The importance of hormology in nutrition lies in the emphasis it places upon the concept that stimulation of one or more systems by a compound or element does not make that compound or element an essential nutrient (*15*).

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8 August 1960

Hemoglobin Types of the Caingang Indians of Brazil

Abstract. We studied the hemoglobin types of 440 individuals (306 unrelated) cytologically and by paper electrophoresis. These included 334 (252 unrelated) putative "full bloods." No abnormal types were found.

A great amount of work has already been done concerning the distribution of the abnormal hemoglobins in several regions of the world (*1, 2*). However, the North and South American Indians and Eskimos have not been studied as intensely as other populations. In regard to South America, the only records to date of electrophoresis studies are the findings of Arends and Layrisse (*3*) of no abnormal hemoglobins in a small sample of 51 Carib Indians, and of Layrisse *et al.* (*4*) of one AS individual among 103 Guayqueri mestizos; both groups were from Venezuela.

The study of the possible occurrence of abnormal hemoglobins among these Indians, however, could be of great anthropological interest. For instance, hemoglobin E appears with relatively high frequencies among Mongoloid populations, but not among the Chinese (*1*). If the occurrence of hemoglobin E could be demonstrated among the Polynesians and other inhabitants of the Pacific, if its absence could be demonstrated in Siberian and North Mongolian populations, and if it occurred among the American Indians, we would have new evidence for Rivet's thesis (*5*) that the American aborigines originated, at least in part, from Pacific peoples. The study of the hemoglobin types of the American Indians could result, also, in the discovery of new forms that would only occur among them. These considerations led us to include this characteristic in a long-term study which is being performed among the Caingang Indians of Rio Grande do Sul, Brazil (*6*).

The populations studied live in four localities in the northern region of the state of Rio Grande do Sul. Blood was collected by venepuncture and placed in sterilized tubes, which were kept in an ice-box until arrival at our laboratory, 3 or 4 days after the collection. In the laboratory the samples were washed three times with saline, hemolyzed by repeated freezing and thawing, and centrifuged at about 1300 *g*. Afterward their concentration was colorimetrically adjusted to about 8 percent with Veronal. The separations were made in a horizontal paper electrophoresis chamber, with Whatman 3 mm filter paper, Veronal buffer, *p*H 8.6, ionic strength 0.05, field strength 4 volt/cm, and duration of 12 hours. Constant voltage was supplied by a Heathkit power supply model PS-3.

Emmel's cytological test (*7*) was performed also, which consisted in placing a drop of blood between a microscope slide and coverslip, and in isolating it from the air with a mixture of paraffin and wax. After 48 hours, the preparation was screened for the presence of sickle cells.

A total of 440 individuals were studied, approximately 100 from each locality; 334 of them were classified as "full bloods," and 106 as mestizos, on the basis of their morphological appearance and, in some cases, by interrogating them or other Indians about possible white or Negro ancestry. Of these, 252 "full bloods" and 54 mestizos were unrelated, as shown by detailed genealogical records. None of them presented any abnormal hemoglobin. In Table 1 our results are compared with those of several other authors. The findings in individuals with no signs of white or Negro admixture are generally negative, with the exception of the reports of Rucknagel (*8*) and Carbonell and Alemán (*9*). Rucknagel, however, believes that the Hb^8 gene found in his sample can be explained by undetectable crosses with Negroes, and the same could be true for the two AS individuals found by Carbonell and Alemán.

In some individuals of our sample

Table 1. Abnormal hemoglobin surveys in North and South American Indians. *Methods.* (A) Paper electrophoresis and other biophysical methods; (B) paper electrophoresis only; (C) paper electrophoresis and cytological (reducing substance: metabisulphite); (D) cytological only; (E) cytological only, (reducing substance: hydrosulphite); (F) cytological only, Scriver and Waugh (*17*) method; (G) paper electrophoresis and cytological, Emmel (*7*) method.

Population	Method	Frequency of individuals with abnormal Hb	No. of individuals tested
Eskimos, Alaska, U.S.A. (*12*)	(A)	0	708
Indians, Alaska, U.S.A. (*12*)	(A)	0	44
Aleuts, U.S.A. (*12*)	(A)	0	200
Indians, Alaska, U.S.A. (*13*)	(B)	0	169
Several tribes, U.S.A. (*8*)	(C)		
Indians		AS(0.75)	133
Mestizos		AS(1.59)	126
Cherokee, North Carolina, U.S.A. (*14*)	(C)		
Indians		0	136
Mestizos		0	398
Lumbee, (Indians and mestizos), North Carolina, U.S.A. (*14*)	(C)	AS(1.73) AC(1.73) AD?(0.08)	1332
Caribs, Venezuela (*2*)	(C)	0	51
Guayqueri mestizos (*3*)	(B)	AS(0.97)	103
Serra de Perijá Indians, Venezuela (*9*)	(D)	AS(1.64)	122
Several tribes from Amapá, Maranhão and Mato Grosso, Brazil (*15*)	(E)	0	1379
Fulniô mestizos, Pernambuco, Brazil (*15*)	(E)	AS(1.81)	166
Guaranis, Nonoai, Rio Grande do Sul, Brazil (*16*)	(F)	0	47
Guarani mestizos, same locality (*16*)	(F)	0	5
Caingangs, same locality (*16*)	(F)	0	27
Caingang mestizos, same locality (*16*)	(F)	0	22
Caingangs, Rio Grande do Sul, Brazil (this report)	(G)	0	334*
Caingang mestizos, Rio Grande do Sul, Brazil (this report)	(G)	0	106†

* Of which 252 are unrelated † Of which 54 are unrelated.

we found increased amounts of the normal fraction A_2. Because of the interesting relations of this fraction with hemoglobin E and thalassemia (*10*), plans are being made for the study of this fraction in a quantitative and systematic way in future surveys (*11*).

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26 July 1960

Appearance of a Substance in Acute Phase Serum Which Elicits Cx-Protein Responses

Abstract. Seromucoid was isolated from serum of rabbits during the acute inflammatory period following subcutaneous injection of an irritant and at times after whole body irradiation. It produced a Cx-protein response on intravenous injection into normal rabbits, an anamnestic response in immunized rabbits, leucocyte changes characteristic of inflammation, and marked toxicity in rabbits with reticuloendothelial system blockade. Normal seromucoid did not possess these properties.

C-Protein (CP) and Cx-protein (CxP) are abnormal serum proteins which appear in serum of man and rabbit, respectively, in response to various noxious stimuli. They appear within 24 hours of application of a sufficient stress and disappear as rapidly with its termination. Their function is unknown, although C-protein has been reported to increase leucocyte mobility, and rabbits which produce high titered antibody give stronger Cx-protein responses than those producing lower titered antibody (*1*). Cx-protein apparently enhances the inflammatory tissue response to noxious agents (*2*). Their source and mechanism of appearance in serum is unknown although the reticuloendothelial system has been implicated (*3*).

A second abnormal substance(s) has been found in serum which appears coincidentally with Cx-protein 24 hours after subcutaneous injection of mineral oil-Aquaphor emulsion (incomplete adjuvant) and at various times after 500 r of whole body irradiation (*4*). We refer to it as Co-Cx-protein. It was first recognized by its ability to elicit a Cx-protein response on intravenous injection of small amounts into normal rabbits. Such activity was not associated with comparable fractions of normal serum.

Material with this activity is prepared by Winzler's method for the isolation of seromucoid (*5*) from the fraction of proteins which precipitate from acute phase serum with ammonium sulfate between one-half and three-fourths saturation. Table 1 summarizes the properties of a number of such preparations.

Table 1. Properties of various seromucoid preparations.

Source rabbits	Samples (No.)	Cx-protein titer* of serum source	Yield of seromucoid (mg/100 ml)	Dose injected in test rabbits† (mg)	Cx-protein titer of test rabbits 24 hr after injection
Normal	6	neg.–trace	3.5–6.7	0.35–2.1	5 neg., and 1:2
24–48 hr post adjuvant	4	1:8–1:16	13–21	1.2 –5.0	1:4–1:64
1 hr post irradiation	2	neg.	6.6–9.4	1.3 –1.9	1:4, 1:8
3 hr post irradiation	3	neg.–trace	5.4–9.7	1.1 –2.0	neg., 1:2, 1:2
6 hr post irradiation	3	neg.–1:8	5.8–16	1.2 –3.2	neg., neg., 1:2
12 hr post irradiation	2	1:2–1:8	13–19	2.5 –3.8	neg., 1:1
24–48 hr post irradiation	4	1:4–1:16	13–25	1.1 –5.1	1:1–1:8

* Cx-protein titers are recorded as the highest dilution of serum giving a positive test with specific antiserum in capillary precipitin tubes (*10*). † Usually the dose selected was equivalent to 20 ml of donor serum, although active samples were tested in lower doses and inactive samples at higher doses on repetitive tests.

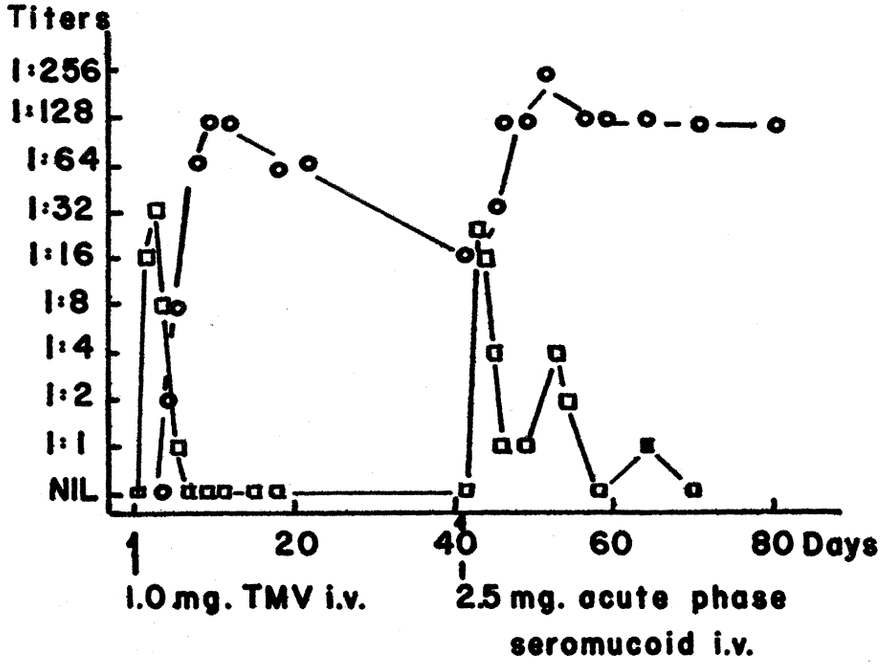

Fig. 1. Cx-protein and anti-tobacco mosaic virus titers following injection of 1.0 mg of tobacco mosaic virus (first arrow) and 2.5 mg of seromucoid (second arrow). The Cx-protein levels are denoted by squares, and anti-tobacco mosaic virus levels by circles.