LETTERS TO THE EDITORS

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β-Globulin Variants in Man

Using starch-gel electrophoresis, Smithies has discovered several β-globulin patterns in human plasma. He refers to these as βC, βBC, βCD and βD [1,2]. βC is the type most commonly found, but βBC occurred in about 1 per cent of Canadians and βCD in about 4 per cent of American Negroes and even more frequently in Australian Aboriginals. The formation of the different β-globulins B, C and D appears to be genetically controlled and Smithies suggests that each may be determined by one of three allelic genes.

In a search for such β-globulin types we have recently encountered four unusual patterns. The starch-gel electrophoresis was carried out on plasmas to which hæmoglobin had been added to saturate the haptoglobins, using the discontinuous buffer system of Poulik[3]. Under these conditions the β-globulin region is clear of either the hæmoglobin – haptoglobin complexes or free hæmoglobin (Fig. 1) and it is possible to pick out unusual β patterns in one-dimensional separations. The unusual plasmas were further subjected to two-dimensional paper/starch-gel electrophoresis[4] to confirm the identification of the new components as β-globulins.

In a series of 153 Africans from Gambia we observed four individuals who had, besides β-globulin C, a slower moving β-globulin component which was present in about the same amounts as β-globulin C. In one of these individuals, however, the unusual β-globulin component had a distinctly slower mobility than that found in the other three. Thus two distinct β-globulin variants appeared to be present in this African population, and since it is probable that one of these corresponds to the β-globulin D of Smithies we will refer to them for the present as β-globulins D_1 and D_2 (Fig. 1).

In a series of 139 English people no example of phenotypes βCD_1 or βCD_2 was observed. However, two individuals were encountered with an unusual β-globulin component moving faster than β-globulin C. In both, the new component was present along with, and in about equal amounts to, β-globulin C. The mobility of the new fast-moving component was, however, different in the two individuals (Fig. 1). Since one of them probably corresponds to Smithies'

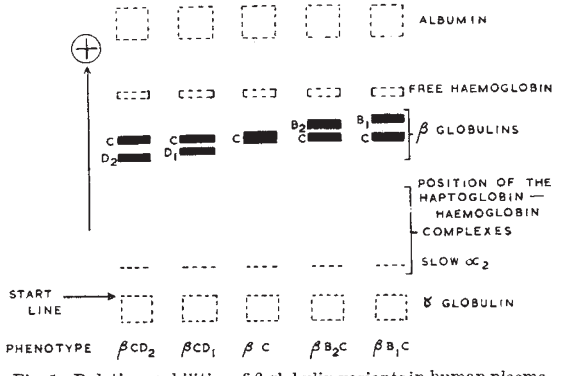

Fig. 1. Relative mobilities of β-globulin variants in human plasma. (Starch-gel electrophoresis with the discontinuous buffer system of Poulik)

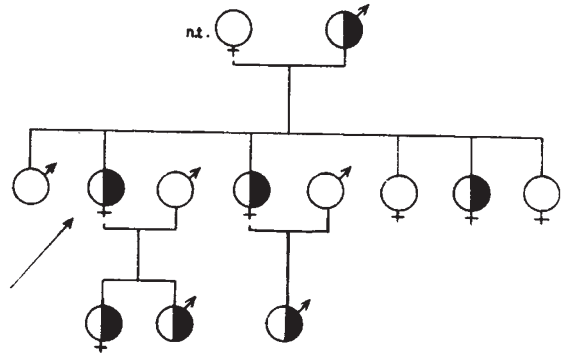

Fig. 2. Pedigree of family *W*. β-globulin phenotypes: ○, βC; ◑, βB_1C; *n.t.*, not tested

β-globulin B we will refer to these two new components as β-globulins B_1 and B_2.

Among the relatives of the individual with phenotype βB_1C six further individuals were encountered with the same phenotype. The pedigree is shown in Fig. 2, and it seems reasonable to infer that the formation of β-globulin B_1 is genetically determined and that the individuals in this family with the βB_1C phenotype are heterozygous for the appropriate gene.

So far it has not been possible to carry out family studies on any of the other variants observed. However, these results, combined with those of Smithies[2], suggest that a whole series of genetically determined β-globulin variants can occur and the situation may well prove to be analogous to that found with respect to the genetically determined hæmoglobin variants which have been so extensively studied in recent years.

We would like to thank Dr. J. Humphries, who kindly put at our disposal the samples from the population in Gambia.

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June 5.

[1] Smithies, O., *Nature*, **180**, 1482 (1957).
[2] Smithies, O., *Nature*, **181**, 1204 (1958).
[3] Poulik, M., *Nature*, **180**, 1477 (1957).
[4] Poulik, M., and Smithies, O., *Biochem. J.*, **68**, 636 (1958).

High Resolution of Human Plasma Components by Starch Gel Electrophoresis

With one-dimensional starch gel electrophoresis, the following experimental procedure allows the separation of human plasma into a large number of components.

The gel is poured into 'Plexiglas' trays (internal dimensions 370 mm. × 50 mm. × 20 mm.). The sample (a mixture in equal parts of plasma and 30 per cent soluble starch in 0·025 *M* borate buffer) is applied in a slot, 40 mm. × 2 mm. Electrical connexion with the ends of the gel is obtained by means of thick filter paper ('Cofram' *MAB C* 3).

A potential of 450 V. is applied for 18 hr. at +4° C. After electrophoresis, the gels are fixed in