

jects showing respiratory alkalosis, it appears significant that in the one subject (S. K.) displaying no change in respiration urine phosphorus was appreciably diminished. The changes in the renal excretion of inorganic phosphorus may well reflect some change in the carbohydrate metabolism. Leipert and Kellersman¹⁷ found in human subjects at 5500-6200 meters that a decrease in the phosphorus of blood and urine was compensated for by an increase of phosphate ester in the blood, an effect further augmented by glucose. Similar changes in rats could be correlated with greatly increased liver glycogen. Whether this relationship existed

¹⁷ Leipert, T., and Kellersman, E., *Z. Physiol. Chem.*, 1942, **276**, 214.

in the present experiments at moderately low altitudes cannot be stated. In this connection, it was found that the blood sugar level remained unaffected at the 8,000 and 10,000 ft. levels.¹¹

Conclusions. 1. No appreciable change in total urine output from ground level values was found to occur in human subjects during prolonged exposures to simulated altitudes of 8,000 and 10,000 ft. under conditions of restricted food and water intake.

2. The renal excretion of phosphorus was significantly decreased at altitude.

3. These experiments indicate that alteration in the mineral metabolism may occur in the unacclimatized human being at altitudes as low as 8,000 ft.

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Blood Agglutinins in Filariasis.

M. B. FRANKS.* (Introduced by H. M. Zimmerman).

From the United States Naval Medical Research Unit No. 2.†

In a recent study of filariasis on Okinawa,¹ data on the frequency distribution of the A, B blood groups were collected. Certain differences in the frequencies of the blood groups, in comparison to the systematic variation in the general population, were noted to occur in filarial patients who had circulating microfilariae; these differences warrant a brief note at this time.

The blood-group percentages of 1,000 persons from the villages of Fukeyama, Jinusza

* The writer is indebted to Comdr. Harold Fink, MC, USNR, who rechecked the blood group typings on all of the filarial patients, and who is responsible for the compilation of the A, B blood group percentages of the Okinawans.

† The Bureau of Medicine and Surgery of the United States Navy does not necessarily undertake to endorse the views expressed in this paper.

¹ Franks, M. B., Chenoweth, B. M., Jr., and Stoll, N. R., *Am. J. Trop. Med.*, 1946, in press.

and Soke² (approximately 5% of the population) were compared with the frequency distribution of the A, B blood groups in 180 persons, from the same villages, who had circulating microfilariae. The degree of microfilaremia was determined by dilution counting¹ and its relationship to the blood group percentages was also studied. As noted in Table I, the incidence of filaremia is greater in persons whose sera contain no natural antibody to group A red blood cells. When the data were examined without reference to the variables that influence the degree of filaremia, it was found that persons whose blood did not contain α -agglutinins had, as a rule, higher microfilarial counts. High α - and β -isoagglutinin titers (800-1600) were observed in the sera of many filarial patients, even in those who did not have microfilaremia. In several instances, the sera contained ag-

² Fink, Harold, report to be submitted.

TABLE 1.
Frequencies of the A, B Blood Groups in Persons with Microfilaremia Compared with the Systematic Variations in the Frequencies of the Blood Groups on Okinawa.

	A	AB	O	B
% in 1,000 Okinawans*	40.8	8.3	31.8	19.1
% in 180 persons with filaremia	52.0	10.3	25.9	11.8
†Statistical significance of differences	Significant	Not significant	Possibly significant	Significant

* Comdr. Fink has since done 500 additional typings from these villages without any appreciable change in percentages given here.

† The odds against the occurrence of the differences in the ratios arising by chance alone are approximately 40 to 1 for A, 1 to 1 for AB, 10 to 1 for O, and 140 to 1 for B.

glutinins active for the agglutinogens present in their cells. One group A and 4 group AB patients gave anomalous reactions of this type. The α -agglutinins were found in 4 of these cases and were present in low titer.

The possible physiological function of the blood group substance is not known. The serological relationship of A substance to some bacterial carbohydrates suggests that the blood group substances may have an immunological role. However, there is no experimental evidence that one blood group or type enjoys any advantage over the other in this respect.

Oliver-Gonzalez^{3,4} has been able to demonstrate that the polysaccharides of several helminths (originally isolated by Campbell from *Ascaris lumbricoides*) inhibits the α - and β -agglutinins of human sera. Although a similar polysaccharide has not been isolated in the filarid, it is possible that such a substance related to the blood group substances exists and might account for the relationship noted above in the filarial patients. In another experiment, Oliver-Gonzalez⁵ reported extraordinarily high isoagglutinin titers in

malaria patients with blackwater fever, suggesting that the malaria parasite contains blood group substances or related antigens. Heidelberger and Mayer⁶ recently noted that persons of blood group O or B, who were vaccinated with malaria parasites, were more likely to cease relapsing than persons of blood group A or AB. They also demonstrated significant rises in agglutinin titers of the blood group O or B volunteers whom they injected with malaria vaccine prepared from infected O or B blood. Control subjects injected with normal human blood group O stromata showed no changes in their α -agglutinin titers.

The data here are not detailed enough to determine the immunological significance of the presence of autoagglutinins in the 5 sera from filarial patients. An attractive hypothesis is one that provides for the production of the agglutinin as the result of the stimulation by a blood group-like substance in the filarid. However, our present knowledge lends no support to such a view. The data are difficult to assess, but the suggestion that there might be a relationship between the natural antibodies of the red blood cells and the antibodies that have a selective action on an organism, indicates the desirability of adding information along these lines.

³ Oliver-Gonzalez, Jose, *J. Infect. Dis.*, 1944, **74**, 81.

⁴ Oliver-Gonzalez, Jose, and Torregrosa, M. V., *J. Infect. Dis.*, 1944, **74**, 173.

⁵ Oliver-Gonzalez, Jose, and Montilla, E., *Proc. Soc. Exp. Biol. and Med.*, 1944, **56**, 169.

⁶ Heidelberger, Michael, and Mayer, Manfred, *N. R. C. Bulletin on Malaria Research*, September 20, 1944.