HAEMOGLOBIN K IN AN EAST INDIAN AND HIS FAMILY

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The abnormal haemoglobins in East Indians so far described are principally sickle-cell haemoglobin (haemoglobin S) and haemoglobin D, and to a less extent haemoglobin E. Haemoglobin S is found in some aboriginal communities of Southern India, where in the Panyans and in the Irulas the percentage incidence is about 30, and in some tribes in Western India (Lehmann and Cutbush, 1952a, 1952b; Büchi, 1955; Sukumaran, Sanghvi, and Vyas, 1956). The rather high incidence of 55% has been mentioned for the Parjah Kondhs by Foy, Brass, and Kondi (1956). Although some families with the sickling trait have been noticed among Biharis working as labourers in Assam (Dunlop and Mozumder, 1952), sicklers were not detected amongst 23 Karias and 100 Oraons employed as forest labourers on the Andaman Islands (Lehmann and Ikin, unpublished). Shukla and Parande (1956) have observed sickling in a Mahar family. The Mahars are a "scheduled caste" in Maharashtra, and it is noteworthy that the earliest communities of India, including the Veddoids, were either driven by the later arrivals into remote places where they retained their identity or were subjugated and incorporated into what we know to-day as the scheduled castes. Though first reported in isolated instances from America and Europe, haemoglobin D has been found to occur in 3% of Sikhs and in 1% of Gujaratis (Bird and Lehmann, 1956a; Jacob, Lehmann, and Raper, 1956). India would thus appear to be a reservoir for this abnormal haemoglobin. Haemoglobin E was first discovered in a child of mixed Hindu ancestry (Itano, Bergren, and Sturgeon, 1954), but none has been found in many Indian communities investigated since, except for some occasional observations in Bengalis (Bird and Lehmann, 1956b; Chatterjea, Saha, Ray, and Ghosh, 1956; Saha, Dutta, and Ghosh, 1957). The incidence of haemoglobin E is of course high immediately East of Bengal in Burma and in the neighbouring Siam and Malaya.

The "Fast-moving" Abnormal Haemoglobins

The first abnormal haemoglobins to be discovered by electrophoretic technique were all migrating more slowly at alkaline pH than normal adult haemoglobin (haemoglobin A). In the last two years, however, four haemoglobins have been described which move faster than haemoglobin A at alkaline pH: H, I, J, and K. There has been some confusion about the nomenclature, and the following is based on a discussion of this problem at a working party meeting under the chairmanship of Dr. J. V. Neel during the 6th Congress of the International Society of Hematology in Boston in 1956 (see Lehmann, 1957).

Haemoglobin H (Rigas, Koler, and Osgood, 1955) has been found in Chinese, in Filipinos (Motulsky, 1956), in Siamese (No-Nakorn and Minnich, 1956), and in one Malaysian Malay (Lehmann and Singh, 1956). The only observations in non-Mongoloids are in two Greek families (Gouttas, Fessas, Tseveris, and Xefteri, 1955), in a Greek Cypriot

(Ager, unpublished), and in a Jordanian Arab (personal communication by Dr. J. C. White).

Haemoglobin I was seen in an American negro family and in Algiers (Rucknagel, Page, and Jensen, 1955; Cabannes, Sendra, and Dalaut, 1955).

Haemoglobin J was discovered in an American negro family (Thorup, Itano, Wheby, and Leavell, 1956). It was noted in West Africa—at first called "Liberia I" (Robinson, Zuelzer, Neel, Livingstone, and Miller, 1956)—and was found according to Robinson *et al.* (1956) in a French Canadian family by Colonel W. H. Crosby. Huisman, Noordhoek, and da Costa (1957) have found this haemoglobin in an Indonesian family; and Raper (1957) has described an example in a Gujarati Indian.

Haemoglobin K has been described in three Berber families by Cabannes, Buhr, and Sendra (1956), and by Robinson *et al.* (1956) in a survey of Liberians—provisionally named "Liberia II." Edington and Lehmann (unpublished) have seen three examples amongst members of the Dagomba tribe from Northern Ghana. In a man of East Indian origin and in his son we have now seen a haemoglobin which has the electrophoretic properties described for haemoglobin K.

Electrophoretic Properties of Haemoglobin K.—Haemoglobins H and I move at pH 8.6 considerably faster than haemoglobin A and are separated from it about as much as haemoglobin E in the reverse direction. Haemoglobins J and K move more slowly than H and I; haemoglobin K is the slower. While haemoglobin J just faintly separates from haemoglobin A, haemoglobin K tends to appear as a band in front of haemoglobin A but barely separated from it. At pH 6.5 the situation is reversed and the abnormal component is attached to the rear of the haemoglobin A band. There is, however, a discrepancy between the reports on haemoglobin K: Cabannes *et al.* (1956) found a separation between haemoglobins A and K at this acid pH, whereas Robinson *et al.* (1956) found no such separation in their mixture of haemoglobin A and "Liberia II," which latter—subject to a final comparison between the two—is thought to be identical with haemoglobin K.

Findings

The subject of the present investigation, an Indian resident in London, was born in South Africa, where his grandfather had immigrated from India (Madras). Though he married a woman of Scots and West Indian origin there is no evidence in his appearance or from his family history that there has been any admixture of non-East Indian blood amongst his own ancestry. He was 43 years old and was being examined for assessment of Addison's disease and treatment of pulmonary tuberculosis. As he was a non-European he was examined for abnormal haemoglobin. There was no anaemia, and no abnormality was found in the size or appearance of his red cells; the osmotic fragility of these cells was normal. The sickling test was negative, and alkali-resistant haemoglobin (haemoglobin F) was absent. The solubility of the reduced haemoglobin was within normal limits (Itano, 1953).

On paper electrophoresis at alkaline pH the haemoglobin was seen to consist of two components—one resembling haemoglobin A in its electrophoretic properties, and another, amounting to 38%, which was moving faster than haemoglobin A though it was barely separated from it. His haemoglobin mixture was compared with mixtures of haemoglobins A+H and A+J respectively each both at alkaline and at acid pH. The first was obtained from a Greek Cypriot and the second was kindly made available by Dr. A. B. Raper. Furthermore, Dr. H. A. Itano and Dr. T. H. J. Huisman obliged us by comparing the haemoglobin of our patient with mixtures of haemoglobins A+J, and Dr. R. Cabannes by comparing it with a haemoglobin A+K mixture. The outcome of these comparisons was that the abnormal haemoglobin of our patient moved on paper electrophoresis at alkaline pH very much more slowly than haemo-

globin H (or I) and rather more slowly than haemoglobin J, but identically with haemoglobin K (Fig. 1).

As noted above, Cabannes *et al.* (1956) found their haemoglobin A+K mixture to separate into two fractions on paper electrophoresis at pH 6.5, but Robinson *et al.* (1956) failed

FIG. 1.—Paper electrophoresis at pH 8.6, barbiturate buffer. Comparison of haemoglobins A+J with the haemoglobin of the patient (A+K). It will be seen that the patient's haemoglobin consists of haemoglobin A and of another component migrating faster than haemoglobin A but more slowly than haemoglobin J.

FIG. 2.—Paper electrophoresis at pH 6.5 phosphate buffer. Comparison of haemoglobins A+H with the haemoglobin of the patient (A+K). It will be seen that at pH 6.5 haemoglobin A moves towards the cathode, and haemoglobin H towards the anode, and that the abnormal component of the patient's haemoglobin does not separate from haemoglobin A.

to achieve a separation with their sample at this pH. Our sample behaved like that of Robinson *et al.* (1956) (Fig. 2). Edington and Lehmann's three samples of haemoglobins A+K from Ghana (unpublished) also did not separate on paper electrophoresis at pH 6.5.

On examination of the patient's family one child was found to have the same abnormal haemoglobin as the father (Fig. 3). Its blood picture was normal, foetal haemoglobin was absent, and the osmotic fragility was within normal limits.

Comment

Haemoglobin K has so far been seen in Kabyles, Libyans, and Dagombas, all from Africa. The present example occurred in an Indian and in his family. Recently Huisman *et al.* (1957) and Raper (1957) have found haemoglobin J in an Indonesian family and in an Indian woman respectively. It seems that these rare haemoglobins are not confined to Africa, but further results have to be awaited before their anthropological significance can

FIG. 3.—Family of the propositus. White = haemoglobin A; black = haemoglobin K.

be assessed. Haemoglobins C, D, and E, have been found to exist at higher frequency in populations other than those in which they were originally described. Although haemoglobin K is "rare" at present, it may well not be considered rare in years to come, when more populations have been examined for abnormal haemoglobins.

Summary

An abnormal haemoglobin was discovered in a South African of Indian extraction living in London. The haemoglobin had the electrophoretic properties of haemoglobin K. One son showed the same abnormality.

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A European seminar on "The Nurse in Industry" was held in London recently under the joint auspices of the International Labour Office and the World Health Organization. About 50 representatives from 15 countries attended the seminar, and among those who took part were industrial nurses, social workers, industrial medical officers, and medical inspectors of factories. There were discussions on the importance of the nurse as a member of the occupational health team, which might include an industrial medical officer, first-aid attendant, social worker, chemist, and safety officer. Among the suggested duties of the occupational health nurse were the first care of accidents and sickness, occupational and non-occupational, the follow-up of this care, rehabilitation, assisting with the prevention of accidents and physical and mental sickness. She should also assist in the planning and carrying out of the programme of health education for individuals and groups; and she should be responsible for the organization and administration of the nursing services and the training and supervision of first-aid attendants and auxiliary nursing personnel where they are employed. In addition to all this she should be concerned with establishing and maintaining good relationships with employers, employees, foremen, supervisors, and the social services—and she should be independent in relation to the factory management.