On the Prevalence of Hemoglobin D in the American Negro

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THE PURPOSE of this communication is to report the significant prevalence of Hemoglobin D in the American Negro. A survey of hemoglobin types carried out in 1000 midwestern Negroes selected at random demonstrated that 0.4 per cent were heterozygous for Hgb D. Until recently only sporadic instances of Hgb D have been encountered, largely among Caucasian individuals. Originally detected in a "white" family of English, Irish, and American Indian extraction,[1, 2] Hgb D has also been found in a British family of Spanish and Austrian extraction,[3] in an Algerian Moslem,[4] in a Sikh soldier,[5] in a mulatto child of an English mother[6] and in a Turkish family.[7] Recently, during the course of our own study, a survey of Sikhs living in the Punjab area has uncovered an incidence of approximately 2 per cent Hgb D heterozygotes among 290 individuals examined.[8] One possible instance of homozygous Hgb D disease has also been found.[9]

Hgb D differs from other varieties of hemoglobin in two main characteristics.[10] Its electrophoretic pattern, both by Tiselius and paper electrophoretic technics, may be distinguished from that of other hemoglobins except Hgb S (fig. 1) Hgb D may be separated from Hgb S, however, by its greater solubility in the reduced state and hence by the inability of Hgb D to form tactoids and cause sickling.[11] In all other respects Hgb D resembles the normal adult compound, Hgb A.

Hemoglobin solutions from 1000 Negro subjects were subjected to paper electrophoretic analysis by techniques previously described.[10] The subjects were unselected admissions to the clinics of the Homer G. Phillips Hospital and Washington University School of Medicine.* The prevalence of the various hemoglobin types encountered is listed in table 1. The red cells of all patients whose hemoglobin specimens resulted in a pattern which appeared to be Hgb A plus Hgb S (sickle cell trait) were tested with 2 per cent Na metabisulfite. Four failed to show sickling. Solubility studies on these four samples indicated that they were completely soluble in 2.24 molar phosphate buffer and hence had the solubility characteristics described for Hgb D.[11] Subsequent studies on members of the families of these subjects, plus one additional kinship not included in this survey, have uncovered four more heterozygote carriers of Hgb D as well as one

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TABLE 1.—*Distribution of Hemoglobin Types in 1000 Negro Individuals*

Hgb types	Number	Per cent
A	896	89.6
A + S	94	9.4
A + C	26	2.6
A + D	4	0.4

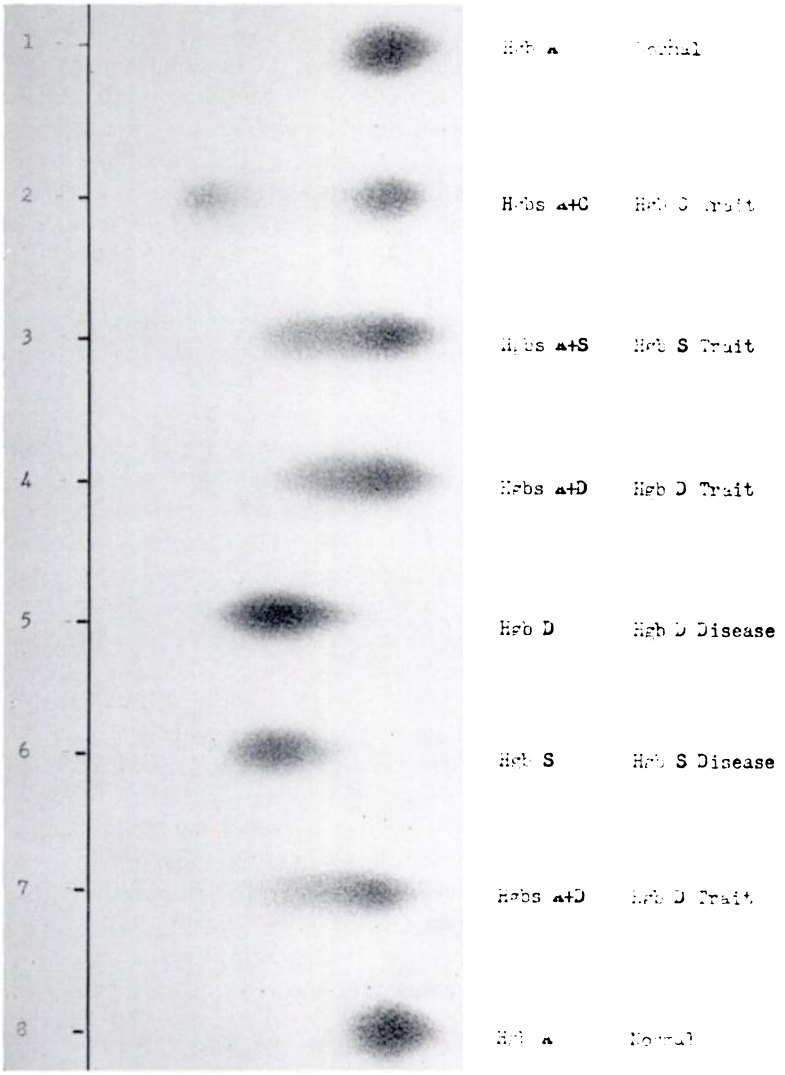

FIG. 1.—Electrophoretic patterns of specimens containing hemoglobin D

individual homozygous for Hgb D. A complete genetic, clinical and hematologic study of these individuals will be the subject of a subsequent report.

Although the present survey establishes the significant incidence of an abnormal hemoglobin hitherto believed to be extremely rare, the data are also of

interest in that they suggest that Hgb D is not limited to any one racial group. In marked contrast are the data relative to the prevalence of those other types of abnormal hemoglobin which occur with sufficient frequency for evaluation. Thus, with but rare exceptions, Hgb S and Hgb C are limited to individuals of Negro ancestry, Hgb E to Oriental peoples descended from the inhabitants of southeast Asia, and Hgb H to the Chinese. Hgbs. G, I, J and K have been detected in too few people for such evaluation. Hgb D, however, has now been observed in Negroes, Caucasians, Algerians and Indians. It is therefore, the first of the abnormal hemoglobins to cross such wide racial and color lines, a fact which suggests that the genetic mutation or defect resulting in this anomaly arose in several independent areas. Among the subjects with Hgb D referred to in this report, African Negro, American Indian and white English ancestry are claimed. The anthropologic implications of these findings will be difficult to evaluate until more extensive population surveys are undertaken.

Summario in Interlingua

In un studio de 1000 negros del west central del Statos Unite, 4 esseva trovate qui esseva heterozygote pro hemoglobina D. Le investigation de lor familias resultava in le discoperta de 4 casos additional de portatores heterozygote de hemoglobina D e de un caso de un individuo homozygote pro hemoglobina D. Hemoglobina D ha nunc essite constatate in negros, caucasianos, algerianos, e indios. Su distribution racial es plus extense que illo de omne altare hemoglobina anormal.

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