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# POPULATION GENETIC STUDIES IN INDONESIA

A thesis submitted for the degree of

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This thesis describes the results of research carried out in the Department of Human Biology, John Curtin School of Medical Research, Australian National University, Canberra, between November, 1979 and November, 1982, during the tenure of an Australian National University Research Scholarship. The results embodied in this thesis are my own work carried out under the supervision of Dr R.L. Kirk, except where they are otherwise acknowledged in the text.

A.S.M. SOFRO



CHAPTER 1

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## ABSTRACT

Some three thousand blood samples from various Indonesian populations have been tested for electrophoretic variations of 21 red cell enzymes, three serum proteins and haemoglobin. In addition G6PD deficiency was also screened in the field and red cell morphology was also examined from unstained blood films to diagnose ovalocytosis.

Among 21 red cell enzymes tested, excluding G6PD, nine enzymes were polymorphic, five showed rare variants and six were monomorphic. In serum proteins, two proteins were polymorphic and one was monomorphic. For haemoglobin, in addition to two rare abnormal haemoglobins, Hb E was polymorphic. New variants were discovered in esterase D, carbonic anhydrase 2, 6-phosphogluconate dehydrogenase and transferrin.

A clinal pattern was observed in the distribution of $\underline{GLO}^1$, $\underline{GPT}^1$, $\underline{PGD}^C$ and $\underline{Hp}^1$ across the Indonesian archipelago. There is a trend of increasing $\underline{GPT}^1$, $\underline{PGD}^C$ and $\underline{Hp}^1$ gene frequencies and of decreasing $\underline{GLO}^1$ gene frequency towards the east. For systems with more specific alleles, the distribution of $\underline{PGM}_2^9$ and $\underline{Tf}^{D1}$ showed the western limit as far as Java and the distribution of $\underline{Tf}^{D}$Chi and $\underline{Hb}^E$ showed the eastern limit as far as Halmahera in the north and Timor in the south.

Variation in red cell enzymes, serum proteins and also Hb E were used to study the genetic relationship between populations. Employing data for gene frequency distributions in the populations, Nei's genetic distance measure was used to analyse the genetic relationship between Indonesian populations themselves and between Indonesian and neighbouring populations. A separate analysis was also made of the genetic relationship between the Balinese village

populations. The results showed that Indonesian populations may be grouped into a western and eastern Indonesian cluster. The western Indonesian cluster consists of all populations of the Greater Sunda Islands and the Lesser Sunda Islands from Sumbawa to the west, while the eastern Indonesian cluster is composed of populations of the Lesser Sunda Island beyond Sumbawa to the east and those from the Moluccas. When contrasted to the neighbouring populations, the Malays and Tagalog were grouped into the western Indonesian cluster, whereas the Fijians and Motu-speakers from Papua New Guinea were grouped into the eastern Indonesian cluster. The Asmat from Irian Jaya, Angurugu from north Australia and Kadazans from Sabah were distinctive from either cluster.

Analysis of the Balinese village populations showed that their genetic heterogeneity was compatible to some extent with geographical distance and/or topographical setting, but historical factors may also have played a part.

Examination of blood genetic traits associated with malaria indicated that G6PD deficiency and ovalocytosis were widely distributed in the archipelago, whilst the distribution of Hb E showed an eastern limit apparently associated with more recent population migration. Interaction between G6PD deficiency and ovalocytosis shown by the inverse proportion of the respective trait was to be observed beyond Java to the east.

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