High Incidence of Haemoglobin G_{Accra} in a Rural District in Jamaica

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Edington and Lehmann (1954) described a new haemoglobin variant, Hb G, in a West African Negro. Subsequently, a relative of this person was found to be homozygous for Hb G (Edington, Lehmann, and Schneider, 1955). This Hb G proved to be abnormal in the β -chain of the molecule (Gammack, Huehns, Lehmann, and Shooter, 1961), and the abnormality has now been shown to affect the tryptic peptide BTpIX (Lehmann, Beale, and Boi-Doku, 1964), where the substitution of asparaginyl for the normal aspartyl has occurred at position 79 in the β -chain. Haemoglobin G_{Accra} has never been reported again in Africa or from anywhere else in the world. The finding that 2.3% of a random sample of population in a rural district in Jamaica possessed this haemoglobin as the heterozygous trait is therefore of some interest.

Subjects and Methods

In the course of a survey into the prevalence of heart disease, carried out in a rural population in Jamaica in 1962 and 1963 (Fodor, Miall, Standard, Fejfar, and Stuart, 1965), blood samples from 1017 persons were examined by the sickle-cell test, using sodium metabisulphite, and by haemoglobin electrophoresis on filter paper in barbitone buffer at pH 8.6. The subjects in the survey were chosen at random from a population of 7500, established by census, over an area of 15 square miles. The district lies in hilly country some 15 miles north of Kingston and the population there is predominantly of African origin. In the course of this investigation blood samples from 23 persons showed, on haemoglobin electrophoresis, a pattern very similar to that seen in sickle-cell trait, i.e. two bands of haemoglobin, one in the position of Hb A and the other a slower-moving haemoglobin roughly in the position of Hb S, but, in all instances, the sickle-cell test was negative. In Itano's solubility test (Itano, 1953) 50 mg. ferrohaemoglobin from these bloods were completely soluble in a 10 ml. 2.24 M phosphate buffer at 25° C., proving the absence of Hb S. The electrophoretic mobility at pH 8.6 on

filter paper in barbitone buffer was almost the same as Hb S, but on cellulose acetate and starch gel it was quite clearly slightly faster than Hb S (Fig. 1). There was only one Hb A₂ band in these haemolysates, which suggested that the abnormality was in the β -chain. On agar gel electrophoresis at pH 6.5, Hb S separates from Hb A, whereas our haemoglobin did not separate. Blood samples were sent to Dr. H. Lehmann, who found that this haemoglobin from Jamaica had an abnormal peptide BTpIX and that this abnormality was identical to that previously described for Hb G_{Accra} (Lehmann *et al.*, 1964).

Hb S and Hb C have been reported to occur in Jamaica with a frequency of 11% and 3%, respectively (Went, 1957). The incidence of these haemoglobins and Hb G_{Accra} in our survey population is shown in the Table. Investigation of some of the relatives of the propositi for Hb G revealed a further 4 persons with the trait, making a total of 27 persons with this haemoglobin. The relationship of these people to one another is shown in Fig. 2. No homozygous individuals were found.

TABLE
INCIDENCE OF ABNORMAL HAEMOGLOBINS
IN A RURAL POPULATION IN JAMAICA

Haemoglobin	No. of Persons	%
AA	847	83.3
AS	122	12.0
AC	23	2.25
AG _{Accra}	23	2.25
SC	1	0.1
SS	1	0.1
Total	1017	100

Discussion

Seven haemoglobins which migrate on filter paper electrophoresis in the position of Hb G, and having different amino acid substitutions, have been described (Huehns and Shooter, 1965). These are: Hb G_{Philadelphia} (Baglioni and Ingram, 1961) (also previously called Hb G_{Bristol}, Hb G_{Azuokoli},

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FIG. 1. Starch gel electrophoresis tris-EDTA-borate buffer pH 8.6. (Amido black stain.)

FIG. 2. Pedigree of three families in which 23 of the subjects heterozygous for Hb G_{Accra} occurred.

Hb D_{St. Louis}, Hb D_{Washington}), Hb G_{Chinese} (Swenson, Hill, Lehmann, and Jim, 1962), and Hb G_{Ibadan} (Gammack *et al.*, 1961), which are α -chain abnormalities; Hb G_{San Jose} (Hill, Swenson, and Schwartz, 1960), Hb G_{Galveston} (Bowman, Oliver, Barnett, Cunningham, and Schneider, 1964) (also previously called Hb G_{Port Arthur}, Hb G_{Texas}), Hb G_{Accra} (Lehmann *et al.*, 1964), and Hb G_{Coushatta} (Schneider, Haggard, McNutt, Johnson, Bowman, and Barnett, 1964), which are abnormal in the β -chain.

Haemoglobin G_{Accra} is remarkable in that the only person so far described as homozygous for this

haemoglobin (Edington *et al.*, 1955) was not anaemic and his red cells showed no abnormal morphology in stained films, neither was there any increase of foetal haemoglobin, as is commonly found in persons homozygous for other β -chain abnormal haemoglobins such as S, C, D, and E. Apart from Hb S, C, and G_{Accra}, the only other abnormal β -chain haemoglobin occurring in Jamaicans is Hb E, which has only been found in two families, both of Indian extraction. Our finding of Hb G_{Accra} in Jamaica could be explained by derivation from a single African ancestor who settled in this rural area. We have not found this haemoglobin before

in over 500 subjects from another suburban area, nor in haemoglobin electrophoresis tests on some 10,000 patients who have attended the University College Hospital of the West Indies from all over the island. The incidence of the haemoglobin in the population as a whole is therefore probably insignificant, and the high incidence found in this random sample is due to inbreeding in a relatively static community.

We had expected to find, among the relatives of our Hb G carriers, an example of the double heterozygous condition, Hb GS. The haemolysate from such a blood would show only a single, though somewhat broad, band in the position of Hb S on paper electrophoresis at pH 8.6. On agar gel at pH 6.5, however, two bands would appear, the slow moving S band and a Hb G band in the same position as Hb A. Such a person, with Hb GS, would most probably be as asymptomatic as a person with sickle-cell trait, though appearing on routine electrophoresis to be homozygous SS. We have checked over 200 patients diagnosed as SS or S/thalassaemia but have not yet found the double heterozygous state for Hb S and G_{Accra}.

Summary

The finding of Hb G_{Accra} in 2.3% of a rural population in Jamaica is reported. This haemoglobin, originally found in one Negro family in West Africa, has never been reported again from Africa or anywhere else in the world. The significance of the high incidence of this abnormal haemoglobin in a random sample of the population is discussed and attributed to inbreeding in a relatively static community.

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