Anthropology 455
Human Biology of the Pacific

Classic Genetic Marker Data
Karl Landsteiner
human red cells antigens
blood transfusion

ABO Blood Type

The ABO Blood System

<table>
<thead>
<tr>
<th>Blood Type</th>
<th>Type A (A, A)</th>
<th>Type B (B, B)</th>
<th>Type AB (A, B)</th>
<th>Type O (O, O)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red Blood Cell Surface Proteins (antigens)</td>
<td>A antigen only</td>
<td>B antigen only</td>
<td>A and B antigens</td>
<td>Neither antigen</td>
</tr>
<tr>
<td>Plasma Antibodies (antigens)</td>
<td>Anti-A antibody only</td>
<td>Anti-B antibody only</td>
<td>Anti-A and Anti-B antibodies</td>
<td>Neither antibody</td>
</tr>
</tbody>
</table>

This blood is A+.
Starch Gel Electrophoresis

serum proteins
haptoglobin (Hp): 
Hb-binding protein
transferrin (Tf): 
iron-binding protein

Genetic Polymorphisms

Lipoproteins; cholinesterases; protease inhibitors; 
alkaline phosphatases; glucose-6-phosphate dehydrogenase (G6PD); the immunoglobulins; 
hemoglobin (Hb); human leukocyte antigens (HLA)

HbS and sickle cell anemia 
HbA2 & thalassemia
G6PD

► New Guinea and Malaria

Distribution of G6PD, Fucosomes, and Malaria

New Guinea

Australia

Rh-ve gene in Australian Aborigines
‘Australia antigen’ (hepatitis B virus)
**Blood Group Antigens in the Pacific**

- Indonesian: A and B high, or = .6 to .4; R, dominant in Rh
- Melanesian: A and B higher than in Indonesia; M low; R, high.
- Polynesians: B almost completely absent; M above average; S allele found with N allele.
- Australians: absence of B; high A; M low; S almost lacking; R, highest.

**ABO In Polynesia**

- Subgene A2 is very rare
- B antigen may have been absent
- A1 gene unusually high
- Blood Group O moderate to high

**Rh and MNS**

- CDe(r1) haplotype high in Pacific
- cDE (r2) fluctuates widely
- CDE (Rz) very low
- CDE(R2) relatively high in Polynesia
- Cde (r’) in New Zealand Maori
- M lowest freq. in world in PNG
- S very low
- M allele at about 50% in Polynesians
Gene Frequency Studies

"Blood group genetic studies do not tell us the racial components of the Pacific peoples or their paths of migration." (Simmons 1965)

Analysis of Gene Frequencies in Pacific Groups

- Kirk (1989)
- Cavalli-Sforza et al. (1988)
- Roychoudhury (1993)

Kirk (1989) analyzed 72 blood group loci, protein and enzyme systems from six global populations

Highland NG & Australia: 165,000 ya; Coastal New Guinea and Australia: 153,000; Highland and Coastal NG: 145,000 ya
Cavalli-Sforza et al. (1988) - 120 allele frequencies from 42 polymorphic systems

Nei and Roychoudhury (1993) - 26 global populations

Solomon Islands (Rhoads & Friedlaender 1987) Genetic distances based on blood polymorphisms (ABO, MN, Hp, Inv and Gm allele frequencies)
Rhoads (1983)
ABO, MNSs, Gm and Rh
4 primary clusters including 2 from Highlands of New Guinea
No link between New Guinea and Is. Melanesian non-Austronesian (NAN) speakers
Futile to make a distinction between AN and NAN

Boyce et al. (1978)
Karkar Island, north coast of New Guinea, Waskia (NAN), Takia (AN)

Blake et al. 1983
Major Histocompatibility Complex (MHC)
Jean Dusset (1980)
Human Leukocyte Antigen (HLA); 6 closely linked polymorphic loci on short arm of chromosome 6

Human Leukocyte Antigen
Class I antigens, HLA-A, -B and -C, (peripheral blood lymphocytes and other tissues)
Class II antigens, HLA-D (B lymphocytes etc.)

HLA
- highly polymorphic: over a million possible phenotypes
- "population markers" for determining admixture (B8 in Caucasians, Bw46 in southern Mongoloids)
Linkage Disequilibrium (LD)
... denotes the non-random association of alleles at different loci in gametes

Linkage Disequilibrium
If the genotypes at one gene locus in one population are randomly distributed with respect to the genotypes of another locus, the population is in linkage equilibrium for the two loci. Otherwise, the population is in linkage disequilibrium.

HLA Associations with Disease
► e.g. Ankylosing Spondylitis

Ankylosing Spondylitis

- Normal
- Normal
- Ankylosing
- Ankylosing
HLA in the Pacific

- HLA-A alleles limited to A2, A11, A24, A26 & Aw34
- HLA-B alleles: only B13, B15, B16, B18, Bw22, B27, B35, B40 % Bw48 found in Pacific
- HLA-A2 and HLA-B40 increase from west to east across the Pacific, while HLA-Bw22 decreases in the same direction.

HLA in Polynesia

- HLA alleles even more restricted
- HLA-A2 and A11 highest in Polynesia
- HLA-B15, B27 & B35 very low or absent
- Cw4 antigen delineates Polynesians
- HLA-A and -B linkage relationships in Polynesia (e.g., Aw34 linked with Bw61 in Cook Islanders, New Zealand Maori and Hawaiians...)

Sue Serjeantson 1989

Phylogenetic relationships among Pacific and neighbouring populations based on HLA antigen frequencies (from Serjeantson 1989).
Reading


Topics

► 1. What differentiates classical genetic marker data and molecular genetic data? Provide a few examples of each class of data.
► 2. What do classical genetic marker data predict about the peopling of the Pacific region?

For Next Week

1. What is implied by the term, molecular genetic data? Provide a few examples of each class of data.

2. What do molecular genetic marker data predict about the peopling of the Pacific region?