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Possible Relation of Blood Groups to Age and Longevity.

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The writer's purpose is to point out hitherto unrecognized possibilities of blood-group investigations in relation to the problems of human constitution.

Landsteiner found that blood-group formation is physiological, independent of pathological processes.[1] This discovery and the findings of von Dungern and Hirszfeld[2] that groups A and B are transmitted as *dominants,* stimulated much additional research on the problems of serology, heredity, anthropology, paternity and constitution. Hirszfeld[3] has stressed the importance of further research on the relation of blood groups to the problems of human constitution.

The problems of constitution deal primarily with those innate characters which largely preserve individual identity; therefore only those characters which are classifiable into discernible types in the living, and which, after type differentiation, remain permanent, or relatively so, throughout the life span, may be useful in these problems. The results of all investigations show that blood groups are innate and indicate that, after type differentiation early in life, the group inherited by the person remains permanent, regardless of disease and other environmental influences;[4, 3] hence further research on the relation of blood groups to problems of human constitution may be of great promise, although the recorded results, thus far, are very contradictory. May not the reasons for such results be found in the lack of uniformity in technical details, race, stock or even community differences, inadequate numbers and controls and *possibly in the fact that blood groups have not yet been studied in relation to age and longevity?*

The relation of heredity to longevity has long been recognized. Genealogical and other studies show that longevity is heritable not only in man, but in lower forms.[5] In summing up his mathematical

[1] Landsteiner, K., *Wien klin. Woch. Bd.*, 1901, **14**, 1132.

[2] v. Dungern, E., und Hirszfeld, L., *Z. f. Immunitäts.*, 1910, **6**, 284.

[3] Hirszfeld, L., *Ergeb. Hyg. Bakteriol.*, 1926, **8**, 366.

[4] Lattes, L., *Die Individualität des Blutes,* Trans. by Schiff, F., Berlin, 1925.

[5] Pearl, R., The Rate of Living, pp. 1-18, New York, 1928.

discussion on the relation of heredity to duration of life, Pearl[6] states, it "Indicates that from one-half to three-fourths of the death rate is selective in character, because that proportion is determined by hereditary factors. Just in proportion as heredity determines the death rate so is the mortality selective." Obviously the known relation of heredity to longevity, whatever its magnitude may be, has a definite place in the problems of human constitution. But before this relation can be useful in these problems, the types of inherited characters must be shown to remain permanent, or relatively so, after type differentiation, and their possible age incidences must be investigated. *The only investigations of inherited characters in relation to age and longevity, recorded in the literature, are those on human scapulae.*

A brief summary of the writer's studies based on human scapulae will indicate the possibilities of similar studies of other inherited characters and among these, blood groups. Incident to family studies in 1906, he was led to classify the scapulae of man and some other mammals into *convex* and *scaphoid* (straight, concave and mixed) *types.* Observing in 1907, that *convex* types predominate in the *old* and *scaphoid* types in the young, he was led to investigate the origin, permanence, distribution and age incidence of scapular types, as well as their possible relation to longevity.[7–20] His investigations show: that, in man, the range in variation of scapular types is from the extremely *convex* through the *straight* to the extremely *concave;* their origin is primal; in man, they are transmitted with unusual constancy, regardless of sex, *the scaphoid* (straight, concave and mixed) *types* as *dominants;* they are differentiated in man in prenatal life; they remain *permanent* in type in man throughout the life span, regardless of ageing processes, nutrition, health, disease, oc-

[6] Pearl, R., The Biology of Death, p. 177, Philadelphia and London, 1922.

[7] Graves, W. W., *Med. Record* (N. Y.), 1910, **78**, 861.

[8] Graves, W. W., *Trans. Nat. Assn. for Study of Epilepsy and Care and Treatment of Epileptics*, 1911, **8**, 56.

[9] Graves, W .W., *Contrib. Med. and Biol. Research*, dedicated to Sir William Osler, 1919, **1**, 525.

[10] Graves, W. W., *Am. J. Physiol. Anthropol.*, 1921, **4**, 111.

[11] Graves, W. W., *Am. J. Phys. Anthrop.*, 1922, **5**, 21.

[12] Graves, W. W., Trans. Am. Assn. of Life Ins. Med. Directors, 1923. (Discussion: Dublin, L. L., Rogers, O. H., Patton, J. A., Hoffman, F. L., and Graves, W. W.)

[13] Graves, W. W., *Arch. Int. Med.*, 1924, **34**, 1.

[14] Graves, W. W., *Z. f. Konstitutions.*, 1925, **11**, 717.

[15] Graves, W. W., *Arch. Int. Med.*, 1925, **36**, 51.

[16] Graves, W. W., *Glasgow Med. J.*, 1925, 315.

cupation and other environmental influences; they are found in varying percentages in the remains of ancient and modern man and of some other mammals (gorilla, orang, champanzee, armadillo, bat *et al*); they are present in varying percentages in the excellently, well and poorly adaptable, regardless of age, race, stock and body build; in similar age periods, they may be present in varying percentages in different communities of the same race or stock; and in skeletal material and in healthy and sick groups, representing successive age periods from childhood to old age, the percentages of *convex* types *increase,* while those of *scaphoid* types decrease. His more recent figures on the age incidence of scapular types in white stocks are approximately as follows: 6 to 15 years: scaphoid types 65%, *convex* types 35%; 60 years and over: *scaphoid* types 35%, *convex* 65%.

Since adequate investigations, including follow-up, lead to the conclusion that scapular types remain *permanent* throughout the life span, the only tenable explanation for their age incidence is *better adaptability, less morbidity, greater longevity among the bearers of the convex than among the bearers of the scaphoid types.* This explanation is supported by the writer's figures and those of others[17, 19, 20] showing that in the healthy and sick groups studied in similar age periods there are approximately from 1¼ to 2¼ times as many *convex* types in the healthy as in the sick groups. Whether the types of other inherited characters will show similar age incidences in relation to the problems of constitution (adaptability, morbidity and longevity) cannot be known until such types have been similarly investigated.

Since blood groups had not been investigated in relation to age and longevity, and since it seemed that investigations of their possible age incidence might reveal the presence or absence of such relation, investigations were begun in 1933 by Mr. H. C. Pulley, Assistant, Department of Bacteriology and Dr. J. B. Mitchell, Jr., Instructor, Department of Pharmacology, St. Louis University School

[17] Graves, W. W., The Relations of Shoulder Blade Types to Problems of Mental and Physical Adaptability, The Henderson Trust Lecture, No. IV, Edinburgh, 1925.

[18] Graves, W. W., *Eugenics Rev.*, 1931, **23**, 215.

[19] Graves, W. W., A Note on Inherited Variations and Fitness Problems. I. The Types of Scapulae. Trans. Third Internat'l Congress of Eugenics, Baltimore, 1934.

[20] Graves, W. W., The Relation of Inherited Variations of Structure and Function to Problems of Health, Disease, Education, Duration of Life, and Adaptability in General. I. The Types of Scapulae. (In publication.)

of Medicine and Sister Mary Francis, Technician, University Hospital. The investigations of Sister Mary Francis deal with healthy and with hospitalized and out-patient material (white males and females) in successive age periods from birth onward. The results of her investigations will be published elsewhere. Those of Pulley and Mitchell are with white male students in the Medical School and ambulatory white male inmates of the St. Louis Infirmary (Alms House). The results of their investigations thus far available, arranged according to the international classification, are shown in Table I.

TABLE I.

Age	Total	O		A		B		AB	
yrs.		No.	%	No.	%	No.	%	No.	%
22-26	281	115	40.9	112	39.9	38	13.5	16	5.7
60+	500	232	46.4	203	40.6	48	9.6	17	3.4
		% increase 13.9		% increase 1.7		% decrease 28.8		% decrease 40.4	

As far as known, the first investigations on the possible age incidence of blood groups are those of Pulley and Mitchell and of Sister Mary Francis. Pulley's and Mitchell's results, thus far, are based on admittedly small numbers and while the number and percentage differences in relation to age are comparable, they are not conclusive, even for the age periods represented. However, the known age incidence of scapular types and its explanation suggest the possibilities of further blood-group investigations in relation to age. Such investigations by many workers with large numbers, representing healthy and sick groups of different races or stocks and different communities of the same race or stock, may disclose definite answers to the questions: Is there an age incidence of blood groups? If so, can it, like that of scapular types, be explained on the known relation of heredity to longevity? Affirmative answers to these questions will enlarge the usefulness of blood groups in relation to the problems of human constitution, as these are expressed in innate predisposition to health or disease, innate capacities for living and adaptability in general.

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