of interest is the high frequency of groups B and A<sub>1</sub>B. It appears that the frequency of B has increased at the expense of the frequency of O, whereas the frequency of A<sub>1</sub> has remained within the range of frequencies commonly found in most larger Eskimo populations previously typed.

	Phenotypes				Genes %		
	O	A <sub>1</sub>	B	A <sub>1</sub> B	<i>r</i>	<i>p</i>	<i>q</i>
Observed number	6	23	11	3	42.74	38.55	18.56
Expected number	7.86	20.56	8.30	6.15			
Observed percent	13.95	53.41	25.58	6.98			
Expected percent	18.25	47.81	19.31	14.31			

All persons of group A proved to be division A<sub>1</sub>. Eskimos, American Indians and Asiatic Mongoloids appear to lack the allele for A<sub>2</sub> in contrast to European and African Negro populations where A<sub>2</sub> may constitute 25% or more of the total A alleles. Presence of A<sub>2</sub> in the Anaktuvuk sample would have been presumptive evidence of European or Negro admixture.

Owing to the fact that B is absent in North American Indians there is no question about the correctness of classifying these people as Eskimos.

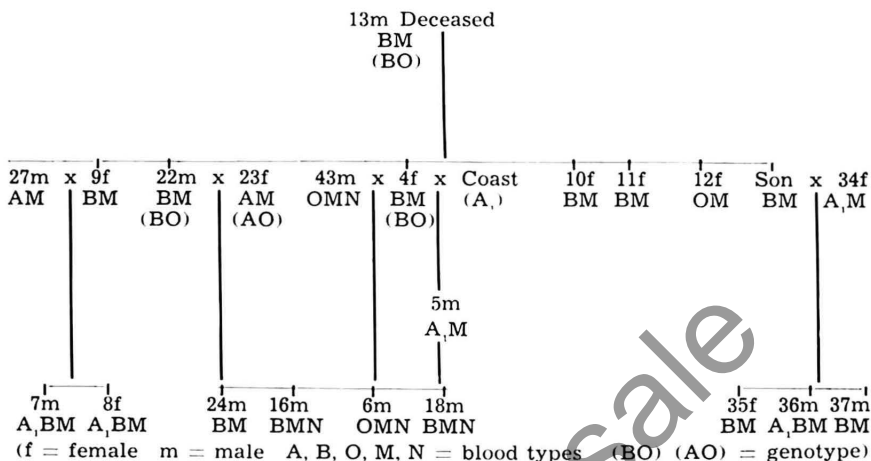
The sample is small, as is the isolate which it represents. In addition there is a high degree of relatedness within the sample. As a consequence the gene frequencies are more subject to accidents of family size than in a larger population. Only six persons in this sample have no genetic relationship to each other. Taking one person from the family which is unrelated to the other four families, the four men of the first generation and the female from the coast who is unrelated, we have four of type A<sub>1</sub>, one of B and one of O. The resulting proportions would be similar for O, higher for A<sub>1</sub> and lower for B.

These frequencies were calculated using the Bernstein's equation, with corrected values as recommended by Mourant, 1954, pp. 215-219.

#### Inheritance of ABO Groups in Family Lines

Of the five family lines represented, two had seven children, one had four children, one had three children in the second generation. The fifth family line resulting from the marriage of one man with one daughter from each of the two largest families, has three children from one marriage and two from the other. The effect of these disproportionate size families in such a sample is of considerable interest. It has raised the relative proportion of type B by a large amount. Accordingly all of the B genes (*q*) in this sample belonging to 11 type B and 3 A<sub>1</sub>B persons may be traced to one first generation mating.

# GENEALOGICAL TABLE



A number of deductions are possible from this family line. It is obvious that number 13 was heterozygous for B, and equally obvious that his wife must have had at least one gene for O. It is equally apparent that at least some of the children are heterozygous. For example, the A<sub>1</sub>M child resulting from the mating of 4f with a man from the coast indicates the heterozygous condition of the mother and permits us to deduce the A<sub>1</sub> type of the father. This family line is of further importance owing to the fact that the founder, number 13, and his deceased wife, are of interior parentage.

## Comparison of Anaktuvuk with North Alaskan and Canadian Isolates

A most valuable series of Mackenzie River Eskimo has been typed by R. R. Gates. Although it is too small to be of use for relative frequencies, it clearly establishes the presence of blood type B in that area to the east of Anaktuvuk (Gates, 1929). At the same time this series also gives valuable information on the location or movements of the Eskimos from the interior of Alaska. Sixteen persons were typed at the school at Hay River and at Aklavik on the delta of the Mackenzie. Listed by birthplace they are:

	O	A	B	AB
Alaska			1	
Herschel Island			2	
Mackenzie Delta	2	2	1	
Nunatomiok family	1	1	2	
Kittigazuit				1
Baillie Island	1	1	1	
	4	4	7	1

The possibility that the "Nunatomiok family" or the one person

from Alaska are represented in the Anaktuvuk sample, at least by means of relatives, is a real one.

Aside from this small series there are series of Eskimos from Point Barrow and Nome which are especially pertinent in view of the likely fact that the interior Eskimos have been drawing genes from both of these groups. In addition, Indians in Alaska and on the Mackenzie have been typed and provide good evidence that blood type B was not present in North American Indians.

ESKIMOS	No.	Phenotype Percentages			
		O	A	B	AB
Anaktuvuk. W. S. Laughlin	43	13.95	53.41	25.58	6.98
Point Barrow (pure). Levine (1950)	329	40.73	47.11	9.73	2.43
Nome (pure). Levine (1950)	254	43.31	42.52	11.81	2.36
Bethel. Matson and Roberts (1949)	341	36.95	44.87	11.73	6.45
INDIANS					
Lower Mackenzie. Gates (1929)	71	84.5	15.5	0.0	0.0
Tlingit. R. B. Williams (1953)		75.8	24.2	0.0	0.0
Alaskan. Pauls, Victors, Dodson (1953)	333	60.96	36.34	2.40	0.30
British Columbia. Chown and Lewis (1952)	394	80.96	18.27	0.76	0.00
British Columbia. Gates (1934)	300	86.70	12.70	0.60	0.00

On the basis of present evidence the distinction between Eskimos and Indians appears well marked. Indians do not regularly possess group B. It should be noted that to the east of the Mackenzie River the Central Eskimos, including the Polar Eskimo of far northern Greenland, have little or no group B. Group B is found again in varying frequency on the west coast of Greenland and on the south east coast (Laughlin, 1950; Mourant, 1954). The distribution of the major blood groups of the Eskimo can be summarized by noting that in the areas of continuous distribution group B is present in all the samples tested. The areas of continuous distribution are the Alaskan coast, including the Aleutian Islands, to and probably including the Mackenzie Eskimo, and the coast of western and southeastern Greenland. The area of discontinuous distribution is the intervening area including Labrador and the Cape York district of Greenland. Here the population density is very low, and contacts between groups are much more intermittent. It is likely that blood group B has been lost many times from various isolates and replaced when contact and mixture were again reestablished. It is clear that the Anaktuvuk Eskimo belong to the western area of continuous distribution. They may have had a degree of isolation comparable to that of the Mackenzie Eskimos, apparently not enough to lose group B.

#### The MN Blood Types

The significant point to be noted concerning the MN types of this isolate is the low frequency of the gene for type N. This value (.140) is the low for Alaskan Eskimos. Only the frequency of N in the Western Aleuts (0.049) and in the Angmagssalik Eskimos (0.075-0.087) of east Greenland is lower (Skeller, 1954). This constitutes rather good evidence that there is no European admixture in the Anaktuvuk Eskimos, or that the degree of mixture is so small as to be undetectable.



A consequence of this low frequency is the absence of any persons of phenotype N. All the genes for N are carried by heterozygotes, MN. This absence of individuals of phenotype N has also occurred in the western isolate of the Aleutian Islands. There, a similar sized isolate, numbering 41, has all the genes for N carried in the heterozygous form. A chi square test reveals that there is a very good fit between the observed numbers and the expected numbers.

	Phenotypes						Genes	
	M	%	MN	%	N	%	Total	m n
Observed	31	(72.09)	12	(27.91)	0.00		43	.860 .140
Expected	31.80	(73.96)	10.35	(24.08)	0.84	(1.96)	42.99	

A chi square value of 1.1321 ( $p = .20 - .30$ ) confirms the observation that the proportions of these genes are within a state of equilibrium. Similarly, the west Aleuts of Attu and Atka display a very good fit when tested with chi square. The western Aleuts are the least mixed of the Aleutian Aleuts. The eastern isolate of Aleuts, Nikolski and Unalaska, show a considerably higher degree of mixture with an N frequency of 0.213.

When compared with the Point Barrow Eskimos, using those designated as "pure" by Victor Levine (Laughlin, 1950) it is interesting to note that there is no significant difference (chi square of 2.48) even though the Point Barrow Eskimos showed a much higher frequency of N. In making such comparisons it must be kept in mind that there were isolate differences before the arrival of Europeans and all the larger N frequencies can not be entirely attributed to admixture. It is apparent that the aboriginal values could range at least from 0.049 to possibly 0.174, the frequency found south of Nanortalik, Greenland where the Eskimos were estimated to be almost entirely pure.

#### The Rh Blood Types

All persons reacted with anti-D ( $Rh_o$ ). The presence of Rh negative persons would have provided presumptive evidence of European admixture. In this respect they conform to all other Eskimos, Indians and Asiatic Mongoloids who are free of European admixture. It is apparent that they are high in CDe ( $Rh_i$ ), cDE ( $Rh_z$ ) and CDE ( $Rh_iRh_z$ ). At least one person of the latter group is probably CDE/CDE ( $Rh_zRh_z$ ). The anti-c ( $hr'$ ) serum could not be used under optimum conditions and as a consequence it is likely that weak reactions were undetected. The same may apply to a lesser extent for the anti-C ( $rh'$ ) reactions. All these bloods should be retested with at least two different sera of each kind in order to remove any ambiguity concerning those which frequently give extremely weak reactions.

For comparative purposes the Rh blood types of the full-blooded Eskimos at Bethel, on the Kuskokwim River, as identified by three anti-sera is given (Matson and Roberts, 1949). The Bethel blood types include several villages on the Kuskokwim River, Nunivak Island and the villages of Napakiak and Napaskiak.



	Rh-cde			Rh <sub>1</sub> -CDe		Rh <sub>2</sub> cDE		Rh <sub>1</sub> Rh <sub>2</sub> -CDE		Rh <sub>0</sub> -cDe	
	No.	%		No.	%	No.	%	No.	%	No.	%
Anaktuvuk	43	0	0.00	10	23.26	10	23.26	23	53.48	0	0.00
Bethel	315	0	0.00	110	34.92	62	19.68	140	44.45	3	0.95

#### Evidences of Interior People on the Coast

To a certain extent the same people have been referred to as coastal or interior. K. Rasmussen, V. Stefansson and D. Jenness all collected information or measurements of the interior Eskimos, but on the coast. As previously noted R. R. Gates typed interior Eskimos on the Mackenzie River. Thus, they have provided much concrete evidence concerning the relations of these groups and, hence, of the genetic origins of the groups from which the Anaktuvuk isolate is drawn.

Stefansson measured members of six different groups of interior Eskimos on the coast at or near the Colville, Barrow (Cape Smythe), and Point Barrow when they came down to the coast for the whaling season, and at Herschel Island where they also went to contact the whaling ships. These groups included: Nunatagmiut proper, Noatagmiut, Kuvugmiut, Kangianirmiut, Killirmiut and Kagmallirmiut. A seventh group, Oturkagmiut, was classed with the Barrow group (Seltzer, 1933, pp. 319-321).

Of fourteen individuals at Point Hope measured by Jenness in 1913 only four had both a mother and father from Point Hope. One had one parent from Point Hope and the remainder were derived from Oturkag, Napaqtok, Kikittaruk, Kivallik, K vallinak and Noatak (Jenness, 1923, p. 34B).

When Rasmussen collected a word list for interior Eskimos in 1924 he used a man from the Colville River who was in residence at Icy Cape (Osterman, 1941).

Starvation has undoubtedly been a major factor forcing interior people to the coast. The most recent depopulation of the interior area took place around the turn of the century and has been succinctly referred to by D. Jenness in a footnote of his study, *Physical Characteristics of the Copper Eskimos*.

"The old coastal inhabitants of northern Alaska and the Mackenzie delta largely disappeared during the last years of the 19th century through the ravages of European diseases. Their places have been taken by natives from inland, those dwelling on the Noatak and Colville rivers going to Point Hope, Barrow and Point Barrow, while the more eastern inlanders drifted out to the Mackenzie delta. At the present time the old and the new coast populations are inseparably mixed, and I am inclined to believe that even Stone's data from the Mackenzie delta may reflect this inland element." (Jenness, 1923, p. 48B)

Rodahl notes that in 1907, starvation forced most of the interior people to the coast, primarily to Point Barrow and to the east. He further notes that in 1935, seven or eight families of the coastal Eskimos from the area between Barter Island and the Canadian Arctic, including some originally interior people, started back into the moun-

tains by way of the Colville and Killik rivers and reached Anaktuvuk Pass in 1941 (Rodahl, 1952).

A basic insight into the relation of coastal and interior Eskimos is provided by linguistic evidence. On the basis of a preliminary examination of linguistic materials collected by Helge Ingstad at Anaktuvuk Pass, K. Bergsland has provided the following communication:

"The main bulk of the material is due to the now well-known Simon Paneaq and his father-in-law, Elijah Kakinnaaq, both belonging to the eastern group of the Nunamiut, the Tulugarmiut of Anaqtuuwak Pass. The informants stated to Ingstad that their language is the same as that spoken by the Napaaqturmiut, the Noatak people, and the former Utuqqarmiut, the people on the Utukok River. In fact, two of Paneaq's great grandfathers were Utuqqarmiut, and of his great grandmothers one was from Pt. Hope and two from Kobuk River. Of Kobuk descent is also another of the Tulugarmiut represented in the material, whereas the western group, the Ki'lirmiut, is represented only by an immigrant from Pt. Barrow.

Anyhow, the available material does not seem to indicate any linguistic cleavage between the inland and the coast. The dialect of the Nunamiut is essentially the same as that of the North Alaska coast and does not seem to have anything particular in common with the inland dialect of the Caribou Ekimos—other than the obvious fact that both are typical Eastern Eskimo dialects." (Knut Bergsland, private communication of August 17, 1956)

Some of the interior people went annually to the coast. Umiat, the name of a village on the Colville, is a plural form of umiak and notes that this was the place where the umiaks were stored. Above here travel was by means of foot and dog sled. Sufficient accounts of the trade routes and of the congregation of different groups for dances have been given in the literature to substantiate the fact that contacts between all the mobile caribou hunters were relatively frequent.

In consequence of the close connections with coastal Eskimos, either directly or indirectly, the possible effects of random genetic drift or of any high degree of isolation may be discounted.

#### SUMMARY AND CONCLUSION

1. The presence of blood type B has been established in the interior Eskimos of Alaska.

2. The closest Eskimos for whom data exists, Pt. Barrow, Nome, Bethel, and Mackenzie River all have varying frequencies of B. The Indians of Alaska and the Mackenzie River either lack B or have an extremely small amount, most likely attributable to admixture with Whites or Eskimos.

3. The Anaktuvuk sample contains many related people, only six persons are not known to be related to each other. The extent of relationship has not been provided for other groups with whom they may be compared.

4. The Anaktuvuk Eskimos fit within the framework of the western Eskimos who have a relatively continuous distribution and high population density in comparison with the Central Eskimos (Kroeber, 1939). That they retain blood group B and a high proportion of A is contributing evidence to the fact that they have maintained direct and indirect contacts with other western Eskimos.

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